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Message from the Editor-in-Chief

Dear Readers,

TOJET is happy to inform you that the new issue January 2011 has been published. TOJET is interested in educational technology. The field of educational technology is one that requires a high level of problem solving critical thinking, and interpersonal skills to solve problems that are often complex and multi-dimensional. Analyzing cases provides an opportunity to explore professional issues through an environment that allows action researchers, practitioners and students to analyze and reflect on relevant theories and techniques to understand a real problem, ponder solutions and consequences, and develop responses.

The articles should be on how to use educational technology in classroom for teaching and learning activities, how educational technology changes learning and teaching activities, and distance education. These articles should educators to improve the quality of both theory and practice in the field of educational technology.

We have a guest editor for this issue. The guest editor is Prof. Dr. Gwo-Dong Chen from National Central University Chung-Li, Taiwan. He reviewed papers and accepted thirteen papers. IETC-2010 and past issues papers had also reviewed for this issue. TOJET thanks and appreciate guest editor and the editorial board who have acted as reviewers for one or more submissions of this issue for their valuable contributions.

And as you know TOJET will organize IETC 2011 (International Educational Technology Conference - 2011) at İstanbul University between May, 25-27 2011. IETC series is an international educational activity for academics, teachers and educators. This conference is now a well known educational technology event. It promotes the development and dissemination of theoretical knowledge, conceptual research, and professional knowledge through conference activities. Its focus is to create and disseminate knowledge about the use of instructional technology for learning and teaching in education.

We are pleased to announce that the presented papers at the International Educational Technology Conference 2011 will be reviewed for the July, 2011 and October, 2011 issues of TOJET. The guest editors of these issues are Prof. Dr. Ferhan Odabaşı, Prof. Dr. Arif Altun, Prof. Dr. Rozhan M. Idrus, Prof. Dr. Toshiyuki Yamamoto, Assoc. Prof. Dr. Cengiz Hakan Aydin, and Assoc. Prof. Dr. Eralp Altun.

Call for Papers
TOJET invites article contributions. Submitted articles should be about all aspects of educational technology and may address assessment, attitudes, beliefs, curriculum, equity, research, translating research into practice, learning theory, alternative conceptions, socio-cultural issues, special populations, and integration of subjects. The articles should also discuss the perspectives of students, teachers, school administrators and communities.

The articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET.

Prof. Dr. Aytekin İŞMAN
Sakarya University

Preface to the Guest Editorial

Dear Readers,

I am very honored to be the Guest Editor of this issue. We have followed the rigorous review process. Finally we decided to publish thirteen papers. In these articles, there are seven papers investigating the ICT and the Internet affect the teaching and learning, includes a variety of courses, activities and students of different ages, and covering the scope of individual to the nation.

Mustafa KOÇ in the paper entitled "Internet Addiction and Psychopathology" examined the relationships between university students' internet addiction and psychopathology in Turkey. The study was based on data drawn from a national survey of university students in Turkey. Yu-Tzu Chiang, San-Ju Lin, Chao-Yang Cheng, and Zhi-Feng Liu in this paper entitled "Exploring online game players' flow experiences and positive affect" conducted two studies to explore online game players' flow experiences and positive affect. Their findings indicated that online game can evoke flow experiences and positive effect, and games of violent or nonviolent type may not arouse players' aggression

Bahar Baran, and Esra Keles in this paper entitled "Case study discussion experiences of computer education and instructional technologies students about instructional design on an asynchronous environment" reveal opinions and experiences of two computer education and instructional technologies departments' students about case study discussion method about instructional design. Another paper entitled "An Investigation on Teaching Materials Used in Social Studies Lesson" is by Halil Ibrahim SAGLAM, with its purpose to analyze the teaching materials adopted during social studies lessons on the basis of certain variables. Different factors are also discussed through lots of data and examples. The paper entitled "Attitudes of the English Language Teachers at Tertiary Level Towards the Use of Computers " was aimed at the measurement of the attitudes of the English Language teachers from two hundred universities towards computers. Nilgün TOSUN and M. Fatih BARIŞ in the paper entitled "The Role of Using ICT in School Improvement and Estonia Model "visited the Estonia, Kohtla-Jarve and examined the using facilities of ICT in the improvement of a school.

There are three articles is the study of student teachers and the distance students. Erdogan Halat, and Murat Peker in this paper entitled "The effects of mathematical representations developed through WebQuest and spreadsheet activities on the motivation of student teachers" compare the influence of instruction using WebQuest activities to the one using spreadsheet activities on the motivation of pre-service elementary school teachers in mathematics teaching course. The results indicated that developing WebQuests had more positive influence on the motivation of the pre-service elementary school teachers than doing spreadsheet activities in mathematics. Ebru Melek Koc in the paper entitled "Factors affecting student teachers' perceptions on mentor roles: a study at distance English language teacher training program" investigated whether perceptions of 4th year student teachers enrolled a distance English language teacher training program about mentor roles. The results indicated that these variables did not affect student teachers' perceptions as to their perception about mentor roles. Marko Radovan in the paper entitled "The Relation among Distance Students' Motivation, Their Use of Learning Strategies, and Academic Success ""used the "Motivated Strategies for Learning Questionnaire" to discover possible relationships between self-regulated learning dimensions and academic success in a distance-learning program.

The other three articles, the paper entitled "The Effects of Text Density Levels and the Cognitive Style of Field Dependence on Learning from a CBI Tutorial" is by Ismail Ipek. He investigated the effects of variations in text density levels and the cognitive style of field dependence on learning from a CBI tutorial, based on the dependent measures of achievement, reading comprehension, and reading rate, and of lesson completion time. İsmail ŞAHİN in the paper entitled "Development of Survey of Technological Pedagogical and Content Knowledge (TPACK)" aims to develop a survey of TPACK. The survey consists of seven subscales and is implemented through five phases. Another paper entitled "The comparison of the effect of block flute accompanied song teaching with multi-sound notation and vocalization program accompanied song teaching on the success of students' song learning behavior" did an experimental study to see if using computer supported notation and vocalization program for teaching songs instead of using block flute accompanied song teaching has any significant effect on students' singing behavior. Results showed that the experimental group had a higher level of success in all the five dimensions, named singing the song in accordance with its melody, singing the song in accordance with its rhythm, singing the lay of the song in accordance with its rhythm, singing the song in accordance with its intonation, and singing the song as a whole.

Many people helped me complete this work. Especially Prof. Dr. Aytekin İŞMAN, Assoc. Prof. Dr. Eric Zhi-Feng Liu, Dr. Chin-Yeh Wang, Dr. Liang-Yi Li, and Dr. Chun-Hsiang Chen, they help me very much. I would like to thank them, all of the reviewers and the editorial board.

Sincerely,

Prof. Dr. Gwo-dong Chen
Guest Editor

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A COMPUTER-ASSISTED LEARNING MODEL BASED ON THE DIGITAL GAME EXPONENTIAL REWARD SYSTEM

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ABSTRACT
The aim of this research was to construct a motivational model which would stimulate voluntary and proactive learning using digital game methods offering players more freedom and control. The theoretical framework of this research lays the foundation for a pedagogical learning model based on digital games. We analyzed the game reward system, which is recognized as one of the most important mechanisms to engage players in active sustainable digital game playing. In general, the reward system is designed similar to an exponential learning model. This paper compares the reward systems of four typical digital games which have more than 10 million school-age players around the world. Based on the results, we propose a computer-assisted exponential learning model similar to that applied in digital game based learning models. By applying these results to educational algorithms associated with the field of artificial intelligence, we are able to motivate emergent learning. Using the proposed method, it is possible to form a model of computer-assisted learning, adequate for all learning levels.
Keywords: digital game reward system, exponential learning model, computer–assisted learning model

INTRODUCTION

This research analyzes enthusiasm towards digital games and questions whether teenagers are capable of applying the motivation mechanisms activated by digital games to education situations.

With advancements in digital technology, digital games are now enmeshed in popular culture (Oblinger, 2004). The feature which most distinguishes digital games from cinema or other media is the fact that players need to intervene to interactively solve issues according to provided rules (Juul, 2002; Moreno, 2006). The inter-activeness of digital games is not only a result of a gathering of players, it requires discovering and learning certain rules contained within the game text and actively organizing while experiencing the game (Kiili, 2005a; Koc & Bakir, 2010; Prensky, 2001; Teo, 2009b; Tutgun & Deniz, 2010).

In newer digital games, cutting-edge psychological and artistic techniques are being applied in addition to various information processing technologies including artificial intelligence. These processes are intended to captivating interest and further promote the emotional satisfaction of the players by maximizing the interactive elements. Although negative aspects are highlighted at times, the emotion based technologies used in digital games are being applied in various parts of our lives through their convergence with cognitive science and information technology.

Most digital games are designed so players must actively complete quests based on a reward system (Koster, 2005). Players accumulate skill points through the process of collecting and discerning information required for creative reconstruction. This framework is very similar to the problem base learning model (Colby & Colby, 2008; Rosinski & Squire, 2009). Such methods of digital gameplay are one reason why it is being regarded by many in the field of education as an appealing interface to maximizing learning.

The learning method applied in digital games is an ideal mechanism in which anyone can proactively participate even at a very early age in the ‘interest element’ of ‘play’ through the virtual world. Furthermore, it has the advantage of being able to naturally induce problem solving capabilities and social learning (Browne, 2003; Calendra & Lee, 2005; Campos, 2005; Finneran & Zhang, 2003; İşman & Çelikli, 2009; Jonassen, 2006; Juul, 2002; Perkins, 1991; Prensky, 2001; Radford, 2001; Stevenson, 2007; Vygotsky, 1986). Accordingly, many

educators have long recognized the value of the digital game based learning model as an effective framework allowing users to creatively construct opinions and realize self-organized learning.

Furthermore, the gameplay model, which uses concepts similar to the learning model commonly designed in the field by educators such as chatting, writing, speaking and team-playing, is being frequently applied in the latest digital games. Accordingly, many educators are trying to apply such digital gameplay examples to various types of pedagogical learning models including those in the field of emergent learning (Kiili, 2005a; Papastergiou, 2009; Pilke, 2004).

Arguably, the young student generation forms the major age group of digital games users on a global level. We, accordingly, reviewed the reason for their interest in digital games and the possibility of designing a learning model based on the reward system used to induce play. From this perspective, functional mechanisms of the reward system in digital games were comparatively analyzed. Furthermore, based on the exponential learning equation model proposed by educators we suggest a computer-assisted learning model design.

Based upon information from previous studies, we present a set of designs for an effective digital pedagogy which takes the important step of analyzing the level-based 'experience point' (EXP) reward system as the main factor responsible for continuous, active commitment of players to digital games. To ensure objectivity, this work focused on two types of digital games made in South Korea and the USA for comparative analysis.

The first game type includes two cases of 'education-emphasized digital games' (EEDG) made in South Korea, which are available to all ages and have over 10 million student-age players around the world. The other game type includes two cases representative of massive multiplayer online role-playing games (MMORPG) of 'amusement-emphasized digital games' (AEDG) available to those 15 years of age and older.

Data from the analysis was examined through a process known as normalized evaluation. Experimental results suggested that the pedagogical function formula and the computer–assisted learning model which digital games are based on are very similar to the active absorption factor inherent in games played voluntarily by teenagers.

LITERATURE REVIEW

Learning Model Function

Along with the recent advancements in computer technology, there are many international cases in which functional formulas have been applied to motivational learning model studies of computer-assisted education such as emergent learning. We concentrated on several researchers which have proposed exponential learning equation models from a mathematical perspective similar to that suggested by this study.

In academia, various methods have been proposed in studies that apply functional formulas as a way to increase learning effects in the field of education. Actually, several creative educators have proposed models adjustable according to the learning environment and the disposition of learners for the purpose of enhancing learning effectiveness.

Carroll proposed a standardized functional formula related to the school learning effect (1963). In this model by Carroll, important factors that affect various types of school learning were extracted and an effective learning plan based on the interrelation of these factors was devised. This model is a very important teaching/learning model in the sense that a practical method for increasing school learning efficiency was presented through a specific functional formula. The model by Carroll proposed that learning efficacy is determined by the actual amount of time needed by a learner to accomplish a given assignment. The functional formula proposed is as follows:

$$Learning = F\left(\frac{\text{time actually spent}}{\text{time needed}}\right)$$

In this model, the learning effect is determined by the 'time actually spent' and 'time needed'. The 'time actually spent', indicates the time of active concentration by the learner required to perform a learning assignment. Generally, the time spent passively by the learner during the learning process is excluded from the time spent learning. Carroll emphasized the fact that this time may be affected by elements such as perseverance, learning opportunities, etc., and is therefore important to consider. The 'time needed', indicates the time required by the learner to reach the teaching objective. This element includes aptitude, quality of instruction, etc. This model is a concept which simultaneously emphasized the importance of considering individual learner differences and

environmental characteristics in teaching design. Furthermore, the model of school learning devised by Carroll also provided the theoretical foundation for mastery learning presented by Bloom (1976).
Johnston and Aldridge suggested an effective teaching/learning design that considered learner characteristics such as individual abilities and motivation through a functional formula in addition to learning effect (1985). In their exponential learning model, efficacy is determined by considering learner level and the amount of time spent problem solving. The formula for the exponential function learning model devised by Johnston and Aldridge is:

$$L = 100[1 - e^{-k(t+t_0)}]$$

where L =learning effects, t = learning time, t_0 = time spent on the subject before beginning to learn it, $k=cm$ where c = ability and m = motivation, and e =logarithm.

In this functional formula, L is a constant which can be converted into a percentage and $e^{-k(t+t_0)}$ is a function of the absolute effect on learning efficacy which increases as this value decreases. In other words, this formula takes into account not only internal elements such as the attitude of the learner during the learning process but also environmental elements such as the level of difficulty appropriate for the learner and the clarity of the objective.

According to Johnston and Aldridge, this functional formula considers exponential growth. They emphasized the fact that the learning effect can change based upon elements such as time, abilities of learner and teacher, environment, and motivation. The exponential learning equation models proposed by Carroll (1963, 1989) and Johnston and Aldridge (1985) were applied by Hwang who proposed a learning dynamic model based on the Newton mechanism (Hwang et al., 2004).

Hwang et al. (2004) proposed methodology that could increase learning efficacy by adding learning dynamics and learning energy. This exponential learning model referred to as a Learning Response Dynamic Model applies the theory of Newtonian mechanics. In addition, learning dynamics, energy, speed, force, and acceleration were considered as important elements to increase learning efficacy in digital-based network learning circumstances.

The majority of researchers emphasize the fact that a functional mechanism produces exponential growth which is not linear in form (Hwang et al., 2004). Theoretically, this functional mechanism has a very similar structure to the reward system of digital games. It is an established theory that most digital games have been designed with a logarithm structure where attaining the next level is relatively easy during initial gameplay to increase motivation but gradually becomes more and more difficult.

Accordingly, it is highly likely that the learning model presented in this study can also be applied to the digital game-based learning model design since the digital environment is mostly exponential in function with a nonlinear framework. In other words, setting the appropriate difficulty level according to learner level by controlling the function and motivational elements is feasible.

We examined the reasons why a majority of student-age individuals are attracted to digital games and explored the possibility of applying the game reward system which they are currently familiar with to learning model applications.

The digital game reward system based on an exponential mechanism
Generally, the reward system in digital games is classified as one of the most important elements in game structure responsible for stimulating active and sustained game playing. The reward system is designed to function similar to the learning model and is adjusted according to players' capabilities in diverse levels of difficulty which are assessed with several open test processes.

The reward system is divided into three types: 'level-based progression', 'skill-based progression' and 'freeform advancement'; however, gameplay is conducted based on experience points (EXPs) attained in all areas.

EXPs are a numerical display denoting the problem solving skills of game players (Koster, 2005) which can be compared to learning environments where credit is awarded according to the efforts of students. The reward system of digital games is assumed to have originated from the level up system of 'Dungeon' perceived as a

traditional role-playing game model (Koster, 2005) which entails increasing levels attained by moving from point A to B to a complex type of mission where various items must be obtained in a given time.

Unlike the general case related to the game character, there are also instances that have been designed to change EXPs throughout the game map. However, most digital games have been designed so that progression to the next level is based on the accumulation of EXPs. As for the gameplay method, most cases use the quest performance method which entails defeating monsters or obstacles using the game character. However, there are also cases in certain games such as 'GURPG' and 'World of Darkness' that change according to the method of solving the mission. Such methods transform in various ways according to the game genre or platform.

In most cases, the reward system of digital games has been designed so players receive EXPs in gradation according to their individual efforts and capabilities. Furthermore, this mechanism is connected to various fun elements of the game domain thereby enticing continuous play.

Arguably, such digital game reward system mechanisms have a very similar functional structure to the exponential learning equation model proposed by Johnston and Aldridge. In other words, the reward system of digital games has also been designed with an exponential equation as a function of time and motivational elements according to player level similar to the exponential learning equation model (Koster, 2005) and as such, is very similar to the learning model commonly used in the field by educators despite being electronic.

Accordingly, it is highly possible that the reward system of digital games can be applied to an effective learning model that can be adjusted in gradation according to learner level for elements directly responsible for learning efficacy such as difficulty level and motivation in a computer-assisted learning model environment.

METHDOLOGY

Research Design

We analyzed the reward system of digital games, which is an element that makes teenagers become immersed in game-playing. To investigate the possibility of its application in learning model applications, the following areas were examined during the experimental process:

- a level-based comparison of EXPs between Education-Emphasized Digital Games (EEDG) and Amusement-Emphasized Digital Games (AEDG);
- an analysis of major stages in the game-playing process in EEDG and AEDG;
- derivation of the functional formula of digital game reward systems;
- applicability of a learning model based on EEDG;
- differences in exponential curves based on motivational parameters from the normalized data fit;
- feasibility of a computer-assisted learning model, applied to exponential-learning, based on the digital game reward system.

Data Collection

Digital games sampled in this research are based on two types of massive multi-player online role-playing games (MMORPG): EEDG and AEDG. The first type stresses both playing and studying while the latter emphasizes only playing. These digital games are known to have more than 10 million members worldwide, the majority of which are students. Based on our evaluation of the characteristics of EEDG and AEDG, we propose that the particular mechanisms which attract players to these games may have applications in educational learning models.

Data from Tables 1 to 4 are based on open sources provided by each digital game production company. While the general digital game level-up system is designed by mathematical formulas, it is often customized by manufacturing companies to meet their needs. The digital game level-up system is available to the public to help players advance in the games and is reviewed by expert online sites related to digital game analysis as well.

To obtain the most appropriate data, we selected 40 players and divided them into 10 categories, from novices who have played each game for only a year to experienced players who have played each game for more than three years. We had them play at five levels lower than what they typically played. As a result, we confirmed four cases of EXP data provided by the game production company that agreed with the actual process of playing and subsequently collect these as samples.

Digital games in Tables 1 and 2 are popular across generations. *Maple Story* in Table 1 features exploration of an imaginary world in adventure form. *Tales Runner* in Table 2 is a racing game integrating athletic sports with an

imaginary fairy-tale world. Tables 1 and 2 list level-based EXPs appearing in both games. Figure 2 shows the graphs produced from the data in Tables 1 through 4.

The level-up systems in these games actually include up to approximately 130 levels, but for experimental effectiveness the graphs show only 50 levels. Furthermore, *Maple Story* and *Tales Runner* emphasize learning differently from other digital games which are violent in nature. These digital games were selected as suitable to be used for statistical research in relation to digital pedagogy, as they are voluntarily played by young people all over the world.

It should be noted that level-based EXP values may be compromised through the process of repeated testing with common users. For example, *Maple Story* in Table 1 has been enjoyed by over 50 million members from over 10 countries including Korea, Japan, China, Taiwan, Thailand, Singapore, Malaysia, America, Canada, and EU since it was released in Korea in 2003. The game, on average, has approximately 210,000 simultaneously connected users.

Tables 3 and 4 show EXP data from *Suddenattack* produced by GAMEHI & CJ Internet Company and *World of Warcraft* (*WoW*) an iconic digital game for entertainment available around the world to anyone over 15 years of age, manufactured by BLIZZARD Entertainment Company.

Data Analysis

Comparative Analysis of Level-Based EXPs in a Reward System

There are two common characteristics of EEDG summarized in Tables 1 and 2. One is the fact that level-up is easily achieved through a small amount of effort until levels 15 to 20 which correspond to the powerful level-up areas in Figure 2 (a) and (b).The other is that when players reach certain stages as a result of their own will and effort, level-up becomes more difficult due to the fact that the digital game system is designed based upon a logarithm which makes it difficult to achieve level-up at certain times and in certain situations.

In comparative analysis of two AEDG and two EEDG, the emphasis on motivation which consisted of three different areas—powerful level-up, adjustment level-up, and level-up—was found to be similar to learning theories related to step learning in constructivist educational pedagogy.

The degree of difficulty is designed by dividing game sections into stages, as shown in Figure 2 (a) and (b). This form is common to all general EEDG. This design style is thought of as similar to the traditional theory related to constructivist pedagogy, that is to say, that learning with media should provide motivation and opportunity in an active and voluntary way, fertilizing the fields of motivation.

Tables 3 and 4 are expressed as graphs in Figure 2 (c) and (d). The model of AEDG depicted in Figure 2 (c) and (d) shows short-term lines in the powerful level-up area providing players with motivation. This feature is very different from Figure 2 (a) and (b) where the line can be seen rapidly increasing.

Figure 2 (c) and (d) depict typical models of extreme forms of digital games with goals of entertainment. Some structures which make it irresistible and urgent to get rewards, may cause social problems as players develop an excessive desire for compensation. The areas in the circles in Figure 2 (b) and (c) denote the possibility of various scenarios occurring within the game. The irregular lines reflect this aspect which is intended to prevent player anxiety or boredom.

Table 1. *Maple Story* level-based EXP

EXP	Level	EXP	Level
15	1	54900	26
34	2	63666	27
57	3	73080	28
92	4	83720	29
135	5	95700	30
372	6	108480	31
560	7	122760	32
840	8	138666	33
1242	9	155540	34
1716	10	174216	35
2360	11	194832	36
3216	12	216600	37
4200	13	240500	38
5460	14	266682	39
7050	15	294216	40
8840	16	324240	41
11040	17	356916	42
13716	18	391160	43
16680	19	428280	44
20216	20	468450	45
24402	21	510420	46
28980	22	555680	47
34320	23	604416	48
40512	24	655200	49
47216	25	709716	50

Table 2. *Tales Runner* level-based EXP

EXP	Level	EXP	Level
0	1	143400	26
600	2	167400	27
1200	3	191400	28
1800	4	215400	29
2700	5	265400	30
3600	6	365400	31
4500	7	465400	32
5400	8	565400	33
6900	9	665400	34
8400	10	765400	35
9900	11	865400	36
11400	12	1065400	37
14400	13	1315400	38
17400	14	1665400	39
20400	15	2015400	40
23400	16	2415400	41
29400	17	2865400	42
35400	18	3365400	43
41400	19	4365400	44
47400	20	5365400	45
59400	21	6365400	46
71400	22	7365400	47
83400	23	8365400	48
95400	24	9365400	49
119400	25	10365400	50

Table 3. *Suddenattack* level-based EXP

EXP	Level	EXP	Level
2,999	1	1524999	26
8,999	2	1674999	27
17999	3	1824999	28
29999	4	1974999	29
44999	5	2174999	30
64999	6	2374999	31
84999	7	2574999	32
104999	8	2774999	33
134999	9	2974999	34
164999	10	3174999	35
194999	11	3474999	36
224999	12	3774999	37
274999	13	4074999	38
324999	14	4374999	39
374999	15	4674999	40
424999	16	4974999	41
474999	17	5374999	42
574999	18	5774999	43
674999	19	6174999	44
774999	20	6574999	45
874999	21	6974999	46
974999	22	7374999	47
1074999	23	7874999	48
1224999	24	8374999	49
1374999	25	8874999	50

Table 4. *WoW* level-based EXP

EXP	Level	EXP	Level
0	1	338000	26
400	2	374400	27
1300	3	413300	28
2700	4	454700	29
4800	5	499000	30
7600	6	546400	31
11200	7	597200	32
15700	8	651700	33
21100	9	710300	34
27600	10	773100	35
35200	11	840200	36
44000	12	911800	37
54100	13	987900	38
65500	14	1068700	39
78400	15	1154400	40
92800	16	1245100	41
108800	17	1340900	42
126500	18	1441900	43
145900	19	1548200	44
167200	20	1660000	45
190400	21	1777500	46
215600	22	1900700	47
242900	23	2029800	48
272300	24	2164900	49
304000	25	2306100	50

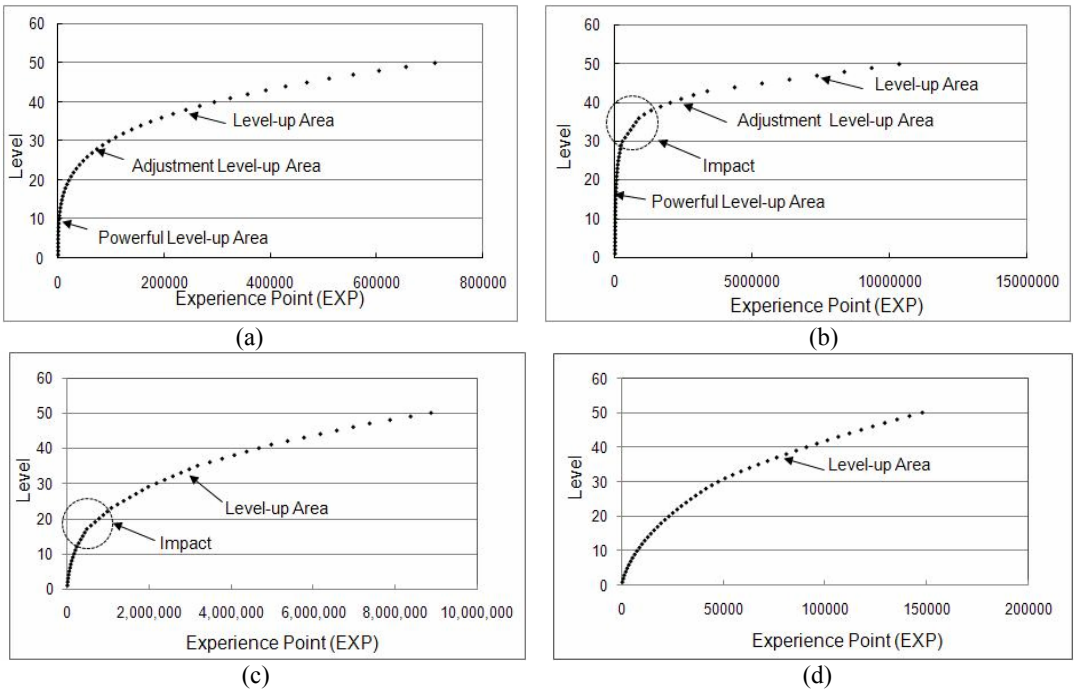


Figure 2. Level-up curve, (a) *Maple Story*, (b) *Tales Runner*, (c) *Suddenattack*, (d) *WoW*

Game Playing Procedure Stages

Figure 3 depicts a model of the step-by-step course in playing the digital games presented in Figure 2. Motivation is the focus of the powerful level-up area. Players experience motivation (a) and show will (b) in the course of adjustment. Players with this background are well-developed to commit to action (c) with their own skills, knowing that they are going to be faced with difficult problems to solve in certain situations.

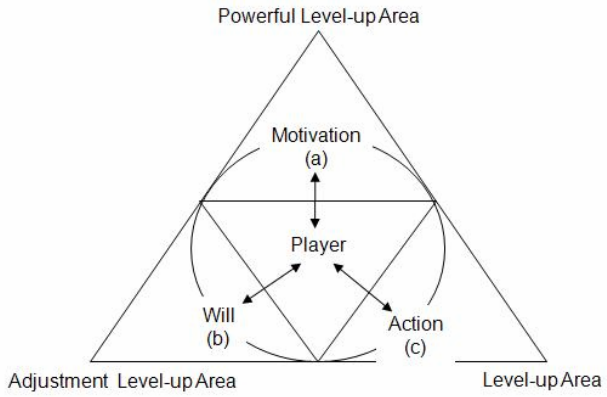


Figure 3. Game playing procedure and elements

The adjustment level-up area has the support functions and knowledge for skill accumulation useful in gaining an edge against fellow players. Motivation and will, presented in Figure 3 (a) and (b), can be thought of as mental attributes providing players in the powerful level-up and adjustment level-up areas the means to attain educational goals. Players can attain the confidence necessary to navigate these courses successfully. The level-up area, common in both EEDG and AEDG, offers limited rewards compared to effort required; however, it is possible to design other fun types of level-up systems like that depicted in Figure 2 (d) to motivate players to actively partake in the games.

Level-Based EXP Data Modeling

Figure 4 depicts a form of modeling used to derive the functional formula indicated in Figure 2. It shows that it is easy to increase from level E_1 to E_3 on the x-axis, identifiable as a gentle slope from A of E_3 on the x-axis according to the degree of difficulty. The model depicted in Figure 4 can be constructed using the formula:

$$Level = K \log_e EXP$$

$Level$ = game level, K = a constant (the degree of difficulty in digital games), e = exponential, EXP = Experience Point.

According to Figure 2, in the case of Figure 4 being designed with a fan-shaped structure in which the levels on the y-axis increase consistently, it is very easy for players to lose interest and experience anxiety or boredom. However, players who experience E₁ to E₃ accumulate a certain amount of skills gained from 1 to A and are therefore continuously challenged by the possibility of attaining high numerical points.

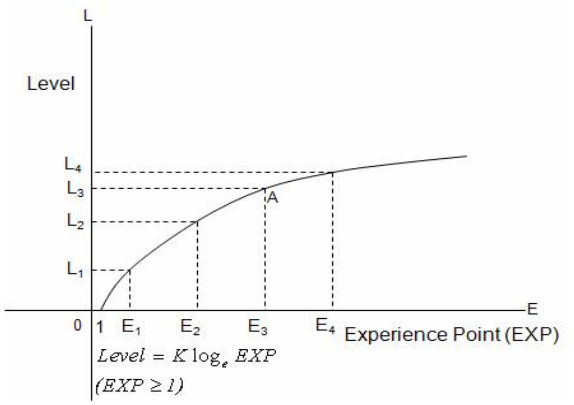


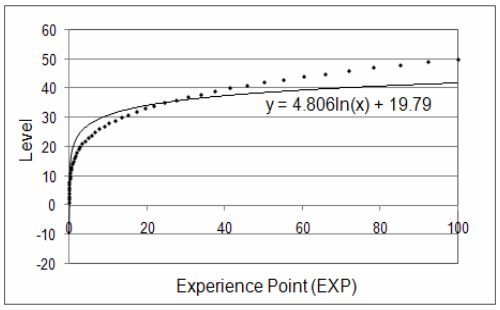
Figure 4. Experience Point Data Modeling

DATA FITTING OF THE REWARD SYSTEM

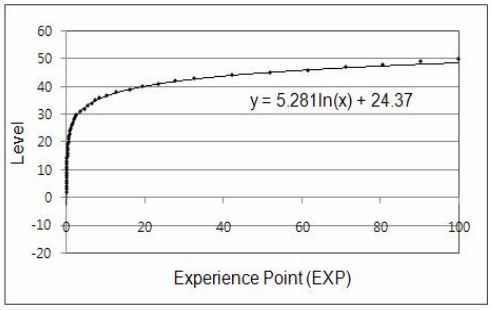
Data Normalizations and Fit

The level data from four digital games (Tables 1-4) were subjected to the process of normalization as a percentage, resulting in the fit model of Figure 5. The main characteristics of each group based upon comparative analysis of the fit model of four cases of EEDG and AEDG in Figure 5 are as follows:

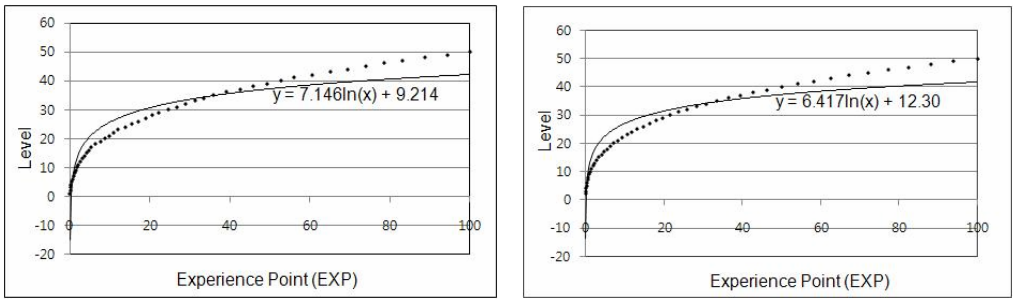
- Data obtained from the normalization is similar in form to Figure 2; however, in drawing the trend line, Figure 5 (a) and (b) in the fit model emphasize the powerful level-up area devoted to motivation.
- A section of powerful level-up area appears clearly and distinctly in two cases of EEDG (Fig. 5 a, b), but a powerful level-up area can only be drawn short-term or not at all in two cases of AEDG (Fig. 5 c, d).
- The fit graph shows concretely that Figure 5 (c) and (d) reach above Figure 5 (a) and (b), corresponding to the changes at the x-axis in the gradual process of the level- up area.
- The functional values of EEDG and AEDG differ from each other in functional formulas based on trend lines.



(a)



(b)



(c) (d)

Figure 5. Data fit (a) *Maple story*, (b) *Tales Runner*, (c) *Suddenattack*, (d) *WoW*

Table 5 shows the functional formulas deduced by means of a trend line. A functional formula derived by the trend line does not always indicate accurate normalized values in the parameters, but values and a functional formula can be deduced, thereby enabling understanding, i.e.

$$Level = K \ln EXP \pm W$$

where $Level$ = game level, K = a constant, that is the degree of difficulty in digital games, $\ln$ = logarithm, EXP = Experience Point, and W = motivational element constant.

Table 5. Function formulas derived from data fit

	K W
Figure 5 (a)	$Level$=4.806*ln EXP+19.79
Figure 5 (b)	$Level$=5.281*ln EXP+24.37
Figure 5 (c)	$Level$=7.146*ln EXP+9.214
Figure 5 (d)	$Level$=6.417*ln EXP+12.30

Compared to the EEDG group, the AEDG group (Fig. 5 c, d) has a constant K which is highly expressed and defines the width of its graph. The structure in the AEDG group is designed so the line radically heads upward as game playing progresses. The constant K in the EEDG group is relatively lower, with values of 4.806 and 5.281, compared to the constant K in AEDG, which is set higher at 7.146 and 6.417.

The values 19.79, 24.37, 9.214, and 12.30 correspond to the first, second, third, and fourth entries of W in Table 5. The functional formulas are the constants that influence the width in motivation which is reflected in the design with the purpose of increasing motivation in players in the powerful level-up area. When W is high, as in the first and second entries in Table 5, the graph moves towards the left indicating a long and active powerful level-up area (Fig. 5 a, b). On the other hand, when the value is low, as in the third and fourth entries in Table 5, the powerful level-up area is short and slightly expressed (Fig. 5 c, d). W as well as K have distinct differences in each group.

These differences make it easy to distinguish between EEDG and AEDG which has been difficult to achieve in an academic way until now. Furthermore, these results could be adapted for the possible construction of models with adjustments to the functional values that would enable effective computer–assisted learning programs suitable for each age level.

RESULTS

Figure 6 is derived from the process of plotting the functional formula deduced from Table 5 using MATLAB™. The groups of EEDG and AEDG take a common form as a logarithm; however, it is easy to see that there are differences in the fan-shaped lines of all groups plotted.

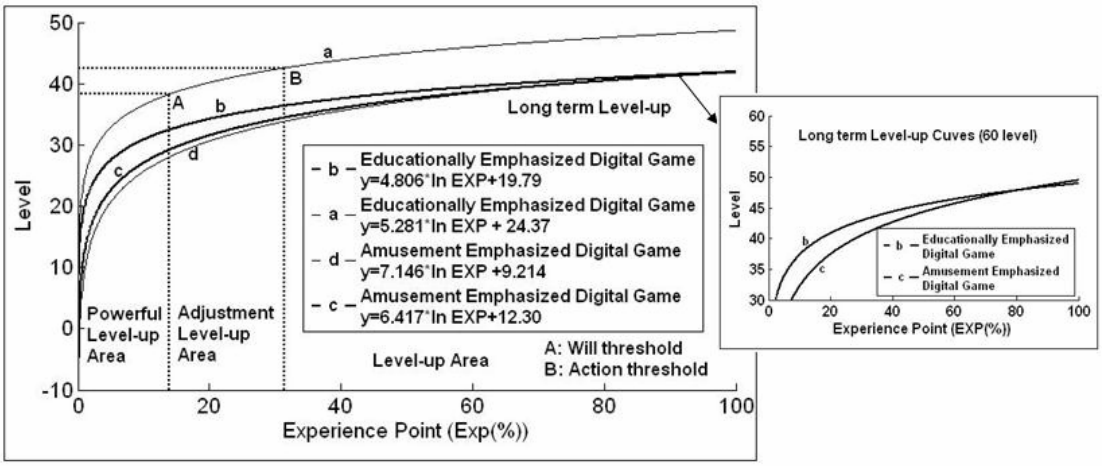


Figure 6. Plotting results: exponential curves of function formulas

The 'a' and 'b' lines in Figure 6 represent EEDG, while the 'c' and 'd' lines depict AEDG. The 'b' and 'c' lines are drawn in bold for typical samples that demonstrate a clear difference between the two groups. EEDG consist of three areas, namely powerful level-up, adjustment level-up, and level-up, which are the same as in the fit results from Figure 2. AEDG are designed with short sections, or without sections and at the same time designed to go upward to increase time spent. The inset graph (small box) demonstrates the clear difference between 'b' and 'c' lines.

Label A in Figure 6 indicates the will threshold step for learners who are able to change themselves very actively after they've experienced the first step of the powerful level-up area. Label B in Figure 6 denotes the action threshold step for learners who experienced a will threshold so that they could actively accomplish the learning steps in the long term. The functional formula in Table 5, verifies the flexibility between the two groups in that EEDG and AEDG are determined by a constant K , and depending on the value of K , they can differ from one another.

The constant W determines the width in motivation at the powerful level-up area. It also differs between the two groups. Evaluation of Figure 6 demonstrates the possibility of adjusting entertaining materials to educational ones with a computer–assisted learning model framework based on domains in digital games, and the possibility of designing the structure of educational methods that bring about accomplishments in each learning phase through a step-by-step process according to the learner's level.

DISCUSSION

The Exponential Learning Model

As mentioned previously, digital games are based on a functional formula in relation to an educational model wherein a schema can be defined as a log-function. A functional formula derived from Figure 5 and Table 5 can be applied as follows where $Level \approx$ Learning Level, and $Exp \approx Schema$:

$$L = k \log_e Schema \pm w$$

L = the accumulated learning level; k = a constant (the degree of difficulty in the computer–assisted learning model; the amusement, learning usability level); e = educational exponential; w = a constant (learning motivation elements); $Schema$ = accumulated learning skill.

It is possible to design various educational models appropriate for various learning capacities and ages through a process of adjustments in the constants k and w which consist of certain factors possessing several particularities. The functional formula of the constant k includes many parts: rules, competition, compensation, degree of freedom, and community (Colby & Colby, 2008), while w includes motivation. The addition of an alternate expression of players' personal capacities, such as computer competency and learning attitudes, might improve educational benefits. According to this research, it is possible to establish a boundary in digital games which can be divided into two parts, one for educational purposes and one for entertaining purposes, depending on the numerical values of k and w.

The computer–assisted learning model can be effective if factors involved in gameplay are permitted to function through several processes. However, learners' efforts may not always come to fruition. If the powerful level-up area does not function distinctively or if irregular events happen without any relation to education it would be difficult to accomplish the primary goal of learning with this system.

A Computer-Assisted Learning Model

When the main characteristics resulting from the analysis in this experiment are put together with the theory of educational models (Davidovitch et al., 2008), a computer–assisted learning model can be constructed. This is similar to an instructive educational model designed to accomplish learning step-by-step based upon the constructive educational theory via digital games. From a theoretical aspect, by using EEDG in association with the educational principles of constructivism, various forms of active models can be designed to motivate learning voluntarily by means of amusement. This is depicted in the example of a powerful level-up area as seen in Figure 7.

The adjustment level-up area causes learners to concentrate on the learning process with self-examination and co-operation. Learners in this area commit themselves to systematic thoughts, achieving their goals by solving problems. At the same time they can examine their knowledge and capacities through interaction with fellow learners.

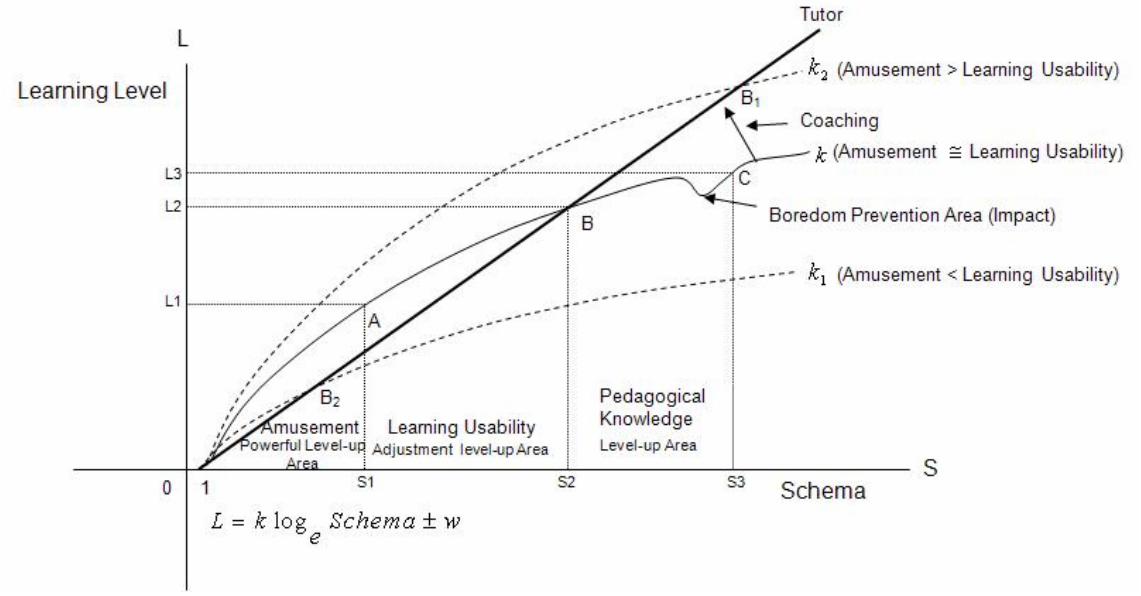


Figure 7. Proposed computer–assisted learning model

The level-up area helps learners attain pedagogical knowledge. This area offers creative materials in affective and cognitive aspects by tutoring, creating situated learning and a cognitive apprenticeship (Seufert, 2003). The function of the tutor in the level-up area is considered to be important for enhancing creative activities to prevent the learner from falling into a state of boredom

The slope of schema increase curve in Figure 7 would be determined with the values of k in a logarithm function. The schema of the x-axis in the modeling function consists of amusement, learning usability, and pedagogical knowledge. According to the research results shown in Figure 6, k line is one of the most ideal types. In Figure 7, if k_2 at point B_1crosses the tutor line, the condition of amusement is larger than learning usability so that it becomes a model similar to AEDG placing more weight on amusement than education. When k_1 crosses the tutor line at point B_2relatively early, learning usability is greater than amusement, pointing out that learners do not find learning interesting without amusement. Therefore, the most ideal model of computer–assisted learning could theoretically be achieved if amusement ≅ learning usability, with the k line presented above.

A section of A (S_1, L_1) on k line indicates amusement and a section of B (S_2, L_2) shows the process of learning usability. The section of C (S_3, L_3) is the step entering into pedagogical knowledge. Learners entering into

pedagogical knowledge proceed to learning very actively because they have already accumulated knowledge and schema as shown in section C (S□, L□).

An area drawn irregularly on the *k* line indicates boredom prevention, derived from the event effects used in the reward system (Fig. 2 b, c). The framework of the reward system of (b) and (c) in Figure 2 provides players with various events that play an important role in helping and encouraging them to commit consistently to games that are fun. This fact makes it possible to effectively design many diverse models related to impact learning (Papastergiou, 2009), which prevent users from entering a state of boredom. From the viewpoint of cognitive apprenticeship, the area of coaching is the space that provides learners with outside assistance such as hints and feedback by experts and tutors observing the learners' activities during their tasks (Gee, 2003; Hayes et al., 2008; Zeichner, 2007; Zwart et al., 2008).

CONCLUSIONS

It has been determined on an international level that the majority of digital game users are of student-age. Most voluntarily participate in digital games and together with their online buddies, they collect, discern, and creatively reconstruction information. During this process, they discover the rules in the game space and repeat a self-organizing learning process.

Similar framework to the self-regulated learning constantly emphasized by educators in the field is actually occurring naturally during digital gameplay. Accordingly, many educators have attempted to apply the flow induction mechanisms of digital games to the educational learning model design (Csikszentmihalyi, 1990; Finneran & Zhang, 2003; Kiili, 2005a; Pilke, 2004).

As shown in the results of this study, the core device of the mechanism that constantly induces the flow of users to digital games is the reward system. In most cases, the reward system of digital games is designed in slightly different ways according to the genre (learning game, entertainment game, etc.) and the age of user. Additionally, it naturally induces flow through the use of fun elements based on a reward system.

Since the majority of digital game users are of school-age, there is a high possibility, in theory, that the learning efficiency of students can be naturally increased through this model. From this perspective, we analyzed the reward system, which is the core device for inducing user flow to digital games, and examined the possibility of applying it to a learning model.

The study results revealed that the two models contain common functional mechanisms. Appropriate compensation was provided through this functional mechanism according to the players' level in the gameplay process. In addition, it induced continuous gameplay and level up progression through the use of fun elements. As we expected, these results demonstrate a high possibility of designing a learning model which applies the reward system employed so effectively in digital games.

In addition, it was discovered that the EEDG group sampled has been designed to enable powerful level-up with less effort during initial gameplay compared to AEDG. This design method was commonly encountered in the EEDG group sample. This model is similar to the motivated learning model commonly applied in the field by educators. Accordingly, the emphasis on learning in EEDG is a design for inducing continuous gameplay by providing motivation to users.

Through the shape of the exponential curve trend line, it was also confirmed that digital games are designed differently according to genre and objective. The functional formula proposed in this study was deduced based upon the exponential curve which is the modeling result of EXP data. Based on this functional formula, we propose an exponential model that can be applied to a computer-assisted learning and a learning model design method.

The most distinguishing characteristic of this functional formula is the fact that it enables design of a learning model which considers the learner's level. This formula is basically similar to the exponential learning model of Johnston and Aldridge (1985) which is adjustable according to the individual characteristics of learners such as ability and motivation. However, the functional formula proposed in this study is considered to be more applicable to the actual field since it clearly classifies the constants which determine learning difficulty level and motivation.

In academia, many types of learning activities and materials are affected by the motivational curve of the exponential equation model similar to that for players in the digital gaming environment. The exponential

learning equation model proposed by previous researchers is still being applied in various areas in the field. It is thought that the proposed exponential learning model can maximize learning efficacy by enabling the application of motivational materials differentiated according to the personalities or individual characteristics of students by adjusting the constants.

In addition, we propose a computer-assisted learning model design method based on the exponential learning equation model explained in this study. This model has been designed based on comparative analysis of the level up system of EEDG and AEDG. Accordingly, the curve can be adjusted with the constants of the exponential learning equation model proposed in this study. In other words, we present a concrete method for a design adjustable to meet the needs of particular learners or learning environments through adjustment of motivation and learning efficacy elements. The significance of this model lies in the fact that it presents a design method to effectively enhance performance learning through specific functions.

Appropriately providing motivational elements in the learning environment has an absolute effect on learning, which is a concern shared by most educators. Accordingly, the intensity of the motivational elements needed in a particular learning environment for individual learners can be predicted and adjusted by gradation in the learning model design used in this method. Studies of learning models applied to digital games are being conducted very actively on an international level. However, there are hardly any cases that evaluate the functional mechanism in the digital game domain and apply it to an exponential learning equation model in specific ways.

The exponential mechanism of digital games is automatically integrated and controlled through digital technologies including artificial intelligence technology. The functional formula and learning model design method proposed in this study are considered applicable in various types of computer-assisted learning methods, and considered important in the 'impact learning model' and 'emergent learning model', when integrated with technologies in the digital-based learning environment.

This is only the initial phase of this innovative idea. It is necessary to thoroughly review its application in the field. Accordingly, we will be conducting actual field tests based on the functional formula proposed in this study. We propose that this issue presents important possibilities in the area of education and is worth exploring through further research.

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AN APPLICATION OF LATENT VARIABLE STRUCTURAL EQUATION MODELING FOR EXPERIMENTAL RESEARCH IN EDUCATIONAL TECHNOLOGY

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ABSTRACT
As the technology-enriched learning environments and theoretical constructs involved in instructional design become more sophisticated and complex, a need arises for equally sophisticated analytic methods to research these environments, theories, and models. Thus, this paper illustrates a comprehensive approach for analyzing data arising from experimental studies using structural equation modeling (SEM) procedures that can formulate and test theories regarding how interventions affect observed outcomes, in comparison to traditional MANCOVA design. Researchers in the field of instructional systems and educational technology are encouraged to incorporate this method into their analyses of experimental investigations, because this method allows for a close examination of mediating processes that are responsible for the outcomes observed and for the estimation of both random and correlated measurement errors.
Keywords: Structural Equation Modeling, Experimental Research, Generative Learning, Latent Variable

INTRODUCTION

Conventionally, studies related to educational technology have used statistical techniques to test mean differences between groups. The t-test, analysis of variance (ANOVA), and analysis of covariance (ANCOVA) allow researcher to determine the effects of interventions. However, cognitive functioning and processes related to learning are intricate and human learning involves various psychological constructs. In other words, theoretical advances for understanding human cognition and learning processes require the consideration of more psychological constructs when designing learning environments.

Moreover, with technological advances, educators infuse more technologies into learning environments to improve students' learning. However, the effectiveness of these innovations cannot simply explained by testing mean differences, because these interventions could be related to underlying mediating processes that might be responsible for the desired outcomes (Koetting & Malisa, 2004, Delialioglu, et al., 2010). Thus, researchers in the field of educational technology should be more interested in explaining how interventions affect learning (Alenezi, Abdul Karim, &Veloo, 2010, Yukelturk, 2010).

The traditional approach has been successful in finding the effectiveness of interventions, but not in understanding the intervening psychological constructs that might influence how an intervention affects learners' achievement. Accordingly, the need arises for a more comprehensive approach that can formulate and test those complex mechanisms. In this paper, structural equation modeling is presented as a possible method. Although structural equation modeling has been used extensively in recent studies, most of the studies have used the method in non-experimental survey contexts. One reason could be that the procedures are relatively new and not easy to deploy in comparison to traditional methods such as ANOVA and MANOVA. For the same reason, there is no clear rationale for preferring structural equation modeling to traditional analyses of experimental data.

Thus, the purpose of this paper is to demonstrate a comprehensive approach to analyzing data from experimental studies using latent variable structural equation modeling that can formulate and test theories regarding how interventions affect observed outcomes (Bollen, 1989; Kline, 2005). To illustrate this statistical approach, this paper analyzes data drawn from an actual experimental study.

The Experimental Context

To demonstrate the use of structural equation modeling for MANCOVA designs, this paper applies the procedures to data derived from an actual experiment that examined the effects of generative learning strategy prompts and metacognitive feedback on learners' self-regulation, use of learning strategies, and learning performance (Lee, Lim, & Grabowski, 2010). In that experiment, the researchers wanted to create experimental conditions where interventions would influence students' learning performance directly and indirectly. The prediction was that the interventions would positively affect learning performance, but through their effect on self-regulation and use of learning strategies.

In the study, 223 participants were randomly assigned to one of the three treatment groups. One group was given only generative learning strategy tools as the control (T1); the second group was given additional generative

learning strategy prompts (T2); and the third group was given additional generative learning strategy prompts and metacognitive feedbacks (T3). The participants took an online pre-test and were instructed to download the instructional material and study it. Afterwards, the participants completed a survey about their self-regulation while they were studying and took post-tests to explore two criteria: their recall and comprehension of the instructional material. The instructional materials that learners used during the experiment were collected and assessed to measure the quality of the learner's overt use of generative learning strategies.

In this experimental condition, researchers want to know whether the three groups differed significantly with respect to four dependent variables - learner's self-regulation, quality of overt use of generative learning strategies, recall, and comprehension - when controlling learners' prior knowledge. This question could be answered with a MANCOVA analysis. However, as instructional designers, we might be more interested in the mechanism among the four dependent variables. That is, researchers could hypothesize that metacognitive feedback would improve learners' self-regulation and use of generative learning strategies, which in turn improve learners' recall and comprehension. This mediational hypothesis could be tested by using latent variable structural equation modeling (hereafter SEM), but cannot be tested using traditional MANCOVA analysis.

MODELING

In applying structural equation modeling, researchers usually follow five basic steps of SEM recommended by Kline (2005): (1) Model Specification; (2) Model Identification; (3) Data Preparation and Screening; (4) Estimation of the Model; and (5) Model Re-specification, if necessary. Since the primary purpose of this paper is to demonstrate analyzing data from experimental studies with SEM, the general data analysis procedure of SEM is beyond the scope of this paper. Thus, the following sections present modeling one-way MANCOVA with a latent variable structural model, and alternative modeling to test mediating effects.

Modeling One-Way MANCOVA with a Latent Variable Structural Model

In general, researchers use MANOVA to test the mean differences across two or more groups on two or more dependent variables simultaneously. By using MANOVA, researchers control the overall alpha level, test mean differences while controlling independencies of dependent variables, and count the relationships among the dependent variables (Bray & Maxwell, 1985). These MANOVA designs can be accomplished by structural equation modeling using a Multiple Indicators and Multiple Causes (MIMIC) model. This SEM approach, in which factors are regressed on one or more dichotomous cause indicators that represent group membership (i.e. coded 0 = control, and 1 = treatment), allowed testing for multiple group differences on latent variables (Kaplan, 2000), which is analogous to interconnected dummy variable regressions.

As the one-way MANCOVA design shows, effects of treatments - generative learning strategy prompts and generative learning strategy prompts with metacognitive feedback - were tested after controlling for learner's prior knowledge. Figure 1 presents the model used to examine the case with four latent dependent variables, three groups, and one covariate, adopting Kühnel's (1988) one-way MANOVA design and applying the LISREL notation (Jöreskog & Shörbom, 1984).

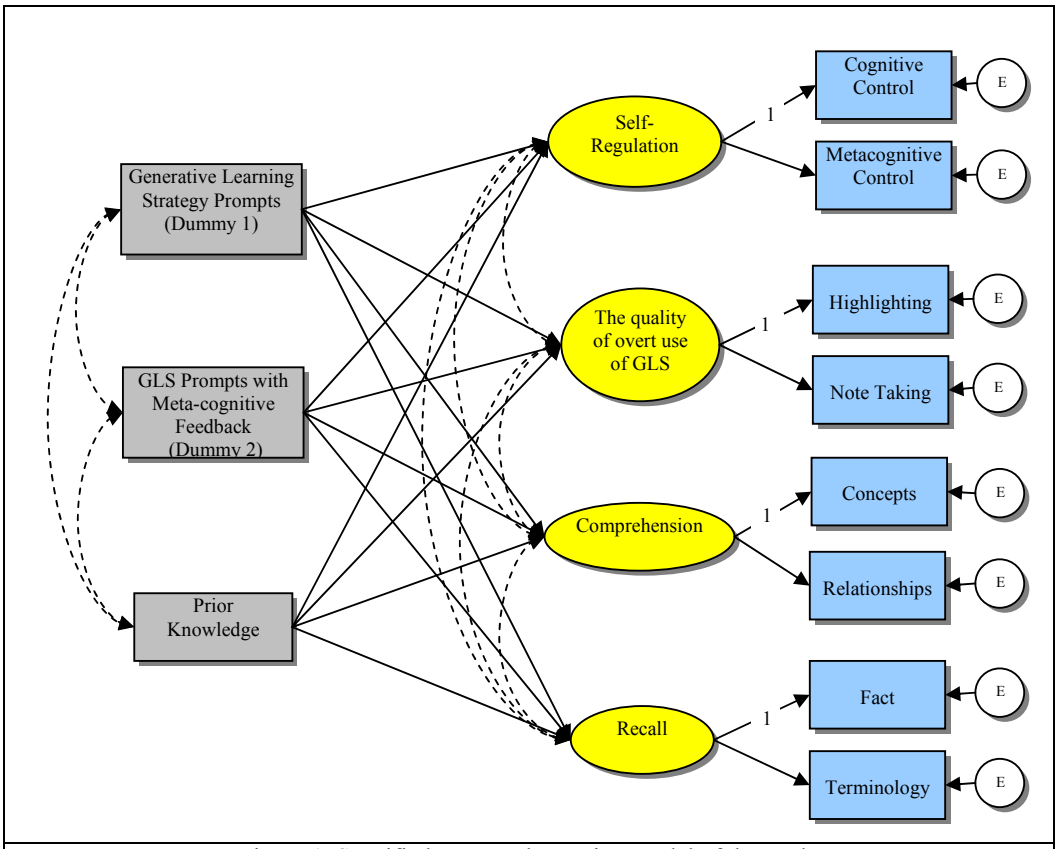


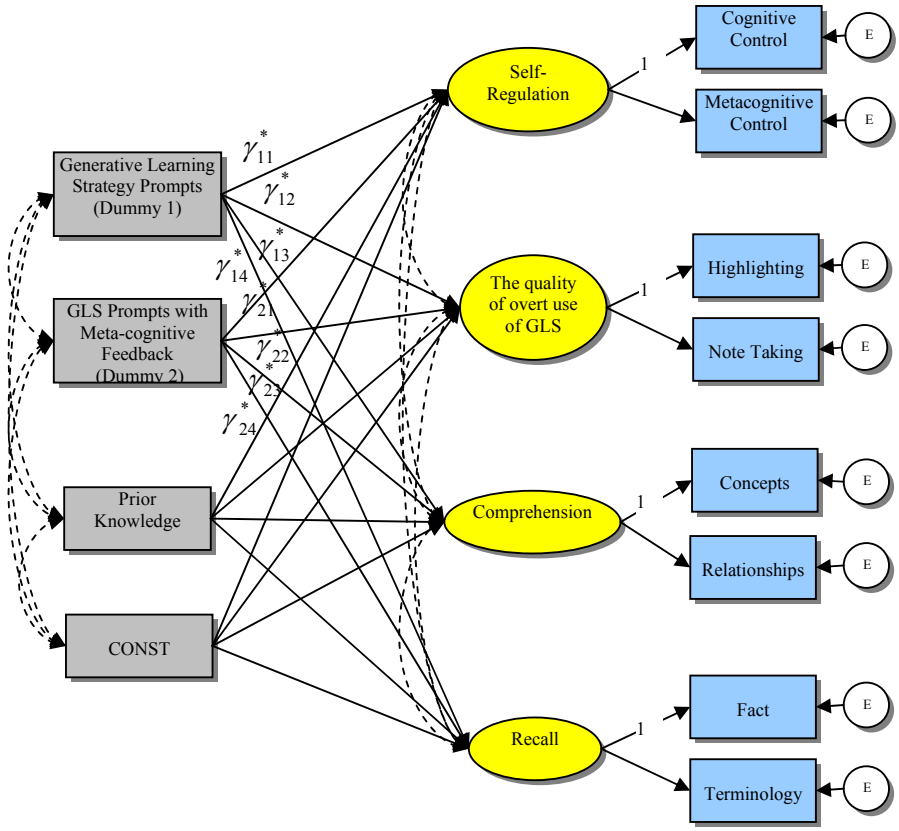
Figure 1. Specified structural equation model of the study

The two causal indicators in the structural model of Figure 1 are two dichotomies using the *group code* (*dummy code*) approach (Aiken, Stein, & Bentler, 1994). One dummy variable, Dummy 1 (g1), was coded as 1 = generative learning strategy prompts group (T2), or 0 = control group (T1) or the generative learning strategy prompts with metacognitive feedback group (T3). This dummy variable, g1, represents the comparison between the generative learning strategy prompts group (T2) and the control group (T1). Another dummy variable, Dummy 2 (g2), was coded as 1 = generative learning strategy prompts with metacognitive feedback group (T3), or 0 = control group (T1) or the generative learning strategy prompts group (T2). This dummy variable, g2, represents the comparison between the generative learning strategy prompts with metacognitive feedback group (T3) and the control group (T1). Table 1 shows this dummy code system.

Table 1. Dummy codes for the MIMIC model

Group	Dummy 1 (g1)	Dummy 2 (g2)
Control group (T1)	0	0
Generative learning strategy prompts group (T2)	1	0
Generative learning strategy prompts with metacognitive feedback group (T3)	0	1

In order to analyze the means of observed dependent variables as a function of the categorical independent variables, a pseudo-variable (i.e. "CONST") was added to the sample moment matrix as another variable, having 1 in the diagonal and the means of all other variables as off-diagonal elements constant ("CONST"). The initial structural model analyzed the means of the observed dependent variables as a function of the categorical independent variables (Bagozzi & Yi, 1989). By doing this (see Figure 2), the first set of regression coefficients, $\gamma^*_{11}, \gamma^*_{12}, \gamma^*_{13}$ and γ^*_{14}, were the differences in the means of four dependent latent variables between the generative learning strategy prompts group and the control group. In the same way, the second set of regression coefficients, $\gamma^*_{21}, \gamma^*_{22}, \gamma^*_{23}$ and γ^*_{24}, were the difference in the means of the four dependent latent variables between the generative learning strategy prompts with metacognitive feedback group and the control group.



Note. CONST = Pseudo-variable for Mean Structure.

Figure 2. Structural equation model specification of one-way MANCOVA with four latent dependent variables of multiple measures, three groups, and a covariate

Thus, an examination of the paths from the dummy exogenous variables to the dependent latent variables enabled testing of the multivariate null hypothesis: equality in means of the dependent variables across groups. This is analogous to the omnibus test commonly used in traditional MANCOVA analyses (e.g., the Pillai's Λ or Wilks' Λ). That is, if all regression coefficients from the dummy variables equal 0, then the null hypothesis - the means of dependent latent variables are equal across groups - is retained. In order to test the null hypothesis of equal means across groups, a chi-square difference test between a full model and the other restricted model (i.e., $\gamma^*_{11} =, \gamma^*_{12} =, \gamma^*_{13} =$ and $\gamma^*_{14} = 0$ and $\gamma^*_{21} =, \gamma^*_{22} =, \gamma^*_{23} =$, and $\gamma^*_{24} = 0$) can be conducted (Kaplan, 2000).

As an illustration, the chi-square statistics of the full model, allowing for the difference in means as specified in Figure 2, and the restricted model, constraining the mean difference parameters to zero, appear in Table 2. The Satorra-Bentler scaled chi-square difference test (chi-square (8) = 164.00; $p < .001$) suggests rejecting the null hypothesis of equal means, as predicted. That is, generative learning strategy prompts and metacognitive feedback significantly affected learners' self-regulation, use of learning strategies, and learning performance in one or more instances.

Table 2. Chi-square statistics of the structural model for one-way MANCOVA

	χ^2_{NT}	*p*-value	χ^2_{SB}	*p*-value	*df*
Full model	78.10	0.00	78.26	0.00	30
Restricted model	220.77	0.00	227.36	0.00	38

Note. χ^2_{NT}: Normal theory weighted least squares chi-square
χ^2_{SB}: Satorra-Bentler scaled chi-square

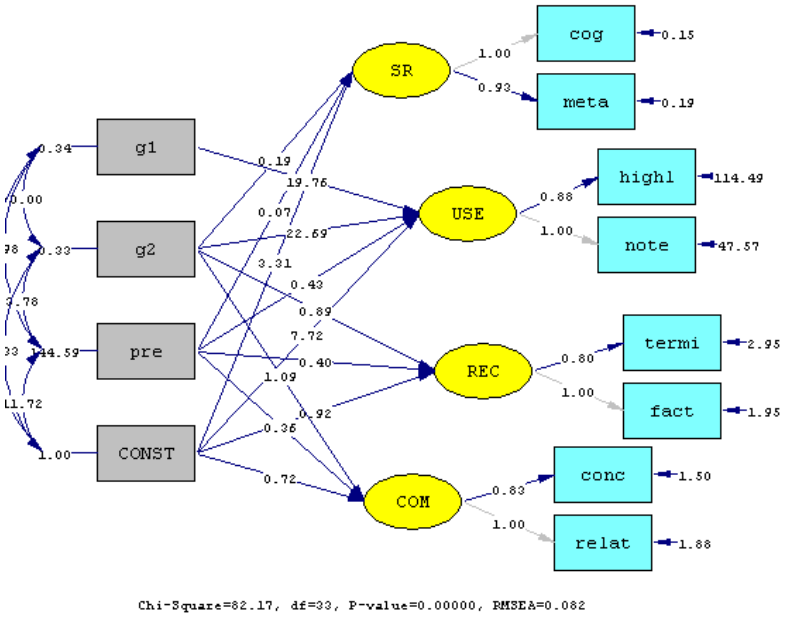
After rejecting the null hypothesis, a significant test of each regression coefficient linking the dummy variables to the dependent latent variables allows researchers to examine which group affected which criteria. This test is analogous to the univariate ANOVA analysis of the dependent variables, but holds other variables in the model constant. To examine the univariate effect of the treatments, the regression coefficients from the dummy variables to the latent variables were inspected. Table 3 presents the unstandardized regression coefficient, standard error, and t-value.

Table 3. Path coefficients, standard error, and t-value of treatments

Latent variable	Dummy 1 (g1): Control vs. generative learning strategy (GLS) prompts group		Dummy 2 (g2): Control vs. GLS prompts with metacognitive feedback group	
	Path coefficient	t-value	Path coefficient	t-value
Self-regulation	.12 (.14)	.87	.25 (.019)	1.97*
The quality of overt use of GLS	20.69 (1.40)	14.83*	23.15 (1.35)	17.09*
Recall	0.48 (.37)	1.31	1.14 (.37)	3.03*
Comprehension	0.66 (.38)	1.76	1.42 (.40)	3.52*

Note. Standard errors are in parenthesis
*: $p < .05$

According to the previous results, five significant paths were identified, linking treatments to four dependent variables, including from Dummy 1 (g1) to USE and from Dummy 2 (g2) to four dependent variables (see Figure 2). Conversely, three paths, linking Dummy 1 to self-regulation, recall, and comprehension, were not significant. Thus, these insignificant paths were removed and the modified structural model was estimated with only statistically significant paths, as recommended by Kline (2005) and Kaplan (2000) (see Figure 3). The modified model obtained a significant chi-square (χ2SB=82.17; df =33; p < .000), the CFI = .95, the RMSEA = .082, and the SRMR = .016. Although the chi-square was significant and RMSEA was slightly greater than the criteria (.06), other fit indices satisfied the criteria, suggesting acceptable model fit.



Note. g1: dummy code for T2 group, g2: dummy code for T3 group, pre: prior knowledge,
SR: self-regulation, cog: cognitive control, meta: metacognitive control,
USE: the quality of overt use of generative learning strategies, highl: highlighting, note: note taking,
REC: recall, fact: fact, termi: terminology,
COM: comprehension, conc: concept, relat: relationship

Figure 3. Structural model with significant paths

Alternative Model to Test Mediating Effects

After researchers confirm that groups differ on variables, they may want to know if those differences are directly affected by the interventions, or indirectly as a result of a causal ordering among variables. For example, the second research question of the study examined whether or not variation in learners' performance in recall and comprehension was due to a direct association with the treatments, its dependence on learners' self-regulation, or overt use of generative learning strategies. Thus, three paths, linking self-regulation to learners' use of generative learning strategies and learners' use of generative learning strategies to recall and comprehension, replaced the error covariance among them, as hypothesized (see Figure 4).

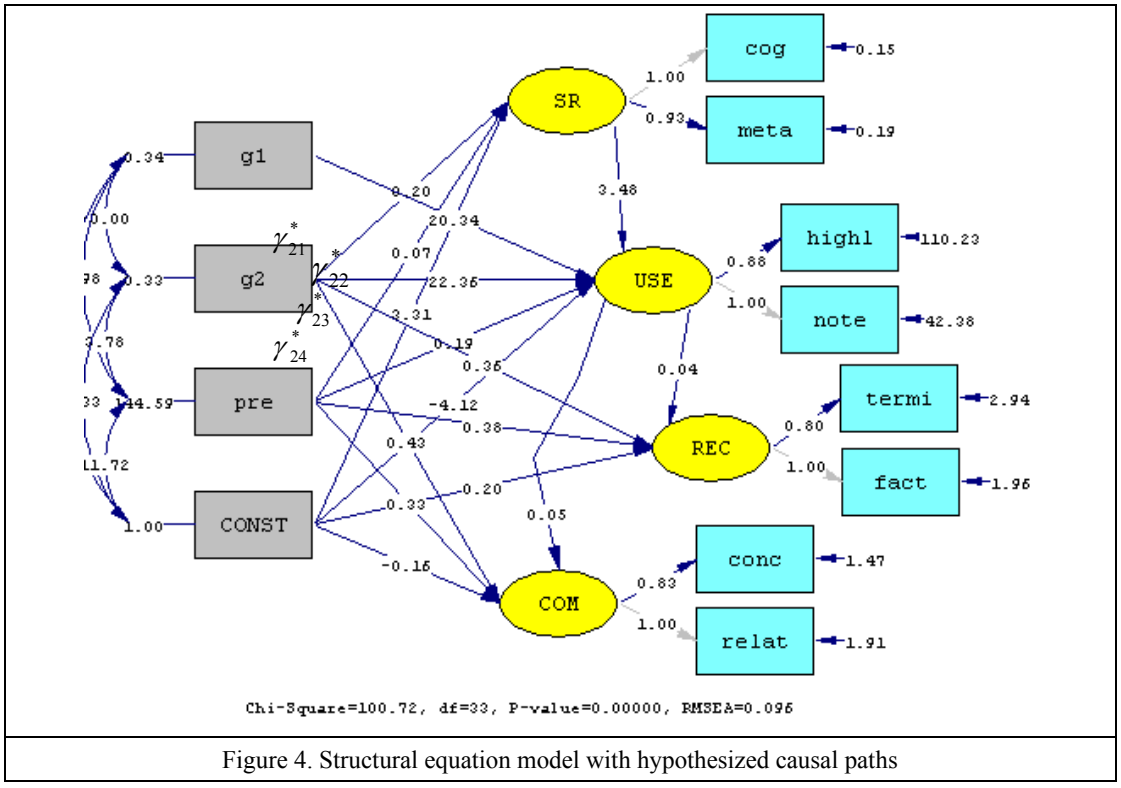


Figure 4. Structural equation model with hypothesized causal paths

To test the mediational hypothesis, the scaled chi-square difference between the model (see Figure 3), which includes the direct effects of generative learning strategy prompts with metacognitive feedback (g2) on recall and comprehension and the model which does not include these direct paths (i.e., $\gamma^*_{23} = \gamma^*_{24} = 0$), was tested. The chi-square statistics of these two models appear in Table 4.

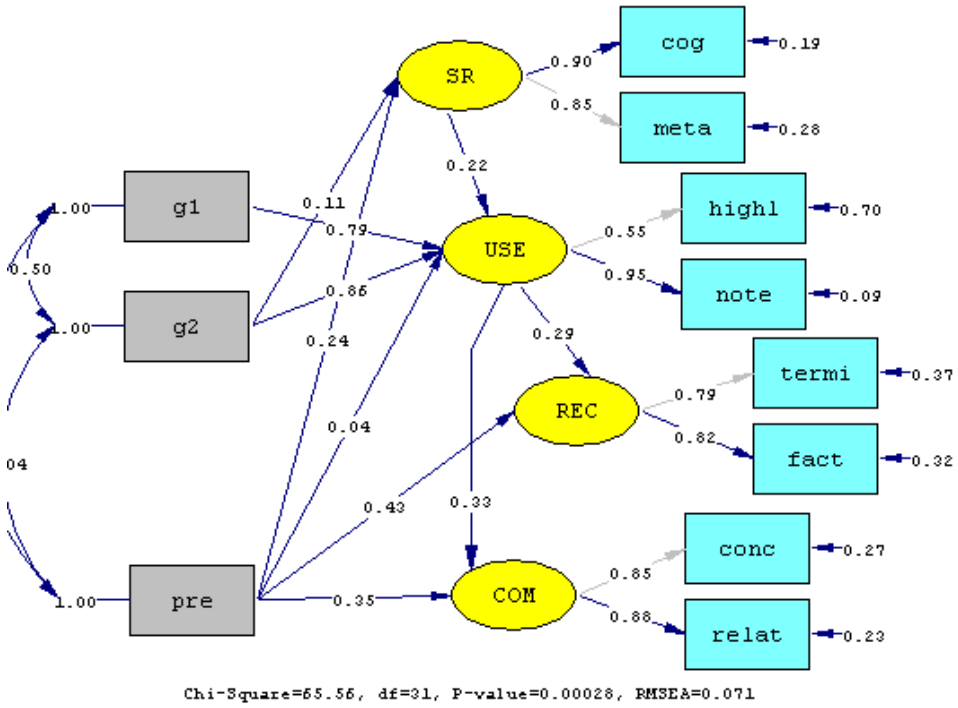
Table 4. Chi-square statistics of the structural model with causal paths

	χ^2_{NT}	*p*-value	χ^2_{SB}	*p*-value	*df*
Full model (Model 5)	101.72	0.00	100.72	0.00	33
Model with $\gamma^*_{23} = \gamma^*_{24} = 0$	102.69	0.00	101.62	0.00	35

Note. χ^2_{NT}: Normal theory weighted least squares chi-square
χ^2_{SB}: Satorra-Bentler scaled chi-square

The Satorra-Bentler scaled chi-square difference test (chi-square (2) = .95, p > .05) suggests that retaining the null hypothesis of the direct effects of generative learning strategy prompts metacognitive feedback on recall and comprehension, thus supporting the indirect effects of self-regulation and learners' use of generative learning strategies. That is, the improvement of learners, who received generative learning strategy prompts with metacogntive feedback over the control group learners on recall and comprehension, can be explained with the improvement of the quality of their overt use of generative learning strategies. Also, self-regulation had significant, indirect effects on recall and comprehension through the quality of overt use of generative learning

strategies, supporting the mediation effect of learners' self-regulation and their use of generative learning strategies. The final structural equation model of the study is shown in Figure 5.



Note. g1: dummy code for T2 group, g2: dummy code for T3 group, pre: prior knowledge,
SR: self-regulation, cog: cognitive control, meta: metacognitive control,
USE: the quality of overt use of generative learning strategies, highl: highlighting, note: note taking,
REC: recall, fact: fact, termi: terminology,
COM: comprehension, conc: concept, relat: relationship
Note. the disturbances between SR and REC, SR and COM, and REC and COM are correlated

Figure 5. Final structural equation model

DISCUSSION

The major goal of instructional systems or educational technology is to design learning environments, providing meaningful instructional interventions to help learners. Accordingly, examining the effectiveness of the instructional interventions is a prime concern of the research in this field (Koetting & Malisa, 2004). Conventionally, studies have used statistical techniques to test mean differences between groups, such as the t-test, analysis of variance (ANOVA), and analysis of covariance (ANCOVA), to determine the effects of interventions. However, as current technology-enriched learning environments and theoretical constructs involved in instructional design and development become more sophisticated and more complex, a need arises for equally sophisticated analytic methods to research these environments, theories, and models. This paper demonstrated a comprehensive statistical analysis, structural equation modeling (SEM), which is a methodology that combines factor analysis and path analysis (Bollen, 1989; Kline, 2005; Russell, Kahn, & Altmaier, 1998). This SEM approach can be used to answer the research questions, exploring how interventions affect learning and examining the indirect effect of related psychological constructs.

Although educational studies have used this SEM approach extensively, the majority has used this method for analyzing non-experimental survey data. The advantages of using SEM with experimental data over traditional MANOVA/MANCOVA analyses are: 1) estimating and removing both random and correlated measurement errors; and 2) examining mediating processes (Bagozzi & Yi, 1989; Kahn & Altmaier, 1998). First, the traditional MANOVA/MANCOVA analysis assumes that dependent variables have no measurement errors. Ignoring the measurement errors of dependent variables increases the chances of making Type II errors, whereas SEM uses latent variables, which allows estimation and corrects the measurement errors. As a result, the latent variable SEM approach estimates the experimental intervention effects more accurately than traditional methods (Kahn & Altmaier, 1998). Second, as this study formulated, SEM can test factors that hypothesize the mediation

treatment effects on the dependent variables. This allows the uncovering of underlying processes of treatment influences. Obviously, the traditional approach has been successful in finding the effectiveness of interventions, but not in understanding how the interventions are effective. Analyses of the processes underlying a treatment might allow researchers to design more effective instructional treatments by refining the treatments to focus on processes that are positively related to treatment outcome (Kahn & Altmaier, 1998).

However, two important issues need to be addressed before applying this alternative procedure. First, a path analysis in SEM involves the estimation of causal relations among variables with correlational data. However, correlation does not imply causation, thereby not enabling statistical causal modeling to prove causation either. Inferring causation from correlation requires a solid theoretical base and careful specification of variables and predictive directions. For example, this study hypothesized that learners' self-regulation would cause improved overt use of generative learning strategies with theoretical basis; the final model (see Figure 4) supported this hypothesis. However, an alternative hypothesis that predicts effects from the opposite direction (i.e. from learners' overt use of generative learning strategies to learners' self-regulation) is a possible equivalent model. This alternative model obtained worse model fit indices (χ^2_{SB}=72.06; *df* =31; p=.000; CFI = .97; RMSEA =.077; and SRMR =.043) than the final model. Thus, the direction from learners' self-regulation to learners' overt use of generative learning strategies was supported by the model, but caution is still advised; SEM itself does not prove any causal relationships.

Second, an SEM analysis with latent variables needs more than 200 cases to produce accurate estimates (Kline, 2005). Also, researchers should consider the number of parameters being estimated as well as sample size. Bentler and Chou (1988) suggested that the ratio of participants to parameters should be at least 5:1 for appropriate estimation. Obtaining the appropriate number of research participants can often be challenging for educational researchers.

Cognitive functioning and processes related to learning are intricate and human learning involves various psychological constructs. Theoretical advances for understanding human cognition and learning processes require the consideration of more psychological constructs when designing learning environments. In addition, technological advances allows educators to infuse more technologies into learning environments, but testing mean differences cannot explain the effectiveness of these innovations; underlying mediating processes are more responsible for the desired outcomes.

Therefore, researchers in the field of instructional systems and educational technology are encouraged to assess learners' interaction with instructional interventions in technology-enriched environments. Current technologies permit developing user-oriented Web instructions that allow users to manipulate Web pages and record all learners' activities during their interactions, such as times of visits and revisions of notes. In this way, future investigations might reveal how learners interact with instructional interventions and how these interactions affect their learning. Thus, incorporating structural equation modeling for the analyses of experimental investigation is recommended. This method informs instructional designers about the direct and indirect effects of instructional interventions, and how intervening psychological constructs affect learning, rather than focusing only on the direct effects. Accordingly, this method enables instructional designers to identify problems in the treatment mechanisms and implement appropriate treatment.

CONCLUSION

The latent variable structural equation modeling approach has a major advantage over traditional analyses in that the comprehensive approach allows for a close examination of the mediating processes responsible for the observed outcomes. The traditional approach has been successful in finding the effectiveness of interventions, but not in understanding why the interventions were successful. Analyses of the processes underlying an intervention may allow researchers to design more effective instructional treatments by refining the intervention to focus on processes that are positively related to treatment outcome.

In addition, the SEM approach using latent variable modeling procedures allows for the estimation of both random and correlated measurement errors. As a result, the SEM approach provides more accurate estimates of the effects of experimental interventions than traditional approaches that ignore measurement errors of dependent variables that increase the chance of making Type II errors. Even though this alternative approach requires a larger sample size than the traditional approach, researchers in the field of educational technology are encouraged to incorporate this method into their analyses of experimental investigation, since this method allows them to analyze more sophisticated and advanced future learning environments.

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AN INTERACTIVE ATTENTION BOARD: IMPROVING THE ATTENTION OF INDIVIDUALS WITH AUTISM AND MENTAL RETARDATION

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ABSTRACT
This paper presents a tool named "Interactive Attention Board" (IAB) and an associated software named "Interactive Attention Boards Software" (IABS) for individuals with Mental Retardation and Autism. The proposed system is based on several theories such as perception and learning theories, and it is intended to improve hand-eye coordination and attention duration of disabled individuals. Furthermore, the IAB system offers an interactive environment both for disabled individuals and educators, and enables a rapid improvement of disabled individuals' responses to various stimulants, and increases attention duration on a certain object. IAB aims to decrease disabled individuals' reaction time to stimulants, and to increase total concentration and attention period on a single object. Thus, these improvements in the attention help the educator to teach individuals about various cognitive concepts such as long, short, small, big, and colors, as well as educational concepts such as animals, vehicles and professions.
Keywords: interactive learning environments; teaching/learning strategies; human-computer interface; computer aided learning

1. INTRODUCTION

Interactive Attention Board (IAB) is an interactive visual and auditory education material which is basically intended to improve hand-eye coordination, increase attention duration, and decrease reaction time. IAB is intended to remedy the deficiency of current educational materials used to augment the hand-eye coordination of individuals with certain disabilities, namely Attention Deficit Disorders/ Attention Deficit Hyperactivity Disorder (ADD/ADHD), particularly Mental Retardation (MR) and Autism. IAB development has been highly motivated by a disabled individual who is referred to by the alias 'BoyXY' to protect his privacy.

BoyXY is a person with severe mental retardation who can understand simple sentences, but whose verbal communication is limited to a very small number of words and sounds. He enjoys physical activity and social communications, and he can express himself using body language. However, his concept of communication is mainly limited to hitting and hugging others, throwing objects, touching the other's genital organs, and rushing to other's ears. In fact, this kind of behavior is attention-seeking to gain the attention of others (he simply wants them to perceive his attraction). Because of his preference for stimulus/response for communication, BoyXY is extremely interested in the IAB.

The main purpose of the study is to develop a new tool according to BoyXY's educational requirements and so disabled individuals. At the early stages of the study, BoyXY's educational development was very slow, because his perception was very problematic and his attention period on a certain subject was too short. In addition, he was interested in only a number of activities and he was worried quickly. Since the learning process would be satisfied if attention during certain time of period on a subject which is desired to learn is satisfied, several objects and subjects that BoyXY is interested in for long periods have observed. Main activities and games in IABS were inspired by activities which excites BoyXY and which are likely take BoyXY's interests.

Furthermore, BoyXY was an inspiration individual for the study, and the study developed according to many different disabled individuals who have attention problem. Finally, the tool proposed in this paper aims to improve attention period on a certain subject, hence, to augment the educational development.

2. LITERATURE REVIEW AND MOTIVATION

Many different aspects of hand-eye coordination has been studied over the years including assessing the attention period, increasing the reaction speed, understanding the relationship between reaction and visual

stimulus. In addition, there are various researches on attention deficit disorders (ADD) and attention deficit hyperactivity disorders (ADHD). ADD/ADHD is a neurobehavioral disorder that interferes with a person's ability to stay on a task and to exercise age-appropriate inhibition (cognitive alone or both cognitive and behavioral). Several symptoms of it can be listed as: failure to listen to instructions, fidgeting with hands and feet, leaving projects and having trouble paying attention to and responding to details (NINDS, 2007). While a number of the studies have attempted to understand the common causes of ADD-ADHD and to find a way to decrease ADD-ADHD in children and adults, others have focused on developing treatment tools. This section reviews the literature regarding hand-eye coordination, ADD, ADHD and technology tools developed to improve hand-eye coordination and to treat ADD-ADHD.

Much research into ADD and its effects on the human life has been conducted, and the critical importance of ADD and ADHD has been perceived in education, particularly in special and primary education. A recent study has attempted to explore the characteristics of children who sustained injuries as a result of having ADD-ADHD (Badger et al, 2008). They set out to identify and understand the risk factors of injuries, and they searched for ways to educate individuals to protect a repetition of injuries. In a recent paper investigating the role of mind wondering, Smallwood et al (2008) emphasize the human cost of absent mindedness, concluding that "Successful learning requires that individuals integrate information from the external environment with their own internal representations". In their article, they investigate the role of mind wandering play in education.

For many years, ADD and ADHD studies have tried to find a way to reduce ADD/ADHD effects on children and adolescents emphasizing the significance of this problem. ADD and ADHD are severe problems for disabled individuals as well as other children and adults because a number of the multi-disabilities can be masked by ADD and ADHD. Our claim in this research: in order to rehabilitate individuals with multi-disabilities, including ADD/ADHD, it is necessary firstly to deal with ADD/ADHD. In literature, there are a number of studies looking at different aspects of ADD/ADHD, including: economical impact, primary treatment, measurement of attention and related functions, special education policy and practice, time reproduction, working memory, and behavioral inhibition in children, as well as a case study of a 9 years old Latino boy (Pelham et al, 2007; Dupaul et al, 2007; Culpepper, 2006; Mahone, 2005; Prosser and Reid, 2009; Kerns et al, 2001).

In an article, Batista et al (1999) explained that the neural activities regarding visually guided reaching begin with an image on the retina and end with impulses to the muscles. A plan for reaching is constructed at some point during this process. They assumed that this plan is made during the time of the coordinates of the arm, the specifying direction and amplitude of the movement, or in the coordinates of the eye because visual information is initially gathered in this reference frame.

Harris and Wolpert (1998) presented an integrated theory of eye and arm movements, they assumed the neural control signals are corrupted by noise whose variance increases with the size of the control signal. Next, they propose the variance of final eye and arm position depends on the presence of noise in neural control signals. Fischer and Weber (1993) investigated the reaction time of men and monkeys, combining previous research's "special emphasis on the express saccade" with experimental evidence in an oculomotor to improve their understanding of the coordination of vision, visual attention, and the eye movements. Finally, they proposed a neural network structure that was able to function as a basis for a mathematical model or computer simulations of the optomotor system in primates. The main concern of these articles was strong relation of saccade reaction and hand-eye coordination with brain activity. Another study concludes that there is an anatomical relationship between the parietal and the frontal cortex in hand-eye coordination during reaching movements (Marconi et al, 2001).

Another piece of research entitled "From eye to hand: Planning goal-directed movements" by Desmurget et al (1998) emphasized the lack of understanding of the nature of the neural mechanism required in movement planning. In this study, the target localization, definition of the initial state of the motor apparatus, and hand trajectory formation were identified as main tasks that the nervous system needs to manage. In addition, they addressed a number of issues regarding the main tasks before finally suggesting that the central nervous system was able to use different strategies both to encode the target location with respect to the body and to plan hand displacement. In their study, Johansson et al (2001) analyzed the coordination between gaze behavior, fingertip movements, and movements of the manipulated object in a target-switch pressing exercise. They conclude that they made a decision on that gaze supports hand movement planning by marking key positions to which fingertips or grasped object are subsequently directed.

Vercher et al (1994) studied the execution of an accurate pointing response, investigating the dependency of this response: whether it depends on a prior saccade orientation towards the target or is independent of the view of

the limb. The resultant saccadic eye fixations are quite perceptive behavior understanding much more things about the cognitive mechanism which guide them (Ballard et al, 1992). In the literature, there are numerous recent studies focusing on the examination saccadic responses, interaction with objects, gaze influencing finger movement and visual activations, parietal reach activity, gaze behavior in reaching to remembered targets, sensorimotor accounts of drawing, performance errors and vigilance level, hand-eye coordination of elderly people, arm movement and saccade metrics, and retinal image location of hand (Pratt and Neggers, 2008; Yoshida and Smith, 2008; Bedard et al, 2008; Buneo, 2008; Flanagan et al, 2008; Cagli et al, 2008; Dorokhov et al, 2008; Pei et al, 2008; Kattoulas et al, 2008; Timberlake et al, 2008).

Our study has been based on BoyXY's educational requirements and the idea "when a peripheral visual stimulus is briefly presented in an empty surround, and an observer is required, after a delay of a few seconds, to point toward the remembered location of that target, the responses are strongly influenced by eye orientation at the time of pointing" (Enright, 1995). This present study aims to develop a new tool (combination several hardware tools) and related software with the assistance of emergent technologies improve attention and hand-eye coordination.

A number of materials and tools which are used to improve hand-eye coordination and visual attention have long been in use and some examples can be found in Table 1. The materials and tools listed in the table have several advantages such as ease of manipulation by educators, low cost, high availability, and low maintenance because they are not dependent on emergent technologies. However, with the exception of computer games, most are not interactive, the interaction is supplied by trainer or educator. In addition, many of them are not developed for individuals who need special education. Moreover, computer games developed to improve hand-eye coordination require ability to use mouse or keyboard, and therefore are usually unsuitable for special education because many of disabled individuals lack the capacity to use these kinds of computer peripherals.

Table 1. Some existing materials and tools being currently used to improve visual attention, hand-eye coordination

Material/Tool	Goal
Visual education attention card sets	Improve visual attention
Simple pictures with compositions	Improve visual attention
Paper work with geometric figures	Improve visual attention, Improve memory
Tread and color beads	Improve visual attention, Hand-eye coordination Activation attention
Short and simple texts	Improve auditory attention
Balloons	Improve visual attention, Hand-eye coordination Improve concentration
Memory cards	Improve visual attention, Improve memory
Nail Legos and grid	Improve visual attention, Hand-eye coordination
Animal voices and cards	Improve auditory attention, Improve memory
Nail board	Hand-eye coordination
Roly-poly rope	Hand-eye coordination, Improve attention in fine-motor activities
Puzzles	Improve visual attention, Hand-eye coordination
Sudoku (with images) easy to hard	Improve visual attention, Hand-eye coordination
Line drawing activities	Hand-eye coordination
Pattern completion	Improve visual attention, Hand-eye coordination
Neural-Feedback applications	Improve visual attention, Improve concentration
Computer games (complicated)	Improve visual attention, Hand-eye coordination
Computer games (simple)	Improve visual attention, Hand-eye coordination

Numerous ADD/ADHD treatment and assessment methods developed for both academics and commercial purposes have long also been in use. These methods offer various approaches to remedy ADD/ADHD problems, such as stimulant medications techniques, worksheets and programs, educational software, generic strategy developments, reading-writing exercises, reminders, electronic agendas (Newideas, 2009; MyAdhd, 2009; Lund & Lund, 2008; Parker, 2009; Addcoach, 2009; Teach ADHD, 2009; Miranda et al, 2002; Rabiner & Coie, 2000; Reid & Lienemann, 2006; Baker et al, 2003; Northup & Gulley, 2001; Sahin, 2006). Although almost all of the reviewed studies have attempted to treat ADD/ADHD, none of them offers an interactive improvement tool for individuals with disabilities, particularly individuals with MR or Autism.

This paper explains the development of an Interactive Attention Board (IAB), drawing on previous research and theoretical work. IAB can be effective in improving visual attention and hand-eye coordination for individuals with disabilities especially mental retardation and autism. Since the IAB is a complementary tool for non-interactive educational materials in special needs education, the basic principle of IAB is to improve quality of training using technological equipment and computers. Because IABS has been developed in computer environment, as well as supporting interactivity the computer software facilities can be used for many additional purposes such as storing individuals' information, training data, and trends. Moreover, IABS also enables comparison of previous training data with current results, therefore, creating the opportunity to assess and evaluate individuals' improvements over time.

The human brain has a strong tendency to organize different stimulants as objects which contrast with a certain background. There are a number of important factors to identify what can be perceived such as attention, preparatory set, motivation, sensory depravation and learning. In addition, factors which affect perception can be divided into two main categories: the features of the stimulus and of individual who perceives (perceiver). The first factor which can affect perceptional selection is change in stimulus (used by many advertising company to increase advertising effectiveness), other factors include repetition, size intensity. In the aspect of individual, expectations, interests, needs, beliefs and individual values are other factors which can affect perception (Cuceloglu, 1991:122; Morgan and King, 1971; Morgan, 1995). Factors which affect the perception are illustrated in Figure 1. These all factors and theories were taken into account during IAB system specification and design.

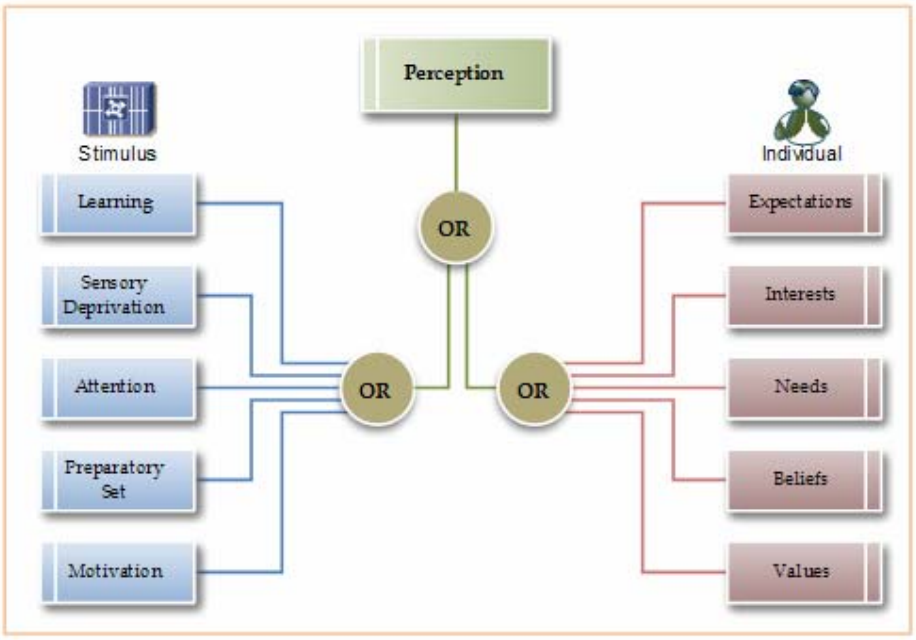

Figure 1. Factors that can affect the perception

3. INTERACTIVE ATTENTION BOARD (IAB)

Basically, IAB system is a very simplified interactive tool which can be used to improve attention duration. The main features of IAB simply are:

1. It provides very simple user interfaces especially for disabled individuals, and it has no complicated data presentations.
2. Rewards of the IAB in case of achievement of a certain task can be selectable by teachers, thus the teachers have a chance to select most appropriate digitized rewards (voice, picture, animation etc.) from their repository (previously used or new) for each individual.
3. Each individual can be monitored distinctly.
4. Since all the responses (wrong, correct, omitted) are stored in database separately, in case of any request they can be easily used for statistical analysis or tracking the individuals' improvement.
5. No training is required for individuals (training is required for teacher).
6. Because of its adaptability, portability and simple structure, it can easily be reproduced using any of computer programming language on various hardware devices.

7. Because of the system's compact and flexible design, new features can easily be added such as digital version of existing materials presented in table 1.

Moreover, IAB is based on various theories about factors that can affect perception, such as attention theory, intensity and size, contrast, repetition, and movement of stimulus and objects. IAB consists of target and reward stimulant figures, videos and pictures, various animations, educational features enhanced with database applications to assess individuals' improvements. Although IAB has been developed for use in special education, especially for individuals with severe and moderate mental retardation, and autism, it can also be used to improve hand-eye coordination and auditory reactions of kids and individuals with mild mental retardation and ADD/ADHD. Furthermore, it can be an effective alternative to conventional class materials in childhood education.

In ADD/ADHD therapies, various types of trainings activities are used, such as perceiving the details of objects or environment, remembering previous works, aligning objects and subjects, increasing reaction speed through games, and finding the appropriate reinforcement and using them in the relevant place and time. However, there are not too much training policies or standards or materials for target group in special education. We believe that IAB can be a complementary tool to existing training activities to improve attentions of individuals with autism and MR.

3.1. Interactive attention board software (IABS)

Figure 2 shows the use-case diagram of Interactive Attention Board Software (IABS). IABS consists of 5 main use-cases:

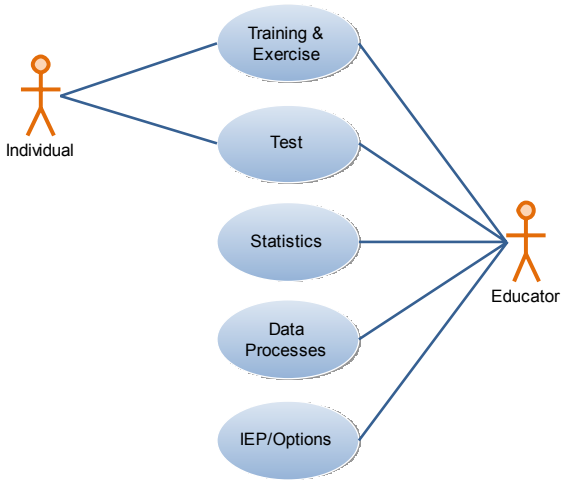

Figure 2. IABS use-case diagram

a. Training/Exercise

In this case, many different attention-exercising tests are applied to prepare the individual for each test stage. The details of this exercising will be given in the operational details section.

b. Test

The real test environment is established for the assessment and education of individuals, and all data gathered from an individual's test are recorded.

c. Statistics

In the statistics case, the individuals' test results are compared, individuals' improvements or regressions are shown graphically, and reported.

d. Data Processes

In data processes unit, database operations are managed.

e. Individual Education Plan (IEP)/Options

In this section, personal information of individual and educator are manipulated. Moreover, the special personal requirements and identifiers of individuals (trainees) are also recorded such as rewards, appropriate colors, sounds, etc. In addition, the Individual Education Plans (Goals, objectives, behaviors) are also identified in this section.

3.2. Operational Details of IAB

The educator (trainer) and special needs student (trainee) sit together in front of a LCD screen with a touch screen feature. Figure 3 demonstrates the IAB system illustration,

Figure 3. An illustration of a training session of IAB

In the first execution of IABS, the educator should record the individual personal information and set up options related to the disabled individual such as, age, diagnosis, training type, goals. After choosing these initial settings, IABS is ready for training sessions.

3.3. Training/Exercising and Test

3.3.1. For Disabled Individuals with Moderate and Light Mental Retardation

The scenario used for both exercising and testing is illustrated in Figure 4. This scenario is based to perception theory. Firstly, the screen is filled with blurred and mat colored object (size, color and blur level of object vary in accordance with the individuals' options identified by educator as individual personal requirements in IEP/Option section, in this scenario a rectangle was used, however other objects can be used and sample object can be seen in Figure 5), and educator starts the exercise. Next, a rectangle is flood filled with bright red, and then active stimulus starts to move, leaving gradient trace on rectangles at a speed of 10 rectangles/second. After each 10-15 rectangles are activated and traced (the number of rectangles depend on size of the screen), the active stimulus direction is changed to up or down. After 3-4 seconds, the active stimulus stops, and starts to blink until the individual touches it. This process is intended to attract the individual's attention according to perception theory. The educator asks the individual to touch the active stimulus, and assist physically individual to touch the object if necessary. When the individual touches the active stimulus, the object fits to screen (fill the whole screen), and a reward (both visual and auditory) stimulus appears on the screen for 5 seconds. For every target stimulus touch, a different reward stimulus or sequence of rewards should appear. According to an individual's characteristics different kinds of reward stimulus can be identified by educator, such as a picture of the individual's mother, favorite toy, item of the clothing, or a cartoon character. Sample reward stimuli can be found in Figure 6.

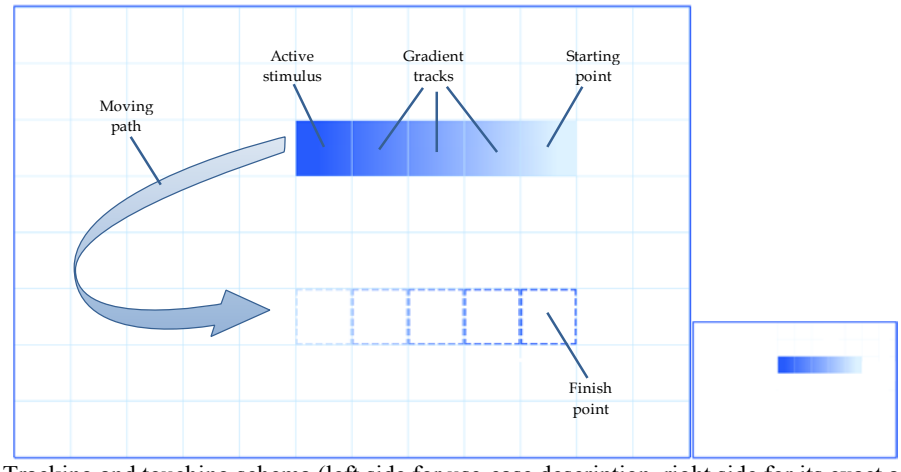

Figure 4. Tracking and touching schema (left side for use-case description, right side for its exact appearance)

Figure 5. Sample active stimulus objects, these objects can also be used as rewards

Figure 6. Sample rewards which can be used to promote individuals

After a reward stimulus disappears, the active stimulus reappears within 0.5 second, and the training continues. If the individual touches a wrong point while training, the active stimulus disappears for five seconds before reappearing. After a number of exercises on the same stimulus, the educator relinquishes the physical assistance, and only indicates the stimulus, and asks the individual to touch it. After a while, only verbal assistance is given by the educator. This period continues until the individual touches the active stimulus independently. When independent attention is achieved on the stimulus, the educator asks the individual to touch the stimulus (such as a game or a competition environment) as fast as possible to improve reaction time to the stimulus.

After exercising on the initial training, the test stage is able to be applied. In the test case, the educator and individual sit front of the LCD as well as exercising mode, and test is started. At the beginning, the educator reminds the individual to touch the correct stimulus (active stimulus) immediately when it appears or stops (it depends on the test type). The educator does neither assist the individual physically nor verbally during the 60 tests. In the first ten, the stimulus blinks for five seconds, in the second, for four seconds and so on. During the test study, all the data about the individual, such as reaction time and wrong/correct touches, are recorded (This test data will be compared to next test data).

3.3.2. For Disabled Individuals with Profound and Severe Mental Retardation

In the case of testing an individual with profound and severe mental retardation, the exercising and testing should be simplified. In the first stage, a bright red rectangle fills the whole screen and blinks slightly. A touch at any location on the screen in five seconds is to be rewarded. In the early stages of this training, the educator acts as model (showing how a touch can be made) and shows before asking the individual to touch the screen. If the trainee shows no willingness, the educator assists the individual with verbal, visual or physical assistance. This process is applied five times.

In the next stage, the size of the rectangle is reduced to 1/4 of the screen size and continues blinking. Figure 7 demonstrates this scenario. Any touch at any red region on the screen is rewarded for 5 seconds. Meanwhile, the rewards in this training can also be selected from previously identified rewards meaningful to the individual. If the individual shows no willingness, the educator assists the individual with verbal, visual or physical assistance, as in the first stage. In this stage, the individual performs this application five times. In the third, the similar procedure is applied five times but with a reduced rectangle (1/8 of the screen) and the same assistance is given at this stage.

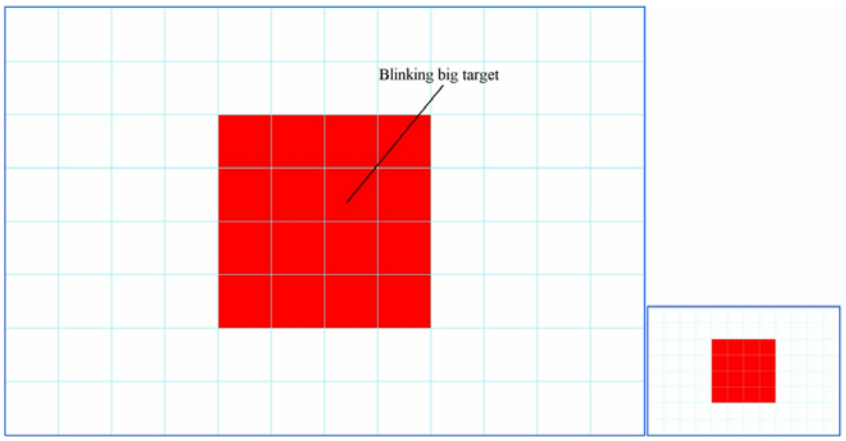

Figure 7. Perceiving and touching schema (left side for use-case description, right side for its exact appearance)

In the test stage, the educator and the trainee are front of the screen which is divided into two different colored rectangles, each 1/16 the size of the screen, white for the educator and red for the trainee (colors can be changed if necessary), however none of them appears initially. Firstly, the white rectangle appears for the educator who touches the target stimulus in the educator side causing the rectangle to expand to the whole screen flash, and then a reward object appears for five seconds. Second, the rectangle in the individual's side appears as a target stimulus. When the individual touches the stimulus on the screen, the red rectangle expands until it eventually fills whole screen and flashes, and then a reward object appears for five seconds. This application is repeated until the individual perceives the stimulus. When the trainee's achievement in perception is quite satisfied, previously divided screen is integrated and the whole screen is left to the individual.

During all exercises and testing studies, the educator encourages the individual with certain words such as "Look at, there is a light here, and I touch that light. Ooooo, do you see what a beautiful object", "Yes it is your turn, the red light, come on catch it immediately" etc.

Many other test types provided by the IABS, such as testing for touching single stimulus, tracking stimulus, moving stimulus, touching dual stimulus with both hands etc. IABS also offers some additional tools for explaining certain concepts:
-Space set (The Sun, The Earth, Moon, Comets, Planets, etc)
-Wild animals set (Lion, Bear, Elephant, Snake, etc)
-Aves set (Eagle, Hawk, Chicken, etc)
-Marina animals set (Whale, Dolphin, Penguin, Fishes, etc)
-Dino set (T-Rex, Brontosaurus, etc)
-Profession set (Lawyer, Doctor, Teacher, Engineer, etc)
-Vehicle set (Bicycle, Motorcycle, Automobile, Truck, etc)

3.4. Data Gathered During Test and Assessment

A number of data is gathered from the tests to be used for assessing the improvement of the individual, and recorded in a form of individual tuple on the database. Table 2 shows the tuple structure for a single training.

Table 2. Individual training data structure

Data	Description	Unit
Individual_Id	Individual who oversees the test	String[11]
Test_Id	Test type which is applied	Integer
Test_Scenario	Test style which is chosen from the options	Integer
Test_No	Test number in the test period	Integer
Response_Type	How the individual's responded the stimulus	[Omitted/Correct/Wrong]
Response_Time	Individual's reaction time	m-second
Date/Time	Time of training	Date-time

In the table, Test_Scenario field is used to identify the test style which can be identified in options according to individual's special needs and includes features, such as reward type, object type and colors. This is very useful for determining the optimum conditions for test environment for the individual's comfort and convenience.

The data listed in Table 2 and 3 are obtained and stored during individuals' trainings, and they are used to create reports about individuals' training session by session, percentage of improvement on attention etc. Using each individual' training data, a number of statistics can be generated for several features, such as assessment and evaluation of an individuals' improvement. Moreover, the data listed in Table 3, IABS enables current statistical results to compare with previously computed results.

Table 3. A number of statistics which can be generated by IABS

Statistic Type	Unit
Which test is trained by the individual	String
Total number of the wrong responses (touching wrong locations)	Integer
Total number of the correct responses (touching correct locations)	Integer
Total number of the omissions (non-response)	Integer
Total number of the correct responses (with physical/verbal/visual assistance)*	Integer
Total number of the correct responses (independent) *	Integer
Average reaction (response) time for wrong responses	msec
Average reaction (response) time for correct responses	msec
The fastest reaction (response) time for wrong responses	msec
The slowest reaction (response) time for wrong responses	msec
The fastest reaction (response) time for correct responses	msec
The slowest reaction (response) time for correct responses	msec
Average achievement (percentage of perceiving the stimulus)	%

* optional

Using these data, individuals' improvements can also be illustrated in form of several graphics which can be used to assess and evaluate the individual's current status. As well as individual level, this data can assess groups of individuals having similar disabilities. Although it is unlikely that two individuals would have exactly the same type and level of disability, statistical data for ADD/ADHD may be able to provide interesting comparative trends using these data.

4. BOYXY: A CASE STUDY

BoyXY has completed 11 training sessions with IABS. The first session was in exercise mode, remaining sessions were test studies. Each session includes 60 independent tests (trainings) and takes approximately 15 minutes. After each session of IABS, BoyXY returned to his normal education, which is identified by an individual education plan. In addition, no assistance was given to BoyXY except in the first session, he has, therefore, completed 10 sessions independently.

The teacher's expectation for improvements of BoyXY's attention and results giving BoyXY's continuous attention durations for several different types of activities, before and after 660 IABS trainings in 11 sessions are shown Table 4.

Table 4. BoyXY's continuous attention durations on several activities before and after 660 trainings with IAB and teacher's expectations

Continuous attention required activity	CAD* (minute) Before	CAD* (minute) After	Total Improvement	Teacher Expectation (face to face)	Improvement (Contribution of IAB)
Books with illustrations	3	5	67%	33%	34%
Books with illustrations	5	7	40%	20%	20%
Books with music	5	8	60%	50%	10%
Puppets	2	6	200%	100%	100%
Computer game**	30	22	-27%	15%	-42%
Listening to the educator	6	7	17%	15%	2%
Painting	6	7	17%	15%	2%
Chatting with the educator	2	3	50%	50%	0%

*CAD (Continuous attention duration)
**In this activity, sometimes the educator is required to hug and kiss BoyXY for 1-2 seconds
***In this activity, the educator is rarely required to warn BoyXY

Figure 8, Figure 9 and Figure 10 show BoyXY response types, response (reaction) times and fastest and slowest responses to the stimuli respectively during 11 sessions (totally 660 trainings).

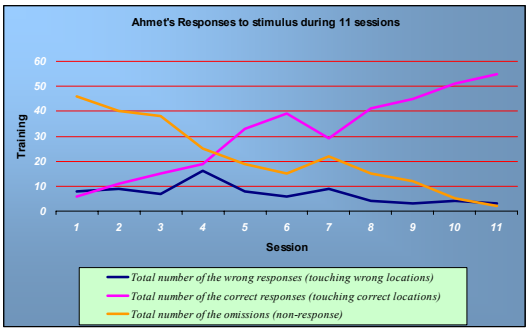

Figure 8. BoyXY's responses to the stimuli during his training

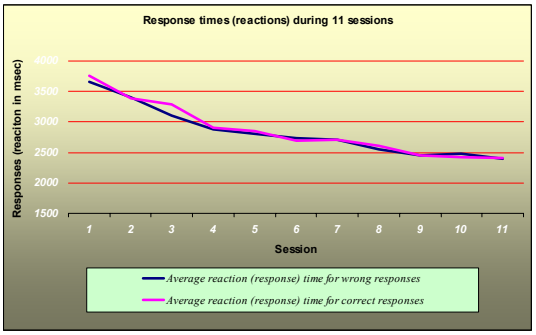

Figure 9. BoyXY's responses times to the stimuli

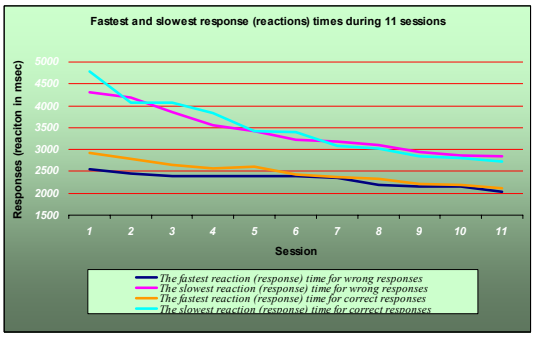

Figure 10. BoyXY's fastest and slowest responses to the stimuli

Table 4 shows certain improvements of BoyXY's attention duration in a number of activities. As a result, the effect of IAB is reasonable, however, his attention period decreased in computer games. Possible reason for this decrease may be the changes in BoyXY's expectations from the computer, and we think that BoyXY still expects a reward to appear on the computer screen. Since, IAB training is supported by face to face (F2F) training (typical training), improvements of BoyXY's attention are results of IAB and F2F trainings together. In addition, the educator notified that "IAB has assisted to increase BoyXY's attention duration, hence level of improvement was reasonable and it made BoyXY have fun". Moreover, Figure 8 shows that he achieved a remarkable improvement on correct stimulus perception, and Figures 9 and 10 demonstrate the improvements in his response times to the correct stimuli objects. In addition, his IEP trainers informed that they have observed improvements in both BoyXY's hand-eye coordination and attention duration after his IAB trainings. The results of this case study show the improvements on attention and hand-eye coordination only for the case of BoyXY, thus the same improvement levels may not be obtained from trainings of all the individuals with same or other disabilities.

5. CONCLUSIONS

This paper presents a new technological tool IAB that can be used to improve hand-eye coordination and attention duration of individuals with certain type of disabilities, particularly MR and Autism. Using the IAB system, a case study has been conducted, and an individual with severe MR has completed 11 IAB training sessions. The results showed that very impressive improvements in eye coordination and reasonable level of improvement in attention duration of the individual were obtained using IAB system. In fact, it is not possible to say with certainly that this system can attain the same level of improvement for every disabled individual, because it is unlikely that two individuals in special education would have exactly the same type and level of disability. However, this system can be used in special education for augmenting the ADD/ADHD treatments and hand-eye coordination, and statistical data gathered from the system may be used for a range of different purposes, such as comparing individuals with similar disabilities, and comparing the achievements of an individual over a period of time.

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AN INVESTIGATION ON TEACHING MATERIALS USED IN SOCIAL STUDIES LESSON

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ABSTRACT
The purpose of this study is to analyze the teaching materials employed during social studies lessons on the basis of certain variables. Specifically, the researcher tried to find out whether teachers' gender, service length, having a personal computer, receiving an in-service training regarding the use of teaching materials, having an interest on using technological devices and sufficiency of the teaching materials in schools effect the usage of printeded materials, audiovisual materials or experience-giving methods (e.g. field trips, a visit to an institution) in social studies lessons. The data were collected from 160 teachers (N=87, female; N= 73, male) who worked in Istanbul and Sakarya during 2008-2009 spring semester. A scale was developed and applied by the researcher on the participating teachers to score and measure the usage of teaching materials in the Social Studies lessons. The results of the study showed statistically significant differences on the usage of printed materials and experience-giving methods based on the gender of the teacher and in service training, in favor of both female teachers and teachers who have received an in-service training. Moreover, statistically significant differences were also observed on the usage of print materials, experience-giving methods and the total score due to the service length of the teacher. The teachers, who have been working for 16-years or more, had significantly higher scores on the aforementioned variables. In addition, it was found that if schools had sufficient materials/equipment, the teachers tended to use the teaching materials more in their lessons. No correlation was found between the service length and the usage of audiovisual materials by teachers, as well as between having a personal computer and usage of teaching materials.
Keywords: Social studies, educational technology, teaching materials, teaching equipment.

INTRODUCTION

The task of developing a democratic society through formal education in Turkey has been mainly burdened on Social Studies Curriculum. Therefore, Social Studies teaching has been a factor in determining whether a society will have democratic attitudes, values, problem-solving and decision-making skills and whether the society will consist of productive and participatory individuals (Ozturk and Otluoglu, 2002; Keeler, 2008). In Social Studies teaching, which is given such an important mission, it is possible to make the learning process easy, enduring and meaningful through the use of teaching materials.

All materials and resources used for developing the desired knowledge, skills, attitudes and values in students are regarded within the scope of teaching materials (Paykoc, 1991; Simsek, 2003). Teaching materials play an important role in making learning-teaching process in Social Studies courses efficient, by presenting signs and explanations to students and making students comprehend these signs and explanations. Teaching materials provide a great deal of convenience in teacher's ability to convey a message to students in an accurate, proper, clear and understandable manner; in making abstract knowledge concrete and in enabling students to comprehend complex ideas through simplification. When properly used, printed materials, audiovisual materials and experience-giving methods, help make the learning process easy and enduring. Studies concluded that the number of sensing organs activated by the teaching materials used in learning-teaching process is directly proportional to an easy and enduring learning process. In other words, the higher the number of sensing organs activated by the teaching materials employed in learning-teaching process, the better and more enduring the learning process is. Correspondingly, forgetting is delayed (Yasar and Gultekin, 2009). Teachers are also given such important roles as making the Social Studies lessons efficient. While preparing their lesson/daily plans, teachers should also think about the teaching materials they will use in their lessons in order to decide where and how to use these materials in a proper way, and to make their arrangements accordingly (Demirel, 1999).

One of the most important tasks of Social Studies teachers regarding teaching materials is to present those experiences that will enable students to gain the educational attainments related to a particular subject. For that purpose, teachers should carry out the learning-teaching process, which has been prepared beforehand, by using the required materials and methods. The crucial part of this operation is that the teacher should be able to acquire and employ teaching materials and methods suitable for student characteristics and attainments and subject of a particular lesson (Cilenti, 1988). In recent years, more importance has been attached to this issue and various studies have been carried out (Can, 2010; Friedman et. al., 2009; Besoluk, Kurbanoglu and Önder, 2010).

Isman et. al. (2004) indicated that with the developments in information and communication technologies, all applications of the instruction start to have tendency toward technology based instruction instead of directed, teacher-centered instruction. It is important to mention that computers are the main instructional support to the learning and teaching process. Technological tools provide the equal standards, opportunities and easy path for the successful understanding and also meaningful learning for students.

Yilmaz (2005) evaluated the effects of technology use on students' achievement and attitudes and found that technological materials have positive impacts on achievement and attitudes. A similar study was carried out by Sevindik (2006), who investigated the effects of the use of smart classes on students' academic achievement and attitudes at higher education.

Koseoglu and Soran (2006) investigated attitudes of biology teachers towards material usage in class activities. They have found that attitudes of teachers towards material usage change according to different characteristics of teachers.

Pala (2006) investigated primary teachers' attitudes towards educational technologies. It has been found that the teachers' attitudes towards educational technology are positive and statistical comparisons revealed that there was no significant difference in teachers' attitudes towards educational technologies in terms of their genders, ages, schools serviced and periods of service. However, Besoluk, Kurbanoglu and Onder (2010) have found that in-service science teachers with over 15 years experience have the least knowledge on the usage of computers. Moreover, they have indicated that most of the science teachers and pre-service science teachers realize the importance of technology usage in science teaching and they desire more knowledge related to educational technology than they have.

Akpinar and Simsek (2007) investigated usage of variety of media by teachers to support students' learning. Though there are many new tools and settlements in learning technologies and their specifications, there has been a fierce debate over learning objects and their development. They examined the effect of pre-service teachers' experience regarding information and communication technology use on their learning object development. They have found meaningful correlation between the uses of some of the learning object components.

Karchmer-Klein (2007) found that having student teachers watch and analyze experienced teachers' high-quality technology supported instructions motivated to use technology in their own future teachings. Similarly, Keeler (2008) found that incorporating technology-rich instructional approaches into the social studies method course helped pre-service teachers become familiar with how to utilize technology in educational contexts and made them be aware of the usefulness and transferability of instructional technology techniques. Research also demonstrated that incorporating technology into method courses and training programs could transform views of technology and epistemological beliefs to constructivist orientations including active learning, problem solving, critical thinking and discovery.

Yavuz and Coskun (2008) investigated pre-services teachers' ideas and attitudes toward the utilization of technological tools. The results of the study showed that the technology-assisted project studies affected students' attitudes toward the utilization of technology in education positively.

Friedman et. al. (2009) investigated beliefs, practices, and efficacy of social studies faculty members from across the United States in terms of instructional technology use. The findings of the study demonstrated that familiarity with the National Educational Technology Standards, as well as confidence with technology are related to the frequency and type of technology that social studies faculty members utilize in their courses.

Can (2010) investigated the attitudes of the pre-service teachers from the department of elementary education towards the usage of teaching materials; overhead projector and projector in their classes. According to the study, students indicated that the use of overhead projector and projector brings some kind of change and variety to the teaching, saves teaching from being monotonous, and contribute to establishing lively, colorful and smooth setting for teaching and learning.

As evident from the presented literature survey above, it is important to determine the state of the use of teaching materials and equipment, which plays a significant role in making learning easy and enduring, making abstract information concrete, increasing motivation and presenting complex information through simplification during social studies lessons. Thus, the main objective of the present study is to determine the usage level of teaching materials employed in Social Studies lessons and the variables affecting this usage. Specifically, the effects

following variables on the usage of teaching materials are investigated; gender of the teacher, teacher's length of service, whether teacher has a personal computer at home or not, whether the teacher received in-service training or not, whether teacher likes technological devices or not, whether the school has sufficient teaching materials and equipment or not.

METHODOLOGY

The data were collected through survey methodology to describe the present situation as currently exists and as described by Karasar (1994). A scale, "The scale for usage of teaching materials during Social Studies lessons", was developed by the researcher and applied to teachers along with the survey in order to collect required data.

Population and Sample

The population of the study is comprised of the classroom teachers and social studies teachers. 160 classroom teachers and social studies teachers participated in the study. 87 of the participants were female and 73 of them were male. The participating teachers were randomly chosen and in an effort to represent the overall teachers population.

Table 1: Demographical information regarding the sample

		f	%
Gender	Female	87	54.4
	Male	73	45.6
Length of service	1-5 Years	28	17.5
	6-10 Years	41	25.6
	11-15 Years	35	21.9
	16 years and more	56	35.0
Personal computer	Yes	137	85.6
	No	23	14.4
In-service training	Received	103	64.4
	Not received	57	35.6

Table 1 presents the distribution of the teachers by gender, service length, having a personal computer and having received an in-service training. 54.4 % of the classroom teachers and social studies teachers participating in the study were female and the remaining 45.6 % were male. When analyzed on the basis of their length of service, it is observed that 17.5 % of them had been serving for one to five years, that 25.6 % for six to ten years, 21.9 % for eleven to fifteen years and that 35.0 % for sixteen years or more. It can also be observed that 85.6 % of the teachers had a personal computer whereas a small percentage (14.4 %) did not. An analysis on the basis of having received or not an in-service training indicates that the majority of the teachers (64.4 %) received an in-service training. The remaining 35.6 % did not undergo such training.

Development and Application of Data Collection Instrument

"The Scale for Usage of Teaching Materials during Social Studies Lessons" which was developed by the researcher was used in the study. During the process of developing the scale, a review of literature was carried out by the researcher and an 18-item scale was devised through interviews with teachers. Opinions from specialists in social studies teaching, research methods and statistics were received in order to evaluate the observations on the view and content validity of the scale from an outside perspective. The scale was shaped in accordance with specialists' suggestions and was administered to 160 teachers so as to investigate construct validity and reliability. Exploratory factor analysis was employed regarding construct validity. The exploratory factor analysis indicated that items numbered 7 and 9 (usage of photographs and overhead projector in lessons) distorted the structure; thus, they were excluded. With the remaining 16-items, the scale was exposed to factor analysis again. The values obtained from the KMO and Barlett test were investigated before conducting factor analysis. Since the KMO test indicated a variation of .86 and Barlett test produced a statistically meaningful variation, it was decided that it would be appropriate to conduct factor analysis on the scale (Buyukozturk, 2007). The factor analysis showed that the scale has a three-dimensional structure consisting of 16 items. The first dimension includes 8 items and factor loadings ranged between .39 and .81. This dimension was named as *printed materials*. Accounting for 21.4 % of the total variance, this dimension had an internal consistency coefficient of .82. The second dimension includes 5 items and factor loadings ranged between .71 and .88. This dimension was named as *audiovisual materials.* Accounting for 22.8 % of the total variance, this dimension had an internal consistency coefficient of .89. Titled as *experience-giving methods*, the third dimension consists of 3 items and factor loadings ranged from .63 to .86. Accounting for 13.4 % of the total variance, this dimension had an internal consistency coefficient of .76. When regarded as a whole, the 16-item scale accounted for 57.7 percent of the total variance and had an internal consistency coefficient of .89.

Data Analysis

Before analyzing the data, responses of each participant to the instrument were analyzed separately. The data of the two participants was excluded from the analysis since the forms received from these participants were incomplete. Therefore the analysis was conducted on data received from 160 participants. In order to numerically calculate the scores of the answers provided by the classroom and social studies teachers, the items in the scale was assigned the following numbers: 4, 3, 2 and 1, which meant "always", "often", "occasionally", and "never", respectively. The data was analyzed through SPSS. ANOVA, t-test, Kruskal-Wallis H Tests were conducted in order to statistically analyze the data obtained.

FINDINGS AND DISCUSSION

In what follows, the findings from the survey and related discussions are presented.

Table 2: t-test results on whether teaching materials used by teachers during social studies lessons depends on gender

Dimensions	**Gender**	**N**	$\bar{x}$	**sd**	**cd**	**t**	**p**
Printed materials	Female	87	24.09	3.94	158	2.42	.017
	Male	73	22.60	3.80			**
Audiovisual materials	Female	87	13.26	4.39	158	.28	.780
	Male	73	13.08	3.70			
Experience-giving methods	Female	87	6.08	2.14	158	2.14	.034
	Male	73	5.38	1.94			**
Total	Female	87	43.43	8.55	158	1.83	.070
	Male	73	41.06	7.69			

Table 2 indicates that there is a statistically meaningful difference (p<.05) between male and female teachers on the use of *printed materials* (t=2.42) and *experience-giving methods* (t=2.14). On the other hand, the scores obtained from the a*udiovisual materials* (t=0.28) dimension and the total scale (t=1.83) did not display a meaningful difference (p<.05) between genders. It was discovered that female teachers ($\bar{x}$ = 24.09) used printed materials more when compared to male ones ($\bar{x}$ = 22.60) and that the former group ($\bar{x}$ =6.08) made use of experience-giving methods more than the latter group ($\bar{x}$ = 5.38). This suggests a meaningful variation in favor of female teachers on the use of not only printed materials but also *experience-giving methods*.

Table 3: The results of the ANOVA test on the teaching materials used by teachers during social studies lessons depending on their length of service

Dimensions	Length of Service	N	$\bar{x}$	sd		Sum of Squares	cd	Mean Squares	F	P	Difference
Printed materials	1-5 Years	28	22.07	3.54	Inter-group	256.15	3	85.38	6.02	.001	1-4
	6-10 Years	41	23.31	4.49							3-4
	11-15 Years	35	22.05	3.13	Intra-group	2210.62	156	14.17			
	16 Years and more	56	25.00	3.64							
	Total	160	23.41	3.93	Total	2466.77	159				
Audiovisual materials	1-5 Years	28	13.96	3.77	Inter-group	107.35	3	35.78	2.19	.091	
	6-10 Years	41	13.19	4.06							
	11-15 Years	35	11.71	4.26	Intra-group	2546.38	156	16.32			
	16 Years and more	56	13.69	4.00							
	Total	160	13.18	4.08	Total	2653.74	159				
Experience-giving methods	1-5 Years	28	5.71	1.99	Inter-group	36.43	3	12.14	2.91	.036	2-4
	6-10 Years	41	5.43	2.14							3-4
	11-15 Years	35	5.20	2.19	Intra-group	650.53	15	4.17			

							6				
	16 Years and more	56	6.37	1.88							
	Total	160	5.76	2.07	Total	686.97	159				
	1-5 Years	28	41.75	7.23	Inter-group	830.85	3	276.95	4.35	.006	3-4
	6-10 Years	41	41.95	8.57							
Total	11-15 Years	35	38.97	7.70	Intra-group	9943.83	156	63.74			
	16 Years and more	56	45.07	8.05							
	Total	160	42.35	8.23	Total	10774.69	159				

Statistically meaningful difference ($p<.05$) in the use of *printed materials* ($F_{(3-156)}=6.02$), *experience-giving methods* ($F_{(3-156)}=2.91$) and in the whole scale ($F_{(3-156)}=4.35$) with respect to the length of service was observed. On the other hand, the scores obtained from the *audiovisual materials* dimension ($F_{(3-156)}=2.19$) did not display any meaningful difference ($p>.05$) on the basis of the length of service. Table 3 shows that the teachers who had been serving for 16 years or more ($\bar{x}$ = 25.00) used printed materials more when compared to those teachers with a length of service of 1 to 5 years ($\bar{x}$ = 22.07) or 11 to 15 years ($\bar{x}$ = 22.05). It also indicates that teachers who had been serving for 16 years or more ($\bar{x}$ = 6.37) used *experience-giving methods* more when compared to those teachers with a length of service of 6 to 10 years ($\bar{x}$ = 5.43) or 11 to 15 years ($\bar{x}$ = 5.20). According to the scores obtained from the whole scale, it was found that the teachers who had been serving for 16 years or more ($\bar{x}$ = 45.07) made use of teaching materials during social studies lessons more when compared to those teachers with a length of service of 11 to 15years ($\bar{x}$ = 38.97). It is interesting that the meaningful difference in the dimensions *printed materials* and *experience-giving methods* and in total was in favor of the teachers who had been serving for 16 years or more. No meaningful correlation was found between length of service and use of audiovisual materials.

Table 4: The results of the t test on the teaching materials used by teachers during social studies lessons depending on whether they had a personal computer at home or not

Dimensions	**Computer**	**N**	$\bar{x}$	**sd**	**cd**	**t**	**p**
Printed materials	Yes	137	23.43	3.97	158	.20	.84
	No	23	23.26	3.81			
Audiovisual materials	Yes	137	13.29	4.14	158	.89	.37
	No	23	12.47	3.71			
Experience-giving methods	Yes	137	5.84	2.06	158	1.25	.21
	No	23	5.26	2.15			
Total	Yes	137	42.58	8.27	158	.85	.40
	No	23	41.00	8.01			

It can be concluded from Table 4 that there was not a meaningful difference in the use of *printed materials* (t=0.20), *audiovisual materials* (t=0.89) and *experience-giving methods* (t=1.25) depending on whether teachers had a personal computer or not. An interesting finding of Table 4 is that the great majority of the teachers (85.6%) had their own personal computers. This can be interpreted as teachers' being open to advancements in the technology and willing to acquire them.

Table 5: The results of the t-test on the teaching materials used by teachers during social studies lessons depending on whether they had received an in-service training

Dimensions	**In-service training**	**N**	$\bar{x}$	**sd**	**cd**	**t**	**p**
Printed materials	Received	103	24.08	4.00	158	2.99	.003
	Not received	57	22.19	3.52			**
Audiovisual materials	Received	103	13.48	4.02	158	1.27	.206
	Not received	57	12.63	4.17			
Experience-giving methods	Received	103	6.08	2.07	158	2.71	.007

	Not received	57	5.17	1.96			**
Total	Received	103	43.66	8.29	158	2.74	.007
	Not received	57	40.00	7.63			**

Table 5 suggests a meaningful difference in the use of *printed materials* (t=2.99), *experience-giving methods* (t=2.71) and the total score obtained from the scale (t=2.74) between teachers who had an in-service training and those who did not. A review of the scores obtained from the dimension *audiovisual materials* (t=1.27) indicates no meaningful difference (p>.05) between the teachers who had an in-service training and those who did not. It was discovered that the teachers who had an in-service training ($\bar{x}$ = 24.08) employed *printed materials* more when compared to those who did not ($\bar{x}$ = 22.19). Another finding implied in Table 5 is that the teachers who had an in-service training ($\bar{x}$ =2.07) benefited from *experience-giving methods* more than those who did not ($\bar{x}$ = 1.96). Total scores obtained from the scale indicate that the teachers who had in-service training ($\bar{x}$ =43.66) made use of materials during social studies lessons more than those who did not ($\bar{x}$ = 40.00). It is important that there was a meaningful difference in the use of *printed materials* and *experience-giving methods* in favor of the teachers who had an in-service training. This indicates that teachers who have received an in-service training are more likely to employ teaching materials and experience-giving methods in order to increase the efficiency of social studies lessons.

Table 6: The results of the Anova test on the teaching materials used by teachers during social studies lessons depending on whether they liked technological devices

Dimensions	Like technology	N	$\bar{x}$	sd		Sum of Squares	cd	Mean Squares	F	p	Difference
Printed materials	A little	44	22.86	3.19	Inter-group	34.21	2	17.10	1.10	.334	
	Quite	75	23.34	4.04							
	Very much	41	24.12	4.42	Intra-group	2432.55	157	15.49			
	Total	160	23.41	3.93	Total	2466.77	159				
Audiovisual materials	A little	44	11.02	3.91	Inter-group	423.13	2	211.56	14.89	.000	1-2
	Quite	75	13.18	3.63							1-3
	Very much	41	15.48	3.86	Intra-group	2230.60	157	14.20			2-3
	Total	160	13.18	4.08	Total	2653.74	159				
Experience-giving methods	A little	44	5.11	1.75	Inter-group	30.66	2	15.33	3.66	.028	1-3
	Quite	75	5.85	2.06							
	Very much	41	6.29	2.28	Intra-group	656.30	157	4.18			
	Total	160	5.76	2.07	Total	686.97	159				
Total	A little	44	39.00	7.19	Inter-group	1011.29	2	505.64	8.13	.000	1-3
	Quite	75	42.38	7.97							
	Very much	41	45.90	8.41	Intra-group	9763.39	157	62.18			
	Total	160	42.35	8.23	Total	10774.69	159				

It was found that there was a meaningful difference (p<.05) in the use of *audiovisual materials* ($F_{(2-157)}$=14.89), *experience-giving materials* ($F_{(2-157)}$= 3.66) and in the *whole scale* ($F_{(2-157)}$=8.13) depending on the level at which teachers participating in the study liked technology. A review of the scores obtained from the dimension *printed materials* ($F_{(2-157)}$=1.10) indicates that there was not a meaningful correlation (p>.05) between the level at which teachers liked technology and the use of printed materials. It was also discovered that teachers who liked technology very much ($\bar{x}$ = 15.48) and the teachers who quite liked technology ($\bar{x}$ = 13.18) used audiovisual materials more when compared to those who liked technology a little ($\bar{x}$ = 11.02). When the dimension *experience-giving methods* is analyzed, it can be observed that the teachers who liked technology very much ($\bar{x}$ = 5.85) employed these methods more than the teachers who liked technology a little ($\bar{x}$ = 5.11). The total

score obtained from the scale demonstrated that the teachers who liked technology very much ($\bar{x}$ =45.90) made use of teaching materials during social studies lessons more when compared to those who liked it very little ($\bar{x}$ =42.38). It is an important finding that there was a positive correlation between the level at which teachers like technology and their usage of *audiovisual materials* and *experience-giving methods*. This means that teachers employ teaching materials throughout social studies lessons to the extent that they like technology. Teaching materials will make social studies teaching more enjoyable.

Table 7: The results of the Kruskal Wallis H Test on the teaching materials used by teachers during social studies teachers depending on whether their schools had an adequate number of teaching materials

Dimensions	Equipment is adequate	N	Mean Rank (SO)	cd	χ^2	p	Difference
Printed materials	Totally disagree	20	58.90	3	22.04	.000	1-3;1-4 2-3;2-4 3-4
	Agree a little	75	70.27				
	Quite agree	51	93.25				
	Totally agree	14	119.68				
Audiovisual Materials	Totally disagree	20	62.10	3	29.47	.000	1-3;1-4 2-3;2-4 3-4
	Agree a little	75	68.34				
	Quite agree	51	91.06				
	Totally agree	14	133.46				
Experience-giving Methods	Totally disagree	20	60.38	3	22.00	.000	1-3;1-4 2-3;2-4 3-4
	Agree a little	75	70.09				
	Quite agree	51	92.84				
	Totally agree	14	120.07				
Total	Totally disagree	20	57.15	3	34.32	.000	1-3;1-4 2-3;2-4 3-4
	Agree a little	75	67.39				
	Quite agree	51	94.24				
	Totally agree	14	134.04				

From the results presented in Table 7, it was determined that there was a meaningful difference ($p<.05$) in the use of *printed materials* (χ^2=22.04), *audiovisual materials* (χ^2=29.47), e*xperience-giving methods* (χ^2=22.00) and in the total score obtained from the scale (χ^2=34.32) depending on the level at which teachers agreed or disagreed with the fact that there was an adequate number of equipment in their schools. A review of the dimension *printed materials* indicates that the teachers who "totally agreed" (SO = 119.68) that there was an adequate number of equipment in their schools used *printed materials* more when compared to the teachers who "quite agreed" (SO = 93.25) and "agreed a little" (SO = 70.27) or "totally disagreed" (SO = 58.90). A review of the dimension *audiovisual materials* indicates that the teachers who "totally agreed" (SO= 133.46) that there was an adequate number of equipment in their schools used visual and audio materials more when compared to the teachers who "quite agreed" (SO= 91.06) and "agreed a little" (SO = 68.34) or "totally disagreed" (SO = 62.10). A review of the dimension e*xperience-giving methods* indicates that the teachers who "totally agreed" (SO = 120.07) that there was an adequate number of materials in their schools used *experience-giving methods* more when compared to the teachers who "quite agreed" (SO = 92.84) and "agreed a little" (SO = 70.09) or "totally disagreed" (SO = 60.38). The total scores obtained from the scale indicated that the teachers who "totally agreed" (SO = 134.04) that there was an adequate number of equipment in their schools made use of teaching materials during social studies lessons more when compared to the teachers who "quite agreed" (SO = 94.24), and "agreed a little" (SO = 67.39) or "totally disagreed" (SO = 57.15). These findings can be interpreted as the fact that the more the teaching equipment in a school is, the more teachers use teaching materials in their social studies lessons.

DISCUSSION

There is a meaningful difference in the use of both printed materials and experience-giving methods in favor of female teachers based on gender. The differences in the usage of *printed materials*, *experience-giving methods* and in total were found to be in favor of the teachers who had been serving for 16 years or more. No significant correlation was found between the length of service and the use of audiovisual materials. It is interesting that the meaningful difference in the dimensions *printed materials* and *experience-giving methods* and in total was in favor of the teachers who had been serving for 16 years or more. No meaningful correlation was found between

length of service and use of audiovisual materials. In her study, Pala (2006) found that there was not a meaningful correlation between teachers' attitudes towards educational technologies and their length of service.

No meaningful difference was found in the use of *printed materials*, *audiovisual materials* and *experience-giving methods* between teachers who had a personal computer and those who did not. 85.6% of the teachers were discovered to have a personal computer. It was observed that no meaningful correlation existed between having or not having a personal computer and the use of materials during social studies lessons in general

There was a meaningful difference in the use of *printed materials* and *experience-giving methods* in favor of the teachers who had received an in-service training. This important finding indicates that teachers are likely to employ teaching materials and experience-giving methods in order to increase the efficiency of social studies lessons once they have received an in-service training. Similarly, Altinisik and Orhan (2002) point out that teachers should undergo an in-service training so as to be able to ensure more efficient learning experiences.

There was a positive correlation between teachers' liking technology and their use of *audiovisual materials* and *experience-giving methods*. This means that teachers employ teaching materials during social studies lessons to the extent that they like technology. Woodrow, Mayersmith and Pedretti (2000) stated that teaching with multimedia, when compared to the one in a traditional setting, led to a positive change in students' attitudes towards lessons. Fidan (2008) reported that teaching materials made lessons more enjoyable, increased motivation and provided enduring learning process.

It was determined that the teachers who "totally agreed" that there was an adequate number of teaching equipment in their schools made use of teaching materials during social studies lessons more when compared to the teachers who "quite agreed" and "agreed a little" or "totally disagreed". It has been observed that the more the teaching equipment in a school is, the more social studies teachers use materials in social studies lessons. These findings support that the amount and variety of technological equipment in a school increase the usage of teaching materials in the learning purposes.

CONCLUSION AND RECOMMENDATIONS

As a conclusion, aforementioned results clearly demonstrated that in service training is a significant factor for the increment of the technology usage. Professional development provides a means for closing the gap between the current and potential uses of technology for instruction. Therefore, teachers need effective courses/seminars related to usage of technology both in their daily lives and in education for social studies lessons. Technological developments should be introduced to teachers through periodic in-service trainings. Moreover, while in-service training, if teachers realize the importance of using teaching materials in their courses they would probably have more positive attitudes towards their use. Also, another result of this study indicates that teachers employ teaching materials during social studies lessons to the extent that they like technology. Availability of the teaching materials in schools increases their usage by teachers, so inadequacy of those materials inhibits usage which may result in poor performance in teaching and learning process.

In the light of the results of the study, the following recommendations can be made:

1. Classroom teachers and social studies teachers should be encouraged to undergo an in-service training in order to increase the use of teaching materials during social studies lessons.
2. Teachers' awareness regarding the importance of technology usage in teaching and learning process should be increased.
3. Therefore, any problems related to insufficient usage of teaching materials in schools should be resolved qualitatively and quantitatively.

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APPLYING COMPUTER-ASSISSTED MUSICAL INSTRUCTION TO MUSIC APPRECIATION COURSE: AN EXAMPLE WITH CHINESE MUSICAL INSTRUMENTS

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ABSTRACT
This study aims to explore the effectiveness of computer-assisted musical instruction (CAMI) in the Learning Chinese Musical Instruments (LCMI) course. The CAMI software for Chinese musical instruments was developed and administered to 228 students in a vocational high school. A pretest-posttest non-equivalent control group design with three classes designated as the experimental group for the "CAMI in LCMI," and another three classes as the control group for the "traditional narrative teaching approach." Collected data were analyzed through descriptive statistics analysis, ANCOVA, and structural equation modeling (SEM) by SPSS 10.0 for Windows and LISREL 8.52. The results indicate that (1) the CAMI approach is superior to the traditional narrative teaching approach, (2) students show a positive perspective on the use of CAMI for instruction in the LCMI course, (3) software interface and content design have positive and direct influence on students' learning attitude and self-awareness learning results, (4) learning attitude has a positive and direct influence on self-awareness learning results, and (5) the CAMI in Chinese musical instruments software is satisfactory assistive material for teachers in the LCMI course.
Keywords: computer-assisted musical instruction (CAMI), music appreciation instruction, and Chinese musical instruments

INTRODUCTION

Music education is one of the humanistic studies that Chinese people have emphasized since ancient times. In Taiwan, the purpose of music education is mainly to nurture students' interest and habits in music through related activities and to enhance their perception of music.

Of all the music courses in high school in Taiwan, the easiest and preferable course to teach and learn is the music appreciation class. "Music appreciation" is an aesthetic learning activity. Through the teaching of music appreciation, we can understand a composer's motivation and historical background as well as the music's form, structure, and style. Students' perception of music can be enhanced, and good personality qualities can be encouraged. Wu (1994) pointed out that a music appreciation course played an important role in music instruction and was one of the most popular classes among students. For those students who have not yet received professional training in music, music appreciation is the most enjoyable learning activity. However, even though music appreciation is the most preferable course in which to learn to enjoy music, how to teach students to appreciate music is still a difficult question (Cheng, 1997).

In addition, lessons in understanding musical instruments are an important part of music appreciation courses because musical instruments are the tools employed by humans to express their thoughts and feelings (Du, 1999). The primary function of a musical instrument is for performing music and transmitting information (Han, 1991).

In Taiwan, the ratio of Chinese traditional music instruction courses to Western musical instruction in high schools is currently quite low, due to the influence and impact of Western culture. Some studies show that the best way to recognize and memorize musical instruments is to allow students to see the physical instruments and actually touch them in courses introducing the instruments. However, limited by teaching resources, facilities and budget, schools usually cannot afford the necessary instruments. Zhu (2006) mentioned in her research that most music teachers felt that understanding the teaching of Chinese instrument appreciation was difficult for them.

There is no doubt that the 21st century is a high-tech information era. Teaching in high school has also gone through a revolutionary change. Integrating computer technology into teaching activities has become a new trend in modern teaching. Through the implementation of computer-assisted musical instruction, a teacher can combine textual materials, images, animation, audio and video on a computer to provide students with a variety of learning experiences. As a result, the CAMI can open up a new door in teaching and dramatically changes ways of learning Chinese musical instruments.

Computer-assisted teaching has six characteristics: it is interactive, adaptive, learner controlled, inexhaustible, and unlimited in time, space and manageability (Zhu and Chang, 1998). During computer-assisted teaching period, teachers can reduce time spent writing on blackboard; teaching materials can be converted into CDs or put on the Internet for students to study for pre-class practice and after-class review. Furthermore, it provides learners with a very convenient learning environment because it is not limited by time and location (Lin, 2003). In other words, students can repeatedly view and practice unfamiliar contents without any time limitations (Lu, 2003; Rosser, 2000). With so many benefits, it has become a very useful mode of teaching and learning.

Style models for computer-assisted teaching systems can be characterized as tutoring, practicing, simulating, game playing or testing (Hsu, 2007). Any model of computer-assisted teaching systems needs to combine varied learning theories as its basis of design. For example, the "behavioral approach" argues that individual learning is the result of stimulus and response. The computer-assisted teaching pattern developed from this approach is practice-style, multi-media computer-assisted instruction (Hsu, 2007) that emphasizes enhancement of existing knowledge. The "cognitive approach" argues that, based on past experiences and knowledge, and using people as a symbol for operation, processing complicated information, and with limited cognition contents to experience multi-stage processing and initially construct knowledge. Based on this approach, the tutor-style computer-assisted instruction tends to emphasize teaching new information (Wang, 1992). In addition, "constructivism" states that a learner should organize and construct his own knowledge system through initial self-motivated attempts and exploration using existing knowledge in the process of acquiring new knowledge. The characteristics that should be applied in computer-assisted teaching would be those characteristics that give a student an appropriate freedom to control the learning process, during which the role of teacher will change from that of the dominant leader of a traditional a classroom to that of a guide and assistant. The conception of "situation learning theory" emphasizes constructing knowledge through students' initial explorations and operations in practical situations. In recent years, many types of teaching media have been designed and developed according to "situation learning." The computer-assisted teaching pattern developed by situation learning theory is simulation-style multi-media computer-assisted instruction.

Computer-assisted music instruction (CAMI) combines computers and music instruction to provide a good learning environment for achieving pre-set teaching goals. Computers could be used in teaching music composition or editing, music appreciation and musical instruments. Many related studies have shown positive and affirmative views on the results of CAMI (Bauer, 2003; Bowyer, 2003; Wu, 2007; Gao, 2007; Cheng, 2007; Ewers, 2004; Chan, Jones, Scanlon, & Joiner, 2006; Yang, Lay, Liou, Tsao, & Lin, 2007; Lee, 2007).

However, very few studies have addressed the topic of computer-assisted teaching of the appreciation of Chinese musical instruments in particular, and related studies do not even exist. Therefore, this study hopes to develop a set of CAMI software for Chinese musical instruments to advance teaching effectiveness for music teachers and enhance students' interest in learning and consequently leads to results that are conducive to the inheritance of Chinese traditional culture. Based on these considerations, this paper tries to integrate CAMI into courses in appreciation and understanding Chinese musical instruments. Using Flash software, we produced a set of Chinese musical instrument software and integrated the software into practical teaching methods with the goal of combining theory and practice.

PURPOSE OF STUDY

Based on the research background and motivation described above, the purposes of this study are as follows:

1. To develop CAMI software for Chinese musical instruments;
2. To explore the differences between CAMI and traditional instruction in terms of students' learning achievements in music appreciation courses;
3. To explore learning satisfaction among students using CAMI in music appreciation course on understanding Chinese musical instruments;
4. To explore the relationship and mutual effects between learning using the software interface, learning attitudes and subsequent changes in self-consciousness;
5. To provide teachers with recommendations and references for applying the CAMI software to music appreciation courses in understanding Chinese musical instruments.

RESEARCH DESIGN AND IMPLEMENTATION

Research Structure

Based on the literature review and purposes of study, the research structure is designed as described in Figure 1.

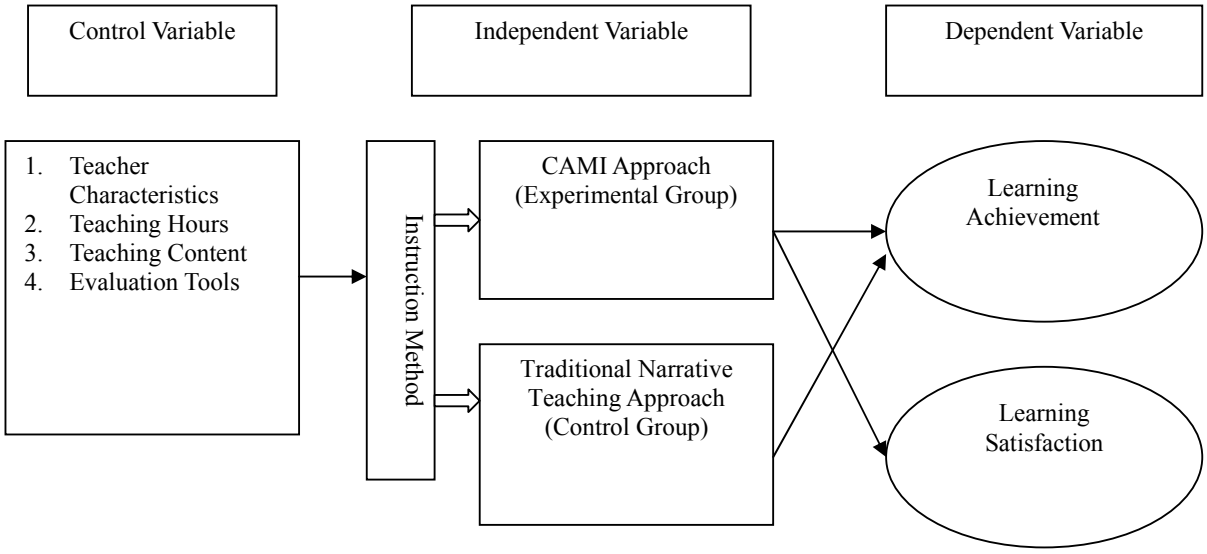

Fig. 1 Research Structure

As shown in Figure 1, the independent variable in the study is the instruction method, that is, the experimental group adopts the CAMI approach, whereas the control group adopts a traditional narrative teaching approach. The dependent variables in the study are learning achievement and learning satisfaction.

To reduce the effects of extraneous variables on the validity of the experiment, the experiment dictated fixed teacher characteristics, teaching hours, teaching contents and evaluation tools. Specifically, both the experimental group and control group were taught by the same teacher during the same teaching hours and using the same teaching contents and evaluation tools.

A quasi-experimental method was used in the study. The purpose of our research was to explore the differences between the CAMI and the traditional narrative teaching approaches in Chinese musical instruments in terms of learning achievement by vocational senior high school students in the "Learning Chinese Musical Instruments" course. The quasi-experimental design is shown in Table 1.

Table 1 Nonequivalent Pretest-Posttest Design

Group	Pre-Test	Experimental Process	Post-Test
Experimental Group	O1	X1	O3
Control Group	O2		O4

The study randomly chose 228 freshmen in a senior high vocational school as research subjects. From these students, three classes (111 students) were assigned to the experimental group, who received "CAMI"; the other three classes (117 students) were assigned to the control group, who received "traditional narrative teaching approach." This teaching experiment was conducted for five weeks.

A pre-test of basic music knowledge was conducted before the teaching experiment. The purpose of the pre-test was to determine the degree of students' knowledge of music in both the experimental and control groups before they received any experimental instruction. The scores of the pre-test will act as covariance in the covariance analysis and exclude the moderating variable by statistical control.

To understand students' learning achievement, we created a post-test according to the subject and teaching materials in the experimental course. Additionally, a Learning Satisfaction Survey Questionnaire was designed for using CAMI in "Learning Chinese Musical Instruments" course in order to understand students' learning satisfaction. The items of the questionnaire were edited and compiled. A five-point Likert scale was used in the survey; higher scores represent higher satisfaction. The reliability coefficient (Cronbach α) of the questionnaire was .93.

The Development of CAMI Software

Design of Software

The CAMI software for Chinese musical instruments was designed to enhance students' learning effectiveness of the "Learning Chinese Musical Instruments" course. In order to develop sound CAMI software, we referred to the outlines of curriculum announced by Ministry of Education, Taiwan and some multimedia and computer assisted software in the markets, and then integrate them with learning theories of CAI teaching and learning.

The development of the flow chart of CAMI software production consisted of five stages, including preparation stage, software design and development stage, materials integration stage, software test stage, and modification stage (as shown in Figure 2).

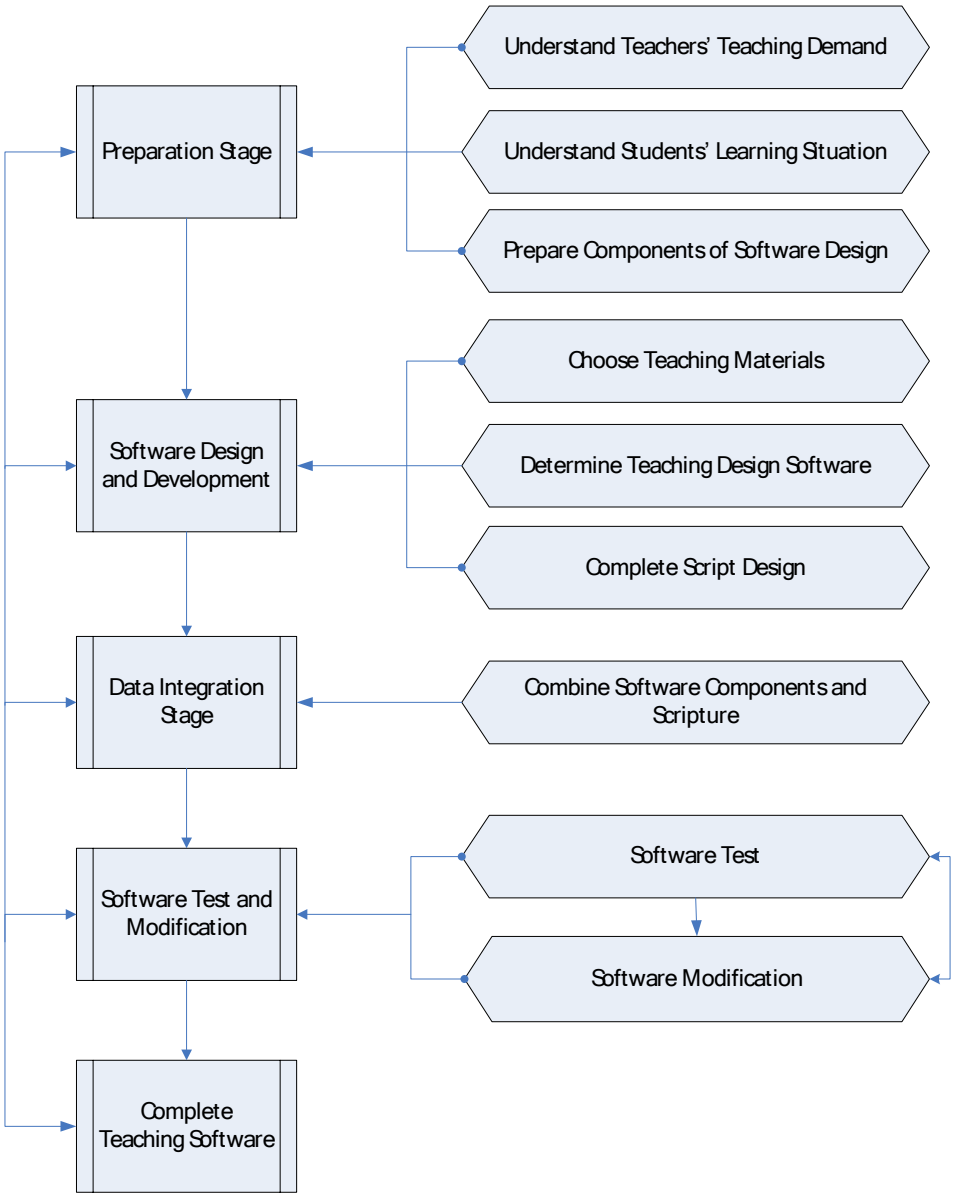

Fig. 2 The Flow Chart of CAMI Software Production

The Content of Chinese Musical Instrument CAMI Software

The Chinese Musical Instrument CAMI Software consists of six parts, including a brief introduction to Chinese musical instruments, the classification patterns of Chinese musical instruments, blowing and wind instruments, string instruments, psaltery instruments, and percussion instruments (as shown in Figure 3). In addition, under each type of Chinese musical instrument, its brief introduction, structure, performance, turning and compass, short story, and comparison are categorized and provided in the software (as shown in Figure 4). Figures 5 to 9 show the four sample

snapshots of the Chinese musical instrument CAMI software interfaces.

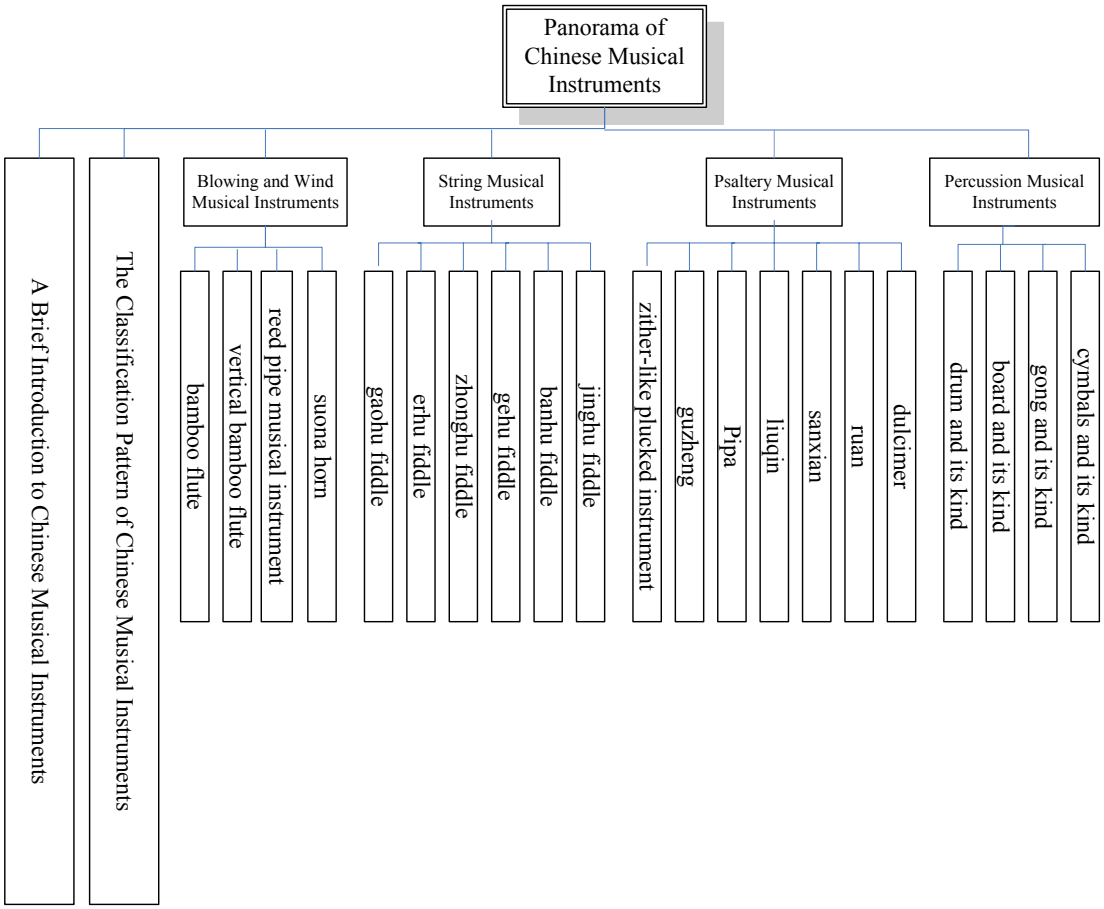

Fig. 3 The Structure of Chinese Musical Instrument CAMI Software

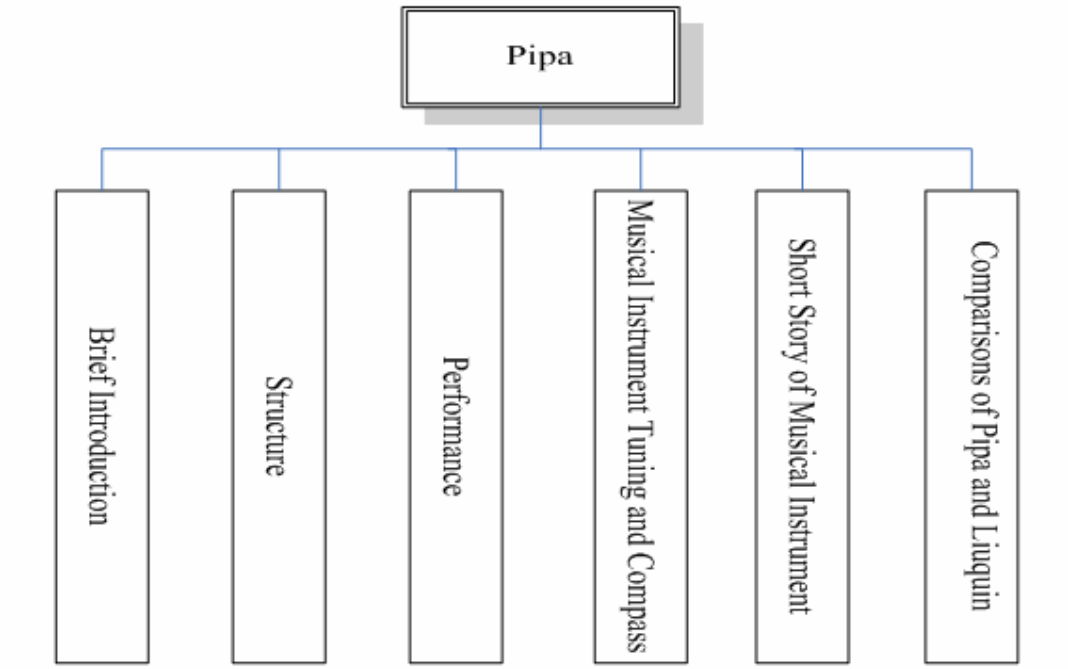

Fig. 4 The Content Structure of Pipa

Fig. 5 A Snapshot of the Chinese Musical Instruments Homepage

Figure 5 shows a snapshot of the Chinese musical instruments homepage, in which the swinging bamboo leaves act as background, and the musical instruments are placed in the foreground to highlight the subject. The little girl in the picture plays a role throughout the program in order to attract learners' attention and interest.

Fig. 6 The Page on the Structure of the Pipa

The buttons at the bottom of the page link to movie files, where users may view an entire musical performance.

Fig. 7 A Snapshot of the Story of Pipa

The vivid illustration can help the learner to enter into the situation of the story. The short story is titled “Art Contest on the Street.”

Fig. 8 A Snapshot of the Evaluation Page

Fig. 9 A Snapshot of the "Reorganizing Musical Instrument Room"

After practicing each musical instrument, the evaluation page can help teachers know how much students understand about Chinese musical instruments. Figure 8 shows a snapshot of the evaluation page. The evaluation page enables the teacher to assess if the learner fully understands the classifications of musical instruments. The "Musical Instrument Reorganization Room" page is designed to assess whether students could match the Chinese musical instruments and their names (as shown in Figure 9).

DATA ANALYSES AND DISCUSSION

Differences in Learning Achievement among Students

To understand whether the teaching materials designed for the experimental instruction were beneficial to the students in the "Learning Chinese Musical Instruments" appreciation courses, the results were analyzed by covariance (ANCOVA) to enable inference and further analyses.

The results showed that there was a significant difference between CAMI and traditional instruction method in learning achievement in the appreciation courses. Furthermore, from post-comparisons shown in Table 3, we inferred that learning achievement (post-test scores) in the experimental group was significantly superior to that in control group. This result indicates that the CAMI that the experimental group received was more effective than the traditional instruction received by the control group.

Table 2 The ANCOVA of Post-Test Scores

Source of Variance	*SS*	*DF*	*MS*	*F*	*Sig.*
Covariance (Pre-Test Scores)	5033.801	1	5033.801	36.870	.000
Variance between Groups	679.565	1	679.565	4.977	.027
Error	30718.693	225	136.528		

Table 3 Post- ANCOVA Comparisons of Post-Test Scores

Post-Test Scores after Adjustment Average	Experiment Group (CAMI)	Control Group (Traditional Instruction Method)
		74.311
Mean	77.816	
Experimental Group (CAMI)	------	*
Control Group (Traditional Instruction Method)	*	------

*p<.05

The results were consistent with studies conducted by other scholars, such as Wu, 2007; Gao, 2007; Cheng, 2007; Carney & Levin, 2007; Ewers, 2004; Chan, Jones, Scanlon, & Joiner, 2006; Yang, Lay, Liou, Tsao, & Lin, 2006, Lee, 2007, Yenitepe & Karadag, 2003; Yusuf & Afolabi, 2010.

Results of the Learning Satisfaction Survey

After experimental instruction, we conducted a survey of "learning satisfaction" among the students of experimental group to understand their feelings toward the experimental instruction. The Likert 5-point scale was used in this study, in which the higher scores the students obtain, the more satisfaction with the experimental teaching they will be. The Learning Satisfaction Survey Questionnaire obtained .93 of Cronbach α.

The analysis showed that in the "teaching software interface and content design" category, 27.1% of the students felt that the narration by written words was not colloquial enough; 82.8% felt that the colors of the pictures of musical instruments were appropriate, clear and definite; the size of the pictures was rated as moderate. Most of the students were also satisfied with the sound effects in the musical instrument performance film, as well as the size of the pictures; 88.3% of the students agreed that the material content design of the software conformed to the goals of the learning curriculum.

The results in "satisfaction with CAMI" category showed that 90.1% of the students agreed that CAMI was more interesting than traditional narrative teaching approach. It was similar to Neo and Neo's (2004) findings, in which 88.6% of the students were favorable to the use of the software. In addition, 84.7% felt that, compared with traditional instruction, CAMI software made it easier to understand the basic concepts concerning Chinese musical instruments; 85.5% liked learning the teaching materials in the textbook using CAMI software instead; 82.8% were satisfied with CAMI as used by their teachers.

In evaluating the learning environment, 19.8% of the students felt that turning off the lights in the class for CAMI might make them sleepy; 72.9% said that they could see the contents shown on the screen clearly, while 9.9% did not agree; 88.3% agreed that they might pay more attention to footage shown on the computer than to writing on the blackboard; 89.2% felt that it was more efficient for a teacher to present material on a computer than on the blackboard.

Overall, most of the students agreed that, while learning Chinese musical instruments, using CAMI was better than traditional narrative teaching approach; in particular, CAMI would allow students to actually see and hear performances with the musical instruments. The results were consistent with studies conducted by Neo & Neo, 2003, Teoh & Neo, 2007, and Tam, Kan, & NG, 2010.

Results of the Structural Equation Model of Learning Satisfaction

The following section presents the analyses of the relationship of structural equation model (SEM) between variables concerning various aspects of the learning satisfaction questionnaire: software interface and content design, learning attitude, and self-awareness learning results. The results of the evaluation of the SEM of learning satisfaction are shown as follows.

Table 4 Overall Goodness of Fit Evaluation Index

1. Normal Theory Weighted Least Squares Chi-Square = 234.89 (P = 0.00)
2. Chi-Square/df=234.89 ÷ 149 = 1.58
3. Goodness of Fit Index (GFI) = 0.82
4. Adjusted Goodness of Fit Index (AGFI) = 0.77
5. Normed Fit Index (NFI) = 0.92
6. Incremental Fit Index (IFI) = 0.97
7. Non-Normed Fit Index (NNFI) = 0.96
8. Root Mean Square Error of Approximation (RMSEA) = 0.072

The goodness of fit index (GFI) in Table 4 shows that the chi-square value (P=0.00) has reached the statistical significance. The chi-square value is usually greatly affected by the number of samples, so scholars believe that we should not rely solely on this index (Huang, 2003). Because GFI = 0.82 and AGFI=0.77, neither are acceptable indices (>0.90). RMSEA is 0.072, indicating a moderate fit. The rest of indices, NFI=0.92, IFI=0.97, and NNFI=0.96, are significantly greater than the acceptable value of 0.90. Chi-Square/df=1.58 is also smaller than the standard value of 2. As a whole, the above indices mean that the model was a moderate fit.

The test of hypotheses is shown in Figure 10, below. The structural equation model shows that "software interfaces and content design" has positive and direct influence on "learning attitude" and "self-awareness learning results." Also, "learning attitude" has a positive and direct influence on "self-awareness learning results."

Note: ***<.001, **<.01, *<.05

Figure 10 The Structural Equation Model of Learning Satisfaction

Teacher Introspection

One of the purposes of this research was to develop a set of teaching software that would make it easier for a music teacher to teach a course on learning Chinese musical instruments; thus, developing teaching materials was one of key points in the study. We spent six months collecting and editing characters, pictures and audio/video materials. A computer company was commissioned to conduct follow-up production. During the production process, the research team regularly met for discussion with the computer engineer to produce a perfect finished product. Thus, once software was complete, we were very familiar with the teaching materials.

In the process of experimental instruction, we could not predict how the students would respond because we had never done this before. However, after the first week of teaching, comparing the control group and experimental group yielded significant differences. Class order was significantly better for the experimental group than for the control class, and teachers found it easier to control the tempo of the experimental class. After the second week of instruction, when the teachers were teaching introductions to the musical instruments, detailed structure, performance, tuning and so on, the timely presentation of materials and magnification of graphs made it easy for teachers to help their students understand various concepts pertaining to the instruments. Students' concentration times were also longer. The software

provided teachers with much help because the materials were complete, and the teacher can timely switch of the picture in order to avoid the troubles of material preparation and shifting between different teaching media, which made the flow of teaching smoother and saved time. Thus, the Chinese musical instruments CAMI software is a good tool for teachers. The voice, animation, picture, and films used by the software structured the teaching situation, triggered students' motivation to learn and made the construction of concepts easier.

CONCULSION AND RECOMMENDATIONS

Conclusion

After synthesizing the analyses mentioned above, the conclusions are as follows:

1. The CAMI software is better than the traditional instruction method in producing learning achievement in students taking the music appreciation course "Learning Chinese Musical Instruments."
2. Students pointed out that the CAMI software interfaces were user friendly and were able to attract their interests. In addition, the design of the content and structure is suitable for learning in-class and after-class because it can clearly present various concepts regarding Chinese musical instruments.
3. Students had a positive view on the use of the CAMI teaching strategy in their courses, according to the results of the learning satisfaction questionnaire. Most of students identified with the static pictures, the effects of the performance films, the design of the teaching material and the software structure. The majority of students pointed out that the CAMI was more attractive and interesting than traditional instruction. They said the CAMI enhanced their learning achievement during the course on learning Chinese instruments.
4. The structural equation correlation of "software interfaces and content design" and "learning attitude" with "self-awareness learning results" has reached statistical significance, indicating that there was a positive structural correlation with "self-awareness learning results." The analyses of path effects also showed that the better "software interfaces and content design" is, the more it could positively enhance students' "learning attitude" and further enhance their "self-awareness learning results."
5. From students' achievement, classroom records and the results of teachers' introspection after the experimental instruction, most students possessed positive views on the use of the CAMI teaching strategies in the course, and the CAMI software for Chinese musical instruments used in the study is a good tool for teachers. The voice, animation, picture, and films used by the software structured the teaching situation, triggered students' motivation to learn and made learning concepts easier.

Recommendations

1. The Design of Teaching Software

(1) Concise Words on a Single Page Making Key Points Easy to Present.

Considering the richness of the contents, we integrated too much writing material into the software. After the experimental instruction period, we found that the students thought it was not easy to learn Chinese musical instruments through the CAMI, and the teachers were obsessed by too many words on a single page. Therefore, software designers should consider how to design software that concisely and clearly describes content.

(2) Enhancing Interaction with Teaching Software

Because the teaching software designed by the study emphasizes use by the teacher, there is space for improvement in the design for interaction between the software and the students. We recommend that research and development of teaching software should focus on the effects of interaction between the software and students. Students could receive immediate feedback through the medium of teaching software and experience an increased interest in learning. We also hope that the software could be transferred onto a CD or put on the Internet for students to study by themselves for practice before class and review after class.

(3) Add Explanation of Melody and the Introduction of Instrumental Ensembles

Because the producer of the teaching software emphasized the introduction of a single musical instrument and was limited by manpower and funding, the software did not include an explanation of melody or the introduction of instrumental ensembles. We recommend that this material is added to make the contents more complete.

(4) Present the Principle of Sound Production by Musical Instruments

From the learning satisfaction survey questionnaire, we learned that it is difficult for students to understand the principle of sound production by musical instruments. We speculated that the principle of sound production is difficult to express by oral reports or pictures. We could use animations to demonstrate how the air flow makes the air vibrate in a musical instrument, how stringed instruments produce sound through bowing or finger picking the strings, or how the sound is conducted through the instrument. Percussion instrument vibration and sound could also be explained. Thus, students would have in-depth understanding of the principle of sound production by musical instruments.

2. Teaching

(1) Adopting a Diversified Teaching Pattern

The teaching pattern should be limited to particular, frequently used teaching patterns or customs. In addition to

traditional narrative teaching approach, teachers should open their minds and accept new teaching methods and different musical performance methods. The results of the study showed that in the course on learning Chinese musical instruments, students are more successful with the CAMI than with traditional narrative teaching approach. Therefore, not only can students benefit from the adoption of the CAMI, but teachers also are able to attain feelings of satisfaction from the CAMI.

(2) Teachers Should Interact with Students in the Classroom

Using the CAMI allows teachers to present rich, diversified contents. However, if teachers are not careful, they may forget to interact with students and simply play the role of the voiceover that is only responsible for reporting on the materials presented by the software. In this way, students' concentration and learning interest would also be reduced, and they would experience learning fatigue. Even when there is well-produced software, it would not be helpful for teaching. Therefore, construction of a warm atmosphere in the class and good interaction between the teacher and students are the keys to successful teaching.

3. The Administrative Cooperation of Schools

To have rich and diversified music instruction, the installation in specialized classrooms with internal equipments, such as computers, a fixed single-beam projector (which features bright illumination and produces a clear picture without needing to turn off the lights), a large screen, stereo hi-fi equipment and so on, should be a basic requirement. A good environment for learning music will enhance the learning results.

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CASE STUDY DISCUSSION EXPERIENCES OF COMPUTER EDUCATION AND INSTRUCTIONAL TECHNOLOGIES STUDENTS ABOUT INSTRUCTIONAL DESIGN ON AN ASYNCHRONOUS ENVIRONMENT*

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ABSTRACT
The aim of this study is to reveal opinions and experiences of two Computer Education and Instructional Technologies Departments' students about case study discussion method after they discussed in online asynchronous environment about Instructional Design (ID). Totally, 80 second year students, 40 from Dokuz Eylul University and 40 from Karadeniz Technical University, participated to the study. Communication among students was managed *via* discussion lists. The data were collected with questionnaire, written reports, observations and interviews. The findings indicated that this learning environment made a positive effect on ID knowledge of students. In addition, students stated limitations and positive results of discussing in asynchronous learning environment. Lastly, students suggested some opinions to make this environment more efficient and effective.
Keywords: Computer Education and Instructional Technologies**,** Instructional Design, discussion list, case study.

INTRODUCTION

Instructional Design Knowledge

"Educational Technology" is a preliminary key concept to understand "Instructional Design (ID)". The concept of "Educational Technology", which is underlying theory of all Computer Education and Instructional Technologies (CEIT) departments in Turkey, has been defied and associated with ID by different scientists studying on the issue. The root of Educational Technology (ET) is attributed to development of three fields; ID, educational media and educational computers (Newby, Stepich, Lehman & Russell, 2006). The Association for Educational Communications and Technology (AECT), the most credible institution about the issue, named the concept with the different dates it has been defined (1963, 1970, 1977 and 1994). The concept has been explained in quite different ways in these definitions (Reiser, 2007; Seels & Richey, 1994; Seatler, 1990). While in early definitions "educational technology" was referred as an educational tool then this definition was strongly criticized and then it was started to be assumed as a process. Along with it was perceived as a process, the principals of instructional design were accepted as the concerns of this field.

The last definition of educational technology is "*the study and ethical practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources"*(Januszewski & Molenda, 2008, p.1). One of the differences of this definition is the word 'ethics'. This term underlines that field experts should respect the professional manner. At the same time, the definition highlights '*improving performance'* as well. One another aim of the instructional technologies is to help students to put the theoretical knowledge and skills they gained into practice. Another function; 'facilitating learning' tells that students have the responsibility of choosing the things they will learn without focusing on the offered innovation; that is, without focusing how to use technology. In addition the former terms; '*design, development and evaluation*' were replaced with '*creating, using and managing*'. "*Using*" begins with selection and continues with diffusion. And "*managing*" combines the project, distribution network, staff and information management. Finally "*creating*" includes the steps of producing learning environments and instructional innovations including designing, developing and evaluation processes in 1994 definition.

The concept of instructional design and learning are closely interrelated. The effects of all theories explaining learning reflect on instructional design with the application of different instructional strategies. Instructional design, which used to be under the influence of the behaviorist theories and so frequently criticized recently, is

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now shaped by cognitive, constructivist and social theory (Schiffman, 1995). Smith and Regan (2005) define instructional design as "the systemic and reflective process of translating principles of learning and instruction into plans for instructional materials, activities, information resources, and assessments" (p.4). Gagne, Wager, Golas and Keller (2005) simply define that instructional design is "the process for creating instructional systems" (p.18). Concerning all these definitions, one can realize that "instructional design" is a systematical process, which tries to design learning environments so as to provide persistent learning.

The most prominent group who is known for mastering instructional design process in Turkey is CEIT graduates. This has two reasons. First of all, opposing to all other departments, an undergraduate course called "Instructional Design" is offered by CEIT departments. This course provides students with sufficient level of theoretical knowledge about instructional design. In addition to this, quite naturally, educational technologies are concerned thoroughly in CEIT departments. Concerning these factors, it can be understood that how important are CEIT graduates in instructional design process. However, the instructional design is not a one hand process, rather it needs team work. The coordinated operation of the team composed of instructional designer, field expert, evaluation expert and teacher is closely correlated to the competences of team members. Considering the issue from this perspective, the necessity of "Instructional Design" course for CEIT department students can be clearly understood.

Obtaining instructional design knowledge is not simply learning theoretical knowledge associated with teaching and learning or understanding procedural steps of a project. Just like a doctor diagnoses an illnesses and then s/he applies the proper treatment; in order to gain the instructional design knowledge, the young designers should first determine the problem correctly, then they should serve the proper solution as a result of the systematic process they follow and they should test the validity of this solution. Hence, this type of knowledge is practical knowledge which is quite hard to obtain. In order this hard and practical type of knowledge to be internalized by learner, meaningful learning should take place. In meaningful learning, the task assigned to students should include effective, constructive, purposeful, authentic and collaborating activities (Jonassen, Howland, Marra & Crismond, 2008; Grabe & Grabe, 2006; Wiske, 1998). So, concerning the content, it is very important to apply variety of instructional methods and techniques in instructional design course for meaningful learning to be attained. Related to this issue, Mehlinger and Powers (2002) reported that; Internet aided education will carry on the most effective teacher education. They think that teachers will admit the technology that is used for their own learning easier and especially candidate teachers will learn more effectively with the new technology by departing from traditional instructional techniques. For this reason, concerning positive opinions about the results to be obtained and the technology acquaintance of the CEIT students, who are the target group of the instructional design course, it is important to try using the Internet for instruction of this course.

Online Asynchronous Environments

Discussion lists are the electronic environments where people with common interest area exchange information. Thanks to these asynchronous environments, students can come together in different locations and time and they can exchange information. There are studies about the benefits and motivating effects of these environments (Dawley, 2007; Baran & Cagiltay, 2010). There are also some foreign studies investigating problem solving strategies of students by observing students' case analysis about the instructional design on asynchronous environment (Stepich, Ertmer & Lane, 2001; Jonassen & Hernandez-Serrano, 2002). However, since cultural differences are really significant, the question "To what extend is sharing information among CEIT students effective on their learning of "Instructional Design" course?" is still an important question to be inquired in Turkey case. In addition, what kind of effects using technology; particularly the internet, in "Instructional Design" course have on students should also be investigated.

The aim of the study

This study aims to comparatively determine the opinions of Computer Education and Instructional Technologies Department students from Dokuz Eylul University and Karadeniz Technical University about the online case study discussion method after they discussed in online asynchronous environment about Instructional Design (ID). Towards this aim, the answers of the following questions have been sought:

- How do case study discussions affect ID knowledge of students?
- What are the positive results of discussing about a case study in online asynchronous environments?
- What are the limitations of discussing about a case study in online asynchronous environments?
- What are the suggestions of the students about the efficiency of discussing a case study in online asynchronous environments?

METHOD

This study, which was conducted on Dokuz Eylul University (DEU) and Karadeniz Technical University (KTU) Computer Education and Instructional Technologies (CEIT) department students, took place in the spring term of 2008-2009 educational year. Sampling students from two different universities provide researchers with the opportunity of comparison of the data.

The sample

The sample of this study is consisted of 80 Computer Education and Instructional Technologies students, 40 of whom from DEU (10 female-30 male) and 40 from KTU (12 female- 28 male).

The procedures

Implementations were conducted in the Spring term of 2008-2009 educational year, in "Instructional Design" course in the second year of the curriculum. The researchers working for DEU and KTU instructed the course in an identical way by forming a common lecture plan and resources. The content of the course was determined as; definition, components, meaning and significance of instructional design, the origins of instructional design, systematic approach, and the steps 'analysis and design, development, implementation and evaluation'. Having covered these theoretical scaffolding, students started to present sample lessons they developed in accordance with instructional design model of ASSURE. During this application the students from both universities were expected to participate to online discussions asynchronously. The debates were scattered along two months in the spring term of 2008-2009 educational year.

This study is about the evaluation of online discussion performed in instructional design course. Since it is hardy possible for all students to be in front of the computers at the same time, 'discussion list' was used for the study. The students were divided into four groups with 20 members; so as to each group has equal number of students from both universities (Figure 1). The reason of grouping is to reduce the number of students in each group and by this way to avoid too many mails and the confusion among the mails sent to discussion. Two case studies taken from the book called; "*The ID CaseBook: Case studies in instructional design*" by Ertmer and Quinn, were used in these discussions. These two cases were translated into Turkish and the characters in the cases were given Turkish names. The case studies were presenting situations related to instructional design field. The students in the sample were asked; to analyze the cases, to answer the directed questions and to create some alternative ideas related to the solutions of the presented problems.

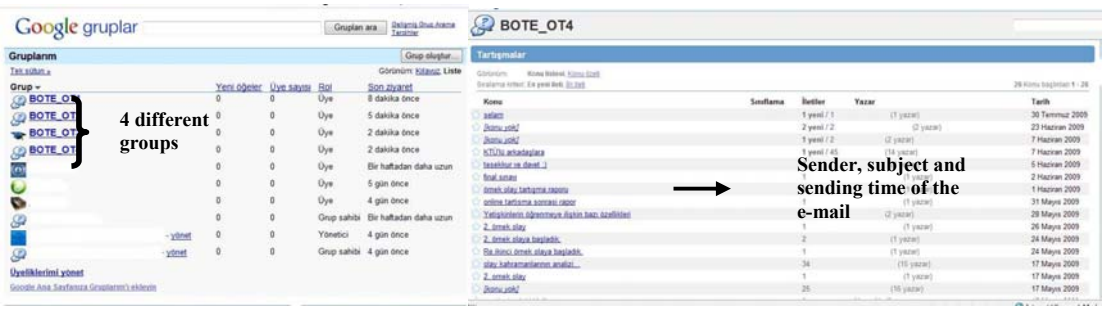

Figure 1. Instructional design discussion list and mails sent

Moderating discussion groups

In this study, discussion groups were shared between the researchers, in such a way that each researcher had two groups. The researchers read the e-mails that were sent to their groups and participate to discussions if it was necessary. Generally, they preferred staying as an observer instead of replying every single e-mail. The researchers participated to the discussions in the other researcher's groups only when their names were mentioned. The researchers were responsible for sending the case studies to the list, starting and ending the discussions. Additionally, each group was administrated by a student from the group. These administrators were responsible for registering the students to the groups and solving the technical problems faced.

Data collection tools

The data in this study were collected with both qualitative and quantitative means. First, the students were surveyed with a questionnaire about their "Internet using styles." Then a semi-structured written interview form was prepared. The students filled and sent the form to the researchers after the e-mail discussion session was over. As a result, only 35 students from DEU and 22 from KTU sent their interview forms to the researchers. For this reason the qualitative data coming from the interviews were presented out of 57 students, not 80 although 80

students participated to online discussions. Finally, the classroom observations during the instruction and informal interviews of the researchers were other data gathering tools.

Data analysis

The data coming from the questionnaire were analyzed quantitatively. Frequencies and percentiles were used for this aim and the Internet using profiles of the students were analyzed with Excel application. On the other hand, in qualitative analysis was conducted with the help of HyperResearch 2.6 software. The interview data were analyzed with this software; the codes and themes were formed, and then the frequencies of codes were determined. The data from observations and from informal interviews were used to support the data from the interviews or to eliminate the unnecessary data. The student responses to written interviews were directly quoted in findings section; the students from both universities were symbolized as D_1, D_2, … D_{39}, and D_{40} and K_1, K_2,… K_{39} ve K_{40}.

Validity and Reliability

Validity and reliability issues in a qualitative natured study are the most important points to make the study credible by other researchers. First of all, different data collecting tools were used to increase the dependability of this study. Secondly, the method of the study was described as detailed as possible to pave a way for the researchers who will study similar topics. In addition, the data were directly collected from the students in computer environment, which prevents data loss. As another factor, qualitative data analysis software was used for the analysis of the data. And finally, the data obtained as a result of the analysis were cross-checked by the researchers.

FINDINGS

Internet using styles

The researchers needed to investigate Internet using styles of the students since the study would be carried out on the Internet by its nature. The data obtained with the questionnaire that was applied to all the students were presented in Table 1.

Table 1. Internet using styles of the students

		DEU (n=40)		KTU (n=40)		Total (n=80)	
Questions	**Answers**	f	%	f	%	f	%
Do you have your own computer?	Yes	36	90	35	87,5	71	88,75
	No	4	10	5	12,5	9	11,25
Where do you mostly access to the Internet?	Home	20	50	15	37,5	35	43,75
	Dormitory	6	15	7	12,5	13	16,25
	Internet cafe	11	27,5	15	37,5	26	32,5
	Friend's computer	3	7,5	3	7,5	6	7,5
How many hours are you online in a week?	None	1	2,5	3	7,5	4	5
	1-7 hours	11	27,5	16	40	27	33,75
	7-14 hours	12	30	11	27,5	23	28,75
	14>hours	16	40	10	25	26	32,5
What are the things you do most when you are online?	1. thing	Search Engine		Search Engine			
	2. thing	Assignment-Research		Assignment-Research			
	3. thing	Reading News		Reading News			
	4. thing	Watching Movies		Games			
	5. thing	Games		Watching Movies			

With the questionnaire it was examined that; whether the students in the sample have their own computers, where they have Internet access, their total Internet connection duration in a week and what the things they do most are when they are online. In Table 1, connecting to Internet at home ratio of DEU students (50%) and connecting at Internet cafe ratio of KTU students (37,5%) were greater figures comparing to the counterpart group. As another difference between groups, the ratio of Internet connection duration more than 14 hours was 40% for DEU but 25% in KTU. The groups, in general, presented similar Internet using style features.

The Effect of Online Asynchronous Environment on Instructional Design Knowledge

In the written reports the students were asked the question; "How did discussing on cases affect your Instructional Design (ID) knowledge?" Table 2 summarizes the student answers for this question by classifying

with respect to universities and presenting the repetition frequencies of the answers. 89,5% of all students, 57,9% from DEU and 31,6% from KTU reported that case discussions affected their ID knowledge. Additionally, the researchers revealed how ID knowledge changed by classifying opinions under different codes. According to this classification it was determined that the students had some gains in terms of ID like "having a broader point of view", "associating the theory with the practice", "understanding problem solving process" and "understanding the aim of the course and ID" (Table 2).

Table 2. Student opinions about the effect of discussions on ID knowledge

		Repetition Frequencies of the Codes by Students				Repetition Number of Codes	
		DEU		KTU		Total	
Themes	Codes	f	%	f	%	f	%
	Yes	33	57,9	18	31,6	51	89,5
	No	2	3,5	4	7,0	6	10,5
Having a broader point of view on ID	Realizing variation of opinions	3	2,4	2	1,6	5	4,0
	Realizing and correcting weaknesses	9	7,2	-	-	9	7,2
	Improving the point of view	9	7,2	4	3,2	13	10,4
	Providing consensus of opinion	2	1,6	-	-	2	1,6
	Acquiring new knowledge	14	11,2	6	4,8	20	16,0
Theory practice relationship	Reinforcing the theory	15	12,0	6	4,8	21	16,8
	Practicing	8	6,4	-	-	8	6,4
	Putting theory into practice	5	4,0	6	4,8	11	8,8
	Persistent learning	7	5,6	-	-	7	5,6
Problem solving process	Researching	3	2,4	1	0,8	4	3,2
	Analyzing information	1	0,8	-	-	1	0,8
	Realizing problems	7	5,6	1	0,8	8	6,4
	Finding solution ways	8	6,4	1	0,8	9	7,2
Understanding the aim	Understanding the aim of the course	3	2,4	1	0,8	4	3,2
	Understanding the importance of ID	3	2,4	-	-	3	2,4

N_{DEU}=35, N_{KTU}=22

When opinions put forward by the students reviewed; "improving the point of view" (10,4%) and "acquiring new knowledge" (16,0%) were frequently repeated items under having a broader point of view about ID theme. In theory – practice relationship theme; positive opinions like "consolidating the theory" (16,8%) and "putting theory into practice" (8,8%) were mentioned. In addition to that, thanks to asynchronous case study discussions, students gained skills like; "realizing and correcting weaknesses", "practicing" and "realizing problems". Some quotations from the student answers are given below:

D2: Sometimes, our point of view was extended when another friend came up with a suggestion or solution we couldn't think of.

D1: While we were discussing the case, we had opportunity to discuss about the theoretical knowledge we previously learned in detail.

K3: With the help of the case studies, I had chance to apply the information I gained during the Instructional Design course and I also had opportunity to use them interactively.

D12: The different comments we made about the case studies made my knowledge about instructional design persistent.

However, opinions related to the themes of problem solving process and understanding the aim were less frequently mentioned by the students. In problem solving process theme; "finding solution ways" and "realizing problems" were the commonly discoursed opinions. In "understanding the aim" theme the opinions that this environment helps understanding the aim of the course and understanding the importance of ID were mentioned.

Contrary to positive opinions summarized above, 10,5% of the students argued that online case discussions had no effects on their ID knowledge. To explain this situation, the students remarked that "there were no original ideas", "there was no share of knowledge", "discussions were far from being scientific", "the environment was not suitable for research", "there were noncreative messages", "the participants could not understand the relation the cases and the theory part of the course content and "the content of the cases were very complex". Some of the student opinions are quoted below:

D29: The discussions did not touch any matters out of my knowledge. Before the discussion I was expecting to face with variety of different opinions and approaches however it didn't happen so; as I wanted and expected.
K1: So, since most of the discussions were not directly about scientific information we didn't learn new things. During discussions the participants came up with solutions by using their experience and logic rather than knowledge. This, I think, made the results ineffective.

In sum, the students of DEU feed more positive opinions towards online asynchronous discussion environment than the students from KTU do (Table 2). Still, few students from both universities stated that this learning environment did not affect their "Instructional Design" knowledge (DEU: 3,5%; KTU: 7%).

Positive Aspects of the Learning Environment
The students were asked the question; "What are the positive aspects of the case discussions carried out on the Internet?"(Table 3). Then, as a result of the classification of the opinions obtained from the student answers, the positive aspects of the environment can be listed under these titles; "academic gains", "social interaction", "learning environment", "discussion dimension" and "contributions to personality".

Table 3. Student opinions about positive results of case discussions on the Internet

Themes	Codes	Repetition Frequencies of the Codes by Students				Repetition Number of Codes	
		DEU		KTU		Total	
		f	%	f	%	f	%
Academic gains	Exchange ideas	17	11,4	7	4,7	24	16,1
	Realizing different points of view	11	7,4	7	4,7	18	12,1
	Finding solution	4	2,7	2	1,3	6	4,0
	Consolidation of knowledge	2	1,3	3	2,0	5	3,4
	Research skills	4	2,7	-	-	4	2,7
	Seeking consensus	3	2,0	1	0,7	4	2,7
	Understanding the issue	1	0,7	2	1,3	3	2,0
	Gaining experience	2	1,3	-	-	2	1,3
Social Interaction	Communicating with other students	14	9,4	6	4,0	20	13,4
	Comparing levels	2	1,3	1	0,7	3	2,0
	Groupwork	2	1,3	1	0,7	3	2,0
Learning environment	Independent from the time	9	6,0	3	2,0	12	8,1
	Independent from the place	6	4,0	4	2,7	10	6,7
	Timesaving	5	3,4	1	0,7	6	4,0
	Internet application in education	2	1,3	-	-	2	1,3
	Storing information	3	2,0	-	-	3	2,0
	Flexible learning environment	1	0,7	2	1,3	3	2,0
Discussion dimension	Learning how to discuss	1	0,7	4	2,7	5	3,4
	Communicating by writing	2	1,3	1	0,7	3	2,0
	Detailed discussion	1	0,7	1	0,7	2	1,3
	Ability to use visuals	2	1,3	-	-	2	1,3
Contributions to personality	Self-confidence	1	0,7	3	2,0	4	2,7
	Participation	1	0,7	2	1,3	3	2,0
	Activating passive students	2	1,3	-	-	2	1,3

N_{DEU}=35, N_{KTU}=22

In the student answers the most frequently repeated positive aspects of the environment were clustered under "academic gains" title. Among academic gains, the most protruding ideas were "exchange ideas" (16,1%) and "realizing different points of view" (12,1%). In addition, the students discoursed positive results like; "finding solution", "consolidation of knowledge", "research skills", "seeking consensus", "understanding the issue", and "gaining experience". Below are some student opinions;

D8: Besides, I've seen once again that my idea or in other words one's own idea may not always be true; listening to others, listening to different ideas and opinions, there are things to learn from them.

K8: We had opportunity to improve our instructional design knowledge and to find new solution ways by generating new ideas and collecting opinions of other students.
K18: This was an environment to apply knowledge we learned during the course.

Another aspect of the issue is this environment let "social interaction" happen. The results showed that the opportunity of "communicating with other students" (13,4%) was perceived as a positive aspect by the students from both universities in the case discussions on the Internet. Besides, this environment gave students the chance of "comparing the levels" of two different universities. "Groupwork" is another positive result mentioned. About the issue, one student noted that:

D21: The most positive result of it to know what our fellows in different universities learn. Sometimes I think to myself what is taught in other universities, what differences we will face when we graduate. This is not only for instructional design course for sure. I got the answer of the question "Where are others, where are we?" for this lesson.

Additionally, the students expressed positive opinions about the "learning environment". The most frequently repeated opinion about the environment was its "independency from time and place" (8,1% and 6,7%). The students specified other positive aspects of this environment as; "Internet application in education", "storing information" and its being a "flexible learning environment". The opinions of two of the students are below:

D2: The most important advantage of discussions on the Internet is that there is no place and time problem. People can join the discussion actively wherever they are and whatever the time is.
D17: Another positive aspect is there was no time barrier. Everybody could check their mails when they were available and join the discussion.

"Discussion dimension" is another positive result reported by the students interviewed. "Learning how to discuss", "communicating by writing", "detailed discussion", "ability to use visuals" were other positive aspects under discussion dimension theme. On this issue, a student said:

D1: One can put things like photos and share with friends on the Internet environment to support his/her idea… Our discussions on the cases affect our lectures positively in terms of using the facilities offered by the computer (picture, video etc.).

The last theme is "contribution to personality". This theme was detailed by students as; "self-confidence", "participation to lesson" and "activating passive students". Two students noted:

K4: Our skills of expressing our meaning to others have improved a little. We improved our reading& comprehension skills by reading and understanding given case studies.
D30: Our friends who are quiet in the class were more active in discussion environment.

It was determined that DEU students mostly repeated the codes like "exchanging ideas", "communication with other students" and "realizing different points of view" about the case study discussions on the Internet. Similarly, KTU students also mentioned "exchanging ideas", "communication with other students" and that they are pleased to "realize different points of view". The students of both universities voiced being "independent from place and time" as a positive side of the environment.

Limitations of the Learning Environment

The question: "What were the limitations of in the case study discussions on the Internet?" was asked to the students. 96,4% of the all students mentioned some limitations but only 2 students from DEU (3,6%) said "there were no limitations". Having examined the answers, the limitations of the environment grouped under "access problem", "communication problems", "technological problems", "discussion problems", "time problems", "first experience", "personal problems" and "written language problems" theme titles (Table 4).

Table 4. Student opinions about the limitations of the case discussion on the Internet

Themes	Codes	Repetition Frequencies of the Codes by Students				Repetition Number of Codes	
		DEU		KTU		Total	
		f	%	f	%	f	%
Access Problem	Internet access restrictions	15	11,1	11	8,1	26	19,3
Communication Problems	Misunderstandings	6	4,4	8	5,9	14	10,4
	Not face to face	6	4,4	6	4,4	12	8,9
	Unable to give and get instant response	7	5,2	1	0,7	8	5,9
	Not knowing other students	4	3,0	3	2,2	7	5,2
	Unable to interpret psychological responses	5	3,7	-		5	3,7
	Unanswered questions	3	2,2	1	0,7	4	3,0
Discussion problems	Overemphasizing the same issue and getting monotonous	7	5,2	3	2,2	9	6,7
	Discontinuity of discussions	2	1,5	3	2,2	5	3,7
	Deviating from the main interest	1	0,7	3	2,2	4	3,0
	Infertile discussion	1	0,7	2	1,5	3	2,2
Time problems	Inability to catch up with the pace of group	8	5,9	3	2,2	11	8,1
	Workload due to other projects	-	-	5	3,7	5	3,7
	Lack of time	-	-	2	1,5	2	1,5
First experience	Being unfamiliar with the application	1	0,7	1	0,7	2	1,5
Personal problems	Thinking the discussion is boring	-	-	1	0,7	1	0,7
	Not being active	2	1,5	-	-	2	1,5
	Anxiety	1	0,7	-	-	1	0,7
Written language problems	Insufficient interaction-communication	5	3,7	2	1,5	7	5,2
	Inability to express thoughts with writing	3	2,2	3	2,2	6	4,4
	Long writings	2	1,5	-	-	1	0,7

N_{DEU}=35, N_{KTU}=22

When the student answers are examined, the most frequently mentioned problem by them was "Internet access restrictions" (19,3%). A student stated that:

> *D6: The biggest handicap was everyone didn't have the Internet whenever they want. For example; I joined the first case very late since I didn't have the Internet connection.*

Another frequently mentioned restriction was "misunderstandings"(10,4%) under the "communication problems" theme title. It was observed that the students interpreted different meanings from each others' written language. For example, a student expressing himself by using exclamation marks was thought as scolding the correspondent. Actually, that student simply meant exclamation. Another important restriction was that the "discussions was not face to face" (8,9%). In addition, the students mentioned a restriction like being "unable to interpret psychological responses" since the discussion was on the Internet. The students also mentioned that they faced problems like; being "unable to give and get instant responses" and "unanswered questions".

The students also speak out the discussion problems. There were variety of problems like: "overemphasizing the same issue and getting monotonous" (6,7%), "discontinuity of discussions", "deviating from the main interest", "infertile discussion". Some students' opinions about this issue are presented below:

> *D36: Since everybody was writing when they want, there might have been some repetitions on topics of discussion. The reason of this was everybody was not checking the e-mails everyday.*
> *D20: Some issues were discussed excessively long and no progress was made.*

Time problem of the student adversely affected their participation to the discussions. For this reason, a problem like "inability to catch up with the pace of group" (8,1%) came out. In addition, some KTU students mentioned

about "workload due to other projects" and "lack of time". Below are some quotations from the students about these issues:

> *D21: When you want to answer an e-mail, you realize that the topic is already finished; they are discussing some other things. So, you skip that part and try to catch up. This happens when you are not connected to the Internet for a long time.*
> *K1: We could not engage to it properly because of the workload of the other courses and projects. Still, I tried to participate as much as I can.*

The students did not know each other before the application. This also had part in the problems of case discussion in asynchronous environment. The students also referred their unfamiliarity with such an application as another restriction. A student said:

> *D3: The students must have been behaving shyly since they didn't know each other. So, they must have been writing their mails accordingly. At least I wrote in that way.*

Some of the students put forward "personal problems" like; "thinking discussion is boring", "not being active" and "being anxious". Finally the students pointed out "written language problems" and noted limitations like; "insufficient interaction-communication", "inability to express thoughts with writing" and "long writings". The opinions of two students are below:

> *D35: People may not express their feelings and their meanings similarly and as impressive as one another in their each writing.*
> *K4: We can't fully express our opinions in writing. Personally, I send my writings after reading 4-5 times.*

To sum up; the common problem of case study discussion, determined by the participant students from 11,1% of DEU and 8,1% of KTU was noted as Internet access restrictions. It was observed that communication problems was discoursed by the students from both universities. The misunderstandings stemmed from not being face to face particularly mentioned by the students from both universities. While the students from DEU focused on discussions' "getting monotonous" and "inability to catch up with the pace of the group", the students from KTU concerned about "workload due to other projects".

Students' Suggestions to Increase the Efficiency of the Learning Environment

The students were asked the question; "What are your suggestions to make case discussions on the Internet more efficient?" The answers grouped under the theme titles of: "management of the environment", "case study", "discussion", "synchronization", "social cohesion" and "participation style" (Table 5).

Table 5. The suggestions of CEIT students about case discussions on the Internet

Themes	Codes	Repetition Frequencies of the Codes by Students				Repetition Number of Codes	
		DEU		KTU		Total	
		f	%	f	%	f	%
Management of the environment	Active participation of the administrator	22	15,1	10	6,8	32	21,9
	Student motivation	8	5,5	3	2,1	11	7,5
	Inclusion of the non-participating students	5	3,4	1	0,7	6	4,1
Case study	Simplifying the topic	2	1,4	4	2,7	6	4,1
	Increasing the number of cases	5	3,4	-	-	5	3,4
	Cases appropriate to the culture, interesting and from daily life	6	4,1	3	2,1	9	6,2
Discussion management	Face to face discussion	11	7,5	1	0,7	12	8,2
	(Not) discussing about a matter longer than necessary	4	2,7	3	2,1	7	4,8
	Level discussion	4	2,7	1	0,7	5	3,4
	Short comments	3	2,1	1	0,7	4	2,7
	Extending discussion time	4	2,7	-	-	4	2,7
	Discussing in a single group	3	2,1	-	-	3	2,1
	Different times for discussion and assignment	-		3	2,1	3	2,1

	submission						
	Preventing one to one discussions	1	0,7	2	1,4	3	2,1
Synchronization	Synchronization	8	5,5	3	2,1	11	7,5
Social cohesion	Mingling students	5	3,4	3	2,1	8	5,5
	Inclusion of different university students	5	3,4	-	-	5	3,4
Participation style	Not grading the participation	4	2,7	4	2,7	8	5,5
	Abolition of compulsory messaging	2	1,4	-	-	2	1,4
	Obligatory (participation)	2	1,4	-	-	2	1,4

N_{DEU}=35, N_{KTU}=22

The interviewed students particularly pointed on management of the environment. By means of "active participation of the administrator" (21,9%), "student motivation" (7,5%) would increase and this would provide "inclusion of non-participating student" (4,1%). Here is a student opinion:

> *K11: To direct students, the instructors should ask critical questions when it is necessary, by means of that the discussion won't stuck and flow of new ideas gets easier.*

The students make some suggestions about the selected cases like; "simplifying the topics of the cases"(4,1%) and "increasing the number of cases"(3,4%). In addition students suggested that "Cases, appropriate to the culture, interesting and from daily life" should be chosen (6,2%).

The interviewed students also submitted some suggestions about discussion management. It was determined that the students would like to go on these Internet discussions face to face (8,2%). Moreover, they also suggested; "not discussing about a matter longer than necessary", "level discussions", "short comments", "extending discussion time", "discussing in a single group", "preventing one to one discussions". Few students from KTU came up with a suggestion like "Different times for discussion and other assignment submission" should be arranged.

> *D18: We can also discuss case studies in the classroom and we can expect more effective results.*
> *D9: The level and manner of the participants should be monitored.*
> *D28: I guess some friends of ours did their best to increase their number of messages. I think the content is more important, one message goes to everyone and everyone can respond it. So we could express our meaning as simple as possible in a message.*

Another suggestion mentioned by the students from both of the universities was about carrying out the discussion synchronously (7,5%). The students think that the student participation would increase in a synchronous discussion.

> *D1: Some definite time may be set and participants may be asked to be connected to the Internet at the same time, the instructor may also be connected at that time to guide participants.*
> *K4: A fixed day is determined and the case study is given in advance so that the participants could research about the case, by this way debaters can prepare better and discussion may become more effective.*

Another theme was social cohesion. Some of the students were thinking that the students of the two universities should be introduced to each other in order the discussions to be more effective (5,5%). Some students from DEU suggested discussion groups which students from different universities can participate in (3,4%).

The students also gave some suggestions about the participation style. "Not grading the participation" and "abolition of compulsory messaging" were two of them. On the contrary, some students suggested that students should be made to "join the discussions obligatorily".

> *K20: Besides, the activity was done for grade. This hindered the progress. Everybody sent mails without content, just for being sent them.*

The data in Table 5 show that active participation of the instructors was suggested by the students of both universities. The students from DEU suggested case discussions should be conducted face to face and synchronous. On the other hand, some students from KTU suggested that the case should be simplified, discussions should not to be converted to grade and different times should be arranged for other assignment

submissions and the discussions. When Table 5 is examined it can be seen that the students from DEU suggested more opinions about online case discussions.

Overviewing the findings, it was determined that Internet using styles of the students from DEU and KTU were similar apart from certain points. The vast majority of the sample thinks that the case discussions on the Internet affected their "Instructional Design" knowledge positively. Exchanging ideas and communication with other students were the positive points of the online asynchronous case discussions mentioned by the students of both of the universities. The most significant problem of this environment was determined as Internet access. A considerable ratio of the students suggested that the instructors should be more actively involved in the case discussions.

DISCUSSION AND CONCLUSION

Instructional Design Knowledge, Case Study and Asynchronous Discussion

In this study, whether the case study discussion in asynchronous environment method affects "Instructional Design" knowledge was investigated in the first place. The results showed that the participants had the general opinion that the method was effective on ID knowledge. In detail, the students said that their vision was extended because of the existence of different universities. In addition, it was revealed that this environment mediated transformation of knowledge between theoretical and practical knowledge. Finally, with the help of the cases some learning gains like the students' understanding problem solving process and the aims of the course were reached. Bradshaw and Hinton (2004) classified the messages that come to discussion lists into four levels with respect to their content. According to this criterion, the students in general sent messages belonging to the second or third levels. These levels are about agreeing or disagreeing with common results and showing that they are aware of different opinions. Actually, this situation supports the result that small group discussions about a case yield good results particularly in the analysis of the case. That is; the analysis performed by a group of people with different backgrounds gives more successful results comparing to individual analysis (Flynn & Klein, 2001). In a similar study based on communities of practice theory, the researcher investigated whether the candidate teachers gain practical professional knowledge with the discussion list in video based case study method (Baran, 2007). This study proved that; primary school candidate teachers gain practical knowledge; realize different points of view and take lessons from the cases studies in the videos with this method. The guidance role of the educator is quite important in terms of setting discussion environments with high quality in asynchronous discussion environments. Using grades to motivate students is a method applied time to time but, at the same time it is very controversial (Soong, Chan, Chua & Loh, 2001). Additionally, it is also known that timely feedback provided by the instructor increases the student contentment in such environments (Kim, Liu & Bonk, 2005).

In short, the most significant result of this study is the students' transformation of theoretical ID knowledge into practical with the help of the small discussion groups in asynchronous case study discussion environment. The principal aim of the case discussion is to provide students with experience by making them associating the application in hand with theoretical framework (Ertmer & Quinn, 2003). In this study this aim was managed by discussing about cases with discussion list. Additionally, the difficulty of the transforming theoretical knowledge into practical knowledge was underlined in SECI knowledge transformation model by Nanoka (1994). Accordingly, the effectiveness of the discussion list in terms of transformation of knowledge is a quite remarkable result of this study.

Evaluation of Instructional Method and Tools

One of the most discussed issues in the field of instructional technology is which one has a real effect on learning: instructional medium or the instructional method. From this point of view, asynchronous case study analysis method was employed in this study as instructional method. The instructional medium of the study was discussion list. In addition two universities, two different points of view, came together in the same environment. This design of this study showed that the discussions about case studies related to instructional design and carried out with discussion list method lead some positive results on candidate teachers living in different geographical locations. These academic gains were effective learning in social environment and learning how to discuss. Actually, the literature also mentions that interaction and academic communication makes these environments attractive (Tennent, Hyland, 2004; Kim, Liu & Bonk, 2005; Gursul, 2008; Sarsar, 2008).

This study also ascertains some limitations in discussion lists which arise from asynchronous communication style. These limitations were communication problems, problems coming out during discussions and timing problem. The most frequently mentioned communication problem was misunderstanding. It is evident that misunderstandings are important factors in such online discussions. The most significant solution noted by the students to overcome these problems is conducting discussions face to face. The lack of face to face

communication was also mentioned by different students participated in similar studies (Sarsar, 2008). It is known that, the means like video conference or synchronous chat tools can be used to talk and by this way more proper communication can be managed in non-face to face cases (Kim, Liu & Bonk, 2005).

RECOMMENDATIONS

Backed with the results of this study, we recommend other educators to apply asynchronous discussion on a case study method for providing students with instructional design knowledge. We can look closer to the methods to make this discussion environment more effective:

1. First of all, the most important factor is the mission of a moderator of discussions. The moderator is responsible for rendering discussion environment effective and to adjust environment to yield intended learning outcomes (Stepich, Ertmer & Lane, 2001; Topcu, 2006; Gursul 2008). For this reason, moderators should actively engage discussions and influence the environment with their ideas. When the classroom is crowded, some students from the class should lead the group and guide them. In online asynchronous environments, selecting a leader student or leader students and letting them manage the discussion is a frequently applied practice (Kuzu, 2005).
2. The content of selected cases also affects the quality of discussions. So, launching as many case study discussions as in the term will help overcoming the problems arising from the content of the cases.
3. Too long one to one discussions and paying too much attention to a single topic should be avoided.
4. When there are students from different universities, leaving a longer time for adaptation of the groups is important in terms of their communication.
5. The participation should not be reinforced with grades not to stress them and the number of submitted messages should be kept in a reasonable limit.
6. In this study the students remarked that synchronous environment should be used. Levin, He and Robbins (2006) pointed out that the participants should be given the opportunity of joining both environments by comparing asynchronous and synchronous discussion environments. For this reason, carrying discussions to synchronous environments at times will eliminate the limitations of asynchronous environments.
7. This study showed that all of the students in the class were not participate to this implementation. Apparently, 23 out 80 students stayed away from asynchronous discussion environment. Guler (2007) specified that students with high level of communication in face to face environments do not need to communicate in online environments. Similarly, students who are reluctant to engage face to face communication interact more frequently in online environments. We assume that the findings of the study by Guler would be explanatory while describing the situation of 23 students, who did not submit the written reports.

We hope that this study will be helpful for Computer Education and Instructional Technologies department lecturers in terms of providing instructional design knowledge. We think there is a need for studies to provide instructional design knowledge with different methods.

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COMPUTER PERCEPTIONS OF SECONDARY SCHOOL TEACHERS AND IMPACTING DEMOGRAPHICS: A TURKISH PERSPECTIVE

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ABSTRACT
Technology use in education is largely influenced by external environmental and personal teacher factors. Adding a Turkish perspective, the purpose of the present study was to explore secondary school teachers' perceptions of computers and influencing demographics characteristics. Cross-sectional survey methodology was employed in three secondary high schools known for their educational and technological eminence. A total of 130 secondary school teachers participated. Teacher perceptions were defined to include computer attitudes, technological affinity, technological aversion, and confidence and comfort. The survey instrument measured these dimensions in four scales. General Linear Model findings illustrated effects of computer experience and training, gender, teaching field and Internet connection availability on perceptions. Ownership of personal computer appeared to be an important predictor of higher level computer experience and training, and consequently, more positive attitudes and higher confidence and comfort. Implications address pre- and in-service teacher development programs. Further research recommendations are made.
Keywords: Computer perceptions, Secondary school teachers, Computer attitudes, Technological aversion, Technological affinity, Demographics, Educational technology, Computing technology, Cross-sectional survey, Pre-service teacher education, In-service teacher development.

INTRODUCTION

Advances in technology have caused vital changes in many domains of societal and individual life. As such, technology has also influenced the way education at all levels was done. As an innovative tool, technology has played a central role in improving teaching and learning in light of educational reforms around the globe. Numerous scholars argue that integrating technology and education can enhance teaching and learning activities in ways that can support student-centered teaching with more active student involvement in the learning process (Alexander, 1999; Beal, 2000; Cajas, 2001; Cope & Ward, 2002; Edelson, 2001; Jarvela, Bonk, Lehtinen, & Lehti, 1999; Jonassen, Hernandez-Serrano, & Choi, 2000; Lancashire, 2000; Scheffler & Logan, 1999).

For educational practices to benefit from technology in an optimum way, a number of factors need to be taken into consideration. Two of these are technological infrastructure and teachers, the implementers of curricula (Erkan, 2003). Similar to Erkan's assertion, Chai and Khine (2006, as cited in Teo, Chai, Hung, & Lee, 2008) argue that teachers' technology use is influenced by factors which can be classified in two broad categories, external environmental factors and the personal teacher characteristics. Also, according to Chou (2003) the two among the several factors of limited or no use of computers and Internet are lack of knowledge and skills as well as insufficient technological equipment. On one hand, in recent years, technology and computers require lesser financial resources, thus spreading at faster rates (Çepni, Taş, & Köse, 2006; Newhouse & Rennie, 2001). On the other hand, teachers have always been the central agents in the utilization of any reform-based innovation. As Arslan (2003) underscores, a school with an adequate technological base may not succeed to provide technology supported education if teachers are not willing to do so and do not carry a positive attitude toward using technology in their teaching.

If the goal is to promote technology enhanced education, it is of primary importance to investigate what teachers perceive of technology and its use in education, what their knowledge and skills are or what skills they need to further develop. Sadık (2006) in his study in Egypt reported that the more positive teachers' attitudes were toward technology the more likely they were to integrate it in classroom. A study carried out with university chemistry professors in the U.S. suggested that pedagogical content knowledge was a stronger predictor of technology use rather than perceptions (Kahveci, Gilmer, & Southerland, 2008). Others found that beliefs about teaching influenced the way Singaporean pre-service teachers used technology in their classrooms (Teo et al., 2008).

Various studies conducted in different countries on teacher attitudes, including Turkey, revealed positive attitudes toward technology and computers (Çağıltay, Çakıroğlu, Çağıltay, & Çakıroğlu, 1998; Hong & Koh, 2002; Ng & Gunstone, 2003). A number of scholars concluded that attitudes were more strongly influenced by prior computer experiences than by gender (Badagliacco, 1990; Levin & Gordon, 1989). Hong and Koh (2002) and Sadık (2006) also established a gender relationship with positive attitudes toward computers in favor of males. Others reported that computers have not been used by teachers for professional purposes as much as for other personal interests (Toprakçı, 2005).

The excess of studies conducted on teacher characteristics including perceptions, beliefs and attitudes indicate the primacy of understanding what drives teachers to integrate technology in their teaching. In contemporary society, issues related with providing sound technology infrastructure in schools have almost faded out as the costs have become more affordable in recent years with policy makers attending to these issues more closely. The teacher factor is yet to be resolved, thus continuing to draw the attention of educational researchers, teacher educators, curriculum developers and stakeholders in promoting educational reform. Various studies conducted in various settings continue to add to the literature on technology integration by rendering perspectives on the complex issue of teacher characteristics, influential in technology use. Uncovering common patterns related with the teacher factor may enable taking joint action or simply, be inspiring and directive for those responsible from transforming education in their own contexts.

RESEARCH PURPOSE AND QUESTIONS

The purpose of the present study was to add a Turkish perspective to the international literature on integrating technology in education through exploring secondary school teachers' perceptions of computers and the relationship of these perceptions with the teachers' various demographic characteristics. This conduct was intended to elucidate what affected teacher use of technology and computers in school contexts where technology infrastructure issues are readily resolved. In this way, a finer focus on the teacher would be possible. For the purposes of this study, teacher perceptions were meant to include computer attitudes as well as technological affinity, technological aversion, and confidence and comfort levels in using computing technology for education. The specific research questions that guided this work were the following:

(1) What are secondary school teachers' perceptions of computers as measured in terms of computer attitudes, technological affinity, technological aversion, and confidence and comfort?
(2) Are there any relationships between computer attitudes, technological affinity, technological aversion, and confidence and comfort?
(3) Are there any relationships between demographic variables such as age, computer experience and training, gender, field of teaching and computer/Internet ownership?
(4) Are there any differences in perceptions based on demographic variables?

METHODOLOGY

Study Design and Context

Survey research methodology was employed to understand secondary school teachers' distribution on demographic variables and their computer perceptions. Cross-sectional survey (Fraenkel and Wallen, 2003) was conducted over four weeks. The research sites were three secondary high schools in a metropolitan area in Turkey. These schools were Anatolian High Schools (AHSs), which are public high schools in Turkey that are among the few school types most successful in terms of student achievement and graduates' entrance to college. Students are selected to AHSs by a central nationwide examination upon completion of middle school, or Grade 8. Teachers are also selected for teaching at AHSs based on criteria of having previous teaching experience of at least three years, a competitive examination and an interview. AHSs are well known for their educational and learning environment eminence. These schools are more likely to have sufficient technology resources than other, non-Anatolian public high schools with AHS teachers having unconstrained access to computers and the Internet during school time.

Instrumentation

The survey instrument comprised of Loyd and Gressard (1984)'s Computer Attitude Scale (CAS) 40-item version, and Hogarty, Lang and Kromrey (2003)'s Technological Aversion, Technological Affinity, and Confidence and Comfort scales consisting of a total of 28 items. Loyd and Gressard's (1984) scale was translated to Turkish by Berberoğlu and Çalıkoğlu (1992), validated, and the reliability tests performed. Further, the researchers found that the four dimensions in the original CAS did not appear to be distinct factors in the Turkish context. The CAS was originally designed to measure computer attitudes in four dimensions: computer anxiety/fear, liking of computers/enjoying working with computers, confidence in ability to use or learn about

computers, and usefulness of computers. Following Berberoğlu and Çalıkoğlu (1992)'s recommendations, the CAS was utilized as a one-dimension scale in the present study.

Hogarty et al. (2003)'s items were translated into Turkish by the authors and validated by back-translation. The instrument was developed to better understand how educators and students used technology in the classroom and the factors important to this utilization. General teacher attitudes were to be measured by two subscales, Technological Affinity and Technological Aversion. The Technological Aversion subscale included items such as "I feel tense when people start talking about computers." Items such as "Computers make my job easier" were included in the Technological Affinity subscale. The Confidence and Comfort subscale was characterized by items regarding confidence and comfort in efficient use of computers for teaching and increasing classroom performance. An example of items for this subscale was "I am comfortable using computers during classroom instruction."

All of the items from the four scales were rated by the study participants using five-point Likert scale, ranging from "definitely agree" to "definitely disagree." Cronbach's Alpha reliability coefficients were computed for the internal consistency of the scales and found to be ranging from .73 to .90 (Table 1), demonstrating acceptable reliability levels.

Table 1: Reliability levels of the four scales in the survey.

Scale	Number of Items	α
Computer Attitudes	40	.90
Technological Affinity	10	.77
Technological Aversion	9	.73
Confidence and Comfort	9	.87

In the survey, demographics information was also sought including years of teaching experience, field of teaching, computer experience, computer education (training in using computers), computer/Internet availability, gender and age. Response options for teaching experience and age were provided as year ranges. Field of teaching was asked as an open ended question and then coded separately for science/mathematics, social sciences (i.e., history, geography, philosophy), literacy (including Turkish and foreign language), physical education and arts/music. Computer and Internet connection ownership items required a yes/no response. The item concerning computer experience provided response categories based on experience ranging from none to integrating computers in classroom teaching. The item concerning computer training involved similar categories of computer experience in a formal training context (categories are detailed in Tables 3 and 4).

Survey Participants and Demographics

Convenience sampling (Fraenkel & Wallen, 2003) was used in the selection of participant teachers from three different AHSs, two of which were the schools where the second and third authors worked. The third school was one with which the third author was in close contact. One hundred and thirty teachers participated in the study voluntarily.

As unraveled by demographics statistics, the sample consisted of 76 female (58.5%) and 54 male (41.5%) AHS teachers. Forty five of them (34.6%) were in the science/mathematics field, 26 (or 20%) in the social sciences, 36 (or 27.7%) in literacy, four teachers in physical education and six teachers in arts/music. Mode of age range was found to be 31-35, and 46.2% of the teachers were 35 years old or younger. Only five of the teachers had teaching experience of 2-5 years with the rest having experience more than that (Table 2).

Table 2: AHS teachers' teaching experience.

Teaching Experience	*f*	*P*
2-5 years	5	3.8%
6-10 years	53	40.8
11-15 years	28	21.5
16 years and over	44	33.8
TOTAL	130	100.0%

The majority of the teachers (109, or 83.8%) had their own computer at home and 95 of them (73.1%) had an Internet connection. With regards to computer experience, more than half of the teachers (67, or 52.8%) stated regularly using application software such as word processing and spreadsheets (Table 3). With regards to formal computer training, learning to use application software received the highest percentage with fifty two teachers (or 40%) (Table 4).

Table 3: AHS teachers' computer experience.

Computer Experience	*f*	Valid *P*
I have never used a computer and I do not plan to use one.	1	.8%
I have never used a computer but I would like to learn.	15	11.8
I use application software such as word processing and spreadsheets.	67	52.8
I use computers for teaching in the classroom occasionally.	19	15.0
I use computers for teaching in the classroom every day.	13	10.2
I use computers for teaching in the classroom every week.	12	9.4
TOTAL	127	100.0%
Missing Data = 3		

Table 4: AHS teachers' training in computer use.

Computer Training	*f*	Valid *P*
No training.	35	27.1%
Basic computer literacy (on/off operations, how to run programs).	31	24.0
Computer applications (word processing, spreadsheets).	52	40.3
Computer integration (how to use in classroom curriculum).	11	8.5
TOTAL	129	100.0%
Missing Data = 1		

DATA ANALYSES AND FINDINGS

Likert data were scored on a five-point scale. For all of the items in the four scales of the survey, the response "strongly disagree" was scored as 1, while the response "strongly agree" was scored as 5. The range for possible scores was 1-5. An option of "not sure" response was also available which was scored as 3. The range for the midpoint 3 of "not sure" being 2.45-3.44 was assumed to be inclusive of scores of "not sure," thus, a mean score higher than 3.44 meant at least "agree." The scoring was reversed for negative statements. Higher scores on the Computer Attitudes, Technological Affinity and Confidence and Comfort scales meant more positive attitudes, higher affinity for and higher confidence and comfort in using computers, respectively. However, higher scores on the Technological Aversion scale meant higher state of technological dislike.

Prior to analyses on relationships among scale variables, normality checks were performed for each of the scales. According to the Kolmogorov-Smirnov tests performed, all four scales showed normal distribution of data (with p's > .05). Thus, parametric tests could be utilized in further analyses. General Linear Model and subsequent relationship analyses were performed to understand effects of the independent variables and differences in terms of the dependent variables emerging from the perceptions instrument.

Relationships between Demographic Variables

The teachers who owned a personal computer were significantly more likely to have computer experience at higher levels ($\chi^2(6) = 16.370$, $p = .012$, $\varphi = .36$) (Table 5). Also, there was a significant relationship between computer ownership and computer training received. Computer owners appeared to have had more training on utilizing computers in education ($\chi^2(3) = 9.729$, $p = .021$, $\varphi = .28$) (Table 6). From these results, the extent to which the teachers had computer experience and received training seemed to depend on their computer ownership.

Table 5: The relationship between computer ownership and computer experience of the AHS teachers.

Computer Experience	Own a computer?		TOTAL
	No	*Yes*	
I have never used a computer and I do not plan to use one.	0	1	1
I have never used a computer but I would like to learn.	7	8	15
I use application software such as word processing and spreadsheets.	11	56	67
I use computers for teaching in the classroom occasionally.	0	13	13
I use computers for teaching in the classroom every day.	0	12	12
I use computers for teaching in the classroom every week.	2	17	19
TOTAL	20	107	127
Missing Data = 3			

Table 6: The relationship between computer ownership and computer training of the AHS teachers.

Computer Training	Own a computer?		TOTAL
	No	*Yes*	
No training.	4	31	35
Basic computer literacy (on/off operations, how to run programs).	10	21	31
Computer applications (word processing, spreadsheets).	6	46	52
Computer integration (how to use in classroom curriculum).	0	11	11
TOTAL	20	109	129
Missing Data = 1			

Computer experience and computer training also differed significantly in terms of the teachers' age. The teachers between ages 31-40 were more likely to use computers in their classrooms ($\chi^2(30) = 101.350$, $p < .005$, $\varphi = .89$). Teachers 41 and over mostly used application software and wanted to learn more about computers (Table 7). As shown in Table 8, as age increased the number of teachers having received training on using computer applications and integrating computers in their teaching, decreased ($\chi^2(15) = 27.768$, $p = .023$, $\varphi = .46$).

Table 7: AHS teachers' computer experience by age.

Computer Experience	Age						TOTAL
	18-25	26-30	31-35	36-40	41-45	46 and over	
I have never used a computer and I do not plan to use one.	0	0	0	0	1	0	1
I have never used a computer but I would like to learn.	0	1	3	1	2	8	15
I use application software such as word processing and spreadsheets.	1	14	19	12	13	8	67
I use computers for teaching in the classroom occasionally.	0	4	4	4	0	1	13
I use computers for teaching in the classroom every day.	0	1	2	7	1	1	12
I use computers for teaching in the classroom every week.	0	2	6	5	3	3	19
TOTAL **Missing Data = 3**	1	22	34	29	20	21	127

Table 8: AHS teachers' training in computer use by age.

Computer Training	Age						TOTAL
	18-25	26-30	31-35	36-40	41-45	46 and over	
No training.	0	4	7	14	4	6	35
Basic computer literacy (on/off operations, how to run programs).	2	2	7	7	6	7	31
Computer applications (word processing, spreadsheets).	0	11	19	7	9	6	52
Computer integration (how to use in classroom curriculum).	0	5	2	1	1	2	11
TOTAL **Missing Data = 1**	2	22	35	29	20	21	129

Teachers' Perceptions: Computer Attitudes, Technological Affinity, Technological Aversion, Confidence and Comfort

AHS teachers' overall attitudes toward computers and technology were found to be positive ($M = 3.69$, $SD = .43$), with 73.8% of the teachers having attitude scores above the "not sure" range (Table 9). On average, the teachers scored highest on the Technological Affinity scale ($M = 3.90$, $SD = .55$). On the Technological Aversion scale, only one teacher had a score above the "not sure" range, which meant that almost all of the

teachers did not agree with items expressing computer and technology dislike. The mean score for the Confidence and Comfort scale was found to be in the "not sure" range and less than half of the teachers agreed or strongly agreed that they were confident and comfortable in using computers. The higher standard deviation score for this scale implied higher perception variability in terms of confidence and comfort.

Table 9: AHS teachers' computer perceptions.

Scale	Minimum	Maximum	*M*	*SD*	Respondents with *M* > 3.44 *n*	%
Computer Attitudes	2.35	4.60	3.69	.43	96	73.8
Technological Affinity	2.50	4.90	3.90	.55	108	83.1
Technological Aversion	1.00	3.56	2.09	.53	1	.8
Confidence and Comfort	1.11	5.00	3.41	.73	51	39.2

Relationships between Computer Attitudes, Technological Affinity, Technological Aversion, and Confidence and Comfort

Unsurprisingly, bivariate correlation analysis based on the Pearson product-moment coefficient demonstrated that positive Computer Attitudes corresponded to higher Technological Affinity, higher Confidence and Comfort, and lower Technological Aversion scores (Table 10). Significant positive correlations were also found between Technological Affinity and Confidence and Comfort. Technological Aversion was found to significantly negatively correlate with these two scales.

Table 10: Pearson product-moment correlations among perceptions scales.

	Computer Attitudes	Technological Aversion	Technological Affinity	Confidence and Comfort
Computer Attitudes	1.000			
Technological Aversion	-.637(**)	1.000		
Technological Affinity	.616(**)	-.552(**)	1.000	
Confidence and Comfort	.619(**)	-.462(**)	.577(**)	1.000

** Correlation is significant at the 0.01 level (2-tailed).

Differences in Computer Attitudes, Technological Affinity, Technological Aversion, and Confidence and Comfort based on Demographics

General Linear Model analysis of data was performed to explore any significant effects of demographic characteristics on the perceptions scores. In the model, nominal independent variables were considered as fixed factors while ordinal independent variables were considered as covariates. Multivariate tests revealed significant effects of computer experience ($F(4, 82) = 3.10$, $p = .020$), computer training ($F(4, 82) = 3.91$, $p = .006$), gender ($F(4, 82) = 2.61$, $p = .049$), and field of teaching ($F(4, 82) = 1.69$, $p = .049$) on one or more of the dependent variables. Further, to understand the direction of the relationships or the differences between the means of the demographic variable categories in terms of computer perceptions, correlational and mean differences analyzes were performed.

Crosstabulation analysis for the relationship between computer experience and the four dependent variables revealed significant relationships between computer experience and Computer Attitudes ($\chi^2(360) = 420.687$, $p = .015$, $\eta = .46$), and between computer experience and Confidence and Comfort ($\chi^2(168) = 210.910$, $p = .038$, $\eta = .38$). More teachers who had computer applications experience or have used computers in their teaching had higher Computer Attitudes scores. The teachers who used computers in their teaching scored higher on the Confidence and Comfort scale compared to the teachers who did not. As compared with others, more teachers with computer applications experience scored in the "not sure" range for Confidence and Comfort signifying that in some way, being informed was paired with being cautious.

Computer training was found to be related to three dependent variables. Tukey's HSD post hoc tests revealed that the teachers who had training in using computer applications as well as in computer integration in teaching had significantly more positive Computer Attitudes than those who had basic computer literacy, $p = .009$ (for both). Also, the teachers with computer training in using computer applications had significantly higher Affinity scores than those who did not receive any training, $p = .009$. In terms of Confidence and Comfort, the teachers with training in using computer applications scored significantly higher than those with basic computer literacy, $p = .015$.

Gender had an effect on computer attitudes and confidence and comfort. According to the independent samples t-tests conducted, male teachers had significantly higher mean scores on Computer Attitudes ($t(128) = -2.122$, $p = .036$) and Confidence and Comfort ($t(128) = -2.969$, $p = .004$) than female teachers (Table 11). The female teachers' mean score on Computer Attitudes was 3.62 while that of the male teachers was 3.79. Given that both of these means were above the cut point of the "not sure" range (3.44), on average, both genders agreed with positive Computer Attitudes with male teachers appearing to be located at the more positive end of the range. The teachers' mean scores for Confidence and Comfort were 3.25 and 3.63 for females and males, respectively. According to these results, on average, female teachers appeared to be unsure of their Confidence and Comfort in using computers while male teachers agreed that they were confident and comfortable.

Table 11: AHS teachers' gender differences in Computer Attitudes and Confidence and Comfort.

	Gender	***n***	***M***	***SD***	***SEM***
Computer Attitudes	female	76	3.6247	.45	.05
	male	54	3.7860	.39	.05
Confidence and Comfort	female	76	3.2500	.69	.08
	male	54	3.6263	.74	.10

The teachers also showed significant differences in their perceptions based on their teaching fields. Although weak, crosstabulation analyses revealed significant relationships between teaching field and Technological Aversion ($\chi^2(92) = 124.155$, $p = .014$, $\eta = .13$), and between teaching field and Confidence and Comfort ($\chi^2(120) = 148.605$, $p = .039$, $\eta = .16$). These relationships were further examined within the categories of Internet connection ownership. Resulting from this analysis, the relationships between teaching field and computer perceptions appeared to be significant only for those teachers who had Internet connection (Table 12) and insignificant for those who did not. Among the respondents with Internet connection, the social sciences teachers scored lower in Computers Attitudes (usually below the "not sure" range) contrary to the teachers in the other fields. The arts/music teachers scored also lower in Technological Affinity. Also, the physical education and arts/music teachers scored slightly higher in Technological Aversion (corresponding to the "not sure range") and lower in Confidence and Comfort as compared with the rest.

Table 12: Teaching field and computer perceptions relationships for AHS teachers with Internet connection.

	χ^2	**df**	***p***	**η**
Computer Attitudes	293.293	220	.001	.26
Technological Aversion	124.862	84	.003	.24
Technological Affinity	112.698	84	.020	.12
Confidence and Comfort	166.691	108	< .005	.27

DISCUSSION

Findings of this study underline computer ownership as an important predictor of higher level computer experience and training. Computer owners were more experienced in computer use and more likely to have attended a computer training program. In addition, the teachers with higher level computer experience in teaching with technology had more positive attitudes and higher confidence and comfort. Based on these results, ownership of personal computer emerged as a key factor in improving both computer expertise and attitudes towards computers of secondary teachers. In the context of AHSs where sufficient technological infrastructure was available and the teachers had access to computers during school time, these findings highlighted the importance of personal computer ownership. Teachers at school might be busy with lesson planning or other duties which might limit their interactions with the school computers. Clearly, teachers owning computers would have more opportunities of tinkering as compared with teachers with access to computers only at school.

This study revealed that teachers with no or basic computer literacy training significantly differed from their counterparts in terms of Computer Attitudes, Affinity and Confidence and Comfort. As in other studies, training emerged as an important factor that affected teacher perceptions (Badagliacco, 1990; Levin and Gordon, 1989). Teachers having received formal computer training can be more positive about computers and more confident about their knowledge. On the other hand, teachers with no training and with knowledge acquired primarily by trial and error cannot be certain to the same degree. Thus, teachers with formal training are more likely to have higher levels of confidence and comfort in computer use.

In Turkey, it is most likely that teachers in their 40s and over had their earliest computer training in college. Informal conversations with the teachers revealed that a number of them learned basic computer programming languages in theory at college with little or no opportunities to practice, similar to the teachers in Cypriot

primary schools, who also do not have a sufficient technology training at college (Vrasidas & McIsaac, 2001). On the other hand, most likely younger teachers encounter application software such as word processing earlier than college and utilize these in preparing homework. This generation difference as well as the recent widespread availability of desktop or portable laptop computers might have led to the younger teachers' adopting computers more readily.

In general, the AHS teachers had positive computer attitudes. Their scoring the highest in Technological Affinity implied not only that they were positive about computers but also that they felt sympathy. Scoring low in Technological Aversion was consistent with the high scorings on attitudes and affinity, indicating a valid measurement. However, despite their positive attitudes most of the teachers were unsure if they were confident and comfortable in using computers for teaching. In other words, teachers carried positive attitudes towards computers, felt affinity for computers and were not averse to computers. Though, they did not seem to be sure about their confidence and comfort. Several reasons may account for this. First of all, to be confident and comfortable in computer use, previous experience is essential. Furthermore, mastering certain computer skills – in this case, computer supported teaching—would be a major factor in having confidence in computer use. Personal rather than pedagogical uses of computers might have been impediments to needed confidence and comfort. Finally, computer integration in teaching may be viewed by senior teachers as challenging their traditional authoritative role in the classroom as their students would likely be more knowledgeable about computers. Thus, they may find it uncomfortable to give up their teacher-centered methods where the teacher is the only authority and primary source of knowledge.

Findings also unravelled that having an Internet connection seemed to benefit more the teachers in the science/mathematics and literacy fields in terms of computer utilization as they scored higher in the perceptions scales in comparison with the teachers in physical education and arts/music. Because of the more practical nature of the physical education and arts/music fields these teachers might have not felt the need to utilize computers as much as the teachers in the other fields. Thus, the Internet and computers might not have been used for more than personal purposes by the physical education and arts/music teachers.

CONCLUSIONS AND IMPLICATIONS

For the particular context, ownership of personal computer appeared to be an important factor in computer experience and training and thus, in computer perceptions. Attending to these results, administrators and policy makers may plan for funding opportunities for teachers who do not have personal computers to become computer owners. For instance in the past, the Ministry of National Education in Turkey made efforts to make every teacher a computer owner by providing teachers more affordable payment options. Similarly in Israel, an essential aspect of a new model for computer integration in primary school teaching was to establish a broad computer infrastructure and provide every teacher a laptop computer (Tubin & Chen, 2002). Taken together, these and similar efforts point to the centrality of computer ownership for teachers in developing positive computer perceptions through training and experience.

Investigation of teachers' perceptions of computers is rather important in the process of shifting to student-centered education supported with computers and technology. Although the findings of the current study are not statistically generalizable, a number of factors such as computer ownership, gender and age emerged as shared patterns with international research findings. These factors were found to be also influential in the Turkish teachers' computer perceptions. Results of the current study may be used to inform policy makers, curriculum developers, teacher educators, and all stakeholders involved in the design of effective teacher preparation and in-service professional development programs. Possible recommendations for practice are summarized as follows:

- Professional development and training programs with a focus on educational computing are strongly needed for in-service teachers, as was also suggested by a number of scholars nearly a decade ago (Bybee & Loucks-Horsley, 2000; Vrasidas & McIsaac, 2001). Training programs need to be designed in different levels covering basic computer literacy skills through skills for using computers in the classroom. In agreement with Liu and Szabo (2009)'s findings with US in-service teachers, these initiatives should be well-planned and systematic.
- Teachers may be provided institutional incentives to complete the educational technology professional development programs at all levels. These incentives may include laptops, release time and services such as paid technology summer institutes (Liu & Szabo, 2009).
- Teachers over a certain age need to be encouraged in more distinctive ways to be involved in in-service computer training. Similarly, female teachers may need more attention and opportunities for computer applications practice.

- Pre-service teacher preparation programs should be designed to include teacher education on computer and technology integration in teaching. For this, as Borko, Whitcomb, and Liston (2009) argue, the major part of the work lays on the shoulders of teacher educators who are to transform teacher education via utilizing digital technologies themselves. Specific courses on teaching with technology may be developed. These courses should be informative in practice. Moreover, in these courses the teaching of a specific subject (i.e., science) with constructivist uses of technology, should be modeled (Vrasidas & McIsaac, 2001).
- Secondary curricula in all disciplines should be of encouraging nature for teachers to use computers and technology in classrooms. Also, workshops and demonstrations of technology utilization across the curriculum should be provided.
- Pre- and in-service teachers could be assisted on how to use the Internet for teaching purposes and professional development.

In specific, further research may explore on a more qualitative basis the way computer ownership affects teacher perceptions in a positive way. Relatedly, experimental studies may be conducted to understand any perception differences for computer owner teachers. Perception variability based on demographic variables such as age and gender may be investigated in advance. Teacher practices could be evaluated by using more in-depth instrumentation than self-reporting with the aim to reveal any relationships between perceptions and actual classroom implementations. Reasons behind recent technological extensive availability impacting young and senior teacher perceptions in a different way might be an additional research focus. Also, confidence and comfort issues in using computers for education require closer attention of researchers as they appear not necessarily to be tightly related with positive attitudes. Finally, perceptions of teachers specialized in subject areas such as physical education and arts/music may be an additional research area to uphold the utilization of educational technologies across pre-college curricula.

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COPING WITH MUSCULOSKELETAL PAIN: IMPLICATIONS FOR OFFICE WORKERS

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ABSTRACT
The aim of the present research was to understand how office workers cope with back, neck and upper limb musculoskeletal disorders at work (and their implications for work). A small (N= 120) questionnaire survey collected information about potential participants' background and history of musculoskeletal disorders. These data were used to inform a sampling process for a qualitative study of 18 office workers who had a back, neck or upper limb musculoskeletal disorder. Each participant was interviewed one-to-one. Interviews were audio-taped, transcribed verbatim and analysed using NUD*IST (N6) qualitative data analysis software. Data were analysed using a grounded theory approach and a conceptual framework that was developed based on pre-specified themes derived from the literature. The results demonstrate that office workers use an extensive range of both cognitive and behavioural strategies to cope with musculoskeletal pain at work. Cognitive strategies include techniques such as distraction, visualization, self-talk, and blocking thoughts. Seeking-social support, exercise/stretching, exposure management, self or accompanied treatment, eating/drinking have emerged as categories that made up the behavioural coping strategies. Many of these had the potential to either further exacerbate the problems or lead to new problems including accidents or impaired work performance. The present study indicates the dangers inherent in the haphazard and trial-and-error nature of many of the coping strategies. Improved guidance and better evaluation of existing advice are required for those who remain at work but in pain.
Keywords: qualitative study, coping strategies, musculoskeletal pain, office workers, computer users

INTRODUCTION

Lifelong learning can be defined as a process of self development that could be achieved throughout training, education and self-experiences. It could help workers (computer users) develop their skills and adapt to the technology that changes dynamically (Yılmaz-Soylu and Akkoyunlu, 2009). Keeping up with the dynamic nature of technology is important in terms of forming the match between technology users and demands of their jobs (Açıkalın and Duru, 2005). A mismatch between the users and systems may lead to stress and therefore musculoskeletal disorders (MSDs).

Musculoskeletal disorders describe a wide range of degenerative and inflammatory disorders of the musculoskeletal system. They result in pain and in some cases disability may threaten both the future of many workers and the effectiveness of many organizations (Buckle & Devereux, 2002). MSDs are not just a source of pain and suffering for the sufferer but also a significant burden to their families, employers, and the wider community (Boden, Biddle, & Spieler, 2001). The literature shows that MSDs follow a pathological process that may lead to disability. During this process workers may be at work despite experiencing symptoms, a phenomenon defined in the literature as 'presenteeism' (Hagberg et al., 1995; Koopman et al., 2002). A Swedish study found that almost a third of their sample had gone to work at least two or three times during the preceding year, when, based on their perceived state of health, they should have taken sick leave. Workers with upper back/neck pain were among those with high presenteeism (Aronsson, Gustafsson, & Dallner, 2000). There has been a considerable increase in the prevalence of chronic pain among full-time U.S. workers within the past decade, (Ortho-McNeil, 2008). This survey also revealed that almost 90% of the workers typically went to work rather than taking sick-leave when experiencing chronic pain.

Such studies indicate that workers, who are lifelong learners, are often at work, despite experiencing musculoskeletal symptoms; however, there is little research into how the workers cope with such musculoskeletal pain in the work system. Car mechanics who experienced musculoskeletal symptoms (Torp, Riise, & Moen, 2001) were found to use coping strategies that included: 'changing working techniques', 'using lifting equipment', 'taking micro pauses', 'avoiding strenuous work', 'asking the foreman for less strenuous work for a period', and 'taking part in the company's health and safety work' The coping strategies identified by

(Torp et al., 2001) were informed by the ergonomics literature; and only included the ones that were suggested by experts as productive measures for coping with WRMSDs. Hence, these studies were limited in their ability to explore the strategies that were being used and might have potential to either further exacerbate the problems or lead to negative consequences such as accidents or impaired work performance.

The aim of this paper is to understand how office workers cope with back, neck and upper limb musculoskeletal disorders at work and the implications of the techniques and strategies that are used for work organisations.

METHODS

A questionnaire survey and qualitative interviews were used. The questionnaire survey collected information about participants' background and history of musculoskeletal disorders. These data were used to inform a sampling process for a qualitative study of 18 office workers who had a back, neck or upper limb musculoskeletal disorder. Ethical approval was given by the University of Surrey Ethics Committee.

Participants

A purposive sampling approach was undertaken and the participants were recruited on the basis of their age, gender, organization and musculoskeletal symptoms. 18 participants (9 Male and 9 Female) were recruited from a range of office jobs consisting of secretaries, administrators, officers, and researchers. The age groups represented were 18-29 (3 persons), 30-39 (6 persons), 40-49 (2 persons), and 50-65 (7 persons). Of the participants, 3 held a managerial position at the time of the study, and the rest were office workers who were suffering or suffered from musculoskeletal symptoms of upper limbs and the back. Among the participants 8 reported that their pain experience was constant (see Table 1).

Data collection

Semi-structured and one-to-one interviews were carried out with volunteers either at their workplace or at the University of Surrey. A flexible interview guide was used. First, the researcher assured the participants that the information they might share would be treated with the strictest confidentiality. This was followed by a warm-up to enable both the researcher and the participant to be relaxed and the actual interview questions. Finally, the researcher (O.O.) reflected back to each participant the main issues raised during the interview to ensure that they agreed with the record that had been made during the interview.

All the interviews were recorded using a digital voice recorder (Sony ICR-B 150) and the interviews lasted up to one hour. The recordings were transcribed verbatim by the interviewer (O.O.) and imported into the NUD*IST (N6) software as text files for qualitative analysis.

Data analysis

The qualitative data were analysed using grounded theory (Srauss & Corbin, 1998); a conceptual framework was developed based on pre-specified themes derived from the literature and by using the approach suggested by Taylor-Powell and Renner (2003). Data were coded line by line using the NUD*IST (N6), based on the key question "What did/do office workers do or think in order to master, tolerate or reduce the stress of musculoskeletal pain at work?" The resultant codes were organized into coherent categories to summarize and bring meaning to the text. The categorization and organization of the data continued until no new themes or subcategories were identified (Taylor-Powell & Renner, 2003).

Table 1: Participant's characteristics

Participant			Condition	Frequency
Position	Gender	Age Group		
Manager	Male	50-65	Low back pain	One or more times a year
Health care administrator	Male	30-39	Neck pain	Constant
			Left-shoulder pain	One or more times a week
			Wrist/hand pain	One or more times a month
			Low back pain	One or more times a year
Health care administrat	Male	30-39	Neck pain	One or more times a month
			Shoulder pain	One or more times a month
Officer	Female	50-65	Neck pain	One or more times a week
			Shoulder pain	One or more times a week
			Upper back pain	One or more times a month

Officer	Female	50-65	Low back pain spreading down into the	Constant
Secretary	Female	40-49	Wrist/hand pain	One or more times a week
Accountant	Female	40-49	Neck pain	Constant
			Shoulder pain	Constant
			Wrist/hand pain	One or more times a week
Secretary	Female	18-29	Low back pain	One or more times a week
			Elbow pain	One or more times a month
Computer programmer	Male	30-39	Low back pain	Constant
			Wrist pain	One or more times a year
Researcher	Male	18-29	Low back pain	Daily
Researcher	Female	30-39	Neck/shoulder pain	Constant
Secretary	Female	50-65	Neck pain spreading out down to the back and down to the arm, comprising the shoulder elbow and index finger	Constant
IT Support	Male	30-39	Low back pain	One or more times a week
			Neck pain	One or more times a week
			Upper back pain	One or more times a month
IT Support	Male	50-65	Elbow pain	One or more times a week
			Low back pain	One or more times a week
Manager	Male	18-29	Low back pain	One or more times a week
			Neck pain	One or more times a month
			Shoulder pain	One or more times a month
Manager	Male	50-65	Low back pain	One or more times a year
			Neck pain	One or more times a month
			Shoulder pain	One or more times a month
Officer	Female	50-65	Right shoulder pain spreading down into the wrist and hand	Constant
Researcher	Female	30-39	Neck/shoulder pain spreading down into the spine, right-arm, wrist/hand and	Daily

RESULTS

Coping strategies

The coping strategies reported by participants were divided into two major categories – cognitive and behavioural – each of which was further subdivided as shown in Table 2. These reported strategies described in the following section with illustrative examples where appropriate.

Cognitive

In order to cope with pain, participants reported using cognitive strategies that included distraction, visualisation, self-talk and blocking thoughts. Aittle was achieved through focusing on their jobs, ignoring the symptoms, thinking of a pleasant memory or focusing on an object. Some strategies were reported to be effective. One of the female participants (Secretary, age group 18-29) successfully used visualization as a method of coping with pain by thinking of the painful area, trying to visualize that everything was flowing normally and believing that her pain was reducing. Another, (age group 40-49) reported that she was successfully able to block pain by "going somewhere in her head". (She was also able to bear dental treatment without being given any anaesthetics by using this strategy). Another female participant (Officer, age group 50-65) successfully used self-talk by thinking of other people who were worse off than her in order to reduce her pain. However, for others cognitive strategies could have negative outcomes. In one case, (Secretary, age group 50-65), self-talk led to self-blame and anger for being "weak".

Behavioural

Participants reported using behavioural strategies that included seeking social support, stretching, changing posture, changing the layout of the workstation, and reorganising their workload. They also used a range of verbal and non-verbal methods in order to communicate their pain to colleagues. These strategies, when

successful, elicited help from the others in the form of emotional support, treatment such as massage, or guidance about the condition experienced. For example, one of the male participants (Computer programmer, age group 30-39) found it helpful to listen to colleagues who had successfully worked through similar experiences of pain and had recovered or improved. Another useful behavioural strategy was to manage the workload with the support of colleagues in their social network. One of the female participants with long term neck/shoulder pain (Secretary, age group 50-65) reported that she passed over some of her tasks to her colleagues when in serious pain. Others paced their activities by slowing down in order to avoid the pain. Others changed their working technique, for example, by training their non-dominant hand to use the mouse so that they were able to swap hands when necessary to alleviate the pain. Others found it helpful to regularly vary their posture. For example one manager with back pain said that he found it helpful to sit in an ordinary chair for a while rather than an office type chair. A number of participants had requested improvements to be made to their workstations. The use of pain killers was common among the participants. One of the participants (Secretary, age group 50-65) reported that she was taking antidepressants. Those who were experiencing less frequent symptoms were more likely to report that pain killers were helpful; although some with long lasting pain conditions gained little lasting effect.

One of the male office workers (Manager, age group 50-65) reported that he had to stop drinking so much coffee as he noticed its effects heightened the symptoms experienced. He found that drinking alcohol helped him to forget about his back pain and his consumption increased when he was in pain.

Others preferred to keep their condition secret and did not ask help. For example one of the female office workers (Accountant, age group 40-49) was afraid of being considered as a 'pain in the neck' and someone who was a health risk for the organization. This was related to feelings of job insecurity. Participants also reported the lack of opportunity for accessing their social support networks at work, as a reason for not seeking social support. For example, one described how, because his colleagues were very busy with their own workload, they were not accessible.

DISCUSSION

This study has identified how office workers cope with back, neck and upper limb musculoskeletal disorders at work. The strategies elicited has been categorised into two major categories as cognitive and behavioural.

Cognitive strategies

Among the cognitive strategies, distraction by means of focusing on work and ignoring pain was a common way of dealing with pain. This has received prior attention in the literature both in experimental and

Table 2: Coping strategies and example quotes from the interviews

Coping Strategies	Quotes
Cognitive	
Distraction	I am able to you know just go somewhere in my head, so it's, I can temporarily just block it out.
Visualization	I was trying to visualize my circulation and that I could see everything flowing in my arms just to make it like work.
Self-talk	• **Blame/regret** I can kick myself and say 'look come on stupid. It's your own fault, you can't blame anybody else.' • **Interpreting sensations** It is something that I am afraid of that it will get worse in the future. • **Minimising and acceptance** I mean you know, you watch news and see people being shot up and losing their children and goodness knows what else…A little twinge in my arm now and then is fairly insignificant isn't it?. • **Encouragement** What I was thinking was 'relax chief, you gonna go home have a nice bath, take your pain killers and have a rest long night and you will be better.' • **Hoping** I just remember I was in such a bad state that you know I just thought 'oh my god I just want this pain to go.'

Blocking thoughts	If I really need to step out I step right out as in the mind will go totally blank and I will focus just on the wall that's it and don't think of anything.
Behavioural	
Seeking social support	• **Communicate pain** On that occasion I can remember, because I was stiff and people noticed that I was stiff. • **Get care** -you get a little sympathy from the people or you get a little you know… • **Get information** I used to quite like listening to how people used to have problems like mine and they are
Exercise/Stretch	When I have a break it gives me the opportunity to walk to stretch a bit, to move around a bit, so that's more comforting me.
Exposure management	• **Changing work technique and postural variation** I have trained my left-hand and I can swap the mouse from right to left when I need to. • **Pacing and breaks** I was getting aches in my arm, into my shoulder, wrist and fingers, so I started to try and type more slowly. • **Workstation improvement** I got myself a better chair with adjustability of the arms. • **Activity/task variation** If the pain gets to a point, I go and find something else to do. • **Workload discharge** I do pass as much as work possible to my colleagues, so it lightens my load.
Self or accompanied treatment	• **Use of medication** I take pain killers but they don't help very much. • **Other treatment** Its one of the lads who gives me a bit of a massage, but he needs a lot more work [means he needs to gain more massaging skill].
Eating and drinking	I do have a couple of glasses of wine and when I have back pain I tend to drink more wine.

clinical settings as a way of controlling pain. For example, attention-based cognitive coping strategies may be effective in pain perception and they may have potential to function in a similar manner to pharmaceutical pain killers (Eccleston, 1995). The use of distraction as a way of coping with pain while at work, however, has received less attention. Some of the participants ignored the pain and continued working despite experiencing pain. Some of them attributed this to high workload, whereas there were others who thought that by ignoring pain, the symptoms would go away. The latter shows the importance of beliefs, attitudes and awareness in coping with musculoskeletal symptoms. Similar results (Linton & Buer, 1995) have , demonstrated possible psychosocial differences among groups of workers who were either at work despite back pain (the 'copers' group) or off-sick (the 'dysfunctional' group). These authors suggested that beliefs that pain was directly related to work activities, and that individuals had little control over their pain, were important qualities of absence. In this study, most of the participants ignored the pain and continued working ; nevertheless the literature shows that ignoring pain and persisting on task performance without taking sufficient breaks may be counterproductive and even damaging to the individuals who are at the earlier stages of developing WRMSDs (Henning, Jacques, Kissel, Sullivan, & Alteras-Webb, 1997; Rohmert, 1973). Turk (2004) suggests that resting and protecting a painful area when the pain is acute may be helpful; however, this may not be appropriate in the case of chronic pain. Further research is required in order to understand whether focusing on work and ignoring pain is an effective coping strategy for the people in this group.

Some cognitive strategies were counterproductive (e.g. negative thoughts). One of the female participants reported that pain was leading her to be angry or sometimes depressed. She was constantly blaming herself for being weak. A group of studies has demonstrated that characterizing pain as 'horrible', 'awful', or 'unbearable' (e.g. catastrophizing) or negative thoughts and feelings related to pain is associated with heightened pain experience and depression (Gracely et al., 2004; Hassett, Cone, Patella, & Sigal, 2000; Sullivan, Rouse, Bishop, & Johnston, 1997).

Without the expert support, knowledge, and training, some cognitive strategies may lead to further physical or psychological damage with negative consequences for the individual and the company (Ackerman & Turkoski, 2000; Menzies & Taylor, 2004).For example, Ackerman & Turkoski (2000) suggest that self-talk (or guided

imagery) should not be used when taking medications for a mental disorder. Moreover, it should not be used when operating a machine or a motor vehicle. There is a lack of research in relation to its use in work settings for coping with musculoskeletal pain despite its potential to lead to errors and accidents while on the task.

Some participants found strategies such as visualization, blocking thoughts, and "going blank" helpful. There is only a small literature (Ackerman & Turkoski, 2000; Menzies & Taylor, 2004; Hamm & O'Flynn, 1984; Morone & Greco, 2007) on these approaches and more research is needed as to which kinds of strategies are inappropriate while on task. For example, one (secretary) reported that when she used the blocking technique her colleagues had to wait for her to finish. This may cause problems in teamwork settings. Clearly we need to know more about the contexts in which these particular strategies are effective and to have more systematic data gathered in controlled settings on how, and in what ways, they are successful or counter-productive.

Behavioural strategies

A major component of the behavioural coping strategies involved seeking social support from others. The present study confirms earlier research (Craig & Prkachin, 1983) that suggested that individuals find it helpful to convey their distress to others using a variety of expressive cues, including verbal reports and changes in facial expressions. Other studies (Woods & Buckle, 2002; Woods, 2005; Evers, Kraaimaat, Greenen, Jacobs, & Bijlsma, 2003; Lazarus & Folkman, 1984), both from the clinical context and also from work settings, have shown that social support is an important resource in both reducing the risk of the occurrence of disease (e.g. MSDs) and also helping individuals to develop behavioural coping strategies and to better adapt to illnesses (e.g. reducing the level of disability). However, our research has raised some work-related issues in relation to both the access of social support and also its content. Carayon (1993) reported that high work pressures that arise as a result of workload may cause workers to be "workstation-bounded" or tied up with their work and may reduce the opportunities for interaction among colleagues, with negative outcomes for the extent of social support received from colleagues (Carayon, 1993; Berkman, 1984). In addition, relationships among colleagues, such as the level of intimacy, appears to be an additional factor that affects decision making in seeking or not seeking social support. Berkman (1984) defines this as "the extent to which members of an individual's network know and interact with one another". This has been illustrated in this study where one manager reported that he felt reluctant to admit that he was in pain to subordinates as this might diminish his authority.

Woods (2005) indicates social support received away from workplace as an important area that needs further investigation, which is also in line with the present study. For example, participants who had social support networks, especially those who wanted to find out more about their situation, consulted other colleagues who were more experienced with musculoskeletal problems. A serious drawback, however, might be that colleagues may not always give helpful advice since their strategies for reducing pain are based only on their own individual experience and may be inappropriate for others. (Berkman, 1984) stresses that the existence of social support networks does not necessarily mean that the individuals always receive adequate support. Further studies would be useful to gain insight into the type of information shared concerning musculoskeletal disorders (Woods, 2005). For example, what kind of advice is given and is it appropriate? It may also be useful in training workers on understanding the needs of someone who is in pain and how to support them (e.g. what type of information and guidance would be useful?). For example, one participant found massage helpful but his colleague advised him against it on the basis of his own experience and limited knowledge. Without more expert knowledge, it is impossible to say which viewpoint was correct.

Exercises/stretches were another behavioural strategies used to deal with musculoskeletal pain at work. Those who did not rely on these strategies indicated the lack of a suitable environment to perform exercises and stretches. Among those who performed exercises/stretches, some followed suggestions given by the healthcare professionals experts (e.g. physiotherapist, chiropractor) while others relied on suggestions given by their colleagues. Moreover, some of the participants did not follow any experts' guidance and performed exercises/stretches, which they thought would be appropriate.

There was also a tendency among the participants to combine exercises with work tasks (e.g. walking up and down the stairs), rather than allocating special time for them. Some of them recognized that their workload was high and therefore they didn't have the opportunity for exercising.

In the literature, there is still a debate concerning the exercises/stretches and their usefulness in preventing musculoskeletal pain (Miranda, Viikari-Juntra, Martikainen, Takala, & Riihimaki, 2001). Hess and Hecker (2003) suggested that physical exercise may have indirect effects in preventing pain (e.g. perception of physical conditioning, self-worth, attractiveness, and strength) and Shrier (2000) demonstrated that stretching increases the tolerance to pain (e.g. it has an analgesic effect.) This finding is in line with the present research, as some of

the participants expressed that they relied on stretching in order to tolerate pain and stay on the task rather than doing it based on the guidelines provided by an expert. The authors emphasised that in order to better benefit from stretching, there is a need to design programs that would be job specific or designed according to the body-parts (e.g. for office workers programs that would focus on the neck, shoulders, upper extremities and the back).

Medication use was another strategy, which some of the participants had often relied on for relief. A range of medication types were reported that the office workers used for treating their musculoskeletal pain. These can be broadly categorised as pain killers and antidepressants. The use of pain killers was more common than the antidepressants, however some of the participants reported that they had recognised the side effects (e.g. vomiting, dizziness etc.) of taking such medications and, therefore, had avoided these..

One of the participants stopped using pain killers as they were ineffective in relieving her pain. These results are similar to those of Haslam, Brown, Hastings and Haslam (2003). One of the participants had the belief that the pain killers were chemicals, that shouldn't be taken unless the pain was intolerable. However there were others who were using pain killers for headaches but not for musculoskeletal pain, demonstrating the effects of beliefs and attitudes on decision making, whether to use medication or not (Avorn & Solomon, 2000). Other factors identified were knowledge and awareness of musculoskeletal disorders, which some of them gained through their social support networks.

With respect to the use of medication, various experimental and field studies demonstrated a relationship with high risk for injury (Haslam et al., 2003; Pickett, Chipman, Brison, & Holness, 1996; Voaklander et al., 2006). In a qualitative study Haslam and colleagues (Haslam, Atkinson, Brown, & Haslam, 2005) explored the range of accidents that was attributed to the use of medication or the symptoms of anxiety/depression. As a result the participants associated a range of falls, minor injuries and industrial accidents with medication use and symptoms of anxiety/depression that they experienced. The present study confirmed findings from the literature about the benefits and also risks of taking medication without proper medical supervision. In the present study one male participant, a manager, reported that he was taking a little alcohol when in pain. Drinking may have consequences for social and performance related problems at the workplace (e.g. relationships, productivity, human error and accidents) (Tómasson, Gunnarsdóttir, Rafnsdóttir, & Helgadóttir, 2004; Zaloshnja, Miller, Hendrie, & Galvin, 2007). Although in this study the participant reported that he was drinking only a little alcohol, there is evidence to suggest that the employees in this group, since they are likely to form a bigger proportion of the workplace drinkers, may account for greater impact on workplace productivity and accidents (Mangione et al., 1999).

CONCLUSION

Office workers use a range of cognitive and behavioural coping strategies while at work. Some of these strategies are successful. However, many of these have the potential either further to exacerbate the problems or lead to new problems, including accidents or impaired work performance. The present study indicates the haphazard and trial-and-error nature of many of these strategies. Improved guidance and better evaluation of existing advice are required for those who remain at work but in pain.

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DEVELOPMENT AND EVALUATION OF MECHATRONICS LEARNING SYSTEM IN A WEB-BASED ENVIRONMENT

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ABSTRACT
The development of remote laboratory suitable for the reinforcement of undergraduate level teaching of mechatronics is important. For the reason, a Web-based mechatronics learning system, called the RECOLAB (REmote COntrol LABoratory), for remote learning in engineering education has been developed in this study. The web-based environment is an educational technology for learning the principles and methodology of performing operations on a mechatronics rig at any time and from any location through the Internet. This study concentrates on a color identification experiment as a case study to illustrate the processes involved in the development and evaluation of the remote experimental procedure. The study was carried out with 55 students at National Changhua University of Education, in Taiwan. Students were divided into two groups with an equal number of students at the same academic level in each. One group was labeled as "Traditional" (without RECOLAB support) and the other "RECOLAB" (with support). The evaluation results elicit some relevant facts: (1) Students mainly agreed that the experiment was challenging and interesting and that they learned useful things during the laboratory. (2) Students valued the process performance. (3) Students enjoyed the way that the classes were devised. They valued the fact that participation was encouraged. (4) The students were not content with the number of laboratory practices and the number of hours assigned to the practices. (5) After evaluating the results, the teachers believe that the experiment significantly improved the quality of the laboratory. This study demonstrates RECOLAB's effectiveness in helping students to understand the concepts and master the technologies for the web-based mechatronics monitoring and control learning system. The architecture proposed in this study is not dependent on specific hardware or software configuration, it represents a generic infrastructure.
Keywords: Web-based learning, Mechatronics, Distance education

INTRODUCTION

The mechatronics system sequence integrates fundamental elements of mechanical, electrical, engineering and information to culminate in a powerful, adaptable, interdisciplinary approach to mechatronics. In a mechatronics laboratory, students are often provided with a wide range of sensors, actuators as well as data collection and control tools that allow for multiple solutions to a given design problem. A broad-based approach, involving student-built projects controlled by using a computer, encourages creativity and generates excitement about the subject (Nelson *et al*., 1995; Kaynak, 1996; Serri, 2003). Mechatronics competency is comprised of three components: the student must be able to specify the control; the student must be able to select each subsystem of the application; and the student must be able to integrate each sub-system (Shyr, 2009).

The rise of Internet has led to become an important approach for disseminating various educational materials to students (Demirci, 2010). This emergence of Internet has reformed the concept and means of engineering education. Remote learning utilizing Web features, is increasingly important for education (Isman and Isbulan, 2010; Jou *et al*., 2010). Remote laboratories provide several benefits especially for higher education environments, by supporting current traditional education as well as creating an alternative for distance education programs. The Internet essentially provides an environment to connect with anyone, anywhere, and at any time. The Internet also serves as an infrastructure for industrial applications (Lin and Broberg, 2002; Parikh and Verma, 2002). A web-based environment provides learners with problem-solving assistance and the tools for carrying out experiments (Pedaste and Sarapuu, 2006). From the perspective of education, the Internet is an enabling technology for engineering education and active learning. From an industrial perspective, it is a competitive service for remote measurement, supervision, diagnosis, and control (Stefanovic *et al*., 2009; Stefanovic *et al*., 2009). A distance and e-learning system could play an important role in providing incentives for university teachers to teach distance education courses (Cook *et al*., 2009).

The web enables more flexible delivery (any time), distance education (any place), new visualization possibilities (interactivity), and cost reduction. In engineering and remote control education, web technologies have been playing an increasingly important role, especially in remote learning (Postlethwaite *et al*., 2005). The role of information technology is becoming more important in the instructional domain. Chang *et al*., (2006), who built a web-based teaching material design and development system, tested its effectiveness in helping in-service teachers develop their teaching plans and materials. In the development of remote access laboratories,

a significant effort has gone into demonstrating their technical feasibility rather than investigating their implications for engineering pedagogy (Zhuang and Morgera, 2007). A basic requirement in engineering education is a significant number of practical activities where students, can verify and practice analytical concepts and methods learned in theoretical courses, by means of laboratory experiments (D'Andrea *et al*., 2008). Many engineering programs have always considered laboratories as an essential element of education, particularly at the undergraduate level (Ginns and Ellis, 2008; Helander and Emami, 2008). The Internet, on the whole, has also become a popular medium for teaching and learning.

Remote laboratory access allows distance learning students to actually operate experimental facilities, collect data and analyze data. Such web-based technologies can also be applied to general remote control systems in many areas of research and engineering. Ko *et al*., (2001) proposed a Web-based laboratory for control experiments. Ko *et al*., (2001) have also developed an internet laboratory about a frequency experiment. You *et al*., (2001) described the design and implementation of a robotic system that utilizes the Internet as an experimental platform. Hayes and Jamrozik (2001) described their experiences with web course development and delivery, as well as developing a set of tools for placing courses on the web. Shin *et al*., (2002) constructed web-based interactive virtual education systems. A system was proposed to provide remote access to laboratory work over the Internet (Colwell *et al*., 2002; Scanlon *et al*., 2004). Casini *et al*., (2004) presented a remote laboratory for automatic control where students interact with physical systems through the Internet. They describe processes for a dc motor, water tank, magnetic levitation system, and two-degrees-of-freedom helicopter simulator. Saygin and Kahraman (2004) presented a web-based programmable logic controller (PLC) laboratory for manufacturing engineering. Mougharbel *et al*., (2006) also evaluated and compared various remote access laboratory installations around the world. Hui *et al*., (2008) suggested that instructors should consider the target knowledge when considering technology-assisted learning options or designing a web-based course.

Many remote experience systems exist and they actually run. Thus, the concept of Web-based laboratory is not new. More importantly, there is still disagreement about whether Web-based learning or traditional teaching is more effective on students' achievement. A lot of studies suggest that there is no difference in test scores between Web-based and conventional format courses, although students may gain confidence in a Web-based course (Leasure *et al*., 2000; Liao and She, 2009). Other studies find that students enrolled in a Web-based course perform worse in a final exam than students educated by conventional instruction (Wang and Newlin, 2000). However, others indicate an apparent increase in satisfaction from Web-based courses (Katz and Yablon, 2002).

Although the above mentioned studies of integration of laboratory based education with internet are effective in supporting a general knowledge about the course, there is a need to find a way to provide hand-on experiment with physical systems. The objective of this laboratory platform is to provide high-quality learning experiences by bringing experiments to the students with the flexibility of time, location and special needs. The architectural configuration of the proposed system is modular and consists of a server, laboratory and experimental modules. The modules are actual systems suitable for remote operation in engineering education. Practical mechatronics examples have been prepared for the system. The users can operate and be monitored in their handling of these examples. The main contributions of this study are as follows: (1) A distance learning platform is developed, and experimentally tested. (2) Learning exercises are specifically targeted to the objective of the laboratory. (3) Mechanisms that further support the students are developed. (4) The system has an intuitive and convenient platform. (5) The technical aspects of the proposed platform are presented.

From a technological point of view, this study focused on the adaptation of concepts and technologies developed in the field of mechatronics and control, and on exploring their implementation in such remote laboratory settings. The evaluation approach of this study emphasized the didactical perspective of such systems, based on specific experimental protocols, combining qualitative and quantitative metrics; a further aim was to assess the effectiveness of these remote laboratories compared to traditional hands-on laboratory learning scenarios. At the technical stage, the platform is a synthesis of the mechatronics system and a learning environment. At the learning stage, the platform builds on modules and functionalities in realistic learning scenarios to introduce the operation of an actual system and to teach skills associated with programming a graphical monitoring language. Finally, at the experimental evaluation stage, a series of experimental studies measures the effectiveness of different learning programs by using a special evaluation protocol combining qualitative and quantitative ratings with the goal being to distinguish different designs for learning and instruction in the field of technology.

Summing up, integrating engineering education into the Web is usually achieved through the following methodologies: (1) employing websites to house various online functions and facilitate management; (2)

providing remote laboratories to replace physical equipment; and (3) offering web-based laboratories that enable students to set up parameters and undertake equipment from remote locations.

ARCHITECTURE OF RECOLAB

The architecture of the RECOLAB (REmote COntrol LABoratory) is focused on maximum simplicity for the students' benefit, while allowing complete control of the process. That is, the main goal is to make all of the PLC inputs and outputs accessible through any web browser; in addition, downloading new programs to the PLC in a remote way should be possible. Client/server architecture has been implemented to achieve these goals. This allows remote users to connect to a HTML page (using any web browser) that resides in a server with Windows powered by Microsoft's Internet Information Server (IIS).

The architecture can be applicable to the monitoring and control of any industrial process. Next, the hardware and software architectures are detailed.

Hardware Structure

Fig. 1 shows the distribution of the elements used in the laboratory setup. The laboratory is composed of a mechatronics module, a PLC, a server PC, and an IP_CAM.

In this example, a client PC is remotely accessing the laboratory through a connection to the HTTP server as part of its Web toolkit which hosts the web site conducting the equipment. The ADAM4571 converts the COM Port of the PLC (programmable logic controller) into an RJ-45 communications interface, which provides the PLC with network functions. The mechatronics module responds to commands from the server by means of the controller. The students can run and monitor the mechatronics module. Authorized students can also prepare new graphical software and apply it to the mechatronics module.

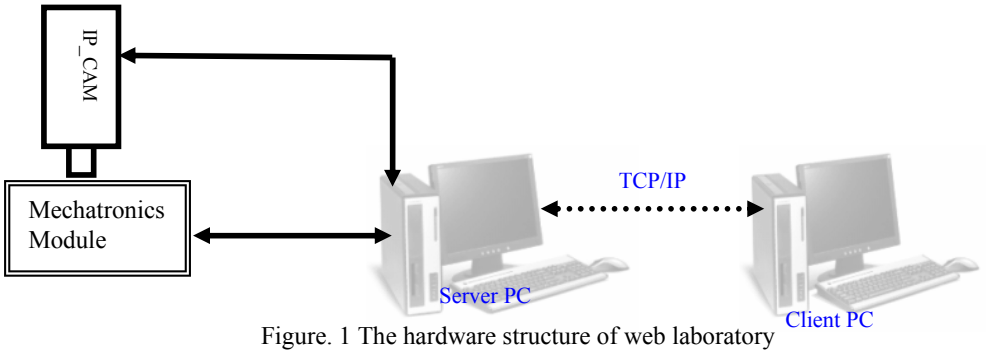

Figure. 1 The hardware structure of web laboratory

The Server and User Units

The students are connected to the server by the Web. The server and user units' main characteristic must be problem-free use. After connecting to the server, they navigate to the web page of the web-based laboratory platform for engineering education. The students can run the actual mechatronics systems via the PLC. Restated, they can apply their control software to actual mechatronics systems and can follow the operation of the system via an IP_CAM installed in the laboratory and simultaneously view the actual system on their monitors.

When students log in to the system over the Internet, they can monitor and control both the computer and the mechatronics rig. An IP-CAM remote monitoring panel can also be used for live broadcast of the actual rig. Students can perform the experiment whether they are on campus or at any remote location. To achieve the remote monitoring and control features, a client-server distributed environment has been implemented.

IP-CAM Control

An IP_CAM has been employed, allowing the students to watch the real-time state of the mechatronics systems. The IP camera is connected through an RS-232 to the serial port of the web server. Web-based control is implemented by continuously running a camera control program on the machine housing the http server to receive command strings from the client for local control. At the remote client user end, Advantech Studio software sets up the sockets for TCP communication with the web server. When the student clicks a button intended for camera control, it generates the corresponding command string and writes it to the TCP connection. Combined with the IP_CAM video camera, the function of the entire factory is clearly visible on the screen.

TCP for Client Server Communication

This popular method of TCP is used to implement client-server communication. The TCP connection established

by a client with a server remains connected until closed by the client. Since establishing a TCP connection implies that the connection is available unless the client closes it, TCP is the ideal communication protocol for implementing web-based control systems requiring frequent parameter adjustments.

MECHATRONICS EXPERIMENTAL MODULE FOR LABORATORIES

The laboratory part consists of twelve experiments. The mechatronics experimental module is easy to develop, and other mechatronic systems can be integrated with this module. This module can even be reconfigured for different laboratory work. This study concentrates on a color identification experiment as a case study to illustrate the processes involved in the development and evaluation of the remote experimental procedure.

The web-based laboratory can be set up by designing experimental content, such as a user interface, for a remote laboratory with step-by-step instructions. The students follow the instructions to conduct the remote equipment. The experiment can be performed by connecting to the web page of the web-based laboratory platform. The students use the software to prepare their own control programs for the mechatronics system.

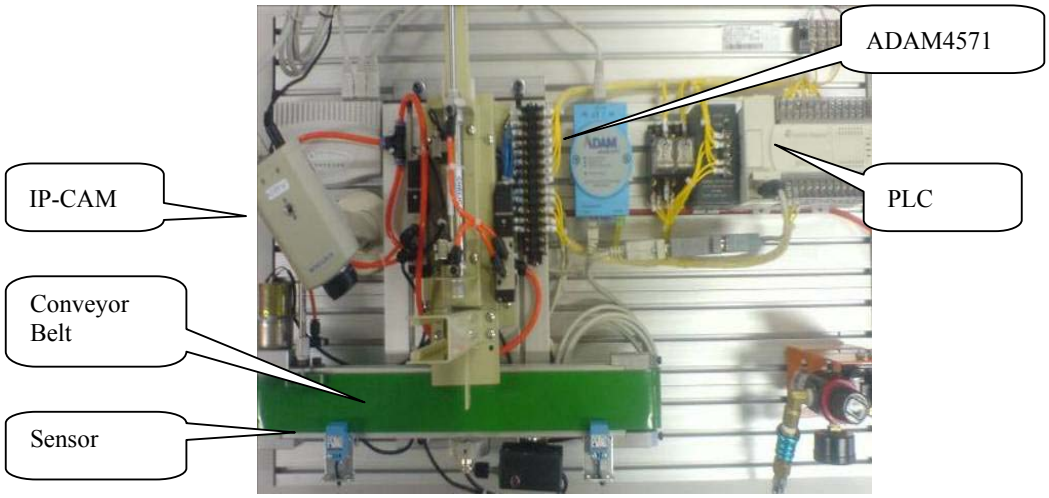

Figure. 2 Color identification module for use in the laboratory

Figure 2 presents the experiment to introduce the use of sensors in a remote laboratory and then uses the sensors to implement a program. Some decisions had to be made according to the state of inputs from the sensors. The use of sensors and actuation corresponding to the state of input is common in PLC programming. A cyclic process is chosen so that students can use the platform during the day or night, when nobody can attend the platform. Different colored devices are placed in the storage area. A pneumatic cylinder deposits one of these pieces on a conveyor belt. At the end of the conveyor belt, another pneumatic cylinder transfers the piece to the tooling area. Two different cylinders and a barrier work in the tooling area. First, a cylinder pulls the piece when the piece is red, and then another cylinder pulls it when it is black. An IP-CAM also displays the operating process on the screen of the laboratory platform.

STUDENT EVALUATION AND EDUCATIONAL RESULTS

Laboratory experiences, which imitate the complexity of real life practices, are essential elements in engineering education. In practical sessions, students learn not only by listening, like in theoretical courses, but also through "learning-by-doing." Learning styles vary among individuals. Some individuals can learn simply from reading materials, while others require hands-on experience. However, psychological investigations have demonstrated that individuals generally only remember about 10% of the content when read and 90% when actually experienced. Students typically learn and retain information well when they are engaged with instructional material. Students generally learn 20% of the material taught via hearing, 40% via seeing and hearing, and 75% via seeing, hearing and doing. Well-designed teaching modules offer the possibility of achieving this 75% goal (Reisman and Carr, 1991; Shyr, 2007). When students interact with laboratory plants, they have the opportunity to verify what happens when they modify and manipulate the experiment.

Evaluation is utilized in order to elevate the standards in terms of teaching, learning, and student achievement. Evaluation quality has a marked impact on student willingness to work hard and encourages teachers to focus on ways of improving individual learning attitudes. Evaluation occurs continually, since judging oneself and others

is common practice. For a system, more than two methods may be combined together, which could give extra confidence regarding the result's accuracy by concurrency of data produced from these evaluation methods. Methods of questionnaire survey, interview, and observation were used in the evaluation. A questionnaire survey was used to collect evaluation data from the participants. Observation and review were used in conjunction with the questionnaire survey as data collection methods.

Questionnaire Survey Results

Implementation and introduction of web laboratories in educational practice in the Department of Industrial Education and Technology at the National Changhua University of Education (NCUE) in Changhua, Taiwan, started in the first semester of 2008. Experiments supported by the web laboratory are a part of the mechatronics course. For the purpose of this survey, students were divided into two groups with an equal number of students at the same academic level in each. One group was labeled as "Traditional" (without RECOLAB support) and the other "RECOLAB" (with support). The survey period covered three semesters: 2008/I (the first semester in 2008), 2008/II (the second semester in 2008), and 2009/I (the first semester in 2009). The number of students included in each group of the experiment is presented in Table 1.

Table 1. Number of students included in experiment

Year/ Semester	Number of Students	
	Traditional	RECOLAB
2008/I	18	18
2008/II	18	18
2009/I	19	19

The RECOLAB was tested and evaluated by 55 undergraduate students in their second year of study. All of the students had previously attended courses and performed the same experiment in a laboratory. The questions asked of the students and their opinions are given in Table 2 (Boix *et al*., 2008). Students were asked to rate nine questions for both units on a five-point scale. Table 3 shows the results of the evaluation.

Table 2. Questionnaire

Q1. Was the experience challenging and interesting?
Q2. Have you learned more than you expected?
Q3. Is the quality of the lab materials high, and easy to understand?
Q4. Were the instructions provided easy to follow?
Q5. Would you recommend system to other students?
Q6. Would you apply concepts learned in your future career?
Q7. Were you able to easily connect to the platform?
Q8. Was the supervisory system appropriate?
Q9. How would you rate this lab?

Table 3. Results of the evaluation (The marks correspond to 1 = strongly disagree, 2 = disagree, 3 = unsure, 4 = agree, 5 = strongly agree)

	Traditional						**Using RECOLAB**					
	1	**2**	**3**	**4**	**5**	**Mean**	**1**	**2**	**3**	**4**	**5**	**Mean**
Q1	0	0	4	20	31	4.49	0	0	3	15	37	4.62
Q2	0	1	5	22	27	4.36	0	0	3	14	38	4.64
Q3	0	1	3	32	19	4.25	0	2	2	26	25	4.35
Q4	0	0	4	26	25	4.38	0	0	4	18	33	4.53
Q5	0	0	4	28	23	4.35	0	0	3	13	39	4.65
Q6	0	0	3	26	26	4.42	0	0	2	14	39	4.67
Q7	0	1	4	25	25	4.35	0	2	4	16	33	4.45
Q8	0	0	5	27	23	4.33	0	0	5	14	36	4.56
Q9	0	0	3	25	27	4.44	0	0	4	13	38	4.62

To determine if there was a significant difference between the "Traditional" and "RECOLAB" groups, an independent t-test at the 0.05 significance level was performed. Table 4 presents these test results. A close examination of Table 4 reveals that the "RECOLAB" group produced score averages that differ significantly from those of the "Traditional" group. The "RECOLAB" group obtained a higher average mark than the "Traditional" group did. The results of this test exhibit significant statistical differences between the groups ($t=4.51$, $p<0.05$).

Table 4. t-test for group difference

Group	N	M	SD	t
Traditional	55	4.37	0.07	4.51*
RECOLAB	55	4.57	0.11	

* $p < 0.05$

The students' open-ended opinions are presented below:

1. Web-based educational tools are attractive enough to be examined in a new light.
2. Using web-based educational tools exposes students to new challenges in learning.
3. Supporting learning with animation makes comprehensible learning more effective.
4. Performing experiments in a real-time web platform enables better and faster learning and provides different experiences with web-based technologies to obtain course goals.
5. Web-based experiments are perceived as safer and the environment is more relaxed when compared to traditional experiments.
6. It is possible to perform experiments repeatedly, independent of time and space limitations.
7. RECOLAB allows students to improve their self-learning capabilities.
8. Monitoring the experimental setup, with a real-time laboratory environment using a camera, helped students understand the experimental environment more concisely.
9. Students appreciated the RECOLAB and were happy and highly motivated to make use of and benefit from it.
10. Most students were willing to use such online applications not only for mechatronics but also for other courses.

Summary of Student Interview Results

As a result of the interviews conducted with students in an unstructured manner, it has been determined that the students can easily use the system for learning technologies presented in this study. In the experiments, the students learned: (1) to specify the control, (2) to select each subsystem of the application, and (3) to integrate each sub-system.

Analysis of the Results of Observation

It was observed that the students enjoyed using the system. However, some students encountered a problem operating the modules at the beginning of the laboratory exercise and required assistance. Reminding the students to read the operation rules first and giving them a chance to practice the operation before beginning, alleviated the problem.

Limitations

Although these results provide insight into effective distance learning initiatives, a number of limitations must be addressed when interpreting them. First, this study represents the test of a theoretical model and should be subjected to further testing with different participants, contexts and technological architectures. Second, the participants were undergraduate students who were completing the course as part of a degree requirement, so these results may not reflect the results of other settings and contexts. Issues of motivation for research participation by undergraduates can also influence results. Third, owing to the course requirements and the focus of the research questions, the research could not completely capture the richness of the reciprocal relationship between social presence and interaction.

DISCUSSION AND CONCLUSIONS

The web-based platform, called RECOLAB, is an effective alternative to setting up a conventional laboratory to support courses in engineering education. This platform can be run in real time through the Web from anywhere in the world, and the actual system can be monitored using an IP-CAM. The platform is flexible and can easily be adapted to different engineering education departments. This study discusses the implementation of such a framework and the evaluation of its success in teaching.

The results of this study present that the students who received a RECOLAB learning system significantly performed the traditional group of students. More importantly, there is still disagreement about whether Web-based learning or traditional teaching is more effective on students' achievement. Many studies suggest no difference in test scores Web-based and traditional courses. Although students gain more confidence with computer use in a Web-based course (Leasure *et al*., 2000), other studies find that students enrolled in a Web-based course perform worse in a final exam than students educated by conventional instruction (Wang and Newlin, 2000). And still others indicate an apparent increase in satisfaction on Web-based courses (Katz and

Yablon, 2002).

Most students involved in this research consider RECOLAB to be effective tool in understanding mechatronics. Use of this technology has the following benefits: (1) it reduces costs by sharing laboratory equipments; (2) it gives students greater exposure by allowing them to perform various experiments based on real equipment, and (3) it enables students to overcome the restrictions of time and space.

The evaluation results elicit some relevant facts: (1) Students mainly agreed that the experiment was challenging and interesting and that they learned useful things during the laboratory. (2) Students valued the process performance. (3) Students enjoyed the way that the classes were devised. They valued the fact that participation was encouraged. (4) The students were not content with the number of laboratory practices and the number of hours assigned to the practices. (5) After evaluating the results, the teachers believe that the experiment significantly improved the quality of the laboratory. Furthermore, students from the RECOLAB group had better final grades than did students from the traditional group (it is important to emphasize that both groups were equal in all respects). Previous questionnaire surveys have also given positive results as to whether web laboratories and remote control can improve the quality of education and contribute to a better fulfillment of educational goals.

Future improvements could include the expansion of materials. Reliability of the results could also be strengthened by applying this study to more extensive student groups.

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DEVELOPMENT OF SURVEY OF TECHNOLOGICAL PEDAGOGICAL AND CONTENT KNOWLEDGE (TPACK)

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ABSTRACT
The purpose of this study is to develop a survey of technological pedagogical and content knowledge (TPACK). The survey consists of seven subscales forming the TPACK model: 1) technology knowledge (TK), 2) pedagogy knowledge (PK), 3) content knowledge (CK), 4) technological pedagogical knowledge (TPK), 5) technological content knowledge (TCK), 6) pedagogical content knowledge (PCK), and 7) TPACK. This study is conducted in five phases: 1) item pool, 2) validity and reliability, 3) discriminant validity, 4) test-retest reliability, and 5) translation of the TPACK survey. To examine language equivalence, both Turkish and English versions of the TPACK survey are administered to preservice teachers studying English language education. It is determined the questionnaire meets the language equivalence. Results demonstrate the TPACK survey is a valid and reliable measure.
Keywords: Survey development; Technology; Pedagogy; Content; TPACK; Preservice teachers.

INTRODUCTION

For teachers to be successful in their career, they need to develop themselves in pedagogy, technology, and their content areas. By using information and communication technologies, teachers can follow developments in their areas, transfer the contemporary approaches and applications regarding teaching methods into their instruction, and keep themselves up-to-date. For these reasons, technology plays a critical role for teacher knowledge improvement.

In recent years, computer and instructional technologies have become an important part of our lives by affecting our learning and communication. Uses of these technologies in our daily lives become widespread since these technologies provide individuals with many benefits and opportunities. For example, the digital video composing feature of computers "can provide rich opportunities for students to learn curricular concepts deeply as they draw on tacit knowledge of media, connect curriculum to their lives through embodied experience, learn multimodal design, and create new identities as designers and active learners" (Miller, 2008, p. 21). Computer and instructional technologies also bring significant novelties to teachers and their classroom instruction.

When teachers integrate technology into instruction, their students become more interested in the subject (Schrum et al., 2007; Sweeder & Bednar, 2001). In the literature, it is stated that teachers with more experience in educational computer use maintain higher expectations for student learning (Hicks, 2006). In addition, use of computers and educational technologies may help increase student performance (Margerum-Leys & Marx, 2002). Hence, teachers should have knowledge in

- identifying subjects to be learned with educational technology in ways that show the added value of educational technology applications,
- determining representations for conveying the context into a comprehensible manner which is hard to teach with the traditional methods,
- establishing teaching strategies which meet learners' needs,
- choosing appropriate educational technology tools which support information transformation and teaching strategies, and
- integrating educational technology activities into the classroom (Angeli & Valanides, 2005).

The literature (Lambert & Sanchez, 2007; Margerum-Leys & Marx, 2002) suggests that teachers' use of educational technology requires comprehensive and multi-faceted knowledge. The goal of a contemporary educational system is to raise individuals, who search for ways to obtain information, know where and how to use it, and have critical thinking skills (Yılmaz, 2007). This goal can be met with teachers who renew themselves with the ever-developing science and technology. Hence, teachers should have the necessary abilities and responsibilities to integrate new technologies into their areas (Hicks, 2006). For instance, rapid diffusion of the Internet and distance education technologies require educators to discuss some issues, such as publishing content online, and interaction between students and educational materials (Peruski & Mishra, 2004).

Increasing quality in teacher education is described as one of the most critical issues (Dexter, Doering, & Riedel, 2006; Strawhecker, 2005). Although the availability of hardware, software, and Internet connections continues to increase in schools and colleges (Miller, 2008), many beginning teachers and preservice teachers do not have the necessary knowledge or experience to incorporate this technology into their classrooms (Buckenmeyer & Freitas, 2005; Niess, 2005). The major reason for their insufficient skills in educational technology is their lack of undergraduate preservice teacher training (Angeli & Valanides, 2005; Koehler, Mishra, & Yahya, 2007). Seeing technology, pedagogy, and content as being independent from each other is a very common problem in preservice and in-service teachers' professional development. Hence, a shift toward training teachers in the use of computers and educational technologies within their academic subject areas has begun (Niess, 2005). Overall, teacher professional development requires a consideration of multiple knowledge domains. So, the need for successful connections between technology, pedagogy, and content in teacher education programs is inevitable.

Examining teachers or teacher candidates' perceptions of their knowledge in technology, pedagogy, content, and their intersections is an essential need to determine the level of their knowledge in each domain. In the literature, it is easy to find surveys developed to assess technology, pedagogy, and content knowledge separately. However, there is a need for an instrument to measure knowledge in not only technology, pedagogy, and content areas, but also their intersections. Although the importance and necessity of technological pedagogical and content knowledge (TPACK) are emphasized, there is currently no comprehensive survey to evaluate TPACK. In fact, it is a common critique for educational technology studies that there is a lack of theoretical framework. Therefore, they ignore the complex and dynamic interaction between technology, pedagogy, and content (Harris, Mishra, & Koehler, 2007). In the current study, the TPACK model is used as the theoretical framework in the process of instrument development, data collection, and interpretation of the results (see Appendix A for the TPACK survey).

Theoretical Framework: Technological Pedagogical and Content Knowledge (TPACK)

Technology changes and develops rapidly. This situation requires determination of its effect on education and teacher beliefs (Margerum-Leys & Marx, 2002). In their conceptual framework for teacher knowledge, Mishra and Koehler (2006) extend Shulman's (1986) "pedagogical content knowledge" model by adding technology knowledge. As seen in Figure 1, the final framework includes three areas of knowledge (technology, pedagogy, and content) and their intersections.

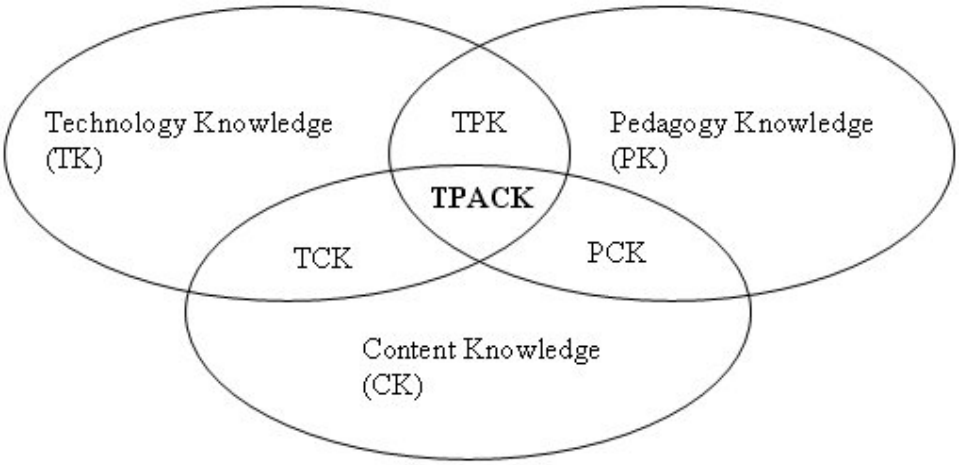

Figure 1: Relationships among Technology, Pedagogy, and Content Knowledge

In the model, the three unitary types of knowledge are technology knowledge (TK), pedagogy knowledge (PK), and content knowledge (CK). The three knowledge constructs are explained below.

Technology Knowledge (TK): This knowledge includes all instructional materials from blackboard to advanced technologies (Koehler et al., 2007). In general, it refers to a variety of technologies used in learning environments (Margerum-Leys & Marx, 2002).

Pedagogy Knowledge (PK): This knowledge includes teaching strategies for addressing individuals' learning needs and methods of presenting the subject matter (Kanuka, 2006). In other words, it refers to practice, procedure, or methods necessary for teaching and learning (Koehler et al., 2007). For instance,

this knowledge consists of general classroom management strategies, course planning, and student assessment.

Content Knowledge (CK): This type of knowledge is about the subject area a teacher instructs (Koehler et al., 2007). In other words, it answers the question of "what will be taught?" (Margerum-Leys & Marx, 2002). It includes terms, theories, ideas, constructs, and applications specific to a content area (Shulman, 1986), such as math, biology, and history. An individual without this knowledge may have misconceptions or misleading facts regarding the area (Koehler & Mishra, 2009).

In addition, the model has the three dyadic components of knowledge: technological pedagogical knowledge (TPK), technological content knowledge (TCK), and pedagogical content knowledge (PCK). These types of knowledge are explained next.

Technological Pedagogical Knowledge (TPK): TPK requires an understanding of general pedagogical strategies applied to the use of technology (Margerum-Leys & Marx, 2002). It requires an understanding of how teaching and learning will change with use of certain technologies. It consists of the integration of technological tools and equipment with appropriate instructional designs and strategies by realizing their strengths and limitations. The majority of popular computer software are not designed for educational purposes (Koehler & Mishra, 2009). Instead, they are produced for business, entertainment, communications, and social-interaction purposes. Thus, teachers need to go beyond the general uses of these technologies and integrate them into instruction.

Technological Content Knowledge (TCK): TCK helps teachers visualize instances where technology can be effectively integrated into their teaching (Margerum-Leys & Marx, 2002). For example, significant developments can be realized by computer simulations in physics and math areas (Koehler & Mishra, 2009). This knowledge type shows that technology and content affect and support each other. Hence, teachers must have an idea about their content areas, as well as the use of certain technologies that improve student learning.

Pedagogical Content Knowledge (PCK): PCK refers to teaching knowledge applicable to a certain subject area (Harris et al., 2007). It is necessary to turn content into instruction, like presenting a subject in different ways or adapting instructional materials, based on student needs and alternative ideas. This supports the links between curriculum, assessment, and pedagogy.

However, as the core of the model, TPACK is the intersection of the three knowledge bases.

Technological Pedagogical and Content Knowledge (TPACK): In this model, it is clear that content-based educational technologies must be pedagogically sound (Ferdig, 2006). Mishra and Koehler (2006) especially emphasize the interactions between the three elements. Successful teaching with technology is a multi-dimensional process that:

> . . . requires understanding the representation and formulation of concepts using technologies; pedagogical techniques that utilize technologies in constructive ways to teach content; knowledge of what makes concepts difficult or easy to learn and how technology can help address these issues; knowledge of students' prior knowledge and theories of epistemology; and an understanding of how technologies can be utilized to build on existing knowledge and to develop new or strengthen old epistemologies (Koehler et al., 2007, p. 743).

TPACK is suggested as effective teaching with technology. In the literature, TPACK is defined as a critical knowledge base needed to be developed by preservice teachers (Angeli & Valanides, 2005). Developing and implementing successful teaching requires an understanding of how technology is related to pedagogy and content (Koehler et al., 2007). "Unless a teacher views technology use as an integral part of the learning process, it will remain a peripheral ancillary to his or her teaching. True integration can only be understood as the intersection of multiple types of teacher knowledge" (Pierson, 2001, p. 427). Although the importance of the TPACK is clear, extensive research on this type of knowledge has not been conducted yet (Strawhecker, 2005). In the present study, a survey is developed to determine preservice teachers' perceptions of their TPACK.

DEVELOPMENT PHASES OF TPACK SURVEY

As mentioned above, the survey developed in the present study consists of seven subscales forming the TPACK model: 1) TK, 2) PK, 3) CK, 4) TPK, 5) TCK, 6) PCK, and 7) TPACK. This research study is conducted in five phases: 1) item pool, 2) validity and reliability, 3) discriminant validity, 4) test-retest reliability, and 5) translation of the TPACK survey. These phases are explained next.

Phase 1: Item Pool

To develop the survey, the theoretical framework and related literature are used. An item pool, including 60 items, is formed. The items for seven subscales of the TPACK model (TK, PK, CK, TPK, TCK, PCK, and

TPACK) are evaluated with the options of "totally measuring," "somewhat measuring," or "not measuring" by 10 faculty members from the programs of Computer and Instructional Technology, Curriculum Development, and Psychological Counseling. Next, the 47 items, labeled "totally measuring" by at least seven faculty members, were selected. In Table 1, minimum and maximum points for each subscale are presented.

Table 1: Minimum and Maximum Points for Each Subscale

Subscale	No of Items	Min. Point	Max. Point
TK	15	15	75
PK	6	6	30
CK	6	6	30
TPK	4	4	20
TCK	4	4	20
PCK	7	7	35
TPACK	5	5	25

Higher scores for each subscale indicate higher perceived acquaintance with the applications of the knowledge base. The survey items are answered by means of a Likert-type scale with five response choices, including "1=not at all," "2=little," "3=moderate," "4=quite," and "5=complete."

Phase 2: Survey Validity and Reliability

Participants: Validity and reliability studies of the survey are conducted with 348 (44.5% female; 55.5% male) preservice teachers.

Procedures: Phase 2 involves testing the construct validity of the TPACK survey. The factor validity of the seven subscales is examined using exploratory factor analysis (EFA). EFA is used to verify whether the survey items for each subscale successfully measure each variable. The Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's Test of Sphericity (BTS) are applied to the data prior to factor extraction to ensure the characteristics of the data set are suitable for EFA. Since the KMO and BTS results indicate the data satisfy the psychometric criteria for factor analysis, the EFA is performed. Furthermore, item-total correlations and Cronbach's alpha internal consistency coefficient are calculated.

Results: Before conducting factor extraction, the KMO and BTS are applied to ensure that characteristics of the data set are suitable for factor analysis. Factor loadings along with the KMO and BTS results are provided in Table 2.

Table 2: Factor Loadings for Each Subscale

Item	TK	PK	CK	TPK	TCK	PCK	TPACK
1	0.773	0.800	0.599	0.831	0.823	0.824	0.872
2	0.751	0.833	0.752	0.903	0.892	0.811	0.891
3	0.816	0.872	0.855	0.895	0.877	0.848	0.884
4	0.706	0.849	0.792	0.819	0.865	0.847	0.832
5	0.774	0.856	0.826			0.859	0.882
6	0.650	0.773	0.772			0.858	
7	0.633					0.764	
8	0.732						
9	0.779						
10	0.736						
11	0.614						
12	0.798						
13	0.653						
14	0.639						
15	0.708						
KMO	0.940	0.896	0.817	0.796	0.789	0.903	0.878
BTS	3186.27	1316.39	998.56	817.54	830.98	1737.51	1279.14
p	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001

Overall, KMO analysis yields higher indexes with statistically significant BTS scores. The KMO and BTS results indicate the data satisfy the psychometric criteria for performing a factor analysis. As seen in Table 2, the factor loads related to the 47 items on the subscales range from 0.60 to 0.90. From this point, it is determined

these items are qualified sufficiently to be included in the scale. Except for the TK subscale, one factor with eigenvalues greater than one emerges for each subscale of the TPACK survey (see Table 3). For the TK subscale, the scree plot for the survey items shows a sudden drop following the first factor. This result suggests the presence of only one factor; in fact, the first factor alone explains more than half of the total variance. Hence, the factor analysis for these items results in a single factor.

Table 3: Eigen Value and Percentage of Variance for Each Factor

Factor	Eigen Value	Percentage of Variance (%)
TK	7.782	51.877%
PK	4.146	69.098%
CK	3.562	59.368%
TPK	2.979	74.485%
TCK	2.991	74.776%
PCK	4.832	69.025%
TPACK	3.805	76.107%

Also, the correlations among the factors are given in Table 4. Statistically significant correlations exist among the subscales of the TPACK survey. These results show knowledge in technology, pedagogy, content, and their intersections are related.

Table 4: Pearson Correlation Coefficients between Subscales

Subscale	1	2	3	4	5	6	7
1. TK	-						
2. PK	0.28**	-					
3. CK	0.36**	0.61**	-				
4. TPK	0.46**	0.67**	0.53**	-			
5. TCK	0.53**	0.60**	0.59**	0.79**	-		
6. PCK	0.29**	0.80**	0.63**	0.73**	0.69**	-	
7. TPACK	0.41**	0.66**	0.56**	0.72**	0.79**	0.72**	-

*: $p<0.05$; **: $p<0.01$

For the reliability of the scale, Cronbach's alpha coefficient is used. The internal consistency scores for each subscale calculated are determined as 0.93 for TK, 0.90 for PK, 0.86 for CK, 0.88 for TPK, 0.88 for TCK, 0.92 for PCK, and 0.92 for TPACK. As presented in Table 5, item-total correlations range from 0.62 to 0.90 for the survey items. When the correlations between the factor scores are examined, highly positive and strong relationships are seen among all of the subscales.

Table 5: Item-total Correlation Scores between Subscales

Item	TK	PK	CK	TPK	TCK	PCK	TPACK
1	0.722	0.802	0.618	0.834	0.829	0.822	0.866
2	0.723	0.830	0.754	0.899	0.892	0.809	0.886
3	0.796	0.867	0.841	0.891	0.872	0.848	0.880
4	0.693	0.850	0.788	0.822	0.862	0.846	0.842
5	0.768	0.850	0.823			0.856	0.885
6	0.644	0.781	0.773			0.856	
7	0.638					0.771	
8	0.735						
9	0.784						
10	0.738						
11	0.627						
12	0.805						
13	0.671						
14	0.656						
15	0.726						

Phase 3: Discriminant Validity

Participants: The discriminant validity study of the TPACK survey is conducted with 205 (46.4% female; 53.6% male) preservice teachers.

Procedures: In this phase, a research study is carried out for the criterion-related validity. The participants' grades in technology, pedagogy, and area-specific classes are obtained from the administration office of the college and matched with the survey data. Next, the correlations between the scores from each subscale and the corresponding grades are determined.

Results: Evidence of discriminant validity is provided by correlating scores on the TPACK subscales with the related grades. As seen in Table 6, each of the TPACK subscale scores is statistically and significantly related to its corresponding grade.

Table 6: Correlations between Subscale Scores and Grades

Subscales	Average Grade of Computer Classes	Average Grade of Pedagogy Classes	Average Grade of Area Classes	Average Grade of Computer & Pedagogy Classes	Average Grade of Computer & Area Classes	Average Grade of Pedagogy & Area Classes	GPA
TK	0.27**						
PK		0.17**					
CK			0.16**				
TPK				0.30**			
TCK					0.30**		
PCK						0.26**	
TPACK							0.34**

*: $p<0.05$; **: $p<0.01$

All positive correlations between the subscale scores and the grade points are statistically significant. Especially, it is important to highlight the highest correlation exists between the TPACK subscale and the GPA scores. Results from this analysis show the discriminant validity of the survey developed.

Phase 4: Test-retest Reliability

Participants: Test-retest reliability analysis is conducted with 76 (44.8% female; 55.2% male) preservice teachers.

Procedures: In Phase 4, the test-retest reliability of the TPACK survey is checked. The questionnaire is administered twice with an interval of three weeks between the two stages of administration.

Results: After the survey is administered twice as described above, a reliability coefficient is determined as 0.80 ($p < 0.01$) for the TK subscale, 0.82 ($p < 0.01$) for the PK subscale, 0.79 ($p < 0.01$) for the CK subscale, 0.77 ($p < 0.01$) for the TPK subscale, 0.79 ($p < 0.01$) for the TCK subscale, 0.84 ($p < 0.01$) for the PCK subscale, and 0.86 ($p < 0.01$) for the TPACK subscale. Overall, these results confirm the test-retest reliability of the survey.

Phase 5: Survey Translation

Participants: The participants of the last phase of the current study are students studying English language education. The original form of the TPACK survey and its English version are administered to 84 students to check the language equivalence of the survey. Since the students may remember their answers on the first administration, a two-week interval is used between the two administration stages.

Procedures: Phase 5 involves translation of the survey into English. Following the procedure suggested in the literature (Kevrekidis et al., 2008), the validation of the translation is made by translation and counter-translation. The survey is translated from Turkish to English independently by the authors and professional translators, three faculty members who work in the Department of English Language Education. Also, the English version is back-translated into Turkish by a bilingual person for crosschecking. Then, the two translated forms are compared and modifications are made accordingly. The changes are mainly related to different alternatives of synonymous words. The structure or the meaning of the scale items is not changed.

Results: A significant positive relationship is found between the scores from the Turkish and English forms of the TPACK survey administered over a two-week period ($r = 0.95$, $p < 0.001$). Therefore, the translated version is accepted as equivalent to the original.

CONCLUSIONS

When the studies regarding the scale development are examined, it is seen that a systematic and step-by-step approach is followed for the validity and reliability of the scale. In this study, a similar process is completed. The

validity and reliability of the TPACK survey are checked with preservice teachers. First, a pool of 60 items is formed and reduced to 47 items after expert evaluation. Then, EFA is conducted to examine the construct validity and the factor structure of the survey. Based on the EFA, the results show the survey items for each subscale successfully measure each variable. KMO and BTS measures also indicate the data satisfy the psychometric criteria for the EFA.

Furthermore, item-total correlations and Cronbach's alpha internal consistency coefficient are calculated. For scales used in research, the level of an acceptable Cronbach's alpha coefficient is suggested as 0.70 (Anastasi, 1982; Tavsancil, 2002). In the present study, findings suggest that Cronbach's alpha coefficients of the subscales show the internal consistency of the scale, and the item-total correlations of the scale items are quite high. Each of the subscales is statistically and significantly related to its corresponding course grade, so the survey also meets the discriminant validity along with the test-retest reliability. Since TPACK is an emerging theme in the literature and the primary contribution of this research is in furthering our understanding of TPACK, the survey should be open to an international audience. Thus, the original scale, composed of 47 items, is translated into English. A significantly positive correlation is determined between the scores obtained from the English form and the Turkish form of the scale. This shows the language equivalence is obtained. In summary, the findings from the present research study demonstrate the TPACK survey is a valid and reliable measure.

In the present study, correlation scores show that significant interactions between technology, pedagogy, and content knowledge bases are evident. Findings from the current study and literature suggest the three knowledge domains should be treated in an integrated manner, not as separate constructs (Koehler et al., 2007; Niess, 2006). From this point of view, the present study supports the intertwined relationship between the three knowledge bases. In fact, if preservice teachers see the value of integration of appropriate educational technologies and pedagogies into their content area, they will more likely use these technologies and pedagogies to support student learning when they become real teachers. It is apparent that much research in this line of inquiry should be conducted. Also, future research could conduct the TPACK survey with different research designs and contexts. In future research, other variables might be included to analyze their impact on preservice teachers' TPACK domains.

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APPENDIX A. ITEMS OF TPACK SURVEY

Subscale	Items (I have knowledge in …)
Technology Knowledge (TK)	Solving a technical problem with the computer Knowing about basic computer hardware (ex., CD-Rom, mother-board, RAM) and their functions Knowing about basic computer software (ex., Windows, Media Player) and their functions Following recent computer technologies Using a word-processor program (ex., MS Word) Using an electronic spreadsheet program (ex., MS Excel) Communicating through Internet tools (ex., e-mail, MSN Messenger) Using a picture editing program (ex., Paint) Using a presentation program (ex., MS Powerpoint) Saving data into a digital medium (ex., Flash Card, CD, DVD) Using area-specific software Using printer Using projector Using scanner Using digital camera
Pedagogy Knowledge (PK)	Assessing student performance Eliminating individual differences Using different evaluation methods and techniques Applying different learning theories and approaches (ex, Constructivist Learning, Multiple Intelligence Theory, Project-based Teaching) Being aware of possible student learning difficulties and misconceptions Managing class
Content Knowledge (CK)	Knowing about key subjects in my area Developing class activities and projects Following recent developments and applications in my content area Recognizing leaders in my content area Following up-to-date resources (ex, books, journals) in my content area Following conferences and activities in my content area
Technological Pedagogical Knowledge (TPK)	Choosing technologies appropriate for my teaching/learning approaches and strategies Using computer applications supporting student learning Being able to select technologies useful for my teaching career Evaluating appropriateness of a new technology for teaching and learning
Pedagogical Content Knowledge (PCK)	Selecting appropriate and effective teaching strategies for my content area Developing evaluation tests and surveys in my content area Preparing a lesson plan including class/school-wide activities Meeting objectives described in my lesson plan Making connections among related subjects in my content area Making connections between my content area and other related courses Supporting subjects in my content area with outside (out-of-school) activities
Technological Content Knowledge (TCK)	Using area-specific computer applications Using technologies helping to reach course objectives easily in my lesson plan Preparing a lesson plan requiring use of instructional technologies Developing class activities and projects involving use of instructional technologies
Technological Pedagogical and Content Knowledge (TPACK)	Integrating appropriate instructional methods and technologies into my content area Selecting contemporary strategies and technologies helping to teach my content effective Teaching successfully by combining my content, pedagogy, and technology knowledge Taking a leadership role among my colleagues in the integration of content, pedagogy, and technology knowledge Teaching a subject with different instructional strategies and computer applications

EXPLORING ONLINE GAME PLAYERS' FLOW EXPERIENCES AND POSITIVE AFFECT

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ABSTRACT
The authors conducted two studies to explore online game players' flow experiences and positive affect. Our findings indicated that online game are capable of evoking flow experiences and positive affect, and games of violent or nonviolent type may not arouse players' aggression. The players could be placed into four flow conditions: flow, boredom, anxiety, and apathy, as determined by level of perceived challenges and skills. The majority of players entered the flow condition when playing violent or non-violent online game. The path analysis results suggested that violent online games may have a significant but indirect effect on positive affect via flow experience mediation.
Keywords: online game play, violent online game, non-violent online game, aggression, flow

INTRODUCTION

In recent years, online games are among the growing rapidly forms of human recreation (Ryan, Rigby, & Przybylski, 2006) which has received an increasing amount of attention (Chang & Zhang, 2008). Online game playing represents a significant and rapidly expanding segment of daily media usage (Roberts, 2000). In light of the clear short-term pleasure, relaxation, and playfulness that online game players experience, a growing number of researchers are exploring positive effects (e.g., flow experiences, Wan & Chiou, 2006; intrinsic motivation, Ryan, Rigby, & Przybylski, 2006; positive mood, Ryan, Rigby, & Przybylski, 2006) emanating from online game play. A previous study (Yagci & Caglar, 2010) found that there was no significant difference in aggression between players and non-players, but the previous study (Yagci & Caglar, 2010) didn't compare the difference in aggression between using violent and non-violent games. Although, some researchers found violent online/video game would exert negative effects (e.g., aggression, Anderson, 2004; Dill & Dill, 1998; Markey & Scherer, 2009; reduced empathy, Wei, 2007) on players. However, the comparison study between violent online games and non-violent online games in positive affects and negative affects was not explored further; even the regression study should be done to build relationships between game types and its' effects. Accordingly, the current research conducted two studies to examine (1) whether violent online game play would evoke players' aggression and (2) players' flow experiences and positive affect aroused by violent or non-violent online game play.

FLOW THEORY AND ONLINE GAMES

According to Csikszentmihalyi (1990), the concept of flow, or optimal experiences, stands at the center of positive psychology. Flow refers to a state in which someone focuses completely on a pleasant activity, with individuals perceiving a balance between skills and challenges. He also posits a correlation between the quality of flow experiences and perceived levels of challenges and skills, with perceived balance between skills and challenges categorized into four conditions: flow, boredom, anxiety, and apathy. Asakawa (2004) defines operationally flow conditions as situations in which perceived challenges and skills are in balance and above the mean skill levels of a group; boredom conditions as situations in which skills but not challenges are above a group mean; anxiety in which challenges but not skills are above a group mean; and apathy in which both challenges and skills are below a group mean.

Csikszentmihalyi (1990) also regards flow as an autotelic experiences—that is, intrinsic rewards come from the activity itself. Characteristics of flow experiences include clear goals, immediate feedback, loss of a sense of passing time, loss of self-consciousness, an integration of self with the activity, increased concentration on the activity, and a sense of control (see also Pace, 2004; Chen, 2006).

We believe that online games have many features that encourage flow states, including the provision of rich and immediate feedback to player actions, enjoyment, playfulness, and the ability to induce high levels of player concentration. Chen (2006), Pace (2004), Pearce, et al. (2004), and other researchers are using the flow concept and experience sampling methodology or interview to explore aspects of human-online interaction. However, limitation of research fund and time, the authors preceded two studies: an experiment and survey to collect more samples rather than using the experience sampling method. Moreover, a challenge for these researchers is the potential crossover of the effects of flow experiences in online games with the impacts of online game addiction. Griffiths and Davies (2005), and Lemmens, Valkenburg and Peter (2009) are on a long list of researchers suggesting that online games can cause some players to become addicted. Oppositely, Wan and Chiou (2006) posit a negative correlation between flow state and inclinations toward addiction, and they also report that flow state is not a significant predictor of subsequent inclinations toward addiction. Chumbley and Griffiths (2007) argue that online game addiction may exist, but only in a small percentage of players, therefore samples of addicted players are hard to establish and comparisons with non-addicted players in terms of general online game effects are hard to make. For this reason, the potential for online game addiction was not included in the current study.

Chumbley and Griffiths (2007) report that differences in online game content arouse different affective responses. Griffiths (1999) notes that the majority of researchers claim that the contents of most online games are violent in nature. Furthermore, Anderson (2004) and Dill and Dill (1998) suggested that violent games would arouse negative emotions. Accordingly, our goal in this research is to gather evidence supporting or refuting the idea that online game content (violent versus nonviolent) exerts negative impacts on player flow experiences and positive affect.

The primary purpose of our dual studies was to investigate players' flow experiences and positive affect in the period immediately following violent and nonviolent game play sessions. Our expectation was that online games would contribute to flow experiences and positive affect, and that players' aggression would not arouse after playing either violent or nonviolent online games. We also expected that participants can be categorized to different flow conditions (flow, boredom, anxiety or apathy) based on balance between skills and challenges which were perceived during game playing sessions.

Two studies were conducted to test these hypotheses. In the first we compared the effects of two games given by the authors, one violent and one nonviolent and collected data on the participants' reported flow experiences, positive affect, and aggression following play sessions. To ensure a successful manipulation check, advanced examinations of the participants' initial emotional states and game playfulness feature appraisals were conducted. For the purpose of counter balance control of game playing order, half of the participants played the violent online game first and the second half the nonviolent game first. Game assignments were reversed later. In the second we surveyed a group of college game players regarding their flow experiences and positive affect. We categorized participants into four flow conditions according to their scores of flow scale and categorized online games reported by participants into violent and nonviolent game according to criteria by our research group. We also performed path analyses for players in terms of the flow condition, violent online games, flow experiences, and positive affect.

STUDY 1

Sample and Procedure

A total of 30 (11 male, 19 female) college students in Taiwan agreed to participate in this study in return for research credit in their educational psychology course. For the purpose of counter balance of game playing order, the participants were randomly divided into two halves, with the first half (16 participants) played the violent online game and the second half (14 participants) played the nonviolent game. Game assignments were reversed two weeks later. Participants were asked to complete an emotion pretest questionnaire, learn how to play the assigned game, then complete additional questionnaires (described below) after 30-minute game sessions.

The violent game used in this study was *Grand Theft Auto*. Players act as criminals in a large city, with missions assigned by underworld figureheads; missions and tasks must be completed in order to progress through a

storyline. Missions and tasks include bank robberies, assassinations, taxi driving, firefighting, pimping, street racing, and learning to fly an airplane. Many tasks and learning scenarios can be completed at any time when main missions are not being completed. The nonviolent game used in this study was *Super Mario Crazy Racing*, in which characters from the *Mario* series of video games race go-karts on a variety of tracks. Players obtain items by driving through question mark blocks. Coins can be used for defensive moves, offensive purposes, or for adding power to engines for short time periods.

Questionnaire

We used existing questionnaires (original and modified) to create instruments aimed at collecting data on emotions (Levine, Wyer & Schwarz, 1994), online game playfulness (Hackbarth, Grover &Yi, 2003), flow during game play (Chen, 2006), positive affect (Chen, 2006), and aggression (Liu, 2003).

The purpose of Levine et al.'s (1994) emotion scale is to measure an individual's emotional state in the pretest phase. Responses to the scale's 14 adjective items are given according to a 7-point checklist, with 1 indicating "strongly disagree" and 7 "strongly agree." Sample items include "happy," "excited," and "depressed" (negative emotions are reverse scored as to indicate positive emotion).

For Hackbarth et al.'s (2003) online game playfulness feature scale (7 items and a online playfulness adjective checklist), participants were asked to select adjectives to describe subjective perceptions for the game they were playing or game characteristics. Sample items include "spontaneous" and "unimaginative" (reverse scored).

The flow during game play and positive affect instruments were modified from Chen's scale (2006) which is originally constructed to measure flow states and positive affect among World Wide Web users; we revised them to fit a online game context. It consisted of 14 items and sample items include "I was absorbed intensely in the game or in my game roles" and "Time went faster than I thought, and I did not sense the passing of time." Responses to scale items were given along a 7-point Likert scale. The positive affect scale consisted of 6 items and was modified into 7-point semantic differential rating: fun–not fun (reverse scored), boring-exciting, sad—enjoyable, active–passive (reverse scored), lonely—not lonely, and tense—relaxed.

Finally, Liu's (2003) aggression scale is originally constructed to measure aggressive cognition, behaviors, and affect among World Wide Web users. It consists of 17 items and responses ranging from 1 ("strongly disagree") to 7 ("strongly agree"). We revised it to serve our purposes of determining increases in the participants' aggressive attitudes. Sample items included "I have no violent feeling from that game" and "I would hit anyone who harassed me."

The small sample size limits the use of a factor analysis to examine the validity of the scales. We therefore examined item-scale correlation (> 0.3) and item discrimination of extreme values (t-test value significant) to ensure the quality of the scales. No items were removed from the emotion scale (Cronbach Alpha coefficient = .78), one item was deleted from the game playfulness features scale (.83), three items were deleted from the flow-during-game scale (.91), one item was deleted from the positive affect scale (.84), and two items were deleted from the aggression scale (.88). The reliabilities of all instruments were acceptable.

Results

To perform a manipulation check, participants were asked to describe their initial emotional state and to appraise the playfulness levels of the two games using the paired t-tests. In addition, the paired t-tests were also used to determine mean differences within halves (when they in switch played violent and non-violent games for counter balance of playing order) for the flow-during-game play, positive affect, and aggression scales.

Results from the paired t-test comparison of violent and nonviolent games are shown in Table 1. In both cases, the participants' mean scores on the emotion pretest were below the scale midpoint of 4.0. The participants reported lower playfulness feature appraisal of the violent game (< 4.0) and higher playfulness feature appraisal of the nonviolent games (> 4.0). They also reported scores above 4.0 for the flow experience and positive affect scales. Paired t-test results indicated no significant differences in the participants' scores on the emotion pretest and (t=-.58, n.s.) and playfulness feature appraisal scales (t=-1.26, n.s.). These findings were used to ensure that the participants' initial emotions and playfulness feature appraisals for the two games at the same level.

Significant differences were noted between the two game types in terms of flow experiences ($t=-5.22$, $p<.001$) and positive affect ($t=-4.07$, $p<.001$). Participants reported higher flow experience and positive affect scores after playing the nonviolent game compared to the violent game (M=5.38 vs. 4.08 and 5.67 vs. 4.30, respectively). Finally, participants playing two type games reported scores far below the midpoint of 4.0 on the

aggression scale (M=2.33 for both the nonviolent and violent groups). No significant differences in aggression (t=-.01, n.s.) were found between the two game types.

Table 1: Results from paired t-tests, violent versus non-violent game players (N=30)

	Violent Games		Nonviolent Games		Paired t
	M	SD	M	SD	
Emotion Pretest	3.12	0.82	3.20	0.82	-0.58
Game Playfulness Feature	3.98	1.47	4.38	1.02	-1.26
Flow Experiences	4.08	1.28	5.38	1.11	-5.22***
Positive Affect	4.30	1.45	5.67	1.08	-4.07***
Aggression	2.33	0.95	2.33	0.95	-0.01

*** p <.001.

Discussion

The findings indicated no significant differences between the two game types in terms of the participants' initial emotions and playfulness feature appraisals. That the mean scores for flow experiences and positive affect exceeded the 4.0 midpoint after playing either violent or nonviolent games suggested a positive effect from online game play. Note also the significant differences in flow experiences and positive affect when playing the violent and nonviolent games, with higher scores reported after playing the nonviolent game. These results find support from Chumbley and Griffiths (2007), who reported that different online game contents trigger different affective responses. In short, our data indicated that nonviolent online games trigger higher positive player affect compared to violent games.

Mean aggression scores between violent (M=2.33) and nonviolent (M=2.33) games were both below the 4.0 response midpoint. No significant differences were noted in aggression scores after playing either game—in other words, the results indicate that online games did not evoke aggression in the participants, regardless of their violent or nonviolent status.

Our results confirmed our principle assumption that online games would exert players' flow experiences and positive affect during game play. However, several limitations must be noted. The first is the small sample size (30 participants). Also, the gender breakdown (36.3% male and 63.3% female) is not representative of actual game player populations, which tend to be dominated to a very large degree by male players. Past research findings have suggested that women's experiences and time allocation of online gaming were less than men of a similar age (e.g., Royse et al., 2007; Williams et al., 2009). We also observed that male players also show a preference for violent online games and female players show a preference for nonviolent games. Even though significant differences were not found in terms of perceived playfulness features between the two game types in this study, we suspect that females in general may prefer nonviolent games and report higher levels of flow and positive affect after playing nonviolent games.

The second limitation concerns flow conditions. According to Csikszentmihalyi (1990), flow experience quality is associated with perceived levels of challenge and skill level. People in different flow conditions tend to report different flow experience levels. In this study, the number of participants was too small for proper categorization in terms of participant flow conditions, thus making it difficult to compare flow experiences and positive affect.

The third limitation concerns the experimental setting. Participants were assigned to different types of games, meaning that some participants were forced to play a game type that they would normally avoid. Csikszentmihalyi (1990) posits that flow experiences are more likely to emerge from preferred or favored activities. Also note that the one item deleted from the playfulness feature scale based on results from an item analysis was "autonomy," therefore we could not accurately assess the participants' perceptions of whether or not they were involved in a preferred activity.

In view of this, extensive survey was used to examine further the participants' flow experiences and positive affect. In response to the second limitation, we further categorized the participants into the four above-described flow conditions. In response to the third limitation, the questionnaires would be according to samples' experiences of the online game that they played in the last game to response.

Furthermore, our data indicated that the mean scores for the aggression scales between the violent (M=2.33) and nonviolent (M=2.33) games were both below the scale midpoints, with no significant differences noted between the two game types. The result of study 1 extended the previous finding (Yagci & Caglar, 2010) and made the

literature more complete in the online game play domain. Further, we made the decision to not address the aggression issue in our second study.

STUDY 2

The purpose of study 2 was to survey college online game players concerning their flow experiences and positive affect after game sessions. Participants were classified into the four flow conditions (flow, boredom, anxiety, or apathy) with games once again divided into violent or nonviolent categories. In addition, a path analysis was conducted to examine whether players are in the flow condition or whether they play violent online games have effects on their perception of flow experiences, and positive affect. We expected that both players in flow condition and violent online game play would have effects on flow experiences and positive affect.

Sample and Procedure

A total of 365 college students from 4 universities in northern and central Taiwan were requested to complete the research instruments; 337 students (246 male, 91 female) returned usable surveys. Of those, 35 (10.4%) stated that they had been playing a particular type of online game for 1 month or less, 94 (27.9%) between 2 and 6 months, 31 (9.2%) between 7 and 12 months, and 177 (52%) for 1 year or more. Regarding hours spent playing per week, 173 (51.3%) reported 7 hours or less, 81 (24%) between 8 and 16 hours, 41 (12.2%) between 16 and 24 hours, 26 (7.7%) between 25 and 40 hours, and 16 (4.7%) 41 hours or more.

Questionnaire

The first survey item was "What is the name of the online game that you last played (today, yesterday, several hours ago)? All of the questions that follow will be about that game and your playing habits."

The rest of the data collection instruments were designed to collect demographic information; data on online game playing habits; and perceptions of challenges, skills, and strategy (Pearce, et al., 2004), flow experiences during game play (Chen, 2006), and positive affect (Chen, 2006). The challenge/skill items focused on participant perceptions of the match between game challenges and personal playing skills for the designated game. The two items in this part of the instrument were, "How do you feel about the game's degree of challenge?" and "Were your skills adequate for the game while you were playing it?" Responses to the two items were measured along a 9 point Likert scale and were used to categorize the participants into the four flow conditions: flow, boredom, anxiety, or apathy. The instruments used to measure flow experiences and positive affect were identical to those used in the first study but in a 9-point Likert scale.

The two scales were validated by factor analysis using principal component and varimax rotation methods. Our results indicated that the scale of flow experiences is composed of 2 factors (naming antecedent flow and flow state) which together explained 67.43% of total variances. Reliabilities for the two factors were .86 and .81, respectively, and .83 for the entire flow experience scale. The positive affect scale extracted one factor with 53.81% total variances explained and its reliability was .78.

The online games reported by the participants were coded as either violent or nonviolent. The established categorization criteria of online games (Griffiths, 1999) were adopted to categorize violent and nonviolent games. Two college expert players were recruited as coders. One expert is an elder leader in a massively multiplayer online game (MMO) and majors in educational psychology and counseling. The other expert is an expert player of the previous target game (Grand Theft Auto) and majors in instructional technology. The scorer reliability for the two coders were .82.

Statistics Method

To examine perceived balances of challenges and skills, we followed the classification procedures described by Asakawa (2004). Challenge and skill level means and standard deviations were computed for the entire sample. Cutoff points were group mean minus one standard deviation, group mean, and group mean plus one standard deviation (Fig. 1). Means and standard deviations for the flow dimension and positive affect scales were computed and compared across the four flow conditions.

The four conditions in the current study included flow, boredom, anxiety, and apathy. Asakawa (2004) regarded the flow condition as situations where both perceived challenges and skills were balanced and above the group means, whereas the apathy condition was regarded as situations in which both challenges and skills were below the group average. The authors categorized the flow condition into three sub-conditions (Flow 1 to Flow 3). The flow 1 condition represented the highest balances between challenges and skills, flow 2 and flow 3 conditions represented the second best, but the apathy condition represented low balances between challenges and skills. The participants in flow 1 condition should perceived higher flow experiences and more positive

affect than the flow 2, flow 3 and apathy conditions (Csikszentmihalyi, 1990; Asakawa, 2004). In order to categorize participants into the four conditions of flow (flow, boredom, anxiety, and apathy), the authors adopted Asakawa (2004)'s suggestion to the combined flow1 to flow3 into one flow condition.

The boredom condition was regarded as situations where skills, but not challenges, were above the group average. The anxiety condition was regarded as situations where challenges, but not skills, were above the group mean. The mapping is presented in Figure 1.

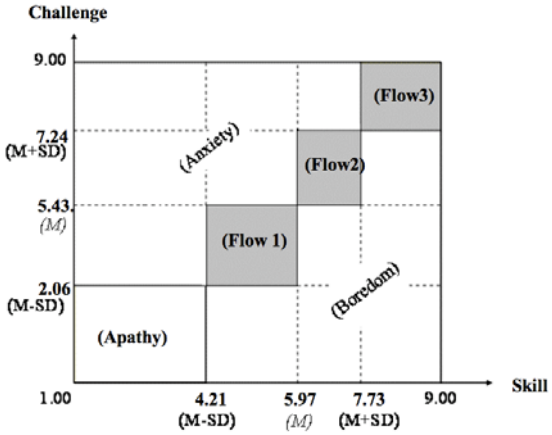

Figure1: Four conditions of flow in a flow channel defined by perceived challenges and skills.

In order to examine whether flow experiential regions in our data (Flow 1 to Flow 3 and Apathy) may represent a flow channel along which challenges and skills are to some extent in balance and the levels of flow experiences and positive affect gradually increase (Csikszentmihalyi, 1990; Asakawa, 2004), the authors compared the differences in flow experiences and the positive affect among participants in flow1, flow2, flow3 and apathy.

There were significant differences in flow experiences (F=11.21, $p<.001$) and positive affect (F=4.59, $p<.01$) among flow1, flow2, flow3 and apathy conditions. Post hoc analysis showed that participants in flow 1 reported higher flow experiences than participants in flow3 and apathy and more positive affect than flow2, flow3 and apathy conditions. Participants in flow 2 reported higher flow and more positive affect than participants in flow3 and apathy condition. Participants in flow 3 reported higher flow and more positive affect than participants in apathy condition. Because the flow in flow 1 and flow 2 both reported high flow experiences, they were not comparable. The results suggested that the intensity of flow gradually increased along this channel and showed adequate validity of the scale of flow experiences.

The path analysis was conducted to examine the effects among participants in the flow condition, playing violent online games, their perception of flow experiences and positive affect. The flow condition was coded as a dummy variable (1 = flow, 0 = boredom, anxiety, or apathy), as was the online game type categories (1 = violent, 0 = non-violent).

Results

1. Four flow conditions based on perceived balances between challenges and skills.

The findings indicated that the study participants could be divided into four flow conditions based on perceived challenge-skill balances. Chi-square analysis yielded that significant different distributions for the four flow conditions (x^2=109.48, p<.001). The largest group was the flow condition, with 143 (42.4%) participants; the boredom condition contained 96 (42.4%) participants; the anxiety condition contained 70 (42.4%) participants; only 13 (3.9%) participants were placed in the apathy group.

Of the 302 game titles reported by the participants (219 by males, 83 by females), 45.4% fell into the violent game category. A significant difference (χ^2=35.37, p<.001) shown by the chi square analysis was noted in game type involvement in terms of gender, with male players constituting the vast majority of violent game players (104, compared to 8 female players).

2. Path analysis: flow conditions, violent online games, flow experiences, and positive affect.

As reported in the first study, both violent and nonviolent online games were capable of triggering player flow experiences and positive affect, with nonviolent game players reporting stronger flow experiences. To determine whether violent online game play is truly capable of triggering strong flow experiences and positive affect, we performed a path analysis to examine relationships among violent online game play, flow condition, flow experiences, and positive affect. According to our findings (Fig. 2), no relationship existed between violent games and the flow condition for the participants in our study. However, violent online game play exerted a significantly positive effect (β=.20, p<.001) on flow experiences, but participants in the flow condition had no effect on flow experiences reported. Our data suggest that positive affect following violent online game play was mediated by flow experiences (indirect effect coefficient = .086). Flow experiences had a significantly direct effect on positive affect (β=.43, p<.001). No direct effect was found for flow condition on positive affect and flow experiences.

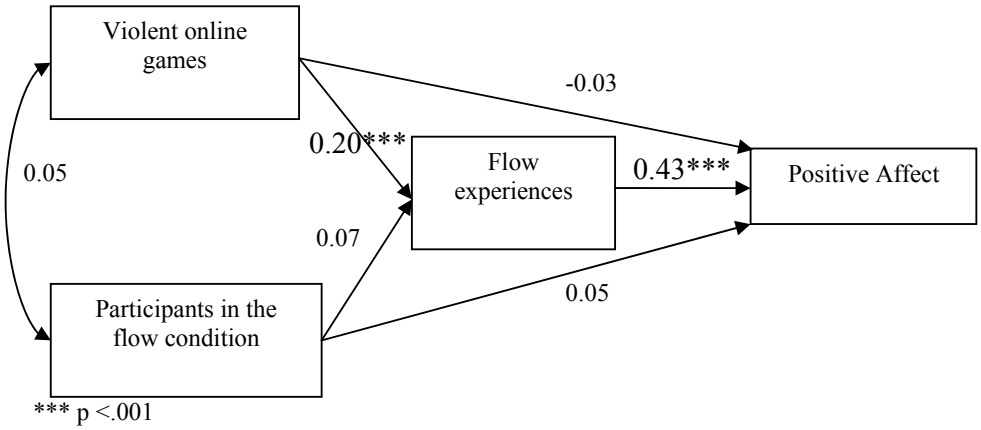

Figure2: Path diagram: participants in the flow condition, violent online games, flow experiences, and positive affect.

DISCUSSION

The study 1 results suggest that both violent and nonviolent online game play is capable of triggering flow experiences and positive affect, with participants reporting significantly higher flow experiences and positive affect after playing a nonviolent game compared to playing a violent game. In the same manner as Chumbley and Griffiths (2007), we found that different online game content generates different affective responses. Mean aggression scores were lower than scale midpoints after playing both violent and nonviolent games. In addition, there were no significant differences in terms of aggression after playing violent versus nonviolent target games. Our findings suggest that violent online games might not be associated with aggression. Another reason is our use of college students rather than younger adolescents to address the topic of violent online games and their potential negative effect on players. Our study participants are likely better able to distinguish between game world and real world violence. Moreover, our findings may have been affected by important gender differences in game preference, with female players selecting a much higher percentage of nonviolent online games and male players mostly choosing violent games.

The study 2 findings support the idea that game players can be placed into four flow conditions based on whether players perceived the balances between challenges and skills. The majority of players were placed in the flow condition. In other words, when playing online games, players tend to perceive themselves as enjoying a balance between the challenges of the games they are playing and their playing skills—the operational definition of the flow condition given by Asakawa (2004).

In study 2, of the game involvements with the 302 participants, nonviolent game titles slightly exceeded those of violent games (54.6% vs. 45.4%). Male players showed a clear involvement for violent games, in accordance with the findings of Royse et al. (2007) and Williams et al. (2009). Female participants were much more likely to play nonviolent games than violent games (75 vs. 8, respectively). The majority of study 1 participants were female (63.3%), and the flow experience and positive affect results reflect that imbalance. In contrast, the study 2 sample was a better reflection of real-world game play: a higher number of college male players, with all players showing a slight involvement for nonviolent online games.

According to Griffiths (1999), the majority of game researchers claim that most online games are violent in nature, even those that feature destruction (e.g., car crashes) but no deaths. They claim that violent online games usually provide participants clear targets for earning points—in other words, clear targets represent clear goals and points represent immediate feedback, which are two characteristics of flow experiences (Csikszentmihalyi, 1990). The results study 1 indicated that nonviolent online game play was more likely than violent online game play to trigger stronger flow experiences and positive affect. Csikszentmihalyi (1990) suggests that positive affect is the end result of flow experiences. However, the experimental research in our study1 was unable to examine the mediating effects of flow experiences between game categories and positive affect. Instead, flow experiences and positive affect was simultaneously regarded as the dependent variables in study 1 while in study 2 the mediating effects of flow experiences were closely examined using path analyses. It is likely that the various research approaches lead to the mixed results between study 1 and study 2. We assert the results of path analysis positing a more prudent and parsimonious model.

The results of path analysis showed that there was no relationship between violent online games and participants in the flow condition. Participants in the flow condition possibly played different online games, and all kinds of online games could let players perceive balance between challenges and skills. However, as we reported in the previous findings, violent games provide some characters are partly consistent with flow characters (Csikszentmihalyi, 1990). Accordingly, the path analysis indicated that violent online games exerted a significantly positive effect on flow experiences.

In addition, participants in the flow condition had no effect on flow experiences. It is likely that the participants in the flow condition perceived a balance between game challenges and their own skills, thus triggering a sense of stress and overstrains to undermine the access to flow experiences. The authors suggested that participants in the flow condition showing slight variations were too similar to show statistical effects on flow experiences. In addition, we found even though participants in the flow condition perceived a balance between challenges and skills, that balance did not necessarily trigger positive affect. This evidence finds support in Csikszentmihalyi's (1990) argument that perceived balance between challenges and skills is the sufficient condition for experiencing flow, but it does not necessarily result in flow experiences or positive affect.

The results fail to yield direct relationship between violent online games and participants' positive affect. Previously, researchers argued that violent online game play triggers negative affects (Anderson, 2004; Dill & Dill, 1998) while few examinations were conducted on its effect of positive affects. Therefore, our findings add to the literature that positive affect does not occur following violent online game play.

A significant relationship was found between flow experiences and positive affect, indicating an increase in positive affect when participants achieved flow experiences from game play. Our path analysis results also indicated that positive affect following violent online game play is mediated by flow experiences (indirect effect coefficient = .086), suggesting that positive affect can be evoked through flow experience mediation. In other words, flow experiences appear to be capable of mitigating the positive effects of violent online game play, leading to higher levels of positive affect among violent online game players.

In conclusion, our findings from the two studies suggest that both violent and nonviolent online games are capable of triggering player flow experiences and positive affect, and that neither violent nor nonviolent online games by themselves are capable of triggering aggression following game sessions. Furthermore, results from our path analysis indicated that violent online game play per se does not produce positive effect; while flow experiences during violent online game play can exert significantly positive impacts on positive affect. In the future, the game evaluation study (e.g., Liu & Lin, 2009) should be done to find the reliable and valid evaluative indicators to select the well-designed games for students to play without negative effects.

LIMITATION

Csikszentmihalyi (1990) suggests that researchers should use experience sampling methods to study human flow experiences. Our use of an experiment and a survey of players' retrospect flow experiences from online games did not allow for immediate observations or measures of momentum flow experiences.

Since flow experiences tend to result from favored activities, these gender-based differences must be taken into consideration when making implications from the data. Furthermore, game addiction was not taken into account in either of the two studies—a potentially important oversight in terms of differences in how addicted players perceive short-term positive affect from game play.

Finally, future research also needs to take into consideration improved sampling methodology as well as construct validity and instrument reliability when designing attempts to replicate these studies and results.

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FACTORS AFFECTING STUDENT TEACHERS' PERCEPTIONS ON MENTOR ROLES: A STUDY AT DISTANCE ENGLISH LANGUAGE TEACHER TRAINING PROGRAM

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ABSTRACT
The present study aims to investigate whether perceptions of 4th year student teachers enrolled a distance English language teacher training program about mentor roles differ significantly according to some factors such as gender, the type of graduation school, the type of the cooperating school they are experiencing teaching practice at, and the number of student teachers in the supervisory group. 1846 student teachers participated in the study. The results indicated that these variables did not affect student teachers' perceptions as to their perception about mentor roles. The study is important in that it provides valuable information for the organization of the student teacher placements prior to practicum and it provides a chance to student teachers to voice their thoughts about their cooperating teachers at distance B.A Program in English Language Teaching.
Key Words: distance teacher education, student teachers, mentoring, computer-mediated communication

1. BACKGROUND TO THE STUDY

Along with the population growth, the demand for all types of education has been increasing whereas the resources such as schools and teachers are limited and impossible to reach adequate levels in short period of time. (Özkul, 2001). Özdemir (1997, pp.1) states the educational problems such as inadequate number of schools at every level, inadequate opportunity of high education for everyone, inadequate number of qualified teachers and a need for educated person in technical areas. Distance education implemented by Anadolu University Open Education Faculty (AUOEF) is the major attempt in Turkey to overcome these problems. In order to find a solution to the need for a big number of English teachers, Turkish Ministry of National Education (MNE) and AUOEF signed a protocol in February 2000 to initiate a four-year Distance English Language Teacher Education Program named 'Distance B.A program in English Language Teaching (ELT)'. This program is a blended teacher training program where the student teachers have face to face education in the first two years, and distance education in the last two years. The computer-mediated communication constitutes a vital part of the Distance B.A program in ELT. There are two basic supports of it: 'academic' and 'socialization'. The distance student teachers do not get face to face (traditional) training during the 3rd and 4th years, but they are provided with online help to enhance their academic development and achievement for most of their courses. For each course of the 3rd and 4th year, the open education faculty appointed specialist tutors who are the university instructors at the ELT department of the education faculty to give support and guidance in the study of the courses. This is the 'academic' aspect. 'Socialization' is the other. The distance format teacher training involves student teachers learning individually. They are isolated from interrogating interactions between their peers and the course instructors (Van Schaik, Barker & Beckstrand, 2003). One of the most common problems of distance education is the limitation of dialogue between instructors and learners, and amongst learners themselves (Kirkup &Jones, 1996; Holmberg, 1989; Tsolakidis, 2000). The use of Computer Mediated Communication (CMC) is a vital part of distance teacher education. CMC is useful to provide the student teachers with the support and communication during field experience (Eden, 2000; Roody, 1999). In addition to this online discussion boards on the Web-CT enable the student teachers to communicate with their peers throughout Turkey. Besides, they have the chance to communicate with the course instructors. Such communication and interaction with their peers and course instructors reduce student teachers' feeling of isolation and make them believe that they belong to a part of a social community (Bloomfield, 2000)

1.1. Practicum at distance ELT program

As to the practicum at distance ELT program, the student teachers at the 4th year take 'School Experience II and Teaching Practice', which is an annual course. The Course organizers at the Open Education Faculty assign each student teacher to a cooperating school and a cooperating teacher working there. During the first term, the student teachers take limited responsibilities when teaching in a classroom under the supervision of the cooperating teacher and are required micro teaching. That is, the student teachers practice teaching for 5-10 minutes in the classroom. In the second term, the students take more responsibility in teaching. Each student teacher makes a lesson plan and teaches a lesson in the classroom under the supervision of the cooperating teacher. During the practicum, each student teacher is supervised by the cooperating teacher assigned by the Open Education Faculty. The student teachers and the cooperating teachers have a chance to contact with the Open Education Faculty via phone or e-mail in order to get information about any issue regarding the practicum

process. Also, the student teachers are provided with online support where they can mention their problems to the course instructor of the 'School Experience II and Teaching Practice' course. Concerning the practicum period, the computer-mediated communication is also important not only for the student teachers but for their cooperating teachers as well. The student teachers at the distance ELT program at the Open Faculty are mentored regularly by only their cooperating teachers whereas the ELT student teachers getting traditional training at the faculties of education are supervised by both a cooperating teacher and a university supervisor, which means they get 'double support'. In order to compensate for the non existence of a regular university supervisor, the Open Education Faculty provides regular support for the students on the Web-CT, on the discussion board and through e-mail. Through the use of computer-mediated communication the student teachers communicate with their peers and their course experts with respect to their experience during school-based teaching. Through the discussion board, the course coordinators provide support and guidance for the students at any time and answer the students' questions regularly.

1.2. Mentoring at distance practicum

Student teachers consider school-based teaching practice to be the most important part of teacher training, for it provides them with opportunities for actual teaching and real learning (Calderhead, 1988; Griffin *et al,* 1983; Feiman-Nemser&Buchman, 1985; Franke&Dahlgreen, 1996). It is not possible to gain the roles, behaviors and the teaching skills only through only theoretical information gathered during pre-service teacher training. The practicum experience provides prospective teachers with the essential bridge between theory and practice and the opportunity to define and refine teaching skills. The current literature supports the importance of teacher practice and identifies student teaching as the most helpful part of their professional education since this period is regarded as the first steps of a personal journey to become a teacher (McIntyre & Byrd, 1996; Rand & Shelton-Colangelo, 1999; Turley, 1999; Thibeault, 2004; Walkington, 2005; Williams, 2001). Cooperating teacher and the university supervisor whose roles are defined as the supervisor, the mentor, the observer, the model teacher and the supporter, are important to help them to gain the essential skills and a teacher identity during this journey.

The term 'mentor' is rooted in Homer's epic poem 'The Odyssey' in which Odysseus gave the responsibility for nurturing his son Telemachus, to his loyal friend, Mentor. Mentor educated and guided Odysseus' son. This education included every facet of his life: physical, intellectual, spiritual, social and administrative development. According to Anderson and Shannon (1988) mentoring can be best defined as:

'a nurturing process in which a more skilled or experienced person teaches, sponsors, encourages, counsels, serves as a role model, and befriends a less skilled or less experienced person for the purpose of promoting the latter's professional and personal development'.

Bey (1990) defines mentoring as 'a professional practice that is emerging as a way for experienced teachers and supervising teachers to offer assistance to new teachers. The definitions above is evidence that there is no clear universal definition of mentoring due to the highly personal interactions conducted under different circumstances in different schools (Zanting, Verloop &Vermunt, 2001). Therefore, in the present study Odell and Huling's mentor definition will be taken as a base in pre-service teacher education. They (2000) define mentors as experienced teachers who mentor pre-service\beginning teachers as they are learning to teach as a part of their professional assignment.

With respect to student teachers' perceptions on school practices, student teachers consider mentoring to be the key aspect of school-based teacher training (Hudson, 2004). The student teachers find it very essential to plan lessons with a mentor, to have mentors observe their teaching and give feedback would be very essential (Hudson, 2004). Wooley (1997) conducted a longitudinal study of students' perceptions of their mentors and results highlighted 9 themes: guide, feedback, expert, style, power, welcome, support, ideas, and evaluation. Zanting et al (2001) investigated the student teachers' beliefs about the characteristics of a 'good mentor'. 30 student teachers were interviewed. The qualitative data were categorized into five factors: 1) the effective aspects of learning to teach, 2) information source, 3) assessment of the student teacher, 4) reflection on student teacher's lessons, 5) the school content \school orientation.

The only study conducted in the Turkish context in relation to the roles of the triad members (cooperating teachers, university supervisors and student teachers) is Demirkol's (2004) in which the expectations for the roles of cooperating teachers and university supervisors during the practice period were investigated. The findings revealed that the triad members didn't hold very clear expectations for the roles of university supervisors and cooperating teachers.

In the continuum of the mentor role, the roles of the cooperating teacher in traditional teacher training contexts have been investigated in detail (Beck and Kosnnik, 2000;Brown, 1992; Dayan, 1999; Demirkol,2004; Hobson, 2002; Hudson,2004; Johnson,2003; Jones,2000; Karmos & Jacko,1977; Kimberly, 2003; Lamant *et al*, 1995; Morin & Lamlech,1987; Penny *et at*,1996; Ramanathan *et al*, 1997; Shippy, 1984; Tanruther, 1964; Zantig *et al,2001*). The only study on the mentor roles during distance student teaching practice is an initial study which investigated the perceptions of cooperating teachers and student teachers about the implementation of mentor roles during distance practicum (Koç, 2008). According to the results, the student teachers indicated that their cooperating teachers most frequently provided moral support and gave feedback on teaching performance and least frequently facilitated socialization and interacted with other cooperating teachers. However, the initial study did not explore whether factors such as the gender, type of the graduation school of the student teachers, the type of the cooperating school where the student teachers are having their teaching practice and the number of the students under the supervision of a cooperating teacher affected the student teachers' perceptions about mentor roles. Therefore, the present study is an extended investigation of the initial study and aims to investigate whether these factors significantly affect the student teachers' perceptions on the implementation of the mentor roles. Based on these quandaries, the study will be guided by the research question: Is there a significant difference among the student teachers' thoughts about their cooperating teachers' implementation of the mentor roles of the cooperating teachers with regard to gender, the type of the graduation school of the student teachers, the type of the cooperating school and the number of the student teachers mentored by the cooperating teacher?

2. METHODOLOGY

2.1. Participants

There were 2463 4th year students enrolled to the Distance B.A Program in ELT at the AUOEF and took 'School Experience II and Teaching Practice' course in 2007. Detailed information about the descriptive of the student teachers is displayed in Table 1. According to Table 1, most of the student teachers are in the Middle Anatolia (N= 813) whereas the least are in East Anatolia (N=56) and West east Anatolia (N=82). Of the 2463 student teachers 1846 of them participated in the present study.

Table 1: Descriptive statistics of student teachers with regard to the four variables

Components of student teachers' demographic profile	Categories of each demographic profile component	N	Percentage %
Gender	Female	1374	74.59
	Male	468	25.41
Type of graduation school	Anatolian teacher training high school	281	15.5
	Other schools	1536	84.5
Type of cooperating schools	Elementary	158	8.568
	Private high school	29	1.573
	Anatolian teacher training high school	114	6.182
	Anatolian high school	1096	59.436
	State high school	424	22.993
	Science high school	23	1.247
Number of the students in the supervisory group	one to four	89	4.83
	five	392	21.23
	six	1252	68.00
	Seven	108	5.86

Table 1 shows that a majority (N=1374) of the student teachers are female whereas one forth (N=468) of them are male. A minority of the student teachers (15. 5 %) indicated that they graduated from an Anatolian teacher training high school, while a great majority (N=1536) indicated they graduated from other schools. More than half of the student teachers (59.4 %) experience their teaching practice at Anatolian high schools, and minority private high school (1.5 %), science high school (1.2 %), teacher training state school (6.9 %) and at elementary school (8.5 %), private high schools (1. 5%), Anatolian teacher high schools (6.5%), state high schools (22. 9%) and science high school (1. 2%). More than half (59.4%) of the student teachers have their teaching practice at Anatolian High Schools. The second most common type of cooperating school is the state school with a percentage of 22. 9 %. As to the number of the student teachers in the supervisory group, most of the student teachers (68%) reported that their cooperating teacher mentored six student teachers. The second most common response is five with a percentage of 21.2 %. Very few (5.8%) of them indicated that their cooperating teacher mentors seven student teachers.

2.2. Data Collection Tool

Student Teacher Questionnaire (Koç, 2008) has two parts. The first part aims to gather demographic information such as the student teachers' gender, type of graduation school, type of cooperating school, and the number of the students in the supervisory group. The second part aims to gather information about their perceptions with regard to the implementation of their cooperating teachers' roles. There are 10 cooperating teacher role categories covering 38 items designed on a five-point Likert scale : 1 is assigned to 'never', 2 to 'rarely', 3 to 'sometimes', 4 to 'often' and 5 to 'always'. In the initial study (Koç, 2008), Cronbach alpha value was determined as 0.928 and principal component analysis explained ten factors, 43 items with a total variance of 60.19%.

2.3. Data collection and analysis

In the initial study (Koç, 2008) the questionnaires were sent to the 2462 student teachers at the end of the first term in 2007 and 1846 student teachers turned their questionnaires. The original data collected in the initial study was re-analyzed, but this time in terms of the four variables: the gender, the type of the graduation school, the type of the cooperating school and the number of the student teachers supervised by the cooperating teacher. The statistical program for the social Sciences (SPSS) version 15.0 was used for the analysis. In order to find out whether these variables significantly affected the responses of the student teachers independent t-tests, one-way between-groups ANOVAs were conducted for each of the ten mentor role dimension.

3. FINDINGS

The findings will be displayed accordingly to each variable.

3.1. Gender

In order to compare student teachers on each factor in terms of gender, ten independent-samples t-tests were conducted. Before the analysis, Bonferroni Adjustment Procedure was followed and the probability value was determined as .005. Means and standard deviations of male and female student teachers on each factor were provided in Table 2. Table 2 displays that both the female and male student teachers indicated that their cooperating teachers most frequently provided moral support (M=4.66; M=4.59) and least frequently facilitated socialization of them (M=3. 47; M=3. 58).

Table 2: Descriptive statistics of males and females for each factor

	Gender	N	Mean	SD
1) Providing facilitative information to enhance classroom performance	Female	1374	4.283	0.548
	Male	468	4.242	0.571
2) Giving feedback on teaching performance using feedback strategies	Female	1372	4.512	0.468
	Male	467	4.450	0.506
3) Helping student teachers' form a professional identity and be aware of their professional development	Female	1369	4.464	0.511
	Male	466	4.419	0.567
4) Providing moral support	Female	1374	4.644	0.486
	Male	467	4.595	0.512
5) Facilitating socialization of student teachers	Female	1374	3.473	0.950
	Male	468	3.585	0.942
6) Scaffolding lesson planning	Female	1373	4.476	0.580
	Male	466	4.430	0.606
7) Facilitative information voluntarily offered by cooperating teachers	Female	1369	4.430	0.566
	Male	466	4.442	0.574
8) Preparation for the mentor role	Female	1374	4.331	0.574
	Male	467	4.316	0.607
9) Using and understanding observation forms	Female	1369	4.332	0.801
	Male	466	4.322	0.811
10) Interacting with other cooperating teacher	Female	1371	3.926	0.777
	Male	467	4.032	0.753

To understand whether differences between male and female student teachers in terms of each factor were statistically significant, ten independent-samples t-tests were conducted as summarized in Table 3:

Levene's Test for Equality of Variances was considered while reporting each t-test result. The test showed that none of the variables disturbed the assumption of the homogeneity of variance. As the results of independent-samples t-tests indicated, male and female cooperating teachers did not differ from each other on any of the factors at a probability value of .005 or below. This showed that male student teachers and female student teachers did not differ in terms of their responses related to the frequency of their cooperating teachers' accomplishing the mentor roles.

Table 3: Independent-samples t-tests comparing male and female student teachers on each factor

	t	df	Sig.
1) Providing facilitative information to enhance classroom performance	1.361	1840	0.174
2) Giving feedback on teaching performance using feedback strategies	2.435	1837	0.015
3) Helping student teachers' form a professional identity and be aware of their professional development	1.598	1833	0.110
4) Providing moral support	1.874	1839	0.061
5) Facilitating socialization of student teachers	-2.196	1840	0.028
6) Scaffolding lesson planning	1.468	1837	0.142
7) Facilitative information voluntarily offered by cooperating teachers	-0.392	1833	0.695
8) Preparation for the mentor role	0.464	1839	0.643
9) Using and understanding observation forms	0.243	1833	0.808
10) Interacting with other cooperating teacher	-2.562	1836	0.010

3.2. Type of the graduation school of the student teachers

Table 4 shows that both the student teachers who graduated from Anatolian teacher high school (N=281; 15.2%) and who graduated from other high schools (N=1536; 83.2 %) indicated that their cooperating teachers always provided moral support (M=4.60; M=4.63) and sometimes facilitated socialization of them (M=3.48; M=3.49). In order to compare cooperating teachers for each factor in terms of the program of graduation, ten independent-samples t-tests were conducted. The probability value was determined as 0.005 as done in previous analyses. Means and percentages for each program of graduation are provided in Table 1.

Independent-samples t-tests were conducted to compare graduates of Anatolian teacher schools with other schools in terms of each factor. The summary table of t-tests is provided in Table 5. The results indicated that student teachers who graduated from Anatolian teacher high schools did not differ from the student teachers who graduated from other schools in terms of their responses related to the mentor role implementation of their cooperating teachers.

Table 4: Descriptive statistics of student teachers in terms of the type of graduation school

	Gender	N	Mean	SD
1) Providing facilitative information to enhance classroom performance	Anatolian teacher	281	4.278	0.560
	Other	1536	4.274	0.553
2) Giving feedback on teaching performance using feedback strategies	Anatolian teacher	281	4.479	0.511
	Other	1533	4.503	0.471
3) Helping student teachers' form a professional identity and be aware of their professional development	Anatolian teacher	279	4.428	0.508
	Other	1531	4.461	0.527
4) Providing moral support	Anatolian teacher	281	4.609	0.500
	Other	1536	4.638	0.493
5) Facilitating socialization of student teachers	Anatolian teacher	281	3.486	0.994
	Other	1536	3.499	0.941
6) Scaffolding lesson planning	Anatolian teacher	281	4.464	0.602
	Other	1533	4.467	0.584
7) Facilitative information voluntarily offered by cooperating teachers	Anatolian teacher	279	4.390	0.637
	Other	1531	4.441	0.555
8) Preparation for the mentor role	Anatolian teacher	281	4.286	0.594

	Other	1536	4.334	0.580
9) Using and understanding observation forms	Anatolian teacher	281	4.272	0.871
	Other	1529	4.339	0.792
10) Interacting with other cooperating teacher	Anatolian teacher	280	3.950	0.804
	Other	1533	3.954	0.769

Table 5: Independent-samples t-tests comparing student teachers on each factor in terms of the type of graduation school

	t	df	Sig.
1) Providing facilitative information to enhance classroom performance	0.094	1815	0.925
2) Giving feedback on teaching performance using feedback strategies	-0.792	1812	0.429
3) Helping student teachers' form a professional identity and be aware of their professional development	-0.955	1808	0.340
4) Providing moral support	-0.896	1815	0.370
5) Facilitating socialization of student teachers	-0.204	1815	0.839
6) Scaffolding lesson planning	-0.074	1812	0.941
7) Facilitative information voluntarily offered by cooperating teachers	-1.259	359.037	0.209
8) Preparation for the mentor role	-1.248	1815	0.212
9) Using and understanding observation forms	-1.287	1808	0.198
10) Interacting with other cooperating teacher	-0.073	1811	0.942

3.3. Type of the cooperating school

Table 6. Summaries of one-way between-groups ANOVAs on type of school students having teaching practice at

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
1) Providing facilitative information to enhance classroom performance	Between Groups	.003	1	.003	.009	.925
	Within Groups	556.864	1815	.307		
	Total	556.867	1816			
2) Giving feedback on teaching performance using feedback strategies	Between Groups	.143	1	.143	.627	.429
	Within Groups	413.583	1812	.228		
	Total	413.726	1813			
3) Helping student teachers' form a professional identity and be aware of their professional development	Between Groups	.251	1	.251	.912	.340
	Within Groups	496.560	1808	.275		
	Total	496.811	1809			
4) Providing moral support	Between Groups	.196	1	.196	.803	.370
	Within Groups	442.996	1815	.244		
	Total	443.192	1816			
5) Facilitating socialization of student teachers	Between Groups	.037	1	.037	.042	.839
	Within Groups	1637.196	1815	.902		
	Total	1637.233	1816			
6) Assisting on lesson planning	Between Groups	.002	1	.002	.005	.941
	Within Groups	624.091	1812	.344		
	Total	624.093	1813			
7) Facilitative information voluntarily offered by cooperating teachers	Between Groups	.620	1	.620	1.916	.166
	Within Groups	584.608	1808	.323		
	Total	585.228	1809			
8) Preparation for the mentor role	Between Groups	.529	1	.529	1.558	.212
	Within Groups	615.994	1815	.339		
	Total	616.523	1816			
9) Using and understanding observation forms	Between Groups	1.072	1	1.072	1.655	.198
	Within Groups	1170.755	1808	.648		
	Total	1171.827	1809			

10) Interacting with other cooperating teacher	Between Groups	.003	1	.003	.005	.942
	Within Groups	1086.012	1811	.600		
	Total	1086.015	1812			

To compare student teachers in terms of the cooperating school they are having practice at, one-way between-groups ANOVAs with an adjusted probability value of .005 were conducted. Results of one-way between-groups ANOVAs were provided in Table 6. As the ANOVA summary table suggested, none of the factors showed a significantly different pattern when different types of school where students having teaching practice were taken into account at a probability value of .005 or below. This shows that the student teachers who attend different cooperating schools do not differ in terms of their responses related to the frequency of their cooperating teachers' accomplishing the mentor roles.

3.4. The number of the student teachers at the supervision group

To calculate the relationship between the number of student teachers in teaching practice group and student teachers' means on each factor, Pearson Product Moment Correlation Coefficients were calculated. Since 10 coefficients were reported for this analysis, the probability value was determined as .005 after a Bonferroni Adjustment. Correlation of each factor with the number of people in groups is provided in Table 7:

Table 7. Correlation coefficients between the factors of the scale and number of students in groups (N=1836)

1) Providing facilitative information to enhance classroom performance	Correlation	-0.004
	Significance	0.861
2) Giving feedback on teaching performance using feedback strategies	Correlation	-0.032
	Significance	0.175
3) Helping student teachers' form a professional identity and be aware of their professional development	Correlation	-0.039
	Significance	0.092
4) Providing moral support	Correlation	-0.001
	Significance	0.952
5) Facilitating socialization of student teachers	Correlation	-0.023
	Significance	0.329
6) Scaffolding lesson planning	Correlation	0.006
	Significance	0.798
7) Facilitative information voluntarily offered by cooperating teachers	Correlation	-0.036
	Significance	0.122
8) Preparation for the mentor role	Correlation	-0.022
	Significance	0.344
9) Using and understanding observation forms	Correlation	-0.016
	Significance	0.507
10) Interacting with other cooperating teacher	Correlation	0.004
	Significance	0.863

As the correlation coefficients between the number of student teachers in groups and factors of the scale revealed, none of the factors was significantly related with the number of the student teachers in each group under the supervision of a cooperating teacher.

4. DISCUSSION

The findings of the study indicated that female and male student teachers did not show any disparity in their perceptions considering their cooperating teachers' implementation of the mentor roles. This means that gender was found not to be a significant variable effecting student teachers' perceptions on mentoring roles. The finding is not line with Çakır's (n.d.) who investigated the perceptions of the first year distance ELT student teachers' views on the teaching profession. The results indicated that the student teachers' perceptions showed significant difference regarding gender.

Another finding showed that the type of the graduate school of the student teachers did not affect their perceptions as to the implementation of the mentor responsibilities. A considerable number of the student teachers (Table 1) were the graduates of Anatolian Teacher Training High Schools. Different from other high

schools, Anatolian Teacher Training High Schools aim to train students for the teacher training programs at the faculties of education. In this regard, besides the standard courses, teacher- profession related courses are offered to the students to help them gain a 'teacher identity' and acquire knowledge, skills and behaviors that a 'teacher' should be equipped with. Any graduate of Anatolian Teacher High School is expected to be well aware of 'the characteristics and responsibilities of a good teacher. Therefore, prior to the present study it was expected that the graduates of Anatolian Teacher Training High School are likely to differ in terms of their perceptions about the implementation of mentor responsibilities.

Most of the cooperating schools where the student teachers were having their teaching experience were high schools, very few were elementary ones. However, the type of the cooperating school was not a significant factor regarding as the perceptions of the student teachers on mentor roles. This indicates that whatever the type of the cooperating school is (elementary or high school), the cooperating teachers fulfill their mentor responsibilities.

The last finding of the study was that the number of the supervisory group was not a significant factor to implement their mentor roles during the distance practicum. This means that for a cooperating teacher it is not a significant factor to supervise a group of 4, 5, 6 or 7 student teachers to fulfill the mentor responsibilities. Such a finding was unexpected. The cooperating teachers participating at the distance practicum have two roles. The first one is the 'class teacher role' which covers up responsibilities such as making lesson plans, teaching English to the students, checking the homework of the students, evaluating the tests and exams, etc. The second one is the 'mentor role'. Giving feedback to the student teacher's lesson plan prior to the teaching, observing the student teacher's teaching practice and giving feedback to the student teacher after the teaching performance are the outstanding responsibilities of the cooperating teacher stated in the handbook prepared by the AUOEF. Nevertheless, trying to implement these both roles is demanding and also time consuming. Therefore, cooperating teachers mentoring seven or more student teachers are assumed to likely to have difficulty in implementing their mentor roles when compared with cooperating teachers supervising fewer student teachers. However, this assumption is not supported by the findings. Therefore, one possible explanation could be the 'lack of quality' in the implementation of the mentor roles. Zeichner (1979) also states that the quality of feedback is as important as the quantity. As a result, 'quality in the implementation of the mentor role' in a crowded group involving six or seven student teachers is a matter of question.

5. CONCLUSION

The present study was undertaken in an attempt to investigate whether some factors such as gender, the type of graduation school, the type of the cooperating school, and the number of student teachers in the supervisory group affected student teachers' perceptions on mentor roles. The results indicated that these factors did not have a significant affect on the student teachers' perceptions as to the fulfillment of the mentor roles. The results of this study contributed to increased understanding of cooperating teacher support related to mentoring process at the distance B.A ELT program at the Open Faculty during teaching practicum. The results could provide valuable insights to be used in the organization of the practicum process at Distance BA Program in ELT at AUOEF. The findings also provide valuable information to choose the cooperating schools and group the student teachers prior to the practicum.

It is really a difficult job to find adequate cooperating schools to place student teachers who are big in number. In 2007, the Open Education Faculty assigned 2463 student teachers to 432 cooperating teachers working in 112 schools in 74 cities in Turkey. 'Quantity' is one problem when organizing the distance field practice. However, quality is another. Robinson (1997) outlined this problem and stated that stability of quality in practicum is very demanding for widely geographically spread students and it is challenging to understand cooperating school conditions and be receptive from a centralized point of control. So, a recommendation for further research is the need to investigate the 'quality' of the cooperating schools and the 'cooperating teachers' of the distance practicum. The student teachers reported that their cooperating teachers implement their mentor roles; however, no information is available about 'the quality of the implementation of these mentor roles'. Another recommendation for further research is the investigation of the practicum members' (cooperating teachers and student teachers) opportunity of utilization of the computer technology. As mentioned before, the Open Education Faculty provides the student teachers with online support where they have a chance to participate in forums and discussions on the Web-CT with their peers and the course instructors. Forums on the Web-CT for the 'School Experience II and Teaching Practice' course offers the student teachers access to supportive information and increases the collaborative opportunities for the student teachers to exchange ideas, receive feedback and ask any questions about the implementation of the field experience. However, it is a very big concern whether the student teachers and cooperating teachers have access to internet and computer.

Khine and Lourdusamy (2003) found that online discussion during the practicum provided the student teachers with a path to discuss their problems and ideas and that responses from peers and instructors helped clear their responses about the situation at distance English teacher training program? Are the student teachers satisfied with the online support provided on the 'School Experience II and Teaching Practice' course? This is another issue that should be investigated in detail.

Although Distance English Language Teacher Training Programme at AUOEF is a great solution to the problem of inadequate number of English teachers, there hasn't been a profound investigation of the distance English Language Teacher Training Programme since it was first put into progress in 2000. Further studies are essential for the development and implementation of a better distance teacher training program and for more effective teaching practices as well.

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IMPLICATION FOR MEDIA CONVERGENCE ON NEWS LEARNING

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ABSTRACT
Over the last decade, comparisons of the effects of the traditional news media and the Internet have been made in relation to comprehension and remembering,. This study aims at assessing the effects of single and compound presentational elements, and making predictions for the future. One of the two main aims of this study is to measure comprehension and remembering effect of the traditional media instruments and the Internet. It includes a comparison of the media instruments and the Internet in order to find out the most effective media instrument for comprehension and remembering. The second aim of this study, after finding the most effective media instrument, is to find the preferences of the user of these instruments in terms of the presentational formats. The results of this study indicate that comprehension and remembering are not due to the individual effects of a stimulus, but rather an increase in the quantity of stimuli also increases the preference of users. When users are exposed to multiple stimuli, they select the dual-stimuli format with which they feel most comfortable, or they are most familiar.
Keywords: Comprehension, remembering, convergence, learning, media effect.

Implication for Media Convergence on New Learning
The effects of the media on individuals and as a result on societies, is almost as old as the history of television. Despite hundreds of studies and tens of different effect methods, common opinions about the definite and social effects of the media (when comprehension and remembering is in question) still not come into existence. On the other hand, media effects research that was conducted on traditional media instruments until the beginning of the seventies gain a new dimension with the invention of digital technologies within these years (so called second media age). Moreover, with the intensive use of the Internet from the mid-nineties, a new perspective is added to the problem. In other words, the Internet is also added to the studies as a new medium and communication instrument besides the traditional media. The revolution that has been taking place with the digital technologies lead to the convergence of the traditional media instruments with the new communication technologies. Many communication technologies are now used on the same instrument.

In the last 50 years, numerous studies were conducted for measuring the effects of media instruments in terms of comprehension and remembering and are diverse in their implications. Many of the studies realized before the mid-1990's generally concentrated on newspaper and television. The findings of the earlier studies indicate the superiority of newspaper in comparison to television (DeFleur, Davenport, Cronin and DeFleur, 1992; Wicks and Drew, 1991; Robinson and Levy, 1986; Furnham and Gunter, 1985; Gunter Furnham and Leese, 1986). Later, at least for certain conditions, a considerable amount of research points out that users remember better from broadcast than print (Neuman, Just and Crigler, 1992; Beentjes, Vooijs and Voort, 1993; Molen and Voort, 1998, 2000; and Molen and Klijn, 2004). Moreover, particularly after the mid-1990's World Wide Web (web) as a mass media tool has been included in this comparison process (Eveland and Dunwoody, 2001; Eveland, Seo and Marton, 2002; and Althaus and Tewksbury, 2000). Furthermore, some studies observe the same effects in both newspaper and the web (Sundar, Narayan, Obregon and Uppal, 1998). On the one hand, the lack of consistency in these results suggests the necessity of investigating the problems from a different angle; on the other hand, there is a necessity to consider the up to date technological developments.

Although some of these studies were related with the structuring of the content, particularly for the television (Molen and Voort, 2000; and Molen and Klijn, 2004), in order to increase comprehension and remembering of the news whether measured immediately after exposure or delayed measure regardless of the media is very limited (Defleur and Defleur, 1998). One of the reasons is that almost all of the research realized up to now was unintentionally concentrated on the comparison of the different media instruments in order to find the effects of these tools on its users in terms of comprehension and recall. However, medium is the channel that carries the signals whereas signal (message) is the stimulator that causes the act of comprehension, storage and recall.

Particularly recent studies in this area ignore the content and technological convergence of the media. Technological developments and media trends currently point towards convergence, a concept entailing two distinct aspects: convergence of content, and technological convergence of the media instruments. The Internet and the opportunities it provides is the main starting point for assessing such trends. The opportunities provided by the Internet foreground the question of content convergence. The news gathered for different media at different times and places, and using different technologies, is now centrally restructured into a format applicable to all media instruments (Riefler, 2002). Many media organizations, beside publishing daily papers, also own

radio and television stations. This economic convergence has led to a structural one in news content production, eroding the traditional pattern of discrete production units maintained by the separate media organizations. It could hence be asserted that difference between print media, radio, and television are diminishing.

When compared with print media, radio and television news presentation is more immediate. Print compensates for this disadvantage by presenting the same news in depth. In general, it is possible to assert that these two aspects are complementary. By watching only television or listening to the radio, it is possible to miss some necessary information, resulting in the possibility of inaccurate inferences due to misunderstanding and incorrect interpretation. Gibbons Vogl and Grimes (2003) state that:

> Commercial television news stories often employ complex story lines involving complicated relationships among characters. The confusion is so great that people who appear in these news stories are unintentionally defamed because some viewers come away having misattributed illegal actions to the wrong person. The human information process might be motivating these misattributions.

However, the convergence of the media will overcome these problems, especially in terms of the problem of reliability of the information obtained from the media due to each media instrument's individual structure. News received at different times through different channels, each with its specific properties (audio, audiovisual, text), which act differently on mind, creates a problem for the user in maintaining 'unity in perception', leading to uncertainty about the 'reality' of the news.

According to the Dual Coding Hypothesis (Paivio, 1971; 1975; 1986), audio-visual stimulus is stored in memory in the form of two separate but related codes whereas textual information is stored in a single code. The information stored in two separate codes is better remembered because, when trying to recall visual information, audio information acts as a clue. The studies on children of Molen (2001) and Molen and Voort (2000) show that audio and visual stimuli employed together have more effects on comprehension and understanding than either an audio or video stimulus alone. Molen and Klijn (2004) further show that, by using good semantic overlap, the effects on comprehension of audio-visual information are greater than the effects of text on its own. Iding (2000) further shows that a group of college students who read a text with an added figure performed better in a multiple-choice test on the material than a group which read only the text. Mayer and Moreno (1998) also mention that audio and visual information increase comprehension and remembering only when both forms are presented together, appropriate and related. Moreover, as Hussain and Adeeb (2009) mention, mobile technologies are appropriate for effective communication and interaction and according to Zhang, Zhang, Duan, Fu and Wang (2010), the psychological process of learning is positively influenced by the features of new communication and information technologies.

In such case, the continuation of the existing studies, become much more difficult particularly with the new and converging media instruments. One-to-many structural forms, which is one of the main aspects of the traditional media instruments, with the new communication technologies turn into the structural form of one-to-one. In other words, the concept of mass weaken, time and space limitations are gradually disappearing. In such a case where the individual come to the fore, the degree that the individual affected from the media and its manner becomes directly proportional to the degree of comprehension and manner of the individual. Learning, on the other hand, motivation and moreover the preferences of the learning instrument and the presentational format which is the reasons for the individuals to preferring these instruments is directly related. Therefore, in order to increase comprehension, the measurement of the preferences of the individuals related with the message that are presented by the media instruments in different formats, need to be considered together.

RESEARCH QUESTIONS AND HYPOTHESES

The common point of the studies mentioned above is the measurement of the effects of media instruments. In these studies, the stimulator which creates learning is the message. On the other hand, the content and the technological convergence of the media instruments bring an opportunity to present either single or multiple stimulus combination on different media instruments. In such a situation, more than the effects of a medium, the effect of a stimulus becomes a significant issue. The aim of this study is neither to measure the effects of technological developments nor to compare technologies currently in place. Hence, primarily audio, visual, and text and their various combinations need to be measured for increasing comprehension and remembering. Therefore, the present study poses three questions:

RQ1: Which stimulus or stimuli-components maximize comprehension and remembering, and thus learning?
RQ2: What arrangement of stimuli components, in terms of the format and instrument employed maximizes user comprehension and learning?

RQ3: To which stimuli in compound presentations do users pay the greatest attention?
This study is composed of two similar experiments to measure the effects of a variety of stimulus and stimuli-components. The last stage, depending on the outcome of the first two experiments is to determine the best presentational format for different stimulus or stimuli-components. There is also a need to consider the form and frequency of users' utilization of the media instruments. Thus:

H1: There is a positive relation between the frequency of use of the mass media instruments, and media sources from which news is obtained, trust in the media instruments, and comprehension and understanding.

Anderson (1995) states that people find it easier to recall information, if they can revise the emotional and physical state in which they learned the information. On the other hand, Lang, Potter and Grabe (2003) mention that revised stories are remembered and evaluated better. Therefore, it is expected that:

H2: In repeated exposures, for every stimulus or compound-stimuli presentation comprehension and remembering increases.

Stimulus Materials
Radio and television present news *en bloc* and in sequence, but in print and online, the amount and order of reading news is under the control of the user. In an experiment, if news is presented to the participants in complex packets, some of the news may attract attention and some may not. Moreover, some may already have information about this news. Eveland, Seo and Marton (2002) note that when compared with television news presentation, news presented in the newspapers is distinguished by its inverted pyramid structure. They also point out in their comparison that if the text version of the television news also appears in print, its ecological validity will be reduced. They further claim that there is more factual information in print newspapers than in the evening news on television and draw the attention to the limitations of the semantic overlap hypothesis of Molen and Voort (2000). By referring to the studies of Brosius, Donsbach, & Birk (1996), Graber (2001) and Grimes (1990), who point out that the visual information in most television news is not compatible with the audio information with a resultant decrease in external validity. Therefore, to increase external and ecological validity and to minimize the problems encountered in the other studies, the stimulus materials for both of the present experiments were prepared according to the inverted pyramid structure and the audio-visual materials prepared in accordance with Molen and Voort's (2000) semantic overlap hypothesis, in which 45% of the total presentation time is supported with relevant visual materials. The stimulus material for the first experiment lasted for 102 seconds and for the second experiment 136 seconds. The use of the extreme topics such as violence, war and disaster that were suspected to increase comprehension and attention was avoided (Philo, 2002; Nathanson, Eveland, Park, Paul, 2002; Lang, Newhagen, 1996; and Newhagen and Reeves, 1992). Therefore, unbiased subject items were selected as presentational materials by considering the age, education, social environment and common culture of the participants. Moreover, when using more than one news item in presentations, there is the possibility that some may attract the participants' attention more than others. Thus, there is the possibility that information may be better retained. To prevent such a biased outcome, in contrast with earlier studies, a single news item was selected as the presentational material this study. Attention was also paid in the preparation of the presentational materials not to use the presentational attribute formats of one media instrument more than the others. The news story for the first experiment was the benefits of breast-feeding to the mother. For the second experiment, the subject of the news story concerned the benefits of celery. All texts included factual items such as names particular to the topic and dates. Both the news stories are presented in Appendix A in their original versions in Turkish.

For both experiments, equal amount of time was given to the participants for each presentational format. In the final stage of the research, participants were asked which presentational format they preferred in terms of the effectiveness of their stimuli components. For each of the news stories, the questions used to measure comprehension and remembering were selected from a pool prepared by eight colleagues at the Faculty of Communication and Media Studies (FCMS) of the Eastern Mediterranean University (EMU).

Participants
The population of the study consisted of 10,705 students who were enrolled at the Eastern Mediterranean University (EMU) in the year 2003 excluding those in the English Preparatory School and postgraduate education, and those studying at the Faculty of Communication and Media Studies (FCMS). The students studying at the FCMS may be more conscious about the news and media; this is the reason for excluding the students of the FCMS from the sample. A random sampling strategy was used for selecting the participants. For the first experiment, 240 students were selected from students who had gained between 2.00 and 2.50 out of a 4.00 cumulative grade average (CGPA) in fall semester. The reason for this was to avoid any effect that the

academic success level of the participants might have on the results. 113 (47%) are male and 127 (53%) of the participants are female. 162 (67.5%) of the participants are Turkish Republic and 78 (32.5%) of the participants are Turkish Republic of Northern Cyprus citizens. 11% of the participants are between 17 and 18, 48% of the participants are between 19 and 20 and 29% of the participants are between 21 1nd 22 years of age. 10% are above 25 years age. 14% of participants are freshmen, 35% of participants are sophomore, 35% of participants are junior and 15% of participants are senior year students. 41% of the students have basic income or lower, the rest 59% have higher income levels.

In the second experiment, 112 participants were selected in two groups, according to their cumulative grade average (CGPA) from the semester mentioned above. The first group (n=56) had cumulative grade average scores, equal to or below 1.99, while the second group (n=56) had cumulative grade average scores of 3.00 or above to search for the effect of academic success level on comprehension and remembering. 56 (50%) are male and 56 (50%) of the participants are female. 66 (58.9%) of the participants are Turkish Republic and 46 (41.1%) of the participants are Turkish Republic of Northern Cyprus citizens. 22 (19.6%) of the participants are between 17 and 18, 40 (35.7%) of the participants are between 19 and 20, 36(32.1%) of the participants are between 21 1nd 22 and 11(9.8%) are between 23 and 24 years of age. 3(2.7%) are above 25 years age. 21.4% of participants are freshmen, 32.1% of participants are sophomore, 31.3% of participants are junior and 15.2% of participants are senior year students. 37.5% of the students have basic income or lower, the rest 62.5% have higher income levels.

For the final stage of the study, 80 participants were asked to place text and audio-video stimuli materials on a television screen or on a web page. After informed consent was obtained and it was ascertained that participants had no audio or visual disabilities, the students were invited to the study.

Procedure

For the experimental environment, the television studios of FCMS were selected. For the first experiment, groups, each with 20 participants, were formed. Each group was exposed to one of the following stimuli or stimulus-components: print, audio, audio-visual and audio-visual-text. Before the presentations, students were informed about the nature of the experiment and were asked to complete a questionnaire consisting of two different sections. The first section was composed of demographic questions and the second involved questions, in the form of a five-point Likert scale, about the participants' daily uses of the television, radio, newspaper, and internet. Immediately after the completion of each presentation, a set of factual and open-ended questions about the subject of the stimulus material were asked, in order to measure the levels of comprehension and understanding of the participants. Grimmes and Rimmer (1994) note that participants, who are tested immediately after the exposure, remember more than participants tested after a period of time (e.g., 48 hours).

In all presentations, the duration of the reading of the text materials was kept constant. In coding the questions used for measuring comprehension, "1" was given for fully correct answers, "0.5" given to half-correct answers, and "0" given for wrong answers. Similarly, for memory questions, "1" was given for correct answers and "0" for wrong answers. In order to provide consistency, the entire coding process was carried out by the researcher. In order to test the internal validity of the results obtained from the first experiment, and to observe the behaviors of the different groups in terms of comprehension and understanding, the second experiment was realized under the same conditions.

Most recent studies have concentrated on comparisons of television and print, television and the web or print and the web but excluded audio stimulus alone. This stimulus was included in the first experiment of the study and, new communication technologies capable of presenting the three stimuli at the same time were favored.

The demographic questions sought to explore the gender, age, and income level of the participants. The attitude-scale questions set out to investigate the use of the media by the participants. The open-ended questions posed following exposure to the presentations sought to find out about comprehension and remembering. Finally, one multiple choice question was asked to explore students' evaluation of their behaviors when exposed to the double- and triple-component presentational stimuli.

FINDINGS

At the first stage, preliminary analysis of both experiments indicated that there were no significant differences in the gender, age and family income level of the participants. For the attitude scale questions, the value scale extended between one (least important) and five (most important). The reliability of the five-point attitude-scale for the first experiment is: alpha=0.811 and mean=3.40.

When the data obtained from the correct answers given to the factual and open-ended questions are analyzed, the calculated mean and standard deviations for different stimuli presentations are given in Table I. In this experiment, in order to find out whether there is a significant difference among the presentational stimuli, ANOVA test is applied. According to between group factor analysis (F (4,59)=16.758, p<0.05), there is a significant difference among the presentational stimuli in terms of comprehension and remembering. In this study, a variable is generated by summing the correct answer for each question. The results of the Tukey HSD multiple comparison test (scores=dependent variable) carried out according to between group factor analysis of the three components stimuli compared with single and double component stimuli, namely, audio stimulus, textual stimulus, audio-visual stimuli and audio-text stimuli. Three component stimuli proved to be more effective in terms of comprehension and remembering. Between audio-text and audio-video double stimuli presentations, audio-text and text presentations and audio-video and text presentations at the level of alpha=0.05 there is no statistically significant difference in terms of comprehension and remembering. At the same time, audio-video and audio-text double presentations are more efficient in terms of comprehension and remembering, when compared with single audio presentation. Finally, according to the results of the experiment, no significant difference is observed between the text and audio presentations in terms of comprehension and remembering. In the second analysis of the experiment, a relationship is sought between the frequency of use of the media instruments, instrument(s) used to obtain news and the trust to the media instrument(s) used to obtain news and the answers given to the questions of comprehension and remembering in the experiment by the participants. To explore whether this relationship exists, answers given to the comprehension and remembering questions and answers given to the attitude scale questions are analyzed by the ANOVA test. The result obtained from this test shows that according to the between groups factor (F(4,19)=0.117), MS=0.115, p=0.974) there is no significant difference between comprehension and remembering and the frequency of use of the media instruments. Similarly, there is no significant difference between comprehension and remembering and the instrument(s) used to obtain news (F(4,19)=0.114, MS=0.450, p=0.976) and between comprehension and remembering and trust in the media instrument(s) used to obtain news (F(4,19)=0.266, MS=0.226, p=0.895).

Table I. Mean and Standard Deviations for different stimuli presentations.

	Mean	Standard Deviation
Triple Stimuli	44.92	9.85
Double Stimuli (Audio-Video)	30.67	7.33
Double Stimuli (Audio-text)	33.42	7.33
Single Stimulus (Text)	26.12	9.77
Single Stimulus (Audio)	11.58	8.46

Finally, participants were asked to evaluate their behaviors when exposed to the double and triple-component presentational stimuli, using a multiple choice question: '*What are you doing while exposed to the presentational stimuli?*' Respondents were asked to select one of the stimulus-components to which they were exposed: merely reading, merely listening, reading and watching, listening and reading, watching, listening and watching, listening and reading. The relationship between the responses given to this multiple-choice question and the number of correct answers given by the participants to the comprehension and remembering questions after double and triple-stimuli presentations were explored. ANOVA test was used to determine the relationship between the responses of the participants to the audio-video double-stimuli alternative and merely audio stimulus. Within groups factor (F(1,16)=5.468, MS=48.375, p=0.033) yield a statistically insignificant difference between the behavioral responses obtained from single and double stimuli forms. Therefore, in this double-stimuli presentation, instead of only listening, participants prefer both listening and watching. Similarly, the behavioral forms for the audio-text double-stimuli and text, audio and audio-text alternatives are tested by ANOVA. Within group factor analysis yield the conclusion that the participants behaviors in audio-text double stimuli presentation rather than merely listening or reading prefer both reading and listening at the same time (for audio-text and text MD=5.33 and p=0.027 and for audio-text and audio MD=11.11 and p<0.001). The results of these two tests show that when the participants are exposed to double-stimuli presentation, instead one stimulus, participants prefer to follow both stimuli at the same time. In the triple-stimuli presentations, participants, instead of following single stimulus either text or audio, double-stimuli such as audio-video, and triple-stimuli text-audio-video, indicate that they show preference towards following one of the double-stimuli alternatives such as audio-text and text-video alternatives (see Table II). According to the results of the experiment, audio stimulus presentation yields lower effects when compared with the others in terms of comprehension and memorization.

Table II. Descriptive Statistics for Participants Behavior

		Mean	Std. Dev.
AV	Audio	9.0	3.27
	Audio-Video	16.66	9.27
AT	Text	7.55	3.6
	Audio	1.77	0.97
	Audio-Text	12.88	5.96
AVT	Text	0.77	1.30
	Audio	0.44	0.72
	Audio-Video	4.0	3.24
	Audio-Text	5.22	2.94
	Text-Video	5.22	4.17
	Audio-Video-Text	0.77	0.97

According to the results of the first experiment in the first stage, audio stimulus presentation yields lower effects when compared with the others in terms of comprehension and remembering. However, audio stimulus is the common factor in the double-stimuli presentations. Therefore, audio stimulus alone was not examined in the second experiment.

In order to test the internal validity of the results obtained from the first experiment and for observing the behaviors of the different groups in terms of comprehension and remembering, the second experiment was administered under the same conditions.

For the second experiment, the invited students were divided into two sets according to their CGPA scores. Each set is then divided into four groups (n=14). In this experiment, one group from each set is exposed to one of the audio-video-text, audio-video, audio-text or merely text stimuli presentation.

28 students participated in each session of the second experiment. At the beginning of each session, participants were asked to answer questions that would provide information about their identity and the use of the media. After the exposure to the presentational stimuli, participants are asked to answer the questions of comprehension and remembering and their behaviors during exposure process. After having the answers of the questions, participants are not allowed to leave the experimental environment. For the second time, participants are exposed to the stimuli materials and once again are asked to answer the same questions.

In the analysis of data obtained from the experiment, the General Linear Model was used. The scores that participants obtained from the comprehension and memorization questions and for the first and the second steps according to their cumulative grade averages (CGPA) and the stimuli materials to which they were exposed are given in the Table III.

Table III. Descriptive statistics for the second experiment.

	Stimulus	CGPA	Mean	Std Deviation
First Score	A-V-T	Below 2.00	7.86	0.86
		Over 3.00	10.71	1.33
	A-V	Below 2.00	7.36	1.01
		Over 3.00	9.50	0.76
	A-T	Below 2.00	7.57	1.09
		Over 3.00	9.29	1.07
	T	Below 2.00	6.07	1.00
		Over 3.00	7.07	0.83
Repeated Scores	A-V-T	Below 2.00	11.00	0.78
		Over 3.00	12.93	0.62
	A-V	Below 2.00	9.50	0.76
		Over 3.00	11.36	0.74
	A-T	Below 2.00	9.43	1.02
		Over 3.00	11.29	0.99
	T	Below 2.00	7.64	0.50
		Over 3.00	8.86	0.66

A 2(CGPA below 2.00 vs. CGPA over 3.00) x 4(audio-visual-text vs. audio-visual vs. audio-text vs. text) factorial analysis of variance test is used for the first scores and the repeated scores. For the first scores test of between-subject effects shows that there is a significant relation between the CGPA and stimulus factors (F(3,104)=4.181, MS=1.014, p=0.008) at the 0.05 level. On the other hand, no significant relation is observed for the repeated scores between the CGPA and stimuli factors (F(3,104)=1.30, MS=0.604, p=0.278) at the 0.05 level.

According to the results of the test conducted in the first phase of the second experiment, pair-wise comparison of the four stimuli presentations (audio-visual-text, audio-visual, audio-text, text) shows that for those participants who were exposed to the triple stimuli presentation (F=56.37, MS=57.14, p<0.001 result obtained from the test of significance for the first scores using unique sums of squares) compared to double stimuli (for audio-visual F=31.71, MS=32.14, p<0.001 and for audio-text F=20.29, MS=20.57, p>0.001) and single stimulus F=6.91, MS=7.00, p=0.01) presentations, comprehension and remembering is higher. Those students who were exposed to double-stimuli show the same performance whereas those who were exposed to a single stimulus show weaker performance. Similarly pair-wise comparison of the two CGPA levels show that those participants with a CGPA of three and over have higher performance in terms of comprehension and remembering than those with a CGPA below two (F(1,104)=102.732, MS=1.04, p<0.001).

According to the results of the repeated test, conducted at the second phase of the second experiment, pair-wise comparison of the four stimuli presentation shows that, the participants who were exposed to the triple stimuli presentation (F=43.08, MS=26.04, p<0.001) yield higher level of comprehension and memorization compared to double-stimuli (F=39.95, MS=24.14, p<0.001 for both audio-visual and audio-text) and single stimulus (F=17.08, MS=10.32, p<0.001) presentations. Those exposed to double-stimuli presentations show the same performance whereas those exposed to a single stimulus show weaker performance.

Similarly, pair-wise comparison of the two CGPA levels for the repeated scores show that those participants with a CGPA of three and over have a higher performance in terms of comprehension and memorization than those with a CGPA below two (F=136.14, MS=0.604, p<0.001). On the other hand, according to the one way analysis of variance method between groups factor reveals that no significant difference is observed between the frequency of use of the media instruments (F(3,7)=6.48, p=0.51), instrument(s) used to obtain news (F(3,7)=4.251, p=0.098) and trust in the media instrument(s) used to obtain news (F(3,7)=5.254, p=0.071) and the answers given to the questions of comprehension and remembering in the experiment by the participants.

In the last part of the second experiment, respondents were asked to explain their behaviors when exposed to double and triple-stimuli presentations. Statistically no significant difference has been observed between the results obtained from the double-stimuli presentations and the triple-stimuli presentations in terms of the participants' forms of behavior (F(3,111)=0.143, MS=0.561, p=0.934). In the triple-stimuli presentation (M=3.93), participants showed preference towards audio-video and audio-text stimuli. As to the audio-visual double-stimuli, participants prefer to follow audio and visual stimuli together (M=4.79). Similarly, instead of following merely the text or merely the audio, participants prefer to follow audio-text stimuli together.

In the second stage of the study, 80 participants were asked to place text and audio-video stimuli materials on a television screen or on a web page. The results show that 57 participants divided the screen into two equal parts. Among these, 45 of them divided the screen vertically and placed the audio-visual materials on the left side of the screen and the text on the right side whereas12 of them divided the screen horizontally into two, and placed the audio-visual materials on the top and text materials at the bottom. 12 participants divided the screen into four equal portions and placed the audio-visual materials on the left upper quarter and the text on the remaining three quarters of the screen. The remaining 11 participants placed the audio-visual materials on the upper part (covering 70% of the screen) and the text at the bottom.

DISCUSSIONS AND CONCLUSIONS

In response to the first research question, the results of the experiments indicate that performance of the participants is better in the triple-stimuli presentation when compared with the double-stimuli and single-stimulus presentations. Similarly, as far as the comprehension and remembering are concerned the double-stimuli yields better results than that of the single-stimulus presentations. These findings, in return, answer the second research question and show that following double-stimuli increases comprehension and remembering more than the single stimulus. While in the triple-stimuli presentation of the experiment, participants tended to follow the audio-video, audio-text and text-video. Indeed, this result indicates that comprehension and remembering are not based on the effect of the stimuli: the increase in the number of stimuli increases the

number of alternatives for the participants. They show preference towards the double stimuli as the one which is the most appropriate and familiar for them.

On the other hand, the responses in both experiments show that, during the compound-stimuli presentations, participants tend to follow and pay attention to the double-stimuli rather than single stimulus or triple-stimuli. Although these findings show that following double-stimuli increases comprehension and remembering more than the single stimulus, this contradicts with the outcome of the third study: comprehension and remembering is higher in triple-stimuli presentations than in the single and double-stimuli presentations, but participants who are exposed to either triple or double-stimuli tend to follow two stimuli at the same time during the presentation. While in the triple-stimuli presentation of the first experiment, participants tended to follow the audio-video, audio-text and text-video. In the triple presentation of the second experiment, participants tended follow the text-video and text-audio double components. Indeed, these results indicate that comprehension and remembering are not based on the effect of the stimuli: the increase in the number of stimuli increases the number of alternatives for the participants; and when they are exposed to triple-stimuli, they prefer the double stimuli as the one that is the most appropriate and familiar to them. These findings support Darley's (1999) hypothesis, which states that the style of information processing is related to the user's perception of the media. It should also be emphasized that since the participants are university students and their proficiency in reading skill is a significant factor that contributed to this outcome. On the other hand, the analysis of the data obtained from the experiments shows that there is no relationship between frequency of use of the media instruments, and trust in the media instrument(s) used for obtaining news by the participants and on their comprehension and remembering. In other words, these results do not support the first hypothesis of the study. Results obtained from the first and second experiments show that the findings, in terms of comprehension and remembering, are directly related with each other. Also the study revealed that repeated exposure increase comprehension and understanding. This outcome supports the second hypothesis.

Finally, in order to answer the third research question, the data obtained from the last stage of the study is analyzed. In this study, participants placed the audio-visual and text materials, in order to maximize comprehension and remembering, on two equal portions of a presentational instrument. In other words, they give the same importance to the text and audio-visual materials.

According to the findings of the second experiment, the academic success of the participants and their comprehension and remembering performances are directly proportional with each other. When the responses given to the comprehension and remembering questions are investigated without considering the medium, there is a significant difference between the participants with lower and higher levels of academic success. This indicates that the differences in comprehension and remembering depend not only on the instrument but also on the individuals. In other words, affected from the media is not directly related with the media instrument but it is directly proportional with their stimuli combination and presentational formats which are increase the learning.

This study has some limitations. The most evident limitation of the study is the external validity of the experiments. In existing presentational instruments, presentational materials consist of several news items. In both experiments, a single news item was used. This highlights problems due to the attention differences in natural and experimental environments. The concept of comprehension and memorization, and hence understanding, is related to the news for which different media channels emphasize various properties. In other words, in showing preference to the topic areas that convey information, education, and entertainment are avoided. This study is limited in terms of the participants, because the results that will be obtained by the research, apply only to students of EMU. In other words, the participants represent only certain age groups and level of education. Hence this study has limited applicability of the results to different age groups and educational levels. Related to this limitation, since the participants are students, there is also a possibility that the reading skills of the participants are developed. This can be the reason why they find this stimulus more effective. Such a possibility implies inequality of effect among the different stimuli. On the other hand, the measure of comprehension and memorization used in this study differs from many other studies undertaken in this area. The absence of a common measuring instrument for comprehension and remembering creates a problem for the internal validity of the experiments performed in the study. Finally, it was noted above that the use of still pictures in combination with text contributes to comprehension and remembering.

In conclusion, in order to create effective presentational information, there is a need to exploit both current and developing communication technologies. The opportunities that these technologies provide should be evaluated considering the habits of individuals and societies. The increase in the number of news presentation tools needs to be directed towards the sense of making an influence and increasing. Otherwise, pluralism tends to promote disorder and ineffectiveness. This study explored which presentational format might create maximum effect,

both in terms of its technological properties and content, parallel to the developments in convergence. Considering the technical properties, content, and speed-dependent attributes, for sending equally represented multiple stimuli as the presentational environment creates the maximum effect.

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Appendix A

SELERİ YE, SAKİN KAL...
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Retrived on: 01/07/2010

Akdeniz mutfağının önemli lezzetlerinden seleri, içerdiği maddeler sayesinde sinirliliği önlüyor. B vitamini, demir ve kireç yönünden zengin olan seleri, şeker, yüksek tansiyon ve romatizma hastalıklarına da iyi geliyor...

Öfke, yalnızlık sıkıntısı, karasevda, çekingenlik ve daha bir dizi ruhsal durumda nelerin yenmesi gerektiği sıralanmış. "Düş kırıklığı" çekenlerin ise, başlıca seleri ve havuç yemesi tavsiye ediliyor. Akdeniz mutfağının önemli yiyecekleri arasında yer alan selerinin, içerdiği maddeler sayesinde insanları sinirlilik halinden uzak tuttuğu bildirildi.

Salatası, çorbası, zeytinyağlı yemeği yapılarak tüketilebildiği gibi, yemeklere kendine özgü bir lezzet de katan seleri, içerdiği değerlerle alternatif tıpta birçok hastalığın tedavisinde de kullanılıyor. Uludağ Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü Öğretim Üyesi Prof. Dr. Rahmi Türk, kış mevsiminin önemli sebzeleri arasında yer alan selerinin, besleyici özelliğinin yanı sıra sağlık açısından birçok yararı olduğunu söyledi.

Yaprak ve kök selerini olarak iki çeşidi bulunan ve anavatanı Güney Avrupa olan selerinin, deniz havası alan rutubetli yerlerde yetiştiğini ve soğuk havada kolayca don tuttuğunu anlatan Prof. Dr. Türk, lezzeti ve besin değerinde kayıp meydana gelmemesi için alırken don yememiş olmasına özen gösterilmesi gerektiğini belirtti.

SİNİRLERİNİZE HAKİM OLMAK İÇİN

Selerinin en çok içeriğindeki "sedanonik anhidrit", "sedanolin", "limonen", "palmitik asid" ve "gayakol" gibi maddeler sayesinde zihinsel yorgunluğun giderilmesine iyi geldiğini kaydeden Prof. Dr. Türk, B vitamini, demir ve kireç içeren selerinin, unutkanlığı ve sinir yorgunluğunu giderdiğini bildirdi.

Idrar söktürücü özelliğe de sahip bulunan seleri, böbrek taşı ve kumlarının düşürülmesine yardımcı olduğunu ifade eden Prof. Dr. Türk, selerinin şeker, yüksek tansiyon ve romatizma hastalıklarına da iyi geldiğini sözlerine ekledi.

"Emzirme, doğal bir doğum doğum kontrol yöntemidir"
Retrived from: http://gebelik.org/dosyalar/emzirme/emzirme2.html
Retrived on: 01/07/2010

Vehbi Koç Vakfı (VKV) Amerikan Hastanesi kadın hastalıkları ve doğum uzmanı Dr. Alper Mumcu, "emzirmenin, doğal doğum kontrol yönteminden kilo verme ve kanserden korunmaya kadar pek çok yararı bulunduğunu" bildirdi.

Dr. Mumcu, "1-8 Ekim Emzirme Haftası" dolayısıyla yaptığı yazılı açıklamada, emzirmenin anne sağlığı açısından yararlarına işaret ederek, bunun ayrıca doğal bir doğum kontrol yöntemi olduğunu belirtti.

Süt üretiminden sorumlu prolaktin hormonunun, beyinde yumurtlamayı kontrol eden hormonların salgılanması üzerinde etkisi bulunduğuna dikkati çeken Dr. Mumcu, "Bu etki sonucu yüksek prolaktin düzeyi varlığında, yumurtalıkta yeni yumurta hücresi gelişimi olmaz. Yumurtlama olmadığı için gebelik olasılığı da ortadan kalkar. Emzirmenin ilk 3 ay için koruyuculuğu yüzde 90'ın üzerindedir" dedi.

Emzirmenin hamilelikte alınan kiloların verilmesini de kolaylaştırdığını vurgulayan Dr. Mumcu, şunları kaydetti: "Emzirme ve süt üretimi, günde yaklaşık 500-1000 kalori harcanmasına neden olur. Emzirmeyen annelerin, bu kaloriyi yakmaları için 1 saatten daha uzun bir süre bisiklet binmesi ya da yürümesi gerekir. Emzirme ayrıca kanserden korur."

INSTRUCTIONAL DESIGN IN EDUCATION: NEW MODEL

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INTRODUCTION

Instruction is a plan of teaching & learning activities in which learning is organized. This instructional plan motivates students to learn. The aim of instruction is to make the learning process take place. According to Gustafson (1996), instructional design is:

1. analyzing what is to be taught/learned;
2. determining how it is to be taught/learned;
3. conducting tryout and revision; and
4. assessing whether learners do learn.

Instruction is a systematic process in which every component (i.e. teachers, students, materials, and learning environment) is crucial to successfully learning (Dick & Carey, 1996). Instruction deals with teaching and learning activities. These activities should assist students to learn knowledge and move this knowledge from short term memory to long term memory. To do that, students need to learn how to rehearse, encode, process and feedback new knowledge to be able to remember when they need.

In the instructional design process, there are a lot of factors that should be taken into consideration. These factors are closely related to each other and affect each other to a certain extent. These factors should be organized in the instructional design steps. For example, if the goals and objectives are not chosen, specified or written properly, then the next and other steps will contain some problems because of the inappropriate and incomplete items in the previous step. In the instructional design, the steps are all interrelated with each other. It is very important to order the steps in a way that will be logical and in relation with other steps. In other words, instructional design is a big responsibility to design teaching and learning activities. All steps should be thought and chosen carefully and should be ordered in a meaningful way. Every detail can play an important role during the implementation. Every decision should be given due to a reason, not just for the sake of doing so. The designer should be fully aware of the relationship among the steps. During the teaching and learning process, the designer should collect reliable data about the students, their backgrounds and their prerequisite learning. Due to the reason that they play an important role on the outcomes of instruction, they should seriously taken into consideration and help designer to create a model that will help them to keep a balance between them. An instructional design model gives method and implication to design instruction. During the instructional design process, I.D. models help educators to visualize the problem. If the instructional design model solves the learning-teaching problems, it means that it is an effective instruction.

Effective instruction is instruction that enables students to acquire specified skills, knowledge, and attitudes (Reiser & Dick, 1996). During the effective instruction, students can be motivated well. To motivate students in the instruction process, all factors must be determined well. During determination process, there are four important principles that play key role. These principles are listed below:

1. Begin the planning process by clearly identifying the general goals and specific objectives students will be expected to attain;
2. Plan instructional activities that are intended to help students attain those objectives;
3. Develop assessment instruments that measure attainment of those objectives;
4. Revise instruction in light of student performance on each objective and student attitudes towards instructional activities (Reiser & Dick, 1996).

Teachers should follow these principles in order to apply successfully their instruction. The major goal of instructional design is to demonstrate planning, developing, evaluating, and managing the instructional process. At the end of this process, it can be seen the student learning performance in instructional activities based upon defined goals and objectives. Instructional design pays attention to instruction from the learner perspective than from the content perspective which is traditional approach. According to Kemp, Morrison and Ross (1994), it involves many factors that influence learning outcomes, including such questions as these:

1. What level of readiness do individual students have for accomplishing the objectives?

2. What teaching and learning methods are most appropriate in terms of objectives and student characteristics?
3. What media or other resources are most suitable?
4. What support, beyond the teacher and the available resources, is needed for successful learning?
5. How is achievement of objectives determined?
6. What revisions are necessary if a tryout of the program does not match expectations?

These questions concerns with student learning because the major goal of instructional design is to accomplish the identified goals and objectives in the instructional activities. In the instructional design process, there are four key elements. These are:

1. whom to teach,
2. what to teach,
3. how to teach, and
4. how to evaluate.

In whom to teach process, knowing student personality is important because the target learners are students. Without students, instructional activities can't be implemented. To design effective instruction, teachers should get information about student characteristics.

In what to teach, instructional goals and objectives are important. Teachers first must make decision on their goals and objectives in instructional design. Instructional goals and objectives give teacher information on what to teach during instructional activities.

In how to teach, teacher gets information on how to deliver goals and objectives to students in the instruction. Instructional delivery methods indicate teacher what kinds of teaching and learning methods will be used.

In how to evaluate, assessment tools are playing key role because teacher can get information on whether students accomplished the goals and objectives or not with the tools. During the educational measurement and evaluation process, assessing tools such as multiple choice, short-answer items, true-false items, matching items, essay questions, problem solving questions and others must be used to determine student learning activities in the instruction by teacher. These assessing tools should have reliability and validity characteristics to determine learning outcomes.

These four elements are usually used to create an instructional design model. There are four kinds of instructional models (Gustafson, 1996). These are classroom model, product model, instructional systems models, and trends and issues. The classroom models such as Gerlack & Ely, Kemp, Heinich, and Reiser &Dick are designed teacher oriented based. Teachers can use this model to design instruction. The product models such as Bergman & Moore and Van Patten are interested in more producing instructional products either for specific clients or for commercial marketing. Instructional system model such as Branson, Seels & Glasgow, Bridggs, Gagne, Smith &Ragan, Gentry and Dick Carey are designed for a complete college course. This model always requires a team effort to design instruction. There are some trends and issues in instructional design models. Hypermedia or internet is one of them. It affects instructional design. It is another area generating considerable excitement and innovation in the design of education and training environments (Gustafson, 1996). The other one is constructivism. It has also affected instruction process. It has gained considerable attention from educators dissatisfied with behaviorism and cognitive psychology. It is based on the belief that all individuals construct their own reality (Gustafson, 1996).

NEW INSTRUCTIONAL DESIGN MODEL

The major goal of new model (Figure 1) is to point up how to plan, develop, implement, evaluate, and organize full learning activities effectively so that it will ensure competent performance by students.

The theoretical foundation of new model comes from behaviorism, cognitivism and constructivism views.

Behaviorism as a theory of learning takes in to consideration on the relationship between stimulus & response, the reinforcement factor and designing environmental conditions. Those are used to motivate students to learn more in this model.

The behaviorist view of instructional design has five factors. These steps are analysis, design, development, implementation, and evaluation. In the analysis steps, instructional designer identifies input information (goals, objectives, the characteristic of teachers, the characteristic of students, materials, and others). In the design step,

instructional designer designs teaching and learning activities. In the development step, instructional designer develops instructional materials and teaching-learning methods. In the implementation step, teacher implements teaching and learning activities. In the last step, instructional designer checks learning outputs.

The new instructional design model uses analysis, design, development, implementation, and evaluation factors to design learning and teaching activities.

Cognitivism is interested in motivation, intellectual learning process (short term memory, retrieve and long term memory), experiences and contents. This new model is interested in how to store the information into long term memory. To store the information into long term memory, instructional activities are designed in the model.

The cognitivist view of instructional design is construct new knowledge with their own experiences. Learner should learn how to think and how to learn to solve their learning problems. The role of instructor is to design meaningful experiences in learning environments. Designed meaningful experiences should motivate students to construct new knowledge in their long term memory. The role of students is to join discussions and colloboration activities.

The new instructional design model is inretested in constructing new knowledge, desiging meaningful learning experiences, motivation and organizing

Constructivism is interested in personal applications. According to McGriff (2001), the learning process must be concerned with the experiences and contexts that make the student willing and enable to learn. This is one of the things that new model uses in instructional activities. Students become active participants, reflect their own thought and become autonomous. During the instructional activities, students try to get their own experience things. Their personal experience motivates students to involve in the process actively. By the help of experience, they will relate their own personal meanings to the learned information and it might be easier to keep in mind, because it will be much more meaningful.

The constructivist view of instructional design is learning by doing. In other words, active learning is the hearth of constructivists' instructional design process. For this reason, constructivists are interested in active process during learning activities. Learners should be active and use cognitive activity to construct new knowledge. During cognitive activity, learning environment is playing a key role to contruct new knowledge. Learning environment must represent real life activities. In this environment, what is learned and how it is learned should be design together because how it is learned depends on what is learned.

The new instructional design model is based on active learning. During teaching and learning activities, learner is active and uses cognitive learning to construct new knowledge. To consruct new knowledge, educational technology materials are used. These materials are related with goals and objectives.

New model (Figure 1) is described a five-step systematic planning process. These are:

1. input,
2. process,
3. output,
4. feedback,
5. learning.

This process can be used to plan a variety of instructional approaches, ranging from teacher lectures to hands-on student-centered activities. In addition, as a result of using this process, teachers should be able to develop effective instruction. This effective instruction can help students to learn more and keep the new knowledge into long term memory. These students will be motivated to join class activities.

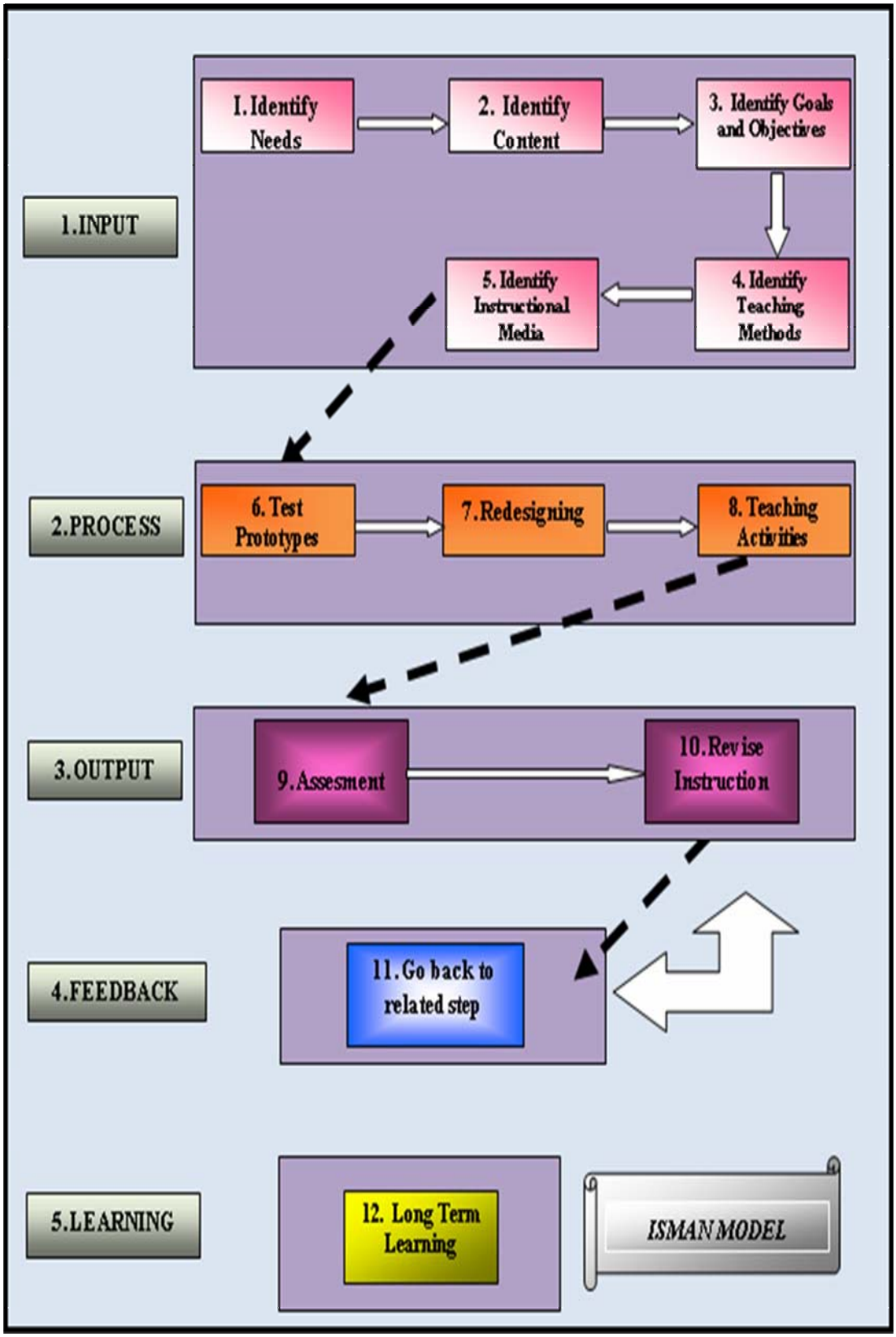

Figure 1: New Instructional design Isman model

The first step in Isman model is to clarify input (Figure-2). The input step is the foundation of instructional activities for learning and teaching. The designer also identifies learner characteristics.

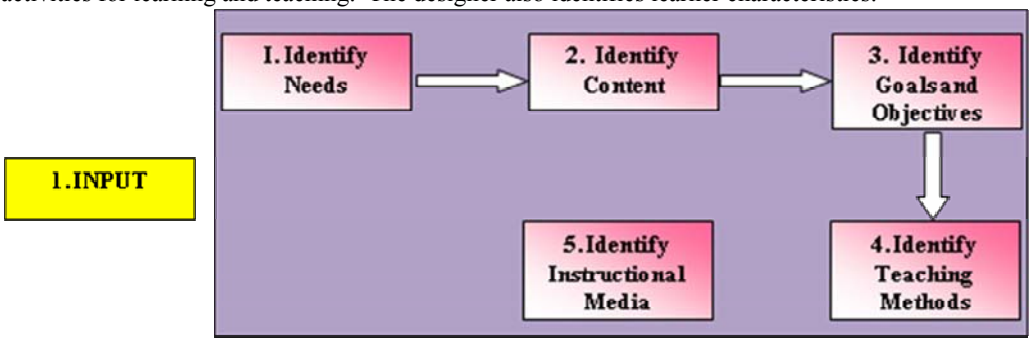

Figure 2: The Input Step of ISMAN Model

This is a key step in the instructional planning because it gives teacher information about the effectiveness of the instruction. In other words, these steps can help instructor to identify what to teach and how to teach instructional activities. The input step has five stages. These are:

1. identify needs,
2. identify contents,
3. identify Goals-Objectives,
4. identify teaching methods,
5. identify instructional media.

The first is to identify needs. It is an important factor in the total design process. Instructional designer uses survey, observation and interview methods to determine what the students need to learn. The definition of needs may be derived from a needs assessment with regard to particular curriculum. The second stage is to identify contents. The contents are derived from students' needs. The main goal of this step is to clarify what to teach. The third stage is to identify goals and objectives. The identification of goals and objectives is an important stage in the new instructional design model. The main idea of identify goals and objectives is to define what students will be able to do after instructional process. The outcomes are ussually clarified as behavioral objectives, learning objectives, or performance objectives. There are five categories of learning outcomes. These are intellectual skills, cognitive strategies, verbal information, motor skills and attitudes. Goals and objectives ussually contain skills, knowledge and attitudes. Skills could be psychomotor skills and intellectual skills. When students learn psychomotor skills, they develop muscular actions. When students learn intellectual skills, they develop cognitive activity such as discrimination, implementation and solving problem. The goals and objectives are derived from need assesment and contents. The fourth stage is to identify teaching methods. After the needs, content and goals have been identified, teaching methods are determined. Teaching methods should be related with content and goals because goals and objectives will be tought with the appropriate method. The last stage is to identify instructional media. It is a delivery method in instructional design process. In other words, it tells us how to deliver the instruction to students. There are two groups of instructional media. These are clasical instructional media and modern instructional media. The classical instructional media includes books, journals, graph, model, picture, poster, cartoon, newspaper, dioramas, trip, blackboard and others. Modern instructional media includes multimedia, films, radio, telephone, television, computer, data projection, internet and others. The instructional media is ussually used to enhance learning by instructional designer. The main goal of media is to apply communication and learning. Identify instructional media is based upon a review of needs, contents, goals and teaching methods. These instructional media should motivate students to learn and keep the new knowledge in the long term memory.

The second step in Isman model is to process (Figure 3).

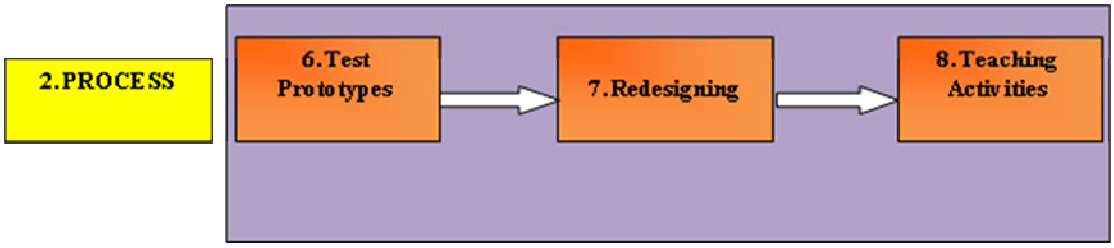

Figure 3: The Process Step of ISMAN Model

The process step has three stages. These are test prototypes, redesigning of instruction and teaching activities. The first is to test prototypes. In this step, teacher will be ready to try out the planned instruction with the students The main goal of first stage is to find out which stages are working and which stages are not working. In other words, the problems in instructional design are identified during testing prototypes. Testing prototypes tells instructor what students realy want to learn and how to get there. The second stage is to redesigning of instruction. After problems are identified, instructional designer reorganizes instructional activities. To reorganize instructional activities, pre-testing plays a key role to design an effective instruction. If an effective instruction is designed well, instructional goals will be achieved successfully. The last stage is to teaching activities. Teacher begins teaching activities interms of content, teaching methods, goals and objectives with instructional media.

The third step in Isman model is to output (Figure 4).

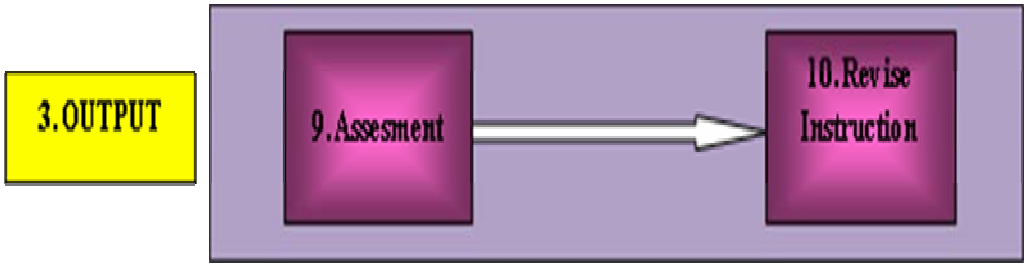

Figure 4: The Output Step of ISMAN Model

The output step contains two stages. These are assessment and revising instruction. In the first stage, teacher assessts teching and learning activities in the instructional design model. Instructional designer uses formative and summative evaluation methods to check goals and objectives. This process requires teacher to implement assessment tools to determine whether the students did demonstrate the skills, knowledge, and attitudes that teacher described in instruction goals and objectives or not. When the students participate in the instructional activities, teachers want to know whether they learned what the instructional plan expected them to learn. To determine student learning, educational measurement and evaluation process should be implemented by teachers. This process gives teachers results on what students learn from the instruction. Teachers should analyze the results and make decision on where to go in the instruction. In the last stage, instructional designer evaluate all instructional activities. Instructional designer finds problems during the instructional design process. Then, instructional designer solve the problems then redisgn the instruction.

The fourth step in Isman model is to feedback.

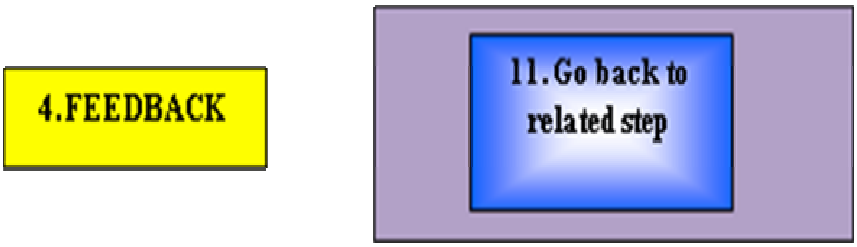

Figure 5: The Feedback Step of ISMAN Model

The feedback step has one stage. This is “Go back to related step”. The feedback process involves revise instruction based upon the data collected during the implementation phase. If, during the phase, teacher finds that

students are not learning what the plan wanted them to learn, and/or they are not enjoying the learning process, teacher will want to go back to related step and try to revise some aspect of their instruction so as to better enable their students to accomplish their goals. If there is a problem in input step, instructional designer will go back to input step. Then, instructional designer will make changes and start process from input. This process will be done until all goals and objectives are learned by learners. During this cycle, instructional designer may go back to any steps to where a problem is occured.

The fifth and final step in Isman model is learning.

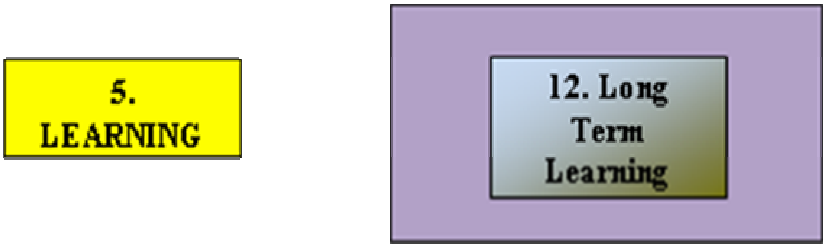

Figure 6: The Output Step of ISMAN Model

The learning step has one stage. This is "Long Term Learning". The learning process involves full learning. In this process, teacher wants to make sure that their students have learned what the instructional plan wanted them to learn. If, during the phase, teacher finds that their students accomplished their goals in the instructional activities, teacher will want to go new instructional activities. At the end of this step, long term learning is accomlished by instructional designer.

SUMMARY

The main goal of new model is to organize long term and full learning activities. The new instructional design model is based on the theoretical foundation of behaviorism, cognitivism and constructivism. During teaching and learning activities, learner is active and uses cognitive, constructivist or behaviorist learning to contruct new knowledge. To construct new knowledge, educational technology materials are used. These materials are related with goals and objectives.

Isman model is based on instructional system theory. It is occured within the five stages. These are input, process, output, feedback and learning.

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INTERNET ADDICTION AND PSYCHOPATOLOGY

Mustafa KOÇ

ABSTRACT
This study examined the relationships between university students' internet addiction and psychopathology in Turkey. The study was based on data drawn from a national survey of university students in Turkey. 174 university students completed the SCL-90-R scale and Addicted Internet Users Inventory. Results show that students who use internet six hours and more a day have psychiatric symptoms. Students whose addicted internet usage have psychiatric symptoms such as Somatization, Obsessive Compulsive, interpersonal sensitivity, depression, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism more than students whose nonaddictet internet usage.
Keywords: Internet addiction; symptoms; psychopathology, university students

INTRODUCTION

Technology is changing the nature of problems (Young, 1996). Symptoms often identified were a preoccupation with the internet, an inability to control use, hiding or lying about the behaviour, psychological withdrawal, and continued use despite consequences of the behaviour (Young, 2007). The internet has positive aspects including informative, convenient, resourceful and fun, but for the excessive internet users, these benefits turn out to be useless. Most individuals use the internet without negative consequences and even benefit from it, but some individuals do suffer from negative impacts. Psychologists and educators are aware of the potential negative impact from excessive use and related physical and psychological problems (Griffiths & Greenfield, 2000). Users who spend a significant amount of time online often experience academic, relationship, financial, and occupational difficulties, as well as physical impairments (Chou, 2001). Some researchers (Brenner, 1997; Nie & Erbring, 2000) have even linked internet use with an increase in psychological difficulties such as depression and loneliness.

Excessive internet use is a more common problem in Turkey. Internet use in Turkey has increased rapidly and has become a major part of daily life. However, the advancement of internet technology not only brings benefits, but also negative results. Of these negative aspects, excessive internet use is increasing dramatically. Internet addiction is called addiction disorder, pathological internet use, excessive internet use, and compulsive internet use (Kim, 2008). Internet addiction is described as an impulse control disorder that does not involve the use of an intoxicating drug and is very similar to pathological gambling (Young, 1996).

"Healthy internet use" is the use of the internet for an expressed purpose in a reasonable amount of time without cognitive or behavioural discomfort. Problematic internet use is "a psychiatric condition which involves maladaptive thoughts and pathological behaviour" (Davis, 2002). Problematic internet use is excessive time spent on various activities on the internet to an extent that might have negative effects on the user's physical and psychological health; social, academic, professional, and marital relationships, and other areas of life (Young, 1997). Morahan-Martin and Schumacher (2000) define problematic internet use as intensive use of the internet, failure to control internet use, serious harm to the user's life resulting from this use. Problematic internet use has been associated with increases in impulsivity and increases in social comfort while online (Davis, 2002). Problematic internet use can cause internet addiction. Young (1996) characterized internet addiction as staying online for pleasure averaging 38 hours or more per week, largely in chat rooms, and concluded that internet addiction can shatter families, relationships, and careers.

Internet addiction, also described as pathological internet use, is defined as an individual's inability to control his or her use of the internet, which eventually causes psychological, social, school and/or work difficulties in a person's life (Davis 2001; Young & Rogers, 1998). Addictive internet use is defined as "an impulse control disorder that does not involve an intoxicant" and is akin to pathological gambling (Young, 1998). Young further categorized five specific types of internet addiction: (1) cyber sexual addiction to adult chat rooms or cyber porn; (2) cyber relationship addiction to online friendships or affairs that replace real-life situations; (3) net compulsions to online gambling, auctions, or obsessive trading; (4) information overload to compulsive web surfing or databases searches; and (5) computer addiction to game playing or programming (Young, 1998). Like other addictions, furthermore, internet addiction has been linked to a variety of problems. Besides little sleep, failure to eat for long periods and limited physical activity, it also disrupts the studies and other aspects of the daily life of an individual (Cao & Su, 2006).

These people demonstrated two or more internet addiction symptoms, namely, spending more time on the internet than intended, feeling an urge to instantly connect to the internet once arriving home, receiving

complaints from family members and friends about too much time on the internet, and unsuccessful attempts to cut back on internet use (Chak & Leung, 2004).

Previous studies indicate that people may develop a new lifestyle through internet activities, which may cause a worsening in their actual social relationships (Whang, Lee, & Chang, 2003). In other words, depressive feelings of people relying on the internet for social support might remain or even worsen toward their real-life interpersonal relationships, increasing their risk of becoming internet addicted (Yu-Chun, Huei-Chen, Jo Yung-Wei, & Chung-Ping, 2008).

Internet use may be beneficial or beign when kept to 'normal' levels, however high levels of internet use which interfere with daily life have been linked to a range of problems, including decreased psychosocial well-being, relationship breakdown and neglect of domestic, academic and work responsibilities (Beard 2002; Weiser 2001; Widyanto & McMurran 2004; Yao-Guo, Lin-Yan, & Feng-Lin 2006; Young 1998). Studies indicated that the potential for negative psychological and social consequences reduced as society became more accustomed to using the internet (Kraut, Kiesler, Boneva, Cummings, Helgeson, & Crawford 2002).

The explosive growth of the internet in the last decade has had a huge impact on psychological research in understanding its role in communication and interpersonal behaviour. There has been increased interest in the addictive potential of the internet and the effect this can have on psychological well being (Niemz, Griffiths, & Banyard, 2005).

Although these findings, relatively little attention is given to the relationships between internet addiction and psychological variables. Thus, the aims of this study were to identify the relationship between internet addiction and Psychopathology in Turkish university students.

MATERIALS AND METHODS

Sample

The sample consisted of 174 students from Sakarya University, Turkey. Of the participants 77 (44,3%) were male and 97 were female (55,7%). Addicted internet users grup 56 (% 32) and nonaddicted Internet users grup 118 (% 68) were found. According to daily internet use; Hours per a day, 0-1: n_63 (%36,2), 2-3: n_35(20,1), 4-5: n_20 (%11,5) an 6+: n_56 (%32,2).

Data collection tools

Demographics.

This section included questions about the participants sex and daily Internet use.

Addicted Internet Users

With the following two cases as university students were dependent on internet addicted in this study. In other words, internet use six hours a day and from five to eightquestions, yes, was adopted as the internet addicted.

1. Young characterized Internet addiction as staying online for pleasure averaging 38 hours or more per week, largely in chat rooms, and concluded that Internet addiction can shatter families, relationships and careers (Young, 1996).

2. She developed an 8-item questionnaire for diagnosing addicted Internet users, which was adopted from the criteria for pathological gambling as referenced in the Diagnostic and Statistical Manual of Mental Disorders–IV (Young, ,1996). In her studies, respondents who answered “yes” to 5 or more criteria were classified as addicted Internet users and those who responded “yes” to less than 5 were classified as normal Internet users. Criteria for Problematic Internet Use Include (Young, 1999):

1. Preoccupation with Internet
2. Need for longer amounts of time online
3. Repeated attempts to reduce Internet use
4. Withdrawal when reducing Internet use
5. Time management issues
6. Environmental distress (family, school, work, friends)
7. Deception around time spent online
8. Mood modification through Internet use

Symptom Checklist-90-Revision.

The subjects'psychological changes were measured using the Symptom Checklist-90-Revision (SCL-90-R), which is a multidimensional, self-report symptom inventory developed by Derogatis et al21 and translated into Korean.22 The SCL-90-R consists of 90 items in total, which are divided into 9 symptom dimensions: Somatization (12 items), Obsessive-compulsive (10 items), Interpersonal sensitivity (9 items), Depression (13 items), Anxiety (10 items), Hostility (6 items), Phobic anxiety (7 items), Paranoid ideation (6 items), and Psychoticism (10 items). The study subjects were asked to select from ''0 = no problem'' to ''4 = very serious'' to describe the extent of their symptoms. Cronbach's alpha was .95 in this study.

RESULTS

1. Results about daily Internet use and psychiatric symptoms

Table 1. Psychiatric Symptoms According to Daily Internet Use

Psychiatric Symptoms	Hour	N	Mean	Std. Devation	F	Sig	The Source of The Difference
Somatization	0-1	63	,76	,60			
	2-3	35	,89	,50	7,16	,000	6+ > 0-1
	4-5	20	1,06	,62			
	6+	56	1,25	,62			
Obsessive	0-1	63	1,13	51			
Compulsive	2-3	35	1,16	,51	3,19	,010	
	4-5	20	1,20	,62			
	6+	56	1,43	,47			
Interpersonal	0-1	63	,89	,49			
Sensitivity	2-3	35	,91	,49	8,82	,000	6+ > 0-1 & 6+ > 2-3
	4-5	20	1,05	,62			
	6+	56	1,36	,57			
Depression	0-1	63	,97	,62			
	2-3	35	1,05	,51	4,12	,007	6+ > 0-1
	4-5	20	1,02	,57			
	6+	56	1,33	,58			
Anxiety	0-1	63	,77	,62			
	2-3	35	,88	,59	5,51	,001	6+ > 0-1
	4-5	20	,75	,67			
	6+	56	1,19	,56			
Hostility	0-1	63	,81	,60			
	2-3	35	,99	,73	13,09	,000	6+ >0-1, 2-3 & 4-5
	4-5	20	,68	,51			
	6+	56	1,49	,73			
Phobic Anxiety	0-1	63	,54	,49			
	2-3	35	,58	,51	11,52	,000	6+ >0-1, 2-3 & 4-5
	4-5	20	,57	,56			
	6+	56	1,12	,72			
Paranoid İdeation	0-1	63	1,02	,61			
	2-3	35	,99	,65	5,10		6+ >0-1 & 2-3
	4-5	20	1,03	,58			
	6+	56	1,40	,59			
Psychoticism	0-1	63	,67	,50			
	2-3	35	,74	,53	6,47		6+ >0-1 & 2-3
	4-5	20	,83	,48			
	6+	56	1,11	,65			

Six hours a day and later in university students who use internet somatization symptoms dimensions are seen more often according to the 0-1 hours of internet use. Daily internet use to have Obsessive Compulsive symptoms dimensions is not a factor. Daily internet use six hours and later university students interpersonal sensitivity symptoms dimensions are seen more often than 0-1 and 2-3 hours of daily internet users. Six or more pey day using the internet for university students with depression symptoms dimensions had more than 0 -1 hours of daily internet users. Six or more pey day using the internet for university students with anxiety symptoms dimensions had more than 0 -1 hours of daily internet users. Six or more pey day using the internet for university students with hostility anxiety symptoms dimensions had more than 0 -1, 2-3 and 4-5 hours of daily internet users. Six or more pey day using the internet for university students with phobic anxiety symptoms dimensions had more than 0 -1, 2-3 and 4-5 hours of daily internet users. Six or more pey day using the internet for university students with paranoid ideation symptoms dimensions had more than 0 -1 and 2-3 hours of daily internet users. Six or more pey day using the internet for university students with psychoticism symptoms dimensions had more than 0 -1, 2-3 and 4-5 hours of daily internet users. The psychiatric symptoms according to daily internet use the hostility score was also highest in the addiction group among the 9 symptom dimensions.

2. Results about addicted internet and psychiatric symptoms

Table 2. Psychiatric Symptoms According to addicted Internet

Psychiatric Symptoms	Addicted/ Nonaddicted	N	Mean	Std. Devation	t	Sig
Somatization	Addiction Group	65	1,25	,63	4,82	,000
	Nonaddiction Group	109	,810	,56		
Obsessive Compulsive	Addiction Group	65	1,48	,48	4,97	,000
	Nonaddiction Group	109	1,10	,50		
Interpersonal Sensitivity	Addiction Group	65	1,39	,57	6,53	,000
	Nonaddiction Group	109	,872	,47		
Depression	Addiction Group	65	1,36	,55	6,61	,000
	Nonaddiction Group	109	,959	,57		
Anxiety	Addiction Group	65	1,20	,59	4,65	,000
	Nonaddiction Group	109	,767	,59		
Hostility	Addiction Group	65	1,43	,74	5,67	,000
	Nonaddiction Group	109	,828	,63		
Phobic Anxiety	Addiction Group	65	1,08	,73	6,03	,000
	Nonaddiction Group	109	,536	,47		
Paranoid Ideation	Addiction Group	65	1,39	,59	4,26	,000
	Nonaddiction Group	109	,989	,61		
Psychoticism	Addiction Group	65	1,56	,63	5,75	,000
	Nonaddiction Group	109	,667	,48		

Of the 2174 participants who fully completed the survey, using the Internet and 65 participants (37,4%) met the criteria for Internet addiction. The 65 participants with Internet addiction comprised 28 male students (43,1%) and 37 (56,9%) female students. Table 2 shows the relationship between the psychiatric symptoms and the Internet user groups. All 9 psychiatric symptom dimensions were significantly associated with the severity of Internet addiction in t tests (p , .001). The t tests showed that all the symptom scores of the 9 dimensions of the SCL-90-R were the highest in the Internet addiction group and lowest in the nonaddiction group. Psychiatric

symptoms according to addicted Internet Psychoticism had the highest average score among the 9 psychiatric symptom dimensions in Turkish university students.

DISCUSSION

Results show that student who use internet six hours a day generally report more psychiatric symptoms, compared to students who did not. The main goal of this study was to investigate the between relationships addicted internet and Psychiatric Symptoms. This study found significant relationships between the daily internet use and the degree of psychiatric symptoms such as depression, obsessive compulsion ,interpersonal sensitivity, anxiety, hostility, phobic anxiety, paranoid ideation and psychoticism. Daily internet usage time is more Psychiatric Symptoms ocur in. Young and Rodgers (1998) reported that the average Internet use among problematic Internet users is 38.5 hours a week and among healthy users is 4.9 hours a week. Students who use the internet of hours per a day can not bring resposibilities such as academic problems and social isolation owing to excessive use of the Internet.

This study found significant relationships between the severity of Internet addiction and the degree of psychiatric symptoms. Addicted Internet use was significantly correlated psychiatric symptoms.Psychologists and educators are aware of the potential negative impact from addicted use and related physical and psychological problems.Users who spend a significant amount of time online often experience academic, relational, economic, and occupational problems, as well as physical disorders. Internet use with an increase in psychological difficulties such as depression and loneliness. Addictet users were more likely than nonaddicted Internet users to be depressed. This study showed that addicts internet used the Internet more often when they were depressed than nonaddicts. It is clear that the relation between Internet use and depression is affected by many variables. Addicted Internet use has been associated with increases in impulsivity

Addicted and nonaddicted Internet users displayed significant difference on interpersonal relationships. İndividuals with addiction internet experience a sense of criticized by others, shyness and a sense of discomfort with against gender and can easily hurt feelings.

Addicted Internet users who perceived lower social support found it easier to create new social relationships online, the consequence of exploring social support online could worsen interpersonal problems in reality, accompanied by psychological problems such as anxiety symptoms. In the female model, both actual social support and virtual social support to Internet addiction were partially mediated through anxiety symptoms

We found significant differences between the addicted internet group and non addicted internet grup for Obsessive- Compulsive symptoms. Addicted internet group have Obsessive- Compulsive symptoms more than nonaddicted internet group. Because addicted internet group; preoccupation with internet, need for longer amounts of time online, repeated attempts to reduce internet use, withdrawal when reducing internet use, time management issues, environmental distress (family, school, work, friends) and deception around time spent online mood modification through Internet use. These people answered “yes” to 5 or more criteria as Obsessive-Compulsive. We found significant differences between the addicted internet group and non addicted internet grup for hostility.

University students in Turkey, will lead internet use because of many factors such as difficulty adapting to life away from home and underlying psychological problems. These includes free Internet access, huge blocks of unstructured time, newly experienced freedom from parental intervention, no monitoring of what they express online, full encouragement from faculty members for Internet usage.

Future studies should continue to examine how personality traits influence problematic Internet use and should investigate whether a similar personality profile may be an etiologic factor in the development of any addictive syndrome, whether it be to alcohol, gambling, or the Internet. There is also a need for more studies of adolescents who visit psychiatric clinics and seek Professional help for addicted Internet use.

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ROLE OF ICT IN SHAPING THE FUTURE OF PAKISTANI HIGHER EDUCATION SYSTEM

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ABSTRACT
This study examined the challenges faced by the Pakistani higher education system (HES) in integrating information and communication technology (ICT); it aimed at understanding ICT needs, measuring the increase in ICT demand, determining the relationship between ICT and HES performance, and understanding how the HES copes with the challenges of implementing ICT. The results of these analyses were used as the basis to suggest solutions. The normative Delphi method was applied to evaluate a sample of 30 HES experts randomly selected from urban and rural areas of Pakistan by administering a literature-based 35-item questionnaire. The experts revealed significant gaps in ICT demand and supply, ICT use, ICT-based higher education problems, and reasons for delays in ICT integration and provided suggestions for developing ICT-driven HES in Pakistan. This study's findings suggest that an effective and robust HES ICT policy could greatly improve the status of the Pakistani knowledge-based economy, thus helping establish ICT policy and planning, administration, and integration at the higher education level.

INTRODUCTION

In many countries, education is more than a means for enabling progress and preventing poverty; it is also critical for the development of knowledge societies and knowledge-based economies. As suggested by many researchers, the role of higher education institutes (HEIs) within the context of knowledge-based economies and globalization is to give individuals the ability to transform information into socially beneficial knowledge, skills, and values; modernize societies and improve the standard of living; and prepare and produce a skilled workforce (Masood, 2010; Kong, & Li, 2009; Shaikh, 2009; Ng et al., 2006). Amjad (2006) defines a knowledge-based economy as "one that bases its growth not on increasing capital or land or labor inputs, but on knowledge."

The advent and spread of ICT in varying degrees over the last two decades have led to the advent of information societies, which are sometimes called knowledge societies. Today, these societies play a momentous role in the development of knowledge economies (Binghimlas, 2009; Dighe et al., 2009; Allen, 2009; Bhattacharya, and Sharma, 2007). These ICT-driven knowledge societies necessitate a workforce skilled in the use of ICT, as well as government support, transparent and autonomous institutions, progressive attitudes, and a sound ICT infrastructure (see Alev, Altun, and Yiğit, 2009; Chowdhury, and Alam, 2009; Czerniewicz et al., 2005). In another study (Yusuf, & Afolabi, 2010; Shaikh, 2009; Jayson, 2008; Shaheeda et al., 2007) argue that ICT not only helps HESs in less developed countries narrow the global digital divide and produce their own knowledge societies, but that it also helps improve the quality of learning and educational outcomes. They further suggest that the state of any education system is determined through the quality of its HES, because the HES contributes to the development of education at all levels.

Several researchers (e.g., Iqbal, and Ahmed, 2010; Shaikh, 2009; Hameed, 2006; Amjad, 2006; Khan, and Shah, 2004) argue that this century demands confidence and efficiency in ICT use in all fields, at both the academic and industry levels, to achieve success in education, employment, and everyday life. Thus, in order to be successful in this century, Pakistan should improve its HES by implementing effective and robust ICT policies.

This study was aimed to gather the expert opinions of university personnel, students, and parents about what role ICT can play in shaping the future of higher education in Pakistan. A questionnaire (comprising 35 questions) was designed based on globally available literature on five core areas: ICT use in universities, ICT-related problems/integration challenges and their solutions, causes of a low standard of higher education, suggestions for ICT-enhanced higher education, and forecasts for the future of Pakistan's HES.

This research contributes findings in the areas of (i) lack of ICT use during lectures, (ii) ICT-based problems

facing Pakistan's HEIs both today and in the near future, (iii) actions and plans that government should implement to maximize the benefits of ICT, and (iv) predictions for the future of Pakistan's HES if the above-mentioned actions are taken. This future-oriented scholarly research adds some rigor to the discussion of ICT policy and planning, administration, and integration at the higher education level, and examines measures that government should consider when designing future ICT policies for Pakistan's HES.

RESEARCH FRAMEWORK

While much of the world is actively engaged in research on ICT's role in the betterment of higher education and the development of knowledge-based economies, Pakistan is concerned that there is a dearth of research material linking ICT and the Pakistani HES. Current literature shows ICT's important role—both in everyday aspects of life, including education, development, employment, economic growth, administration, poverty reduction, community engagement, and research, and in society-wide applications like life-long learning, the emergence of knowledge societies, and globalization (e.g., Aypay, 2010; Shaikh, 2009; Aldridge, 2008; Hameed, 2006). This study examines the link between ICT and higher education in order to understand critical issues such as needs for the Pakistani HES, the relationship between ICT and learning, growth of ICT use, problems with ICT, and the impacts of and future prospects for ICT integration.

In many studies, researchers (e.g., Teo, 2009; Derek, and Dahlman, 2006; Ng et al., 2006; Atkins, 2005; Van der Wende, 2002; Chung, 2001) claim that since ICT use has made world economies more competitive and interdependent, knowledge creation and its use have become focal points for long-term development strategies. They also suggest that since ICT improves the standard of living, modernizes societies, promotes equity in education, enhances the quality of teaching and learning, and, with other technologies, is a force for change, a more diversified and flexible type of HES in which research, teaching, and social engagement remain rich, relevant, and accessible is needed in countries transitioning from post-industrial to knowledge economies. This study strongly affirms that effective, results-oriented, and systematic ICT integration is needed to ensure a bright future for Pakistan's HES.

Bates (2001) addresses the issue of ICT usage in his study and claims that campus-based activities and private sector training markets have been the largest users of ICT tools and applications, and that the education sector has incorporated Internet use for many years. Additionally, he says that since a knowledge-based economy demands technology-ready workers, governments and business communities put enormous pressure on educational institutions to use ICT in their daily routine tasks. However, Isman, et al., (2010), Ojo et al. (2007), and Mumcu et al. (2004) claim that lack of ICT facilities and infrastructure in the workplace is significant barriers to ICT use. They conclude that a robust ICT infrastructure in higher education is a critical enabler and prerequisite for knowledge-driven development. This study's Delphi panel agrees on the inadequate provision of technological infrastructure as an important ICT policy and planning problem related to ICT integration.

In many studies (e.g., Vajargah, & Jahani, 2010; Erkunt, 2010; Shaikh, 2009; Balasubramanian et al., 2009; Gillard et al., 2008; UNESCO, 2008; Ng et al., 2006), researchers address the issue of ICT integration in higher education and suggest that policy makers and teachers can play an important part in this dimension. The former shapes a country's education policies, determines the ICT framework, and makes high-level decisions, while the latter ensures the appropriate, effective, and sustainable use of ICT to provide quality education for all. Hence, both groups need to understand how technology and the education system interact with each other. They strongly suggest that suitable levels of investment, adequate training, good policy, careful planning, restructuring the teaching process, and a systematic approach are required when integrating ICT into the HES in order to achieve maximum educational benefits. Further, they suggest that secondary and tertiary education levels should be given priority when integrating ICT in education. Shaikh (2009) makes a distressing observation concerning ICT skills development training programs in Pakistan. He found that due to fear of a difficult learning process, lack of responsibility and ownership, and poor attitude teachers deliberately miss their ICT training classes. Also, many teachers do not use ICT during their lectures even though they have been trained in ICT skills. Important global issues like ICT use, ICT integration, ICT infrastructure, and ICT-based HES are reviewed extensively in this study, as the questionnaire addresses the following issues: ICT use, ICT demand and supply, ICT integration problems and challenges, reasons for delay in integrating ICT, and suggestions for ICT-enhanced higher education. The study's Delphi panelists discussed, evaluated, and formulated their responses to these issues based on a Pakistani perspective.

The question of whether ICT is the panacea for all problems and grievances associated with the world's HESs is relevant here. Koc & Bakir (2010) and Pelgrum & Law (2003) argue that although ICT provides a solid foundation for quality education, but, educational goals, needs, and careful economics must drive ICT use in education.

The fact that ICTs are used with much greater regularity in universities in developed nations has resulted in different ICT problems in the developed and developing worlds. While HEIs in the developed world have to deal with the problems of interdisciplinary of technologies and departments, global responsibility, and sustainable development, the less developed world faces more serious problems such as massive growth in enrollment and institutional development, bad governance, high expenditures, poor and uneven distribution of ICT resources and infrastructure, incorrectly viewing ICT as a problem for organizational transformation, not making ICT responsive to the organizational vision and mission, and developing a non-systemic method of implementing ICT (World Bank 2009b; Nyandiere, 2006, Tomkinson et al., 2006; Tusubira and Mulira, 2004).

The World Bank (2009a), Rehman (2008), Hussain (2008), and the Boston Group (2004), have reviewed the status of higher education in Pakistan and stated that while HEIs in the developed world provide strategically planned vision and desire for the quest of merit, in Pakistan they witnessed declining academic excellence, lack of insight, mismanagement, bad governance, ignorance, and decay. Until recently, Pakistan either badly neglected or gave very little importance to higher education, science/technology, and research, despite the fact that the higher education enrolment rate has been constantly rising—from 3.5% in 1990 to 5.2% in 2007—and that enrollments are projected to double to 1.0 million by 2010 and triple to 1.9 million by 2015.

Atta-ur-Rehman (2007)—the former chairman of Pakistan's higher education commission (HEC)—defines the core function of HEC as "to facilitate the transformation of Pakistan into a knowledge economy." The steps being taken by HEC in recent years and the funds being provided by the World Bank to support higher education reforms designed to raise the standard of higher education in Pakistan have been recognized and appreciated by many researchers (e.g., Hoodbhoy, 2009; Shaikh, 2009; Amjad, 2008; Rehman, 2008; Hameed, 2006; Khan and Shah, 2004). These researchers have publicized that for the first time in Pakistan's 63-year history, (i) operating budgets at universities have been increased significantly, (ii) faculty cadres have been lifted one grade above other public service employees, (iii) curriculum revision committees have been formed, and (iv) infrastructure such as electronic fixtures, Internet and broadband facilities, education portals, and digital research libraries have been upgraded or newly provided. They also recognize that a pool of highly qualified locally and foreign trained faculty has emerged in Pakistani universities because of the tenure track system, congenial environment, job security, and other fringe benefits. Fully funded scholarship programs in collaboration with local and foreign universities have been introduced to offer local and foreign scholarships to deserving and bright students on a merit basis. Researchers have concluded that the Government of Pakistan now considers ICT to be a lifeline for growth in the twenty-first century, and thus has designed cautious ICT policies in the recent past to promote the use of ICT in higher education. However, due to a lack of resources, and political issues such as inconsistent policies, there has not been an optimal strategy for improvement in the ICT sector.

Pakistan's Medium-Term Development Framework 2005–2010 and Vision 2030 Approach Paper reflect policymakers' vision of how to develop Pakistan into a knowledge-based economy. Rashid (2008) comments on the approach being adopted in these papers as:

> "These papers set out strategic vision to develop Pakistan into a knowledge economy by committing increased resource allocation for: (i) higher education with enrolment at the tertiary level increasing from around 4 per cent (17-23 age group) to 8 per cent in 2010 and 20 per cent in 2022 with efforts focused at enhancing quality and encouraging private sector involvement and ensuring continued increase in funding until 1 per cent of GNP is devoted to this sector; (ii) skills development to make Pakistan's labor force globally competitive including re-introducing technology streams in secondary education to gradually aim for enrolment figures of 50 per cent; (iii) science and technology and research and development (R&D) and to refocus efforts to those areas considered strategic for developing a knowledge-based economy and to encourage collaboration among public research institutions, universities and clusters of industries; and (iv) improvements in ICT infrastructure to ensure that such communications and multimedia infrastructure is state-of-the-art and able to keep pace with rapid advances".

To change the current status of Pakistan as poor in terms of a knowledge-based economy, this study aims to provide solutions regarding ICT-based issues in Pakistan's HES. This future-oriented scholarly research adds some rigor to the discussion of educational policy and planning, administration, and ICT integration at the higher education level from a Pakistani perspective. The recommendations and empirical evidence collected from this study are important contributions to the literature.

METHOD

Hypotheses postulated for this study were as follows:

H_1. There are no significant differences in perceptions among Delphi panelists regarding 13 collective issues related to ICT integration in Pakistan's HEIs, stated as:

- Present and future ICT use
- Use of common ICTs
- Use of educational/research ICTs
- How much faculty/students/staff should rely on ICT
- How much faculty/students/staff should use ICT
- How much help ICT provides to faculty/students/staff
- Reasons for delay in ICT integration
- Causes of low standards for HEIs
- ICT integration challenges in HEIs
- Suggestions for ICT-enhanced HES
- ICT demand in HEIs
- ICT supply in response to ICT demand in HEIs
- Attitude problems

H_2. There are no significant differences in perceptions among Delphi panelists regarding the question: Can ICT shape the future of higher education in Pakistan?

The Delphi research method—which is not only a qualitative approach, but also adds rigor and an audit trail to research by combining both the qualitative and quantitative approaches of modern research—has been used to carry out this study. This study's research decisions have been validated with appropriate statistical tests (sampling, graphs, mean, standard deviation, etc.), and a pilot study. The questionnaire was developed based on globally available literature on ICT-related issues at the higher education level. The Delphi panel was comprised of university personnel, students, and parents from both urban and rural areas of Pakistan.

This study uses normative Delphi, which seeks expert opinion from panelists on a prescribed list of questions/issues, and at the same time gives the panelists the freedom to agree/disagree with the issues discussed in the prescribed list and add any further issues.

Delphi Panelists

While there are no hard and fast rules regarding the selection of Delphi panelists, a number of factors, such as homogeneous/heterogeneous sample, decision quality/Delphi manageability, internal or external verification, etc., need to be considered (Skulmoski et al., 2007). Since the sample of study was almost homogeneous in terms of required expertise—only parents did not have direct experience with ICTs in HEIs, and their expertise is still justifiable since only technology-aware and knowledgeable parents were included in the study—a smaller sample of between 25 and 30 people could yield sufficient results. Also, since this study involves obtaining an individual's personal opinion based on his/her experience regarding ICT use and ICT integration issues in the higher education classrooms of Pakistan, there was no required level of technical expertise needed. Rather, any active and well-educated person could be seen as an expert to whom the questionnaire could be administered. The expert selection criteria laid down by this study for required level of expertise was:

Faculty member: A person currently employed in a university or institute of higher education.
Student: A student in the final stage of studies in any ICT-enhanced university or institute of higher education.
Administrative Staff: A person who works in a university or institute of higher education where ICT tools are used extensively in departments such as library, accounts, examination, or admission.
Parent: A person who considers ICT extremely important for his/her children to stay ahead in this era of globalization, and provides ICT facilities for his/her children at home.
ICT policy maker: A person at the secretary level who plays a vital role in designing government/university ICT policies.

Panelists included both males and females. There were 30 panelists, out of which 21 (70 percent) were male and 9 (30 percent) were female.

Instrument

In order to gather data that helps identify ICT integration problems and suggests solutions that lead to the design of user-friendly ICT policies, a 35-item questionnaire—initially composed of 32 questions in Round I, with three more questions added based on suggestions in Round I responses—based on 13 collective issues was proposed and finalized. It was divided into close-ended (questionnaire forms I and II) and open-ended [identification of new tasks/suggestions/comments (if any)] questions.

Questionnaire form I—based on three collective issues, i.e., ICT use in Pakistani universities, use of common ICTs, and use of educational/research ICTs—was developed to allow panelists to use their expert opinion to rate on a scale of 1 to 5 using likert-style questions, while questionnaire form II—based on the remaining 10 collective issues—was designed to ask panelists to identify (i) why there is a desperate need for ICT, (ii) ICT-related problems and integration challenges, (iii) reasons for delay in ICT integration, (iv) causes of the low standard of HEIs, (v) recommended actions for proper implementation of ICT infrastructure and policy, and, finally (vi) a forecast for the future of Pakistan's HES if the above-mentioned actions were taken.

Procedure

In order to improve comprehension of the Delphi questionnaire and to resolve any procedural problems, a pilot study was conducted using nine randomly selected individuals with equal representation of faculty members, parents, and students. The Delphi questionnaire was administered to each individual for testing and adjusting purposes before finally beginning the Delphi study.

The study was formally begun when a letter of participation was e-mailed to 500 randomly selected personnel requesting nominees for parents, teachers, students, administrative staff, and ICT policy makers. That letter highlighted (i) the importance of ICT in higher education, (ii) the purpose and objectives of the study, (iii) the expert selection criteria and required level of expertise, (iv) probable length of study, and (v) information about the submission of demographic information and queries (if any). The e-mail addresses of personnel were collected through official university web sites, formal requests to university authorities, and personal contacts.

Initially, it was decided that 60 personnel comprising five categories would be surveyed: faculty members, students, parents, administrative staff, and ICT policy makers, with two of each from Karachi, the biggest city and industrial hub of Pakistan; Islamabad, the capital city of Pakistan; and each of the four provinces: Punjab, Khyber Pakhtunkhwa, Balochistan, and Sindh. However, only 32 of those surveyed confirmed their participation through to the end of study. Therefore, based on the criteria laid down for the study (5 categories * 6 locations = 30, one person from each location→1*30=30, two persons from each location →30*2=60, i.e., the number of panelists could be 30, 60, 90 and so on), the responses of two redundant panelists were not included, resulting in a final survey of 30 panelists.

Delphi Round I began when a questionnaire was e-mailed to Delphi panelists with guidance on how to fill it out and submit it back to the Delphi organizers. The results of Delphi Round I were analyzed with the help of appropriate statistical tests such as statistical mean, standard deviation, percentages, etc., in order to measure the central point of the data set, variability in responses, and consensus level. In Delphi Round II, the group average (mean), standard deviation, and percentage of consensus on each particular issue/question were sent back to each panelist along with their previous ratings, and panelists were requested to review their responses with the group averages and once again rate each question/task, in order to achieve minimum level of variability in responses for further consensus. To grasp the overall understanding of issues, comments/suggestions on questions submitted by individual panelists in Round I responses were included in italic print against each question in Round II. Results of Delphi Round II were analyzed again against minimum variation in panelists' response rate on average (<0.5), which forced the Delphi organizers to stop the study at Round II and finalize/interpret results, as panelists had reached the required consensus level.

DATA ANALYSIS

In order to grasp the Delphi results, analysis of each question has been done in tabular form (Asymmetric Lambda) with appropriate statistical tests and bar graphs using the features of MS Excel (Table 1).

Table 1 Showing Round II analysis of Question 1

Question 1 (Present use)														
	Panelist Categories								Percentages				Consensus	
	Score	**A**	**B**	**C**	**D**	**E**	**Total**	**Score**	**Response**	**Participation**	**Mean**	**SD**	**Round off Mean**	**% USE**
Rating	5	0	0	0	0	0	0	0	0.0%	0.0%				
	4	1	3	3	5	3	15	60	51.7%	50.0%				
	3	3	1	3	1	2	10	30	34.5%	33.3%				
	2	2	2	0	0	1	5	10	13.8%	16.7%				
	1	0	0	0	0	0	0	0	0.0%	0.0%				
Total		6	6	6	6	6	30	100	100%	100%	2.93	0.45	3	50%

Participation percentage reveals panelists' interest level while attempting any question during each round of Delphi. Mean is calculated for two purposes, i.e., (i) to know at what point of the data set panelists agree on any particular issue, and (ii) in questions 1 through 15, the panel mean is rounded and mapped—e.g., 2.93=3.0=50%, 3.83=4.0=75%—in order to show panelists' consensus on the nature of that particular question. Panelists' consensus in questions 16 through 35 is calculated by summing the response percentages of strongly agree (i.e., score 5) and agree (i.e., score 4) rows. The standard deviation (SD) column calculates spread or variability in panelists' responses. In order to assume that this study reached a strong level of consensus, the minimum level of SD was set to 0.5.

The panel mean and SD calculated against each question of Round I were added to the Round II questionnaire so that each Delphi panelist could compare his/her rating with that of the panel mean, and either change his/her response if satisfied with the panel's point of view or retain his/her old rating and justify that properly (Table 2). Any important issues brought forward against Round I open questions were added to the Round II questionnaire and panelists were asked to rate them.

Table 2 Showing Question 1 of Round II

Planning, Developing & Organizing instruction		**Your Rating**	**Panel Mean**	**SD**	**% USE**	**5**	**4**	**3**	**2**	**1**
Lesson planning, reading online books, searching text using ICT tools and applications such as MS Office, Google.	Present		3	.73	50%					
	Future		5	.35	100%					
Comments from Round: Presently all the standard books are not available in soft format or online especially for the Basic engineering and science. For new technologies almost most of the resources are available online but not for basic sciences. So how can they fully rely on ICT, as most of their supporting material in teaching is paper-based. Give stress and make them goal / result oriented.										
I did not change my response to the Panel MEAN (CONSENSUS) response because _____										

To decide whether to go for Round III, the SD of each question in the Round II responses was checked against the required minimum level of variability (≤0.5). Most questions fell within the minimum level of variability during Round II analysis, and hence this study came to an end at Round II.

RESULTS

Table 3 describes the results of study in detail.

Table 3 Showing Delphi Round II results

#	**Description of Items**		**Round II results**			
	Tasks that Faculty/Students/Staff perform in their work		***Participation***	***Mean***	***SD***	***Consensus***
1.	Planning, Developing and Organizing instruction	Present	100%	2.93	0.45	50%
		Future	100%	5.00	0.00	100%
2.	Housekeeping and Record keeping Tasks	Present	100%	3.07	0.58	50%
		Future	100%	5.00	0.00	100%
3.	Managing Student Conduct	Present	100%	3.07	0.58	50%
		Future	100%	4.97	0.18	100%

4.	Presenting Subject Material / Teaching	Present	100%	3.13	0.43	50%
		Future	100%	4.97	0.18	100%
5.	Assessing Student Learning	Present	100%	2.97	0.49	50%
		Future	100%	4.87	0.35	100%
6.	Academic Research	Present	100%	2.90	0.40	50%
		Future	100%	5.00	0.00	100%
7.	Administrative Support	Present	100%	3.10	0.31	50%
		Future	100%	4.90	0.31	100%
8.	Meeting Professional obligations / self study: Using social networks/forums in quest of knowledge	Present	100%	3.03	0.49	50%
		Future	100%	5.00	0.00	100%
9.	Database/library research and information (IEEE, ACM)	Present	100%	3.20	0.41	50%
		Future	97%	5.00	0.00	100%
10.	Group discussion/supervision/training	Present	97%	2.21	0.56	25%
		Future	100%	4.93	0.25	100%
	Average Results of Questions (8-10) showing Present use	*Present*	*99%*	*2.81*	*0.49*	*42%*
	Average Results of Questions (8-10) showing Future use	*Future*	*99%*	*4.98*	*0.08*	*100%*
	Average Results of Questions (1-10) showing Present use		***100%***	***3.00***	***0.47***	***49%***
	Average Results of Questions (1-10) showing Future use		***100%***	***4.96***	***0.14***	***100%***
11.	Common ICT tools/applications	Present	100%	4.97	0.18	100%
		Future	100%	5.00	0.00	100%
12.	Educational/Research ICT tools	Present	100%	3.10	0.31	50%
		Future	100%	5.00	0.00	100%
13.	Rely on ICT		100%	4.07	0.25	75%
14.	Use of ICT		100%	4.07	0.25	75%
15.	Help by ICT		100%	4.00	0.37	75%
	Causes of deprived standard of HES of Pakistan					
16.	Poor distribution of ICT, lack of robust ICT policy		100%	4.53	0.68	87%
	ICT integration challenges that HEIs of Pakistan face today					
17.	*Education Policy and Planning:* Inadequate technological infrastructure		100%	4.40	0.67	90%
18.	Under funding, high cost of sustainability of the technology		93%	4.29	0.66	86%
	Average Results of Questions (17-18)		*97%*	*4.35*	*0.67*	*88%*
19.	*Expertise:* Staff training, lack of ICT experts, lack of ICT skills		100%	4.47	0.51	100%
20.	Language and educational content development		90%	3.93	0.77	89%
	Average Results of Questions (17-18,19,20)		***96%***	***4.25***	***0.65***	***92%***
	Reasons for delays in ICT integration in HEIs of Pakistan					
21.	Teachers' lack of ICT competencies		97%	4.47	0.57	93%
22.	Lack of money leading to limited access to computers and software		100%	4.60	0.50	100%
23.	Lack of creativity and unwillingness to change the running system		100%	4.53	0.51	100%
24.	Difficulty in linking ICT to the curriculum		100%	2.37	0.49	0%
25.	Needing ICT facilities in lecture halls rather than in computer labs		100%	4.30	0.60	93%
	Average Results of Questions (21-25)		***99%***	***4.05***	***0.53***	***77%***
	Suggestions for ICT-enhanced HES of Pakistan					
26.	Comprehensive guidelines, time-bound targets, political commitment		100%	4.65	0.55	97%
27.	Careful scrutiny of current state of HES		100%	4.61	0.50	100%
28.	Piloting of the chosen ICT-based model		100%	4.58	0.50	100%
29.	Specification of existing sources of financing		97%	4.65	0.49	100%
30.	Authorities should provide high tech ICT facilities and scholarships		97%	4.80	0.41	100%

31.	HES demands target-oriented, robust and effective ICT policy	100%	4.77	0.43	100%
32.	Effective ICT integration will brighten the future of HES of Pakistan	100%	4.80	0.41	100%
	Average Results of Questions (26-32)	***99%***	***4.69***	***0.47***	***100%***
33.	ICT Demand in HEIs	90%	3.12	0.61	75%
34.	ICT Supply in HEIs	93%	2.31	0.67	50%
35.	Problem of Attitude. Grabbing resources and misuse them.	93%	4.53	0.73	100%

When asked to rate the present and anticipated future use of ICT in Pakistan's HEIs (Questions 1–10), Delphi panelists rated present use as 49 percent and anticipated future use as 100 percent. The response rate achieved was around 99 percent in both rounds. In response to Questions 11 and 12, panelists rated common ICT use as 100 percent and educational/research ICT use as 50 percent presently, and predicted 100 percent use of both types of ICTs in the future. This study shows that 75 percent of panelists rely on ICT, 75 percent use ICT, and they believe that at most 75 percent help is being provided to them by ICT in their daily job routine tasks. Causes of the low standard of HEIs in Pakistan (Question 16) were rated 4.53 with 87 percent of panelists agreeing on these listed causes.

On ICT integration challenges (Questions 17–20), an 88 percent consensus with mean score of 4.35 for educational policy and planning challenges, 100 percent consensus with mean score of 4.47 for expertise challenges, and 89 percent consensus with 3.93 mean score for language and educational content development challenges was recorded. Seventy-seven percent of panelists showed their agreement with the listed reasons for delay in ICT integration (Questions 21–25). Suggestions for ICT-enhanced higher education and the future of Pakistan's HES (Questions 26–32) were rated 4.69 with 100 percent agreement. In response to open questions in Round I, only three new issues were brought forward: ICT demand and supply (Questions 33 and 34) were rated as 75 percent demand with only 50 percent supply. Attitude problems were suggested as one of the main causes of the low standards of higher education. This issue achieved 100 percent consensus (Question 35). Variability in responses (SD column) from higher values in Round I to lower values in Round II shows the consensus building process.

FINDINGS

Findings are based on the results of the study.

Currently, ICT is widely used in Pakistan's big-city HEIs, i.e., those in Karachi, Lahore, Peshawar, Quetta, Islamabad, etc., but when their use is measured throughout the whole country, this study reveals 50 percent use when compared with near-future (year 2019) or with developed countries. It is also assumed that educational/research ICTs are supposed to be used extensively in the near future, but unfortunately their current use is 50 percent. This study concludes that university personnel should use 75 percent ICT in their job-related tasks, should rely 75 percent on ICT (cutting out 25 percent due to local infrastructure, policy mechanisms and panelists' own confidence level with ICT) and that 75 percent help is being provided by ICT to university personnel in their job-related tasks.

Major causes of the low standard of higher education as suggested in this study are (i) poor or uneven distribution of ICT resources and infrastructure, (ii) high ICT expenditures and lack of money, (iii) poor or lack of robust ICT policy, (iv) incorrectly viewing ICT as a problem for organizational transformation, (v) not making ICT responsive to the organizational vision and mission, and (vi) developing a non-systemic method of implementation of ICT policy.

Panelists highlighted the inadequate technological infrastructure, under-funding and high cost of sustainability of the technology as educational policy and planning challenges. They suggested that lack of ongoing staff skills development training and lack of ICT competencies among support staff are challenges related to expertise, and they suggested that since a major portion of educational material is available online and is in English only, there is a need to develop material in local languages, which they identified as a language and educational content development challenge (Figure 1).

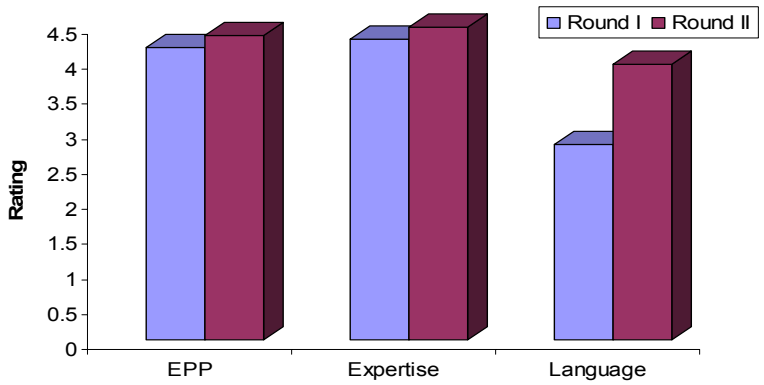

Figure 1. Showing panelists' consensus on ICT integration challenges faced by Pakistani HES

Reasons for delay in ICT integration in higher education include (i) teachers' lack of ICT competencies, as they take too little time to learn ICT skills; (ii) lack of money leading to limited access to computers and software; (iii) lack of creativity and willingness to change the system; and (iv) needing ICT facilities in lecture halls rather than in computer labs. However, it was not considered important that linking ICT to the curriculum is somehow very difficult (Figure 2).

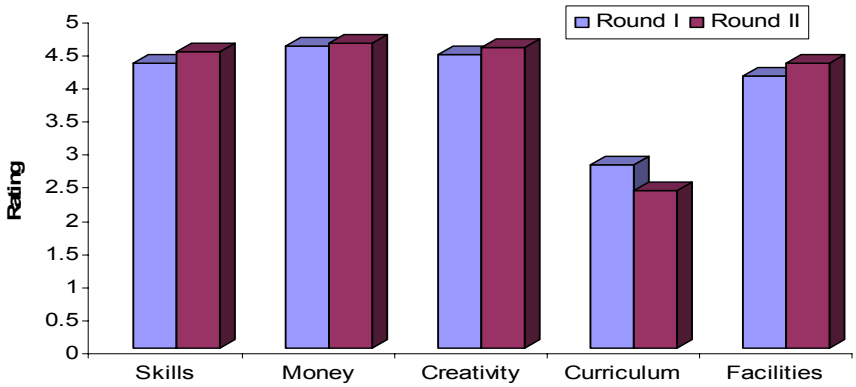

Figure 2. Showing panelists' consensus on reasons for delay in ICT integration

This study suggests (i) development of a systemic and politically committed method of implementation of robust, effective, and target-oriented ICT policies; (ii) adequate provision of technological resources such as fast and affordable internet connectivity, availability of the latest ICTs in higher education, sustainable availability of electricity and telephony, access to computers in schools and households, affordable teleconferencing facilities, free access to digital libraries, etc.; (iii) modifications in current higher education ICT curricula in order to emphasize both theoretical and practical uses of ICT; (iv) piloting the chosen ICT-based higher education model in order to pre-study potential problems in instructional/educational design, implementability, and usefulness; (v) careful scrutiny of the current state of HES, including curriculum, pedagogy, infrastructure, capacity-building, educational content, and ICT financing; (vi) developing sustainable strategies for arranging finances to support ICT over the long term, and (vii) identifying and harmonizing efforts among interest groups (Figure 3).

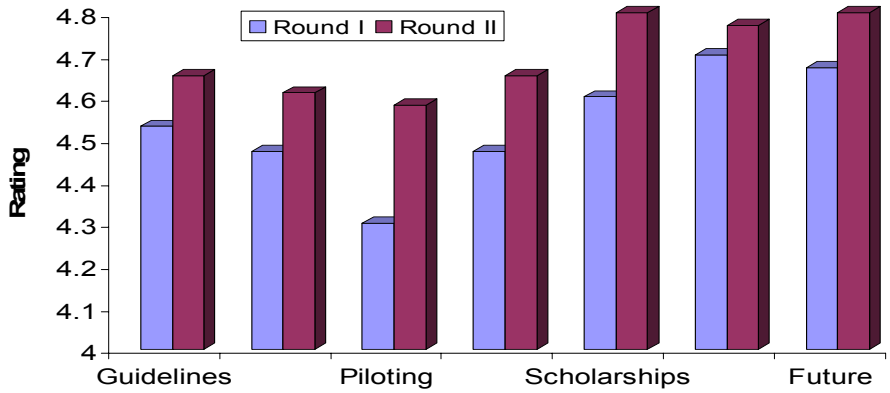

Figure 3. Showing panelists' consensus on suggestions for ICT-enhanced higher education

Panelists suggest that Pakistan's HES demands ICT policy with clear and explicit objectives, planned and time-specific targets, available resources, and political commitment. They identified a major gap in ICT demand and supply in HEIs, i.e., 25 percent. In their views, the current demand for ICT is 75 percent but only 50 percent is provided. This study shows strong agreement about attitude problems and comments that higher education authorities grab ICT resources but don't use them properly.

The overall variation in panelists' views is less than or equal to 0.5, which suggests that panelists reached a strong consensus level in Round II (Figure 4). In response to open questions, only three comments, i.e., ICT demand, ICT supply, and the problem of attitude were made, hence the majority agreed on the comprehensiveness of the Delphi questionnaire.

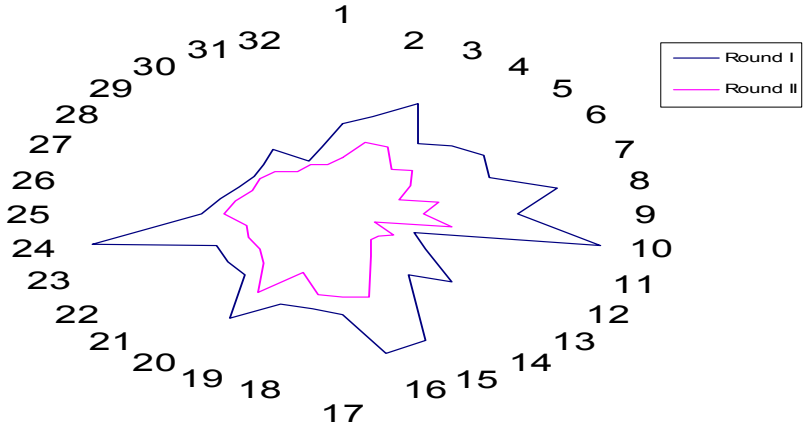

Figure 4. Showing consensus-building process among Delphi panelists

CONCLUSIONS

This study links ICT and the Pakistani HES with the aim of understanding needs, measuring growth, strengthening the relationship, coping with challenges, and, finally, suggesting solutions to problems.

Important global issues such as low ICT use in education, the demand for technology-ready workers, a lack of ICT facilities and infrastructure in workplaces, high ICT expenditures, and other problems specifically related to the Pakistani HES, such as poor distribution of ICT, lack of robust ICT policy, under-funding, teachers' lack of ICT competencies, etc., are reviewed at length in this study. Delphi panelists evaluated, discussed, and formulated their recommendations on these issues from the Pakistani perspective.

Suggestions pertaining to ICT-enhanced higher education and increased ICT use as proposed by the Delphi panelists in this study include: (i) provision of ongoing staff training in developing ICT skills; (ii) generating consistent finances to support ICT use over the long-run; (iii) developing a systemic and politically committed method of implementation of robust, effective, and target-oriented ICT policy; (iv) adequate provision of technological resources; (v) modifications in current higher education ICT curricula while emphasizing both theoretical and practical uses of ICT; (vi) piloting the chosen ICT-based higher education model; and (vii)

careful examination of the current state of HES, including pedagogy, curriculum, infrastructure, capacity-building, educational content, and ICT financing.

This study adds rigor in ICT policy and planning, administration, and integration at the higher education level and affirms that an effective and robust ICT policy for HES can change the current status of Pakistan as poor in terms of a knowledge-based economy to rich. The recommendations and empirical evidence collected from this study are important contributions to the literature.

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RECOMMENDATIONS
Keeping in mind the current and anticipated future ICT status of the Pakistani HES as reported in this study, ICT policymakers can use the results of this study as a roadmap to ICT-driven development. Since this study was administered to the real stakeholders—the students, parents, faculty members, admin staff, and policymakers of the Pakistani HES—its results can undoubtedly shape the future of Pakistan's higher education system.

A separate committee may be formulated to promote educational/research ICTs such as digital libraries, scholarly search sites, encyclopedias, manufacturing/design tools, programming languages, course management systems, learning management systems, web development tools, satellite imagery tools, etc., in order to overcome deficiencies in the use of education/research ICT tools. To meet 75 percent ICT use and the goal that university personnel should rely 75 percent on ICT, the authorities should take the right measures at the grass root level in order to increase the confidence level of university staff in ICT use.

Since the scope of this study was limited to the Pakistani perspective, countries (either developing or developed) with the same nature of ICT integration problems can map the results per their needs.

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THE COMPARISON OF THE EFFECT OF BLOCK FLUTE ACCOMPANIED SONG TEACHING WITH MULTI-SOUND NOTATION AND VOCALIZATION PROGRAM ACCOMPANIED SONG TEACHING ON THE SUCCESS OF STUDENTS' SONG LEARNING BEHAVIOR

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SUMMARY
This experimental study was done to see if using computer supported notation and vocalization program for teaching songs instead of using block flute accompanied song teaching has any significant effect on students' singing behavior. The study group is composed of the 5th, 6th and 7th graders of 2008-2009 educational term in T.O.K.İ. Yahya Kemal Beyatlı Primary School, Türkiye Yardımsevenler Derneği Primary School and Turan Primary School in Burdur province. The song titled "Bir Dünya Bırakın" was taught to randomly chosen pilot group of 5th, 6th and 7th graders accompanied by block flute and it was also taught to the experimental group accompanied by notation and vocalization program written in the stringed orchestra using aural-song teaching method for 10 minutes, then the students sang the song without any accompaniment one by one and these were recorded in the tape. In these recordings, the success rate of the experimental and pilot groups were evaluated separately by three experts in terms of singing the song in accordance with its melody, singing the song in accordance with its rhythm, singing the lay of the song in accordance with its rhythm, singing the song in accordance with its intonation and singing the song as a whole. The data were processed in the SPSS program, frequency was used to get the means and t-test was used to see the success differentiation between the two groups. When the data were analyzed, it was concluded that the experimental group had a higher level of success in all the five dimensions mentioned above. In the result of the study, it can be argued that teaching songs accompanied by multi-sound written in notation and vocalization program will bring a new aspect to music teaching, contributing easy application and higher success rate.
Keywords: Education Technology, Music Education, Song Teaching, Use of Technology

INTRODUCTION

Technological developments should be deployed to improve the quality of general music education as in all fields of education. Application of music Technologies in the classroom setting will improve the quality of general music education.

General music education is compulsory in the primary education curriculum in Turkey. In accordance with the constructivist approach Primary education Music class teaching program was updated and put into effect in 2006. In this program music class is taught by the class teacher till grade 4 and by a music teacher till grade 8.
In the graduate program of class teacher education departments, Music class is put in the curriculum of second grade of the university education. This causes inefficiencies for the class teachers teaching music class in the primary schools till grade four. On the other hand, music education departments in the universities have a comprehensive curriculum and content of music education in their graduate programs. The gap between the music education given by class teachers and the music education given by music teachers can be thought to be minimized through Music education Technologies.

Song Teaching

In accordance with the 28.08.06 dated and 348 numbered decision taken by Ministry of Education, Instruction and Training Committee, which was put into effect in 2007/2008 educational term, the aim of the music education in Primary schools in Turkey is to:
. improve aestheticism through music,
. enable students to express their emotions, ideas and experiences through music,
. improve creativity and competence through music production,
. get to know about local, regional, national and international music cultures,
. contribute to students' personality and self confidence development,
. enable students to improve their mental skills through music,
. help students improve individual and social relations,
. facilitate activities of singing, playing and listening to various types of songs both individually and in groups,
. improve students musical perception and knowledge,
. improve students' feelings of love, sharing and taking responsibility,

. have students possess musical culture and experience that will reinforce national unity and facilitate them to integrate into the world,
.have students comprehend Atatürk's ideas on the development of Turkish music and to educate students as individuals that are committed to Atatürk's principles and innovations by heart (MEB, 2008).

Besides music making, singing, playing musical instruments and doing other musical activities and improving individual creativity through music education, students develop behavioral skills of common culture formation, recognizing cultures of other societies, acculturating, making learning easy, repeating, reinforcing what they learn in other classes associating with music class.

Teaching songs is one of the most important dimensions of music education. The aim of teaching songs is to train students' voice, improve their musical audition and music making skills, so they can have a good musical development.(Bilgin.21004:286) The songs used in Music education are the biggest helper of the music teacher that enable students to have desired target behavior of music education (Bilgin.1992).

Çevik(1998); The basic element in verbal music is language. The composer makes use of language and the music of language while composing a piece. To perform a music piece verbally well depends on how well one knows the language in depth. With her remarks, she emphasizes that there is a strong inseparable bond between the language and music/song and both have mutual influence on each other.

Rudolph (2007); "Making music feeds the imaginations and allows children to achieve their full potential". The most important field in Music teaching, the aim of music education, is to teach songs. Each emotion and thought wanted to be conveyed is supported by the melody. The selection of the right and convenient song and teaching it using the right and convenient method are important.

Technology in Music Education

Use of music technology can supply the quality of music education. But the research shows that; "… students miss out on effective music education because of the lack of equity of access; lack of quality of provision; and, the poor status of music in many schools (Crawford,2009., Department of Education, Science and Training, [DEST] 2005:v). Almost all visual and auditory technological devices can be used in the related branches of music education. The Australian National Review of School Music Education (NRSME) put this point as: "Technology not only serves us, but also enables us to think in new creative ways—to achieve what was previously inconceivable" (MacDowell, 2005). Çakırer (2002) divided them into two groups as passive and interactive devices... The passive ones are TV, tape recorder, video, overhead projector, radio, etc. and the use of these passive devices with the computer or the use of the computer itself on its own, electronic organ and digital piano can be described as the interactive devices. The computer has the greatest impact on music education as a technological device. The hard and software play a big role in Music classes and their importance is growing day by day, so these technologies are an inevitable part of the 21st century music education (Levendoğlu, 2004).

In fact, use of technology in Music education enhances the quality of Music classes and has a positive impact on students, as well. Arapgirlioğlu (2003)" "Technology guides students to make their own music compositions actively with great joy, strengthening their creativity.

Some studies show that use of technology in music education (Yamaha Corporation Music Team, Aktaran: Arapgirlioğlu, 2003);
. increases student' success remarkably,
. helps students comprehend musical structures easily,
. creates a new study field for teachers,
. increases students' concentration,
. increases students' interest,
. provides an easy feedback of students' activities,
. gives students an opportunity to participate in music classes actively.

It is evident that application of technology in music education makes music classes more interesting for students, helps them become self-confident, provides more effective learning environment, and strengthens group work, has a positive impact on critical thinking and problem solving, helps music be comprehended in scientifically artistic dimension and helps students enjoy music classes more through active involvement.

Technological devices used in general music education are often used for listening to music in daily life. These technological devices also provide us with the advantage of making music.

The Aim of the Study
The aim of the study is to determine if there is a significant difference between the use of music instrument block flute and the use of notation and sound program in song teaching in music education at primary schools.

Importance of the Study
The study is important in terms of revealing the applicability of music technologies and their advantages besides conventional song teaching methods.

METHOD
Model Of The Study
The study has an experimental design with the pilot group. The design and the stages of the study are as follows:

Groups	Application	Evaluation
Experimental Group	Accompanied by notation and sound program	Observation
Control Group	Accompanied by block flute	Observation

Study Group
This study was done on randomly chosen 102 students in 5th, 6th and 7th grades at Burdur Toki Yahya Kemal Beyatlı Primary School, Turkish Charity Association Primary School and Turan Primary School in 2008-2009 spring term of education. 51 of these students represent the pilot group and the other 51 of these students represent the experimental group.

Data Collection
In this study, multi-sound arrangement of the song titled "Leave us a world" was made with the stringed orchestra using notation and vocalization program by the researcher. The researcher had the experimental group work on the arranged formation of the song for 15 minutes playing it accompanied by the notation and vocalization program through aural-song training method. On the other hand, the researcher had the pilot group work on the arranged formation of the song for 15 minutes playing it accompanied by a block flute in mono-sound through aural-song training. Afterwards, without accompaniment, each subject sang the song and their voices were recorded. An expert group of three experts evaluated and scored these recordings. The scoring was made in three stages as: Totally, Partly and None. The five dimensions considered in the evaluation are:

- Singing the song in accordance with its melody
- Singing the song in accordance with its rhythm
- Singing the lay of the song in accordance with its rhythm
- Singing the song in accordance with its intonation
- Singing the song as a whole

1. Singing the piece of song in accordance with its melody:
This dimension was evaluated in terms of singing the piece of song in accordance with its melody.

2. Singing the piece of song in harmony with its rhythm:
This dimension was evaluated in terms of the singing of the piece of song in harmony with its rhythm.

3. Singing the lay of the song in accordance with its rhythm:
This dimension was evaluated in terms of the singing the lay of the song in accordance with its rhythm.

4. Singing the piece of song in accordance with its intonation:
This dimension was evaluated in terms of the singing of the piece of song in accordance with its intonation.

5. Singing the piece of song as a whole:
This dimension was evaluated in terms of the students' perception of the song as a whole and his/her singing it without pausing or hesitating.

Data Analysis
All the data was processed in SPSS program. The average percentage and frequency values related to the experts' evaluations on the experimental and pilot group are considered in five dimensions. Then, the data got processed in Independent-Samples T Test to see if there are significant differences between each other.

FINDINGS AND COMMENTS

The findings of the study are given below.

Table 1. T-Test Related to the Behavior of Singing the Song In Accordance with its Melody

Group	N	$\overline{X}$	S	t	sd	p
Experiment	51	2.59	0,49	11.66	100	0,000
Observation	51	1.48	0,46			

Table 1 shows that in the analysis of behavior of "singing the piece of song in accordance with its melody", there is a significant difference in favor of the experimental group in comparison to the pilot group [t= 11.66; p< 0.05]. So, it can be argued that the accompaniment method applied in the experimental group is more effective in teaching the behavior of "singing the song in accordance with its melody".

Table 2. T-Test Related to the Behavior of Singing the Song in Accordance with its Rhythm

Group	N	$\overline{X}$	S	t	sd	p
Experiment	51	2.90	0,25	12.95	70.12	0,000
Observation	51	1.79	0,55			

Table 2 shows that in the analysis of behavior of "singing the piece of song in accordance with its rhythm", there is a significant difference in favor of the experimental group in comparison to the pilot group [t= 12.95; p< 0.05]. So, it can be argued that the accompaniment method applied in the experimental group is more effective in teaching the behavior of "singing the song in accordance with its rhythm".

Table 3. T-Test Related to the Behavior of Singing the Lay of the Song in Accordance with its Rhythm

Group	N	$\overline{X}$	S	t	sd	p
Experiment	51	2.90	0,25	13.03	70.39	0,000
Observation	51	1.79	0,55			

Table 3 shows that in the analysis of behavior of "singing the lay of the song in accordance with its rhythm", there is a significant difference in favor of the experimental group in comparison to the pilot group [t= 13.03; p< 0.05]. So, it can be argued that the accompaniment method applied in the experimental group is more effective in teaching the behavior of "singing the lay of the song in accordance with its rhythm".

Table 4. T-Test Related To the Behavior of Singing the Song within Its Intonation

Group	N	$\overline{X}$	S	t	sd	p
Experiment	51	2.48	0,60	11.93	92.01	0,000
Observation	51	2.24	0,44			

Table 4 shows that in the analysis of behavior of "singing the song within its intonation", there is a significant difference in favor of the experimental group in comparison to the pilot group [t= 11.93; p< 0.05]. So, it can be argued that the accompaniment method applied in the experimental group is more effective in teaching the behavior of "singing the song within its intonation".

Table 5. T-Test Related to the Behavior of Singing the Song as a Whole

Group	N	$\overline{X}$	S	t	sd	p
Experiment	51	2.86	0,29	10.00	71.48	0,000
Observation	51	1.90	0,62			

Table 5 shows that in the analysis of behavior of "singing the song as a whole", there is a significant difference in favor of the experimental group in comparison to the pilot group [t= 10.00; p< 0.05]. So, it can be argued that the accompaniment method applied in the experimental group is more effective in teaching the behavior of "singing the song as a whole".

RESULTS

The findings of the study lead us to the following results.

Instead of using the block flute as an accompaniment instrument in teaching songs, using multi-sound accompaniment prepared in the computer is more effective in teaching the behavior of "singing the song in accordance with its melody".

Instead of using the block flute as an accompaniment instrument in teaching songs, using multi-sound accompaniment prepared in the computer is more effective in teaching the behavior of "singing the song in accordance with its rhythm".

Instead of using the block flute as an accompaniment instrument in teaching songs, using multi-sound accompaniment prepared in the computer is more effective in teaching the behavior of "singing the lay of the song in accordance with its rhythm".

Instead of using the block flute as an accompaniment instrument in teaching songs, using multi-sound accompaniment prepared in the computer is more effective in teaching the behavior of "singing the song within its intonation".

Instead of using the block flute as an accompaniment instrument in teaching songs, using multi-sound accompaniment prepared in the computer is more effective in teaching the behavior of "singing the song as a whole".

DISCUSSION

Song teaching is an important dimension of general music education and has an impact on students' musical development. Using the right song teaching method helps students have a desirable musical behavior. There are few music classrooms in the primary schools in Turkey, but there are technology classrooms or computer classrooms with sound systems in them. Computer supported notation and sound programs that are adjusted in speed and volume can fill the gap of rarely available multi-sound instruments like piano, organ, etc… in music classes, so it can have a positive effect on students' musical success.

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THE EFFECTS OF TEXT DENSITY LEVELS AND THE COGNITIVE STYLE OF FIELD DEPENDENCE ON LEARNING FROM A CBI TUTORIAL

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ABSTRACT
The purpose of this study was to investigate the effects of variations in text density levels and the cognitive style of field dependence on learning from a CBI tutorial, based on the dependent measures of achievement, reading comprehension, and reading rate, and of lesson completion time. Eighty college undergraduate students were randomly assigned to text density levels, after being assigned to three cognitive style groups: field dependent, field neutral, and field independent, based on their Group Embedded Figure Test scores. Instruction was delivered by means of two versions of a CBI tutorial: low density text and high density text. A two-way analysis of covariance was used to investigate whether there are main effects and interactions between the cognitive style of field dependence and text density levels. In order to control statistical power and to equate the treatment groups, Nelson-Denny Reading Comprehension Test scores were used as a covariate. The analysis of regression coefficients between text density type and dependent variables and between field dependence and dependent variables were shown in tables. Although the findings show non-significance in formal tests of hypotheses, a preference for the high-density level was found. Then, the interaction effects between field dependence and text density levels on dependent measures were clarified. Six research questions converted to statistical hypotheses were tested according to the factorial design model. Specifically, the tests of hypotheses generated discussion and conclusions were given at the end of the study.
Keywords: Text density, Cognitive styles, Field dependence, Computer-based instruction, Learning

INTRODUCTION

Theoretical and technological advances in the areas of psychology, learning, and computer technology have intertwined to produce the developing field of computer based instruction (CBI), which is a delivery format that teaches via a computer program. Early CBI tutorials were created according to behavioral models. However, tutorials based solely on the behavioral model did not account for individual differences in terms of aptitudes or cognitive styles. The move toward the use of cognitive models by psychologists has resulted in the need to find new methods of presenting information, in particular, the need for designing text layout that facilitates the learning process (Grabinger & Amedeo, 1988) and text density in learning objects (Akpinar & Simsek, 2007).

Recently, text design levels from print materials to computer screens have been developed to find new methods of presenting information strategies and text content that provide an effective visual design with new technologies. As a part of screen design, text density on the computer screen is vital to providing an effective learning environment in CBI and network systems, such as the World Wide Web (WWW) or hypertext and hypermedia systems (Wiebe & Annetta, 2008). A computer has a limited screen to present data or information. Computer text offers less flexibility than books do in the presentation of text (Morrison, Ross, O'Dell, & Schultz, 1988a; Morrison, Ross, & O'Dell, 1988b; Ross, Morrison, & O'Dell, 1989; Grabinger, 1983; Grabinger & Amedeo, 1985, 1988). Because of these reasons, designers and technologists must be aware of these technological and instructional needs for designing text density levels as well as presenting information. Text presentation and writing styles are important points for designers. Principles for using text in hypermedia emphasize clear communication, legibility and motivation (Grabe & Grabe, 2007).

Text density is a construct for manipulating and reducing the number of words in a text without loosing its main idea. In this study, text density is defined as the number of words and meaningful information in a text (Schultz, 1989; Morrison et al., 1988b). In general, high-density text contains more words than low-density text but may convey the same basic meaning (Ipek, 1995a). Variations in text density levels may effect the interaction between perception and communication, which deals with the reduction of information time and the number of words in a text. Text density is significantly related to manipulating the content, the presenting time, and reading skills. Furthermore, there is no research on learning from CBI tutorials to indicate a relationship between text density type and field dependence for instructional variables. Recently, there is no research on web based instruction or internet based instruction related to text density concepts as indicated here.

These limitations suggest that research is needed regarding variation in text presentation levels on the computer screen. Further research is also needed to investigate how learners with different cognitive styles are affected by different text density displays according to their reading, comprehension, and perception skills (Ipek, 1995a, 2001). To develop text density levels, we need a clear definition of text density in CBI and multimedia systems for future software and instructional designers (Pastore, 2008; Veronikas, S. & Maushak, N. 2005; Yang, 2000). This study may result in an acceptable definition of text density for the future research, instructional, and technological environments with new technologies.

Different Approaches of Text Density Levels in the Literature

Text density consists of two or more levels, such as low density and high density, or control levels. These density levels are determined based on how much the information content has been reduced or the percentage of information that has been presented. In brief, the number of characters or number of words is used as density criteria in a text (Schultz, 1989; Morrison et al., 1988b). Low-density text materials are generated from conventional text by 1) defining a set of rules for shortening the text, 2) having different individuals apply the rules to the rewriting of the text, and 3) requiring those individuals to arrive at a consensus on the final content (Morrison, O'Dell, Ross, Schultz, & Wheat, 1989a; Morrison et al., 1988a, 1988b). Low-density text is modified text based on the number of characters or the number of words in a text. High density indicates the actual text, but it can also refer to text reduced from print materials, because research indicates that text density levels are on a continuum (Schultz, 1989; Morrison et al., 1988b). Learner control is an important factor to investigate when exploring the effectiveness of the text density variable, because "the text density variable represents a contextual lesson property that primarily influences how lesson material appears without changing its basic informational content" (Morrison, Ross, O'Dell & Schultz, 1988c, p. 68). Text layout goes beyond writing style and statement length to encompass the placement of text on the screen and the appearance of the text itself. Text design is based on special characteristics (fonts, bold type size) and text display (Grabe & Grabe, 2007).

In another study, Grabinger & Amedeo (1988) suggested that the idea of text density is related to the meanings among words between the actual text (nominal stimulus) and a reader's representation (effective stimulus). Effective stimulus refers to the integration of information, either within an existing schema or by creating a new schema (Grabinger & Amedeo, 1988; Morrison et al., 1988b; Neisser, 1976). Nominal stimulus refers to the environment (actual text) and to meaningful information in a text. Written text presented on a computer screen is an example of a nominal stimulus that is also high-density text (Morrison et al., 1988c; Grabinger & Amedeo, 1988).

Koroghlanian & Sullivan (2000) studied the effects of audio and text density levels such as text only, full text-full audio, or lean text-full audio in achievement. They found no significant difference in achievement between the three treatment groups, however there was a significant difference in learning efficiency, with the text only group requiring significantly less instructional time and achieving as well on the posttest as each of the other two groups. In addition, both high text density and relevant animation seemed to create high load conditions for visual attentional distribution in multimedia instruction (Pastore, 2010; Wiebe & Annetta, 2008). In addition, presenting learners with audio and visuals is preferred to presenting text and visuals when the verbal and non-verbal representations explain for one another (Low & Sweller 2005).

Meaningful learning in the classroom is based on the learning environment, instructional materials, learner perceptions, and course objectives. Moreover, interactions based on theoretical research findings need to be considered. According to two different approaches in text density studies, the interactions in text density levels were found to be similar and to support each other to make connections between past and current research. These connections are given in Figure 1 (Ipek, 1995a).

Chunking separates a sentence into phrases or idea units through the use of increased space or special cues. The aim of the chunking process is to facilitate the connections of meanings among words between high-density (actual) and low-density (modified) text (Grabinger & Amedeo, 1988). For the purposes of this study, our understanding of actual text and modified text can remain as high density and low density respectively. Paragraph organization deals with hierarchical organization and systematic organization. As indicated by Reynolds (1979), "comprehension will be affected not only by the content of text, but also by its visibility and perceptibility and by the verbal capacity and intelligence of the reader" (p. 312).

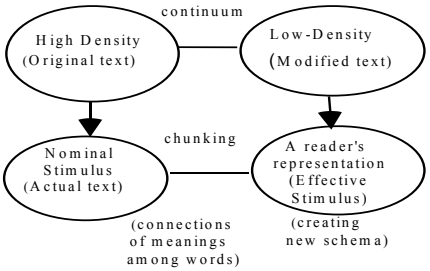

Figure 1 Interaction of Different Approaches in Text Density levels

When information in CBI is presented in a format that must be read, reading speed and reading rate are important learner characteristics in the learning process and multimedia design (Stemler, 1997; Veronikas & Maushak, 2005). The meaning among words must be held constant to manipulate the context of the information presented (Morrison et al., 1988a, 1988b). Grabinger & Amedeo (1988) indicated that "reading, being a perceptual skill, involves not only attending to a stimulus, but also encoding that stimulus in a meaningful manner and cognitively integrating its information with existing knowledge or prior experience for assessing its meaning" (p. 190).

The research on text format variables has focused primarily on the attention phase of the perceptual process. But certain limitations are imposed on comprehension when the main text is read from a computer screen, because perception is a cycle that reacts to nominal and effective stimuli (Neisser, 1976). According to the view of Neisser (1976), the perceptual action consists of three factors: available information (actual environment), schema, and exploration. These factors provide the perceptual cycle, which includes modifications, directions, and samples in this process (Neisser, 1976). Based on these considerations, the "cognitive link between reading and perception is important because it defines a psychological area that may be used to identify processes used by readers in perceiving CRT text, and it sets as a design objective the accurate translation of a nominal stimulus into an effective stimulus" without losing its original idea in a text (Grabinger & Amedeo, 1985, p. 2).

Information Processing and Cognitive Style in Text density Research

One of the most important aspects of visual communication is perception. Perception deals with the awareness of objects in a learning environment. The act of human information processing in psychology provides a foundation for interface design. The human-computer interface is a communications channel between the user and the computer. The interface includes both physical and conceptual components. Physical components include input devices such as mice and touch panels and output devices such as visual displays and sound. Conceptual components include selection methods, such as menus or direct manipulation and representation schemes such as screen layout and mixtures of graphics and text (Marchionini, 1991). During information processing, 1) learners have a working memory limited in the information it can store, 2) learners must have their attention refreshed frequently, and 3) recalling information requires more cognitive effort than recognizing information (Ipek, 2010).

The present study follows and supports the investigations conducted by Ross, Morrison & O`Dell (1989, 1988a, 1988b). A high density version of the CBI, patterned after all of the original textbooks were reviewed. Its total length was 147 (card) frames in a HyperCard program. Within each lesson, the basic instructional orientation involved the definition of the main idea and its application with several examples. For this reason, several criteria were described: text should have a main idea, and its content should be interesting for the learner and should be tested by a given test item. Based on these rules, a text on volcanoes and volcanic activity was designed, in terms of the development of the CBI tutorial, to provide an interaction between text and reader (O'Dell, 1988a, 1988b; Morrison et al., 1988a, 1988b). Both this study and old studies deal with the effects of text density levels on achievement and instructional displays. However, Ross et al. (1988a, 1988b) and Morrison et al. (1988a, 1988b) were interested in print and computer material as group levels. This study, however, focuses on the interaction between the cognitive style of field dependence and text density levels in CBI lessons. To accomplish this, cognitive styles of college students were classified to determine their individual learning characteristics. Then, the combination of CBI text density considerations was analyzed to examine student achievement in reading comprehension, completion time, and learning from a CBI tutorial.

In another study, Ross et al. (1988a) suggested that text density level in content information provides attributes in organization and elaboration for different cognitive styles. When learners witness an event, it is likely that

each learner will describe a somewhat different experience. Their responses are a result of their individual perceptions, which are influenced by differences in gender, cognitive styles, social interactions, interests, achievements, learning styles, and abilities (Witkin, 1976). The individual differences in the ways in which information is organized and processed are known as cognitive styles.

Messick (1976) identified more than 20 cognitive styles. This study will deal with only one style: field dependence. According to Messick (1976), a field-independent person tends to articulate figures as being discrete from their backgrounds and can more easily differentiate objects from the embedded context, whereas a field-dependent person tends to experience events globally. Similarly, Jonassen (1989) indicated that the field-dependent learner views information on the computer screen globally. This definition of field dependence suggests a link between text design—specifically, text density layout—and the cognitive style of field dependence.

DEFINITION OF TERMS

Cognitive Style: Messick (1976) described cognitive styles as "information processing habits representing the learner's typical mode of perceiving, thinking, problem solving, and remembering" (p. 14). Moreover, "they are conceptualized as stable attitudes, preferences, or habitual strategies determining a person's typical modes of perceiving, remembering, thinking and problem solving" (Messick, 1976, p. 5). This study is concerned with the cognitive style of field dependence.

Field Dependence (FD): According to Goodenough & Witkin (1977), field dependence is “the tendency to rely on external referents”, whereas field-independence is “the tendency to rely upon internal referents” (p. 189). Field dependence is marked by a propensity for making intuitive responses that are affected by contextual factors, without determining the relevance of these factors. For this study, field dependence levels were determined as field dependent (FD), field neutral (FN), and field independence (FI), based on GEFT scores. Students who achieved one-half standard deviation below the mean were classified as field dependent, and those in the middle were classified as field neutral (FN) (Dwyer & Moore, 1991, 1992, 1994; Ipek, 1995b; Lee, 1994; Moore & Dwyer, 1991).

Field Independence (FI) is marked by a tendency to distinguish and coordinate items extracted from complex backgrounds that may be confusing to others. For this study, students who achieved one-half standard deviation above the mean were considered to be field independent (FI).

Achievement: is the level of knowledge or skill assessed by individual pretest and posttest scores on a CBI tutorial, by completion time of lessons, and by reading comprehension and rate.

Screen Design: "Screen design is defined as the purposeful organization of presentation stimuli in order to influence how students process information" (Hannafin & Hooper, 1989, p. 156).

Text Screen Design*:* Text screen design is a part of computer screen design. It consists of two parts: text density and screen density (Morrison et al., 1989a, 1989b, 1988a, 1988b, 1988c; Ross et al., 1988a, 1988b).

a. Text Density*:* Text density manipulates the context of the information presented. It deals with the relationship between characters and blank spaces on a computer screen (Schultz, 1989). Text density variables include such attributes as length of material (number of words), redundancy of ideas, and depth of conceptual support for the main ideas (Morrison et al., 1989a, 1989b). For this study, text density criteria include details of content, richness, the main idea, key words, and correct responses for each test item in the CBI.

b. Screen Density*:* Screen density indicates how much information the expository frame should contain on the screen. It considers the "measurement of the amount of information presented at one time on the screen" (Morrison et al., 1989a, 1989b).

Time Spent for a CBI tutorial*:* is the amount of time for completing a CBI geology tutorial. It includes how much time each student spent on learning from the CBI tutorial. Time spent for CBI lessons was recorded on a computer.

Creating Text Density Levels

A low-density text version of CBI, patterned after all rules for the text density were examined. The low-density version was developed by (a) defining a set of general rules, (b) having at least three graduate students who were interested in geology discuss the rules and the interaction between objectives and test items in a text, and (c)

reviewing all materials until consensus was achieved that all criteria were satisfied. The rules in this study were as follows:

- Reduce sentences to their main ideas.
- Delete sentences or words that summarize without presenting new information.
- Use available words or articles to reduce text information without loosing the main idea.
- Discuss details, ideas, and objectives of lessons.
- Present information to be tested by administrated, objective test items.

Finally, a presented text has enough density to be correctly responded to for each test item in two versions (Morrison et al., 1989a, 1989b, 1988b).

The completed low density version consists of 147 modified frames in a HyperCard tutorial. The CBI version of low density lessons was prepared directly from the high density version. Objectives of lessons, a number of practices, pretest, and posttest items were conducted via the same strategy. This study did not deal with the content of geology or its contexts. Also, the amount of learning from different text density types in the tutorial permitted the testing of the research questions that were converted to hypotheses.

A high density version of the CBI, patterned after original textbooks, was reviewed. Its total length was 147 (card) frames in a HyperCard program, in a low density version. Within each lesson, the basic instructional orientation involved defining the main idea and its application with several examples. For this reason, several criteria have been given for both text density styles: a text should have a main idea, its content should be interesting for the learner, and its content should be tested by a given test item. Based on these rules, a text about volcanoes and volcanic activity was designed, in terms of the development of the CBI tutorial, to provide an interaction between text and reader. The study was limited to variation in low density and high density styles.

Low-Density (modified) Text: Low density text indicates computer text that is modified and reduced from the original text. It refers to the integration of meaningful information without losing its content (Grabinger & Amedeo, 1988; Morrison et al., 1989a, 1989b, 1988b). For this study, the CBI version of low density text was created by the researcher from a high density version, by controlling the text-density criteria mentioned before; it was reviewed by three graduate students and was validated by faculty members who taught a fundamental geology course and who are experts in the development of CBI tutorials. In general, high density text was modified from 35% to 40% for each low density text frame.

High-Density (actual) Text: High density text, in general, refers to meaningful information and printed text. Printed text is an example of high density text. In print media, pages are usually arbitrary points for dividing text (Grabinger & Amedeo, 1988; Morrison et al., 1988b, 1989a). High-density text is defined as a nominal stimulus that indicates environment (actual text). The difference between nominal stimulus and effective stimulus is based on the amount of information in a perceptual cycle (Neisser, 1976; Grabinger & Amedeo, 1988). For this study, the CBI version of high density text was created by the researcher from the printed materials.

RESEARCH METHODOLOGY

Purpose: The purposes of this study are to determine if a main effect exists between variations in text density levels on achievement in a CBI tutorial, on the completion time of CBI lessons, and on reading comprehension and reading rate scores. Furthermore, to determine if an interaction exists between variations in text density levels and the cognitive style of field dependence (1) on achievement levels in a CBI geology tutorial, (2) on completion time of the CBI tutorial, and (3) on reading comprehension and reading rate.

RESEARCH QUESTIONS

This study focuses on the effects of variations in text density levels on student achievement in a geology tutorial, on reading comprehension, and on completion time of lesson outcomes. The following research questions were formulated after a review of the relevant literature:

1. Is there a significant main effect between text density levels (a low density versus a high density) on achievement in a CBI tutorial?
2. Is there a significant main effect between text density levels (a low density versus a high density) on the completion time of a CBI tutorial?
3. Is there a significant main effect between text density levels (a low density versus a high density) on the reading comprehension scores?
4. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) as measured by achievement in a CBI geology tutorial?
5. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) in terms of completion time of the CBI geology tutorial?

6. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) in terms of reading comprehension scores?

RESEARCH DESIGN

Procedures: This study utilizes a (2x3) ANCOVA factorial design. Each research question was analyzed by factorial experiments and correlations. To accomplish this, a design model was used to test hypotheses, without which the analysis may not have been controlled between parameters.

A two-factor experimental research design was employed (Freed et al., 1991). In this case, one factor is the treatment variable of text density level, which includes low density (LD) and high density (HD). The second factor is the level of cognitive style. The cognitive style levels were identified as field independent (high), field neutral-FN, and field dependent (low). Field dependence (low) is demonstrated by achieving scores (low scores (scores < $6(X-0.5\sigma)$) on the Group Embedded Figure Test (GEFT), and field independence (high) is demonstrated by achieving scores (scores $\geq 11(X+0.5\sigma)$ students achieving scores ($6\leq$ scores$<11(X\pm0.5_{\sigma})$ were considered to be field-neutral in the study. The test takes approximately 20 minutes for a participant to complete. Materials created by the researcher were used to facilitate and examine the performance of students. The GEFT results are summarized in Table 1. The study employs a randomized blocks design and assumes three cognitive style blocks of participants in the experiment as a fixed-effect model. Stratified randomization was used to assign participants to treatment groups.

Evaluation of the CBI geology tutorial was done in three steps: quality check list, pilot testing, and validation (Alessi & Trollip, 1991; Ipek, 2001). The CBI geology tutorial was reviewed by 20 graduate students who were taking a CBI development and applications course in the School of Education at the University of Pittsburgh and by 15 undergraduate students at the Faculty of Humanities and Letters and the Faculty of Business Administration at Bilkent University in Turkey. In addition, pretest and posttest instructional materials were pilot tested using a group of five graduate students. The process was conducted based on formative evaluation.

Participants: Eighty college freshman students at Bilkent University in Ankara, Turkey, were randomly assigned to text density levels, after being assigned to three cognitive style groups (FD, FN, and FI). The GEFT was used to determine their cognitive style levels as FD, FN, or FI. All participants were volunteers. They were in different programs and not in a geology program, their native language was Turkish, and English was their second language. Instruction at the University was in English.

Table 1. Means and standard deviations on GEFT scores (n = 80)

	n	Mean	Std. Dev.	Std. Error	Min.	Max.
Sex						
male	20	9.65	4.63	.598	1	18
female	60	7.71	4.63	1.221	1	18
TD						
LD	40	8.2	5.0	.798	1	18
HD	40	8.1	4.8	.757	1	18
FDI						
FD	29	3.4	1.4	.261	1	5
FN	26	7.7	1.9	.371	6	10
FI	25	14.2	2.7	.533	11	18

Research Variables: Independent variables of the study were the levels of field dependence and text density levels. Dependent variables were achievement in geology, completion time of lessons, and reading comprehension.

RESEARCH MATERIALS (Instruments)

CBI Versions of Lessons (Tutorial): CBI versions of the high- and low-density lessons were prepared directly from the print materials for a fundamental geology course in general studies at the University of Pittsburgh. For this research, the geology tutorial included three lessons covering types of volcanoes and volcanic eruptions. To create CBI lessons, a hyperCard/hypertalk program was used. Each lesson included subcategories to elaborate the instructional menu. The final versions of the low- and high-density CBI lessons consisted of 147 modified (low density) and 147 actual text (high density) frames, respectively. The CBI tutorial materials were used to measure dependent variables and their effects.

Group Embedded Figure Test (GEFT): This is a version of the Embedded Figures Test (EFT). It can be used for group administration to measure the FD of students (Witkin et al., 1971; Goldstein & Blackman, 1978). For this study, GEFT was administered in a 20-minute testing session. The test contained 3 sections: the first section, with 7 simple items, and the second and third sections, each of which contained 9 more difficult items. The reliability was r= .82. The validity with criterion variable was found to be in the range of .63 to .82.

Pretest: A pretest was given to determine the learner's experience in the fundamentals of geology. To provide additional support for this, learners' backgrounds and experiences with related courses was used to ascertain their knowledge about the subject. The pretest and other criteria were used to control and eliminate these negative effects between treatment groups. The test consisted of ten items. These items are considered to test prior knowledge and incoming information about a text. As a result, the internal consistency reliability of the test was calculated by the KR-20 formula and reached this result: (r_{xy}=.52).

Reading Test: The Nelson-Denny Reading test (form E or F) (Brown, 1981) was administered to assess student reading comprehension and reading rate.

Posttest*:* A posttest was used to define improvements and achievement levels in geology for text density in the CBI tutorial. Field dependent learners have different achievement scores in class, according to the literature. There is a factor that is defined such as text density levels. The posttest results were evaluated to define the effects of text density levels in learning for field dependent learners. There were a number of indications for the content, text style, objectives, and cognitive effects in the instructional process. Additionally, the posttest questions were written and adapted from the test banks of fundamental geology textbooks for the general studies program. For this reason, test items for this study had high reliability and validity. KR-20 Internal consistency reliabilities of the total test were calculated. The reliability of the posttest was found to be r_{xy}=.65. The total test consisted of 15 items. To prepare the posttest, the crosstabulation table was conducted in two dimensions for objectives and content. After writing objectives, the researcher decided how many test items were necessary to control for objectives reached for a text in CBI. In accordance with the testing literature, each objective was examined by at least one or more test items to support a text density approach. Each CBI version of high and low density lessons was developed based on the cognitive objectives of the text.

DATA GATHERING PROCEDURES

Learners were provided with either a low density (LD) text or a high density (HD) text presentation. A computer lab at Bilkent University was used to complete the study and gather information. Before beginning the lessons, participants were given the GEFT to define their cognitive styles. This test has a firm research base, is inexpensive, and is usable for group administration. Researchers have found high validity and reliability sores on the GEFT (Witkin et al., 1971; Witkin & Moore, 1974). Participants were then randomly assigned to treatment groups, as seen in Figure 2. The pretest was administrated before presenting the CBI lessons. The CBI lessons were then presented and taught for an hour in a week at the computer lab using Macintosh computers. The lesson time varied across participants. No time limitation was imposed for studying with either CBI version. The time was recorded by the program. The reading comprehension tests were given to determine student reading comprehension and reading rates. Upon completion of the CBI lessons, participants took an achievement test in the CBI tutorial. The computer program automatically recorded lesson completion time and the scores of the posttest achievement on each multiple-choice item.

DATA ANALYSIS

The first step in analyzing the results of a factorial experiment is usually to gather complete descriptive statistics for a group representing each combination of factors. The mean score of the students on problems representing each of the six combinations (cells) of factors are shown. In addition, correlations between variables and treatment groups were calculated by the Pearson-product-moment correlation matrix.

The next step in analyzing the results of this experiment was to perform an analysis of covariance (ANCOVA) and—using the Nelson-Denny Reading Comprehension Test (N-DRCT) score as a covariate—regression analysis to determine whether the differences between mean scores were statistically significant. If there were differences between at least two groups, according to F ratios, the t test was used to compare treatment groups. As a result, all null hypotheses were tested by F tests to consider the effectiveness or effects of independent variables on dependent variables in the study.

Based on these considerations, a series of two-way analysis of covariance (ANCOVA) was used to test the mean differences of achievement, reading comprehension, reading rate, and lesson completion time for the cognitive style of field dependence (FD/FN/FI) and the text density level (LD/HD) as two independent factors. In order to

control statistical power and to equate the treatment groups (LD/HD), the Nelson-Denny Reading Comprehension Test (N-DRCT) scores were used as a covariate. The correlation between the N-DRCT and achievement scores and the GEFT scores were used to interpret reading comprehension scores for predicting the scores of dependent variables and the effectiveness of independent variables on dependent variables.

For the present study, all statistical analyses were done using a statistical package for Social Sciences (SPSS for Unix version 6.1) on the mainframe, at the Bilkent University Computer Center. To check the validity and the power of prediction, simple regression and Pearson-product-moment correlation coefficients were calculated for the two measured variables using StatView 512+™. In addition, reliability and validity were reviewed for the instructional materials using a covariate measure and judge validity, respectively. The mean differences of dependent measures were analyzed to clarify the main effects by using regression analysis, ANCOVA, and ANOVA. Next, the interaction effects between field dependence and text density levels on dependent measures were clarified. The six research questions converted to statistical hypotheses were tested according to the factorial design model.

RESULTS AND FINDINGS

The purpose of the study was to investigate the effects of text density levels and the cognitive style of field dependence on learning from a CBI tutorial, based on the dependent measures of achievement, reading comprehension and reading rate, and completion time of lessons. Materials created by the researcher were used to facilitate and examine the performance of students. The independent variables were the levels of cognitive styles (FD/FN/FI) and text density levels (LD/HD). Table 2 presents the means and standard deviations achieved by students in the different treatment categories on the criterion measures such as pretest-posttest (gain) and reading comprehension.

Table 2. Means and standard deviations on criterion measures for participants in treatments

Field Dependence			Achievement Scores		N-DRCT Scores	Time (sec.)
			Gain	Post		
LD						
FD	N=14	M	1.50	3.86	31.0	2432
		SD	1.78	2.14	8.22	552
FN	N=13	M	1.69	4.92	33.3	3378
		SD	1.84	1.44	6.39	1194
FI	N=13	M	2.46	5.46	34.0	2637
		SD	2.33	1.85	7.83	861
Total	N=40	M	1.88	4.72	32.75	2806
		SD	1.99	1.92	7.46	968
HD						
FD	N=15	M	2.47	4.93	32.13	3088
		SD	1.80	1.75	5.31	729
FN	N=13	M	2.08	5.31	26.76	2636
		SD	2.10	2.09	6.08	1235
FI	N=12	M	3.33	5.75	30.50	2236
		SD	2.23	1.42	5.72	596
Total	N=40	M	2.60	5.30	29.90	2802
		SD	2.04	1.77	6.00	900
	N=80	M	2.24	5.01	31.32	2804
		SD	2.03	1.85	6.78	935

According to the results of the analysis, a Pearson correlation coefficient of .05 between N-DRCT and achievement test scores was obtained. The regression equation for relating the dependent variable is [y = .014x + 4.588] indicating a very low positive relationship between N-DRCT and achievement scores (r_X = .05). The regression equation for relating pre-posttest difference (gaining) scores to the N-DRCT score is [y = -.129x +31.612], indicating a negative relationship between the gaining score and N-DRCT score (r_X = -.04). The correlation is not meaningful enough to explain information for N-DRCT scores and GEFT scores. Because no interaction was found between factors, I preferred to compare relationships among variables using the posttest achievements of the CBI geology tutorial. The main effects can be interpreted directly. The regression equation for relating the N-DRCT and GEFT scores is [y =.101x +30.497], indicating a positive relationship between N-DRCT and GEFT scores (r_X= .07).

The positive relationship between N-DRCT and lesson completion time (rx=.19) is indicated with the equation [y = 25.041x + 2019.779]. It is important to note that reading comprehension and reading rate are closely related to how learners read a text from a computer screen. Both the reading and the reading rate test indicate very low positive relationships among GEFT scores and FDI levels (r_X = .07, r_X = .04, respectively) (see Table 3). Table 3 indicates the correlation matrix for all measures. The table is important to carry information for future research and to indicate positive and negative relationships in order to clarify how much variables can be changed within and between the groups. These scores can be used for predicting the other criterion variable, when needed. For example, the correlation coefficient between two measures would be used to predict another test performance. The regression coefficient equals the covariance between dependent and independent variables divided by the variance of the independent variable. The absolute value of the regression coefficient will always be larger than the absolute value of the correlation coefficient, when there is more variability of scores on the criterion variable than on the predictor variable. Table 4 indicates means and standard deviations of variables to illustrate their variances in the population.

The study shows the analysis of regression coefficients between text density levels and dependent variables (r_x=.27, $F_{3,79}$ = 1.94, p>.05; $F_{4,79}$ = 1.522, p>.05; $F_{5,79}$ = 1.202, p>. 05). When the standard deviations are equal, the regression and correlation coefficients are equal. These groups have different standard deviations (see Table 4); therefore, the regression and correlation coefficients are not equal. The result indicates a variance of the groups. The magnitude of the regression coefficient is directly proportional to the correlation coefficient. The study shows regression coefficients between field dependence and dependent variables (r_X = .32, $F_{3,79}$= 2.292, p > .05); ($F_{4,79}$ = 1.808, p > .05; $F_{5,79}$= 1.661, p> .05).

R-Squared (R^2) provides an index of how well the independent variables predict the dependent measure. R^2 is the proportion of the variation in the dependent measure that is accounted for by the prediction made from the independent variables. As shown in study, approximately 10% variance may be explained from the field dependence groups. This means that 10% prediction would be possible for a factor. In other words, the standard error of estimate would be the same between observed and predicted values of the dependent measures. These results indicate that N-DRCT, as a covariate, may not indicate enough power to explain its purpose with dependent variables, because the relationship is not strong enough, and the covariate is used to reduce the estimate of random or error variance in the dependent measure. ANCOVA assumes that the relationships between the covariate and the dependent measure are statistically equivalent within all groups or cells in the design. In this table, the relationships between all variables and measures can be named as text density (TD), field dependent-independent (FDI), time, group embedded figure test (GEFT), pretest (Pre), posttest (Post), reading comprehension (R.Com), reading rate (R.R) and difference between pre-post test (Gain) consequently. The cross-tabulation of the variables indicates amount of correlation and significance for instructional variables as follows.

Table 3. Correlation coefficients matrix for all variables (measures)

	TD	FDI	Time	GEFT	Pre	Post	R.C.	R.R.	Gain
TD	1.00								
FDI	-.03	1.00							
Time	-.002	-0.56	1.00						
GEFT	-.005	-.906	-.04	1.00					
Pre	-.045	.13	.09	.11	1.00				
Post	.156	.26	.18	.25	.25	1.00			
R. Com.	-.21	-.04	.19	.07	.12	.05	1.00		
R. Rate	-.036	-.07	-.08	-.15	-.18	-.05	-.18	1.00	
Pre-P. (gain)	.174	.15	.10	.16	-.46	.75	-.04	-.08	1.00

Table 4. Means, median, and standard deviations on all measures' scores (N= 80)

	Mean	Median	Std. Dev.	Min.	Max.
TD	1.5	1.5	.50	1	2
FDI	1.95	2	.83	1	3
GEFT	8.2	7	4.89	1	18
Pretest	2.8	3	1.39	0	6
Posttest	5.0		1.86	2	10
R. Rate	218.4	209	76.40	60	451
Reading Comp.	31.3	32	6.88	12	44
Time spent	2804.2	2721	929.38	859	5827
Pre-post diff.	2.2	2	2.03	-2	7

1. Is there a significant main effect between text density levels (a low density versus a high density) on achievement in a CBI tutorial?
A two-way analysis of covariance was used with achievement tests (pretest and posttest) on the CBI geology tutorial presentation types, with N-DRCT scores as a covariate. Achievement test results indicated no significant differences between treatment levels using LD and HD levels ($F_{1, 79} = 2.566$, $p > .05$).

2. Is there a significant main effect between text density levels (a low density versus a high density) on the completion time of a CBI tutorial?
The study shows the results of the analysis for the completion time of lessons. As shown in the study, on the completion time of a CBI tutorial, no significant differences occurred among the participants at the two levels ($F_{1,79} = 0.139$, $p > .05$). The mean scores for the low-density group (LD) (mean = 2806.37) and high-density group (HD) (mean = 2802.00) are close. The total mean was 2804.19.

3. Is there a significant main effect between text density levels (a low density versus a high density) on the reading comprehension scores?
A two-way analysis of covariance was used with N-DRCT scores as a covariate. According to the analysis, there is no main effect on the reading scores. However, a two-way analysis of variance was used to analyze the effects of treatment groups on reading scores. Reading comprehension scores indicated no significant differences for using the LD and HD levels group (LD/HD) ($F_{1,79}$) = 1.936, $p > .05$). It is interesting that with two-way ANOVA on reading scores, text density (LD/HD) was found to be significant on the reading scores ($F_{1,79} = 3.933$, $p < .05$). But no interaction was noted between the two factors. As a part of reading scores, reading rate scores were found to be significant with two-way ANOVA ($F_{1,74} = 4.733$, $p < .05$). These findings may provide clues to indicate a significant relationship between the two factors.

4. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) as measured by achievement in a CBI geology tutorial?
A non-significant interaction was noted between text density levels (LD and HD) and the cognitive style of field dependence (FD/FN/FI) ($F_{2,73}$) = 0.274, $p > .05$). The study shows the summary of the analysis for the gain score between the pretest and posttest difference. In addition, the study shows comparison among FDI levels and text density levels on achievement (posttest) in the CBI geology tutorial.

5. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) in terms of completion time of the CBI geology tutorial?
A non-significant interaction was noted between text density levels (LD and HD) and the cognitive style of field dependence (FD/FN/FD) ($F_{2,73} = 3.101$, $p > .05$). In addition, Table 5 shows the cell means and standard errors of cell means for the completion time of the tutorial.

Table 5. Cell means, standard deviations, and standard errors for lesson completion time in the CBI geology tutorial

	Count	Mean	Std. Dev.
LD, FD	14	2432.1	52.6
LD, FN	13	3378.4	119.4
LD, FI	13	2637.1	861.8
HD, FD	15	3088.5	729.8
HD, FN	13	2636.3	1235.4
HD, FI	12	2623.4	596.7

6. Is there a significant interaction between text density levels (a low density versus a high density) and the cognitive style of field dependence (FD) in terms of reading comprehension scores?
A two-way analysis of variance was used with reading comprehension and reading rate scores. A non-significant interaction was noted between treatment groups (LD/HD) and field dependence (FD/FN/FI) levels using N-DRCT scores ($F_{2,74} = 2.347$ $p > .05$). However, the F-value in one factor was found to be a significant separate effect ($F_{1,74} = 3.933$ $p < .05$; $F_{2,74} = 0.710$, $p > .05$). On the other hand, reading comprehension scores were affected in reverse According to findings, post-hoc comparison among FDI levels and text density levels on reading was found to be statistically significant.

DISCUSSION AND CONCLUSIONS

Although the findings show non-significance in formal tests of hypotheses, a preference for the high-density level was found. Specifically, the tests of hypotheses generated the following discussion and conclusions:

1. No significant differences occurred between students receiving the different text density type (LD and HD) on the achievement and learning scores from the CBI geology tutorial. The values for LD students ($\overline{X}$ = 4.72 Std Dev. = 1.921) and HD students ($\overline{X}$ = 5.30 Std. Dev. = 1.177) are without significance. Participants displayed preferences while working. Movement within the CBI screens is different for participants and is based on learners' experiences in using computers and technology. High-density text (HD) takes more time and effort than low-density (LD) text. However, it was not expected that students with the low density text (LD) would spend more time than high-density (HD) text readers. The result is not consistent with previous research. The findings indicate a further need for research that shows preferences for the variations of text density levels in CBI tutorials and CBI lessons on the Internet. As indicated in previous research, 31% density screens were preferred, and low-density text (LD) modified from 35% to 40% from a high density (HD) text such as actual text was also found to be preferred. Because of this result, the current finding is consistent with previous preferences. It is important to note that learning achievement, defined as a pretest and posttest difference score, shows some learning from the CBI geology tutorial, although no significant main effect is indicated statistically. Results, according to descriptive statistics, indicate meaningful relationships in perceptual processes for the learners (see the correlation matrix). For instance, human factors such as simplicity, student-computer dialogue, social amenities, spaciousness and relevance (Rambally & Rambally, 1987), and experience using computers seem to be important for recognizing student learning in CBI tutorial lessons.

On the achievement test, students using the LD text type ($\overline{X}$ = 4.75) achieved scores close to those of students using the HD text type ($\overline{X}$ = 5.30). These results indicate that there are no significant differences between the two text density levels. This present study is consistent with the previous reviews of the literature. In other situations, because of a lack of main effects and interaction, the achievement score (posttest) in the CBI tutorial was taken as a criterion measure to compare the effectiveness of the mean values of dependent measures. This conclusion indicates text based density as low and high level. In addition, instructional designers and students in the multimedia era can adopt all sorts of multimedia displays based on new technologies and multimedia design rules. Although this work is limited to text density design rules as a basic performance, students and educators can develop and present all multimedia displays effectively in their works based on research findings and considerations. We still need conducting and presenting text density research studies of the different levels of text density design in web, internet and multimedia lessons as well as screen design considerations..

2. No significant differences occurred between students receiving the LD text lesson and the HD text lesson treatment on completion time of a CBI geology tutorial. It was not expected that HD-using students would spend less time than LD-using students (time spent LD $\overline{X}$ =2806 sec, HD $\overline{X}$ = 2802). From the experiment with the CBI tutorial, students using the HD text worked more comfortably with it, as expected, than students using the LD text, across all field-dependence groups, except in the FD/LD category (time spent $\overline{X}$ = 2432 sec.). This is an unexpected result that is close to what is recorded for other LD text levels. It may be the result of individual learner characteristics and behaviours such as motivation, attention, time limitation, and leaving early from other classes. Students in the FI cognitive style category using HD text achieved high scores, spending less time than LD text using students with FI cognitive styles and used less time (achievement $\overline{X}$ = 5.75 in the HD/FI group; time spent $\overline{X}$ = 2236 sec., and achievement $\overline{X}$ = 5.46; time spent $\overline{X}$ = 2637 sec.). Gain score means the learning from the CBI tutorial that indicates the same result and so does achievement (post) score. It is possible that the majority of students prefer to work with high density screen design, based on their lack of experience with computers and with reading globally. A lack of computer experience may cause loss of attention and recognition for the lesson material, when participants use a CBI tutorial and related technology. Visual movement in order to vary text density levels would result in complex information processing for students in terms of their perceptions and memories. The situation in this study does consider experience in computer use, in that all classes of participants were taking their first technology and computer applications course at the university at the same time. Thus, there is a problem from one perspective, in that students who received HD text focused on learning from the CBI lessons better than those who received LD text.

3. Reading comprehension from the computer screen was expected to be theoretically different for the cognitive styles and text density levels. As indicated by Baker & Anderson (1982) and Garner & Reis (1981), comprehension may be related to cognitive style. Knowledge of cognitive styles can allow researchers the predictive power to delineate comprehension abilities (Pitts & Thompson, 1984). For example, monitoring abilities such as schema-familiar and schema-unfamiliar text may have important implications for instruction and

for the development of CBI computer screens (Pitts & Thompson, 1984). Moreover, as indicated by Spiro & Tirre (1980), field dependent students do not use prior knowledge as efficiently as do field independent students.

There was no significant main effect among text density levels on reading comprehension scores, monitoring, and operating abilities for successful reading from the computer screen. If students have difficulties with applying general rules for screen interface, they may not display high scores in their CBI lessons. In the correlation matrix, the negative relationship between text density levels and reading comprehension scores was shown (r = -.21).

As shown in the findings, however, both LD and HD text density levels, relative to reading scores, were not found to be significantly different for reading comprehension ($F_{1,79}$= 3.538, p > .05). However, a correlation between the GEFT and reading comprehension was indicated (r = .07). The low correlation would likely be based on a lack of reading comprehension because of the students' second language being English. For this reason, the situation does not indicate expected findings. It was assumed that the FI learning style was better than others at the college education level. As noted previously from the literature, FI students gained higher scores than FD and FN students (Dwyer & Moore, 1991, 1992, 1994; Ipek, 1995b, 1997; Ipek & Bayram, 1996; Lee, 1994; Moore & Bedient, 1986; Moore & Dwyer, 1991).

4. A non-significant interaction was noted between text density levels and field dependence on achievement in a CBI geology tutorial. It would also be possible to see an interaction between two factors working with a large sample and a different content area and grade and with the provision of visual attention for the students (Henderson, 1992; Kintsch, 1980).

Further investigation of the various text density levels in CBI development and applications should be performed to review mean differences and their distributions for effective screen design. The study was limited to investigating only two text density levels. We need a clear definition of the text density levels and their preferred styles, for using CBI tutorial and Web design. Such an investigation would provide strategies for how to effectively support perceptual behaviours and cognitive and technological factors to create an instructionally effective CBI screen design with various text density styles. There was a lack of experimental information to support and clarify the effects of cognitive styles by means of perception, cognition, and learner characteristics. We need to explore how text density levels affect teaching and learning processes for the different grades, levels, and disabilities of learners according to their cognitive style of field dependence. Also, human characteristics such as intelligence, cognitive style, and interests; interface design; and a combination of the effects of the designer, user, and system should be checked in order to develop effective instructional strategies in CBI (Eysenck, 1993; Kintsch, 1980; Reinking, 1988; Rayner, 1992). Further research should focus on variations of text density levels and cognitive styles in psychological foundations that combine the effects of learner characteristics, technological factors, and instructional design systems to achieve high scores with success in our classrooms.

5. No significant interaction was found between students receiving LD text and HD text treatments and the cognitive style of field dependence on completion time of the CBI lesson. According to a two-way analysis of ANCOVA, there were no significant main and interaction effects for the two independent variables. As can be seen in this research, the crosstabulation of field dependence levels (FD/FN/FI) and text density levels (LD/HD) indicated meaningful and logical expected findings, which support earlier research findings for cognitive style (Burger, 1985; Dwyer & Moore, 1991, 1992; Ipek, 1995a, 1995b; Lee, 1994; Moore & Dwyer, 1991; Myers, 1997; Witkin, 1976) and comparison of text density levels by using spent time (Morrison et al., 1988b, 1989a; Ross et al., 1988b). Interestingly, however, high density CBI lessons were preferred by learners.

Increases in time spent on CBI tutorials and interest in cognitive styles have been attributed to the unique technological characteristics of text density levels (LD/HD) as a visual display that can influence interactions between the learner and text density level for reading a text (Reinking, 1988). Students in the FI/LD category spent more time than students in the FI/HD category. However, FI learners had higher achievement scores than students in the FD and FN groups. This finding also supports previous research findings. It means that FI learners focus on the computer display with more attention, thereby spending more time on the CBI lesson. In conventional reading, learners prefer to work with printed materials. This point suggests changing learners' behaviors in order for them to be successful in a CBI environment.

6. In the present study, no significant interaction was observed between the cognitive style of field dependence and text density levels on reading comprehension scores. However, it was expected that instructional conditions with visual effects would be influenced by the level of study, the reading speed, reading comprehension, and

student performance. There are significant differences in the treatment of both LD and HD. There is no significance on the reading test, separately.

Notably, there is no interaction between the two main factors. However, reading comprehension scores for both text density levels (LD/HD) were found to be significant. Both reading comprehension ability and the ability to perceive a hidden figure may be related to the effects of eye-movement. We must combine technological, language, contextual, and programming factors to influence a learner's abilities of perception, learning, and memory. We must see and understand the message to learn from it (Pettersson, 1989). All processes may be presented as a perceptual cycle (Gale, 1993; Grabinger & Amedeo, 1988; Neisser, 1976; Woods, 1984). In addition, FI learners achieved higher reading scores than did FD/FN learners in treatments and field dependence levels (LD/FI, HD/FI). It is considered to be a result of the distribution of participants in each category. For the LD/HD category, high minimum and maximum scores were observed, and the findings indicate reading abilities and perceptual processing for each level on the two factors.

RECOMMENDATIONS FOR FUTURE RESEARCH

Previous research results consistently showed field independent students scored significantly higher than field dependent students in similar treatment groups. As noted previously, field dependence is a continuum between two ends (Dwyer & Moore, 1991, 1992, 1994; Moore & Dwyer, 1991; Oltman, 1968). On one end of the continuum, field dependence levels represent different perceptions for creating schema, information, and examples by human visual sense. The results of this study showed no significant differences among FDI groups on dependent measures, achievement in a CBI geology tutorial, reading comprehension, and time spent to complete lessons in a CBI tutorial. There were no significant main effects for the main factors, according to analysis of covariance (ANCOVA). However, the study found no significant difference in reading comprehension scores using two-way variance analysis (ANOVA) among field dependence levels and text density levels. The result is not consistent with previous research (Schwarz et al., 1983). The result of this study shows no significant interactions between factors on dependent measures, achievement on the CBI geology tutorial, reading comprehension scores, and time spent to complete CBI lessons.

For time spent in completing the CBI lesson, it was expected that FI students would use less time than FD and FN students. However, the study found no significant differences between text density levels and among field dependence group levels. This result is consistent with previous research results on text density level use (Morrison et al., 1988, 1989a; Ross et al., 1988b) and is not consistent with time spent on the text density level. There were no significant differences between the LD and HD density lessons with respect to time spent to complete CBI lessons and achievement on the CBI tutorial. The results showed that students tended to prefer a high-density screen in both text density studies, in contrast to the recommendations in the literature suggesting the use of low-density screens with adequate white space and vertical typography. In addition, information display interface in multimedia design can be important in presentation. Text density research results are not the same with the text display of window-scroll and frame-based hypercards (Yang, 2000). Multimedia learning refers to a combination of verbal (text or narration) and non-verbal (diagrams, symbols, and images) representations that are designed to aid learning (Mayer 2005).

To develop text density levels in a CBI tutorial or on the Web, we need a clear definition of and international agreement on creating user-friendly interface design, based on social and international issues. Human factors in future software and Web design should be defined to create new information techniques presenting in content learning. For this reason, software designers and instructional designers should be aware of differences among learners based on cognitive and technological effects in order to avoid making more instructional or visual design mistakes in CBI programs and on Web screens. Additionally, the use of audio or text density as an instructional tool has recently increased due to the popularity of podcasts, which are digital mp3 files that can be in the form of audio, video, and/or audio and static images (Lucking, Purcell, & Christmann, 2006; Pastore, 2008). Redundant text and narration may be detrimental to learning, the learner may in fact prefer this style of presentation (Veronikas & Maushak, 2005).

As a result, this study may provide contributions with screen design and text design in multimedia instruction. It also offers new opportunities in traditional material development and web site design in our classrooms for instructional designers and system developers. Although there are no more studies in text density concept recently, software designers, educators and. instructional designers can apply these findings to improve in future research activities.. The outcomes of the study will be scattered to develop different type of text density levels which are necessary in computer screen design, web screen design and internet environments for the studies. Therefore, which level of screen density is best for learning remains to be examined further. Future research should focus on text density problems such as amount of text and its percentage with each window for

developing multimedia materials, web design rules with amount of text for users and printed documents as well as developing effective lesson design for learners and users.

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THE EFFECTS OF THE COMPUTER-BASED INSTRUCTION ON THE ACHIEVEMENT AND PROBLEM SOLVING SKILLS OF THE SCIENCE AND TECHNOLOGY STUDENTS

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ABSTRACT
This study aims to investigate the effects of the computer-based instruction on the achievements and problem solving skills of the science and technology students. This is a study based on the pre-test/post-test control group design. The participants of the study consist of 52 students; 26 in the experimental group, 26 in the control group. The achievements test on "the world, the sun and the moon" and the Problem Solving Inventory for children were used to collect data. The experimental group received the computer-based science and technology instruction three hours a week during three weeks. In the analyses of data, the independent groups t-test was used at the outset of the study to find out the whether the levels of the two groups were equivalent in terms of their achievements and problem solving skills and the Kolmogorov-Smirnov single sample test to find out whether the data follow a normal distribution and finally, the covariance analysis (ANCOVA) to evaluate the efficacy of the experimental process. The result of the study reveals that there is a statistically significant increase in the achievements and problem solving skills of the students in the experimental group that received the computer-based science and technology instruction.
Keywords: Computer-based instruction (CBI), the Science and Technology Course, learning packet, achievement, problem solving skills, primary education

INTRODUCTION

Great emphasis is placed on the computer-based science and technology laboratories as well as ordinary science laboratories in the educational curricula of the developed countries. One of the aims of the science and technology course is to train individuals capable of keeping up the fast developing and changing science world and capable of utilizing the recent technological discoveries in every field. Researchers have been interested in revealing the effects of the computer-based instruction, which began to be used with the invention of the computer, which is one of the most important technological devices of the time.

As a result of the rapid development of the information and communication technology, the use of computers in education has become inevitable. The use of technology in education provides the students with a more suitable environment to learn, serves to create interest and a learning centred-atmosphere, and helps increase the students' motivation. The use of technology in this way plays an important role in the teaching and learning process (İşman, Baytekin, Balkan, Horzum, & Kıyıcı, 2002). In parallel with the technological advances; technological devices, particularly computers began to be used in educational environments to develop audio-visual materials such as animation and simulation, which resulted in the development of the computer-based instruction techniques.

The best example of the integration of science and technology is the Computer-Based Instruction technique. The use of computers in the teaching and learning activities is defined as Computer-Based Instruction (CBI). CBI is the use of computers in the teaching and learning activities (Brophy, 1999). CBI enables the students to learn by self-evaluating and reflecting on their learning process. CBI motivates children to learn better by providing them with the immediate feedback and reinforcement and by creating an exciting and interesting game-like atmosphere. The studies in the field reveal that the students' achievements increase when the CBI technique is provided as a supplement to the classroom education. CBI is more effective on less successful children. The reason for this is that the computer-based instruction enables the children to progress at their own pace and provides them with appropriate alternative ways of learning by individualizing the learning process (Senemoğlu, 2003). The most familiar function of the science education is to teach the children the science concepts in a meaningful way and enable them to lean how they can make use of these concepts in their daily lives (Çepni, Taş, & Köse, 2006).

The computer based teaching has had an impact on the development of the educational technology to a great extent in the 21. Century and this has resulted in the production of the software for the computer-based instruction. The primary purpose of the educational software is to solve the learning problems in the science courses encountered by the primary school students, to increase their motivation and achievements and to protect them against the negative effects of the rote-memory based educational system.

There are software-supported educational products designed to be used in the computer-based and computer-supported teaching practices. These are the products that the teachers use as complementary materials for taking notes about their students and observations; making tables; developing materials; doing calculations, and preparing simple educational software. The educational software is used as a teaching material in the teaching of a part of a subject or the whole subject (Alkan, Deryakulu, & Şimşek, 1995; İşman, 2005).

According to Alessi & Trollip (2005), it is possible to divide educational software into five different types such as tutorial, drill and practice, simulation, educational games and hypermedia type. For effective and productive teaching, these techniques should be used with some classroom activities. These are: presentation, demonstration, practice and evaluation of learning (Özmen, 2004). The use of computer technology enables learners be active in the learning process, to construct knowledge, to develop problem solving skills and to discover alternative solutions (Özmen, 2008).

The presentation of teaching materials by means of the computer technology helps students to process and develop information, to find alternative solutions, to take an active part in the learning process and to develop their problem solving skills. Most of the scientific and technological advances are realized by the people whose problem solving skills have been developed. In addition, these advances give rise to positive changes in the lives of people owing to the ways and techniques developed by means of the power of the problem solving skills. The use the problem solving skills is inevitable at every stage of our daily lives. As a result of the advances in today's technology and computer devices, it's getting indispensable to use this new technology in the solution of educational problems. The education and technology play an important role in the education of humans. Although the education and technology are different concepts, the use of both resulted in the emergence of a new discipline, the educational technology. Owing to the educational technology, the teaching and learning activities become enjoyable. Students learn willingly, by playing and enjoying during these activities (İşman, 2005).

Among the primary and secondary school students, girls use computer 5 hours a week for the play purpose whereas boys spend 13 hours a week for the same purpose (Christakis, Ebel, Rivara, & Zimmerman, 2004). The use of computer in teaching and learning environments is very important as the children like it very much and can continue playing with it without ever getting bored. In our time, it is evident that visual materials such as TV and computer are utilized in every field. And it is also evident that computer attract students very much. The use of the audio-visual devices and animations with instructional materials results in the enjoyable and productive learning process. In this way, the learning process can become enjoyable and interesting for students as a result of abolishing traditional classroom learning activities.

Technological developments give rise to new teaching and learning facilities. In our time, human beings keep on searching to find out how to use computer in educational activities in a more productive way rather than searching to reveal whether the use of computer in teaching and learning activities is effective (Kara & Yakar 2008). Educational technologies, especially computers play an important role in concretizing abstract concepts, which are difficult for children to learn, by means of animations (Akpınar, 2005).

The computer-based Instruction makes teaching techniques far more effective than those of the traditional teaching methods as it is used for presenting information, testing and evaluation and providing feedback. It makes a contribution to the individualization of education. It motivates students and gets them to take an active part in the learning process. It helps to develop creativity and problem solving skills, identity and self-reliance in learners. CBI provides drawings, graphics, animation, music and plenty materials for the students to proceed at their own pace and in line with their individual differences. It serves to control lots of variables having an impact on learning, which cannot be controlled by means of traditional educational techniques (Kaşlı, 2000; Chang, 2002).

Liao (2007) found out that CBI had a positive effect on individuals by comparing 52 research studies carried out in Taiwan in his meta-analysis study. Senteni (2004) also found out that CBI enabled the students to increase their motivation and achievements and to develop positive attitudes. According to research studies in literature, the use of computer-based education increases students' attitudes and achievements significantly (Berger, Lu, Belzer, & Voss, 1994; Geban, 1995). There is a lot of research on CBI both in Turkey and in the world. Different results have been arrived at in these studies. Some of these studies reveal that CBI serves to establish more effective learning situations than traditional teaching methods which involve teacher presentation, question and answer techniques, and discussions etc (Boblck, 1972; Hughes, 1974; Cavin & Lagouski, 1978; Choi & Gennaro, 1987; Niewiec & Walberg, 1987; Huonsell & Hill, 1989; Jedege, Okebukola, & Ajevole, 1991; Geban, Ertepınar, Yılmaz, Altın, & Şahbaz, 1994; Crook, 1994; Child, 1995; Brophy, 1999; Gance, 2002; Çekbaş,

Yakar, Yıldırım, & Savran 2003; Yenice, 2003; Carter, 2004; Moodly, 2004; Preciado, 2004; Li & Edmonds, 2005; Brooks, 2005; Bryan, 2006; Çepni, Taş, & Köse, 2006; Wilder, 2006; Başer, 2006; Chang, Sung & Lin, 2006; Liao, 2007; Ragasa, 2008; Hançer & Yalçın, 2009; Lin, 2009). It has been found out that CBI serves to develop meta-cognitive skills in students and helps them to learn in a meaningful way instead of rote-memory learning as well as it enables them to increase their achievements (Renshaw & Taylor, 2000). According to some studies there is no significant difference between the CBI and traditional teaching methods (Bayraktar, 2001; Alacapınar, 2003; Çetin, 2007).

This study, which aims to test the effects of the use of the CBI technology, is thought to be important as it will contribute to the wide use of educational software which triggers active participation and enables students to make their own meaning. The research, which was carried out to this end, is considered to make the science and technology education more enjoyable, productive and functional. This study is important as its results serve to complete the other studies done on CBI in Turkey and to provide a basis for further studies.

Theoretical Background of the Study

With the use computers in education, a lot of terms have come into and gone out of use in education (Owusu, Monney, Appiah, & Wilmot, 2010). The overlapping terms related to the uses of computer and associated technologies in science education are categorized into three by Bybee, Poewll, & Trowbridge (2008) as follows: learning about computers, learning with computers and learning through computers.

1. Learning about computers involves the knowledge of computers at various levels such as knowing the uses of the computer and the names of the various parts, knowing how to use the keyboard and computer packages and so on (Owusu et al., 2010). According to Tabassum (2004), the knowledge of computers may be thought of as a continuum which ranges from skills in and awareness of computers at lower level to programming at higher level.

2. Learning with computers, students use computers as a tool in data acquisition, analysis, communication with other people, information retrieval and myriad other ways (Owusu et al., 2010). Learners use computers to get information and do their homework.

3. The term 'learning through computers' involves the use of computer as an aid for the teacher to do his/her presentations, and / or to get the learners to practise and drill. Computers are used to enhance interactive activities, to provide immediate feedback, to facilitate the retention and to enable the learners at diverse levels to work at own their pace.

This study involves mainly learning through computer as well as learning about computer. The theoretical basis of the study derives from the operant conditioning by Skinner as described by Owusu et al. (2010) in their study. Operant conditioning is a type conditioning in which a learner achieves some outcome by producing an action, which is called the operant. If the operant is followed by something pleasant, the outcome is positively reinforced but if it is followed by the removal something unpleasant, the outcome is negatively reinforced. The theory that was influential during the heyday of the Audio-Lingual method which lost favour 1960s was revived after the introduction of the use computers into education. Skinner's reinforcement theory is central to computerized learning; especially drill and practice and tutorial learning (Tabassum, 2004). In these computer facilitated learning, students' behaviours are reinforced by being permitted to proceed to the next frame when they get the right answer (Bigge & Shermis, 2004). Tabassum (2004) indicates that Skinner illustrated how to develop programmed learning sequence which is being used directly to design tutorial modules. According to Owusu et al. (2010), "the use of computer-assisted instruction especially in tutorials mode is supported mostly by the behaviourist view of learning. This is due to the principle of practice and reinforcement. Therefore, the developers of tutorials mostly incorporate this theory of learning in their programme".

The study makes use of the operant conditioning deriving from the practices of Skinner's behaviourism. The materials and activities are presented in graded steps. Learners have the opportunity to be active in the learning process and receive immediate feedback and work at their own pace.

Purpose of the Research

The basic aim of this study is to investigate the effects of the computer-based instruction on the achievements and problem solving skills of the science and technology students.

The Research Question of the Research:
The main research question of the study is stated as follows: "Does the computer-based science and technology instruction have any effects on the achievements and their problem solving skills of the students?"

Sub-questions of the research:
The study aims to answer the following sub research questions.

1. Is there a significant difference between the means of the post-test achievements scores corrected according to the pre-test achievements scores of the control group taught according to the traditional method and the experimental group taught according to the computer-based science and technology program?
2. Is there a significant difference between the means of the problem solving post-test scores corrected with respect to the pre-test scores of the control group taught according to the traditional method and the experimental group taught according to the computer-based science and technology program?

Limitations
The study is restricted to the topics, "Earth, Sun and Moon" in the study field of "Earth and Universe" of the science and technology course and to the 52 fifth graders studying in a primary school at Buca-İzmir in the 2008-2009 school year. Only "the learning package" was used in the process of teaching the experimental group.

METHOD
Research Design
The pre-test/post-test control group design (PPGD) was used in this study. The pre-test/post-test control group design is a mixed design, which is widely used. A mixed design is a factorial design widely used in social sciences, especially in education and psychology. The pre test-post test control group design as one of the mixed designs is one of the most widely used experimental designs. In PPGD, in order to determine the effectiveness of the experimental process, whether the variation between two groups is significantly different is tested by means of the "t" or "F" test Büyüköztürk, 2010).

Table 1 The pre test-post test control group model

Groups	Pre Test	Process	Post Test
E_1	0_1	X	0_2
E_2	0_3	-	0_4

(Balcı, 2007)

As can be seen in Table 1, notations are: E_1=Experimental group, E_2=Control Group, O_1, O_2 = Pre-test and Post-test (Experimental group) scores, O_2, O_4 = Pre-test and Post-test (Control group) scores, X=Process that stands for the experimental variable of the computer based science and technology program.

Participants
The participants of the study were 53 fourth year pupils in a primary school in Buca/İzmir in the 2008-2009 school year. Those 53 pupils were put into two groups by lot and later 26 were placed in the experimental group and 27 in the control group by lot again. As one of the participants did not attend the classes regularly and did not take the pre-test, they were excluded from the research in the data analysis process. In order to avoid the effects of the gender variable, male and female pupils were assigned to the groups equally.

Data Collection Instruments
The Problem Solving Inventory for children with the Cronbach's Alpha reliability coefficient of .85 was used as a data collection instrument prepared by Serin, Bulut Serin and Saygılı (2010). This Problem Solving Inventory serves to test the self-perception levels and behaviour of the primary school students about the problem solving skills. The scale is a five grade likert type scale rating from 1 to 5 and consisting of 25 items that can be administered to primary school pupils between the ages of 7-12. The points range from 24 to 120. High scores represent the pupils' positive perception of their problem solving skills, whereas low scores represent the negative perception of their problem solving skills.

In order to determine the primary school pupils' comprehension levels of the topics "Earth, Sun and Moon in the science and technology course, an achievements test of 25 items was designed. Before designing the achievements test, the behavioural objectives were determined by means of the content analysis. With the help of experts in the field, it was determined that that there were 25 types of critical behaviour to be tested. 75 questions were prepared to test these behaviours. The tentative form was administered to a group of 200 fifth year pupils of

another primary school. The results of the administration were analysed with the TAP program (The Transition Assistance Program). 25 questions that test critical behaviours were included in the final test. On the basis of the item analysis, the achievements test was prepared with the item difficulty ranging from .25 to .90. The test was finalized with the KR-20 reliability as .72.

Contents of the Program Applied

The research was conducted in the "Earth, Sun and Moon" unit which aims to enable students to become familiar with the relative shapes and dimensions of Earth, Sun and Moon, to establish a connection between the movements of Earth and Moon and to acquire information about the results of this relationship and about their effects on daily life. The difficulty of finding quality software and supporting teaching programs is an important factor that impairs the success of computer based instruction. For these reasons, the computer based software pertaining to "Earth, Sun and Moon" was prepared by consulting science and technology teachers and experts. This program was used in order to deal with the issue of quality software. The "Adobe Photoshop" program was used in preparing the graphics. The "learning package" applied to the experiment group was prepared by using the Macromedia Flash 8 program. The reason for the preference of this program is that it offers a better visual medium, as the shapes produced remain clear, the files created are very small in dimension and the files can be disseminated on the internet. The contents of each subject were presented systematically in accordance with predetermined, specific aims in the software. The visual aids used in the software were suitable for the age and educational level of the children. The software contained documentaries and activities related to the subjects. Furthermore, the student could direct his learning process and evaluate his learning; the software had a dynamic structure that enabled the student to see if the answers s/he gave to the questions were correct or not. Apart from this, using this software the student could play various educational games related to the subject when s/he went on the internet through the software. The internet based "teaching package" which was applied to the experiment group made it possible to have interactive lessons using media like the internet, video, slides, CD's, sound, animation and the like. In the program, first topics were presented. They were enriched with visual material and made attractive with animation. The colors used in the software were interesting for the student but not distractive or tiring for the eye. The design of the interface was simple and easy to understand, which made it easy to direct the student. When the student entered the program, s/he encountered an introductory screen which showed all the subjects to be studied throughout the unit. In order to enhance interaction, there were return buttons throughout the program with which the student could go to the main menu or to a previous page. Again, throughout the program, the subjects were presented with rich visual animations. The written material on the screen was minimal but sufficient to summarize the subject. The students studied the subjects with their teacher but also reviewed the subject as much as they wanted. After they studied the subject with their teacher on their own computers, they did the interactive exercises on the screen at the end of each lesson.

Figure 1 Introduction page of the software

When the student entered the program, s/he heard the following (Figure 1): “Hello! Welcome to our program. In this program you can reinforce what you have learned in the exercise section which we prepared for you if you want to learn about Earth, Sun and Moon. Should you be bored, don’t worry. You can always come back to the main page from where you are after you have had fun as much as you want in the games section which we prepared for you. What is more, don’t forget to get support from the help button in places you have difficulty. Now, the program is waiting for you. Cruise and have fun to your heart’s content”.

Figure 2: Let us get to know our world

On the page in Figure 2 was the following audio explanation: “I am Earth. Welcome to my page. If you click on the how am I button, you can reach the place which contains information about me. You can see how I revolve around the sun together with the moon when you click the come along with me button. If you click the where am I button, you can learn how much the distance is between me and the sun and the moon. Finally, if you click the watch video button, you can watch a very beautiful video about me”.

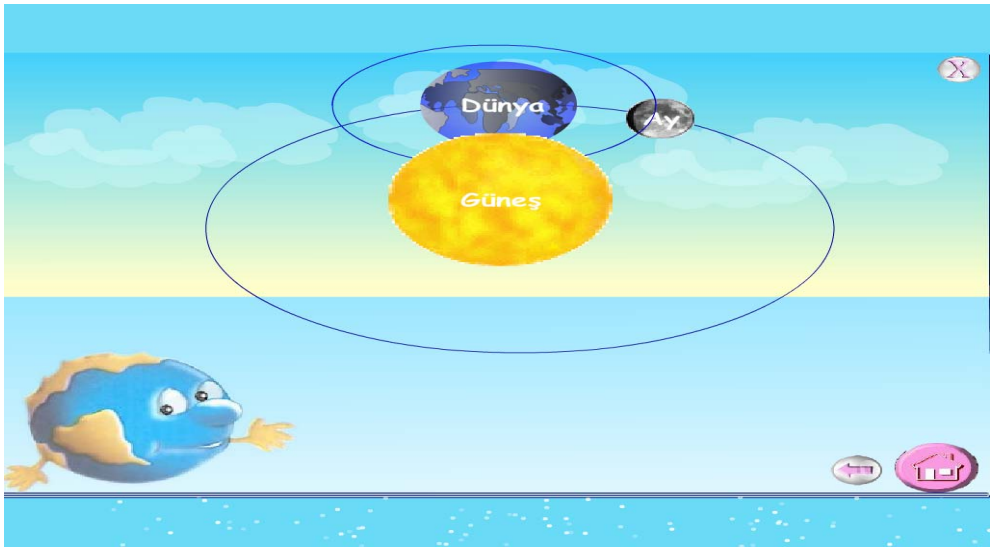

Figure 3: Let us get to know Earth (Where am I?)

Figure 4: Let us get to know the Sun

The page on Figure 4 said, “Hello! I am the sun. Welcome to my page. If you click the how am I button, you can reach the part which covers information related to me. You will love the video about me if you click the “would you like to watch a video” button. When you click the “where am I” button, you can see how far away I am from Earth and the moon”.

Figure 5 Let us get to know the Moon

On the page in Figure 5, the student could hear the following: “Hello! I am the moon. Welcome to my page. If you click the “how am I” button, you can reach the part which covers information related to me. You will love the video about me if you click the “would you like to watch a video” button. When you click the “where am I” button, you can see how far away I am from the sun and Earth”. If you click the “phases of the moon” button, you can learn about my phases”.

Figure 6 Assessment Section.

This section said, “Welcome to the assessment section. Here you can begin answering the true/false, fill in the blanks and the test questions we have prepared for you by clicking the forward button below”.

Figure 7 Shall we exercise? (a)

As can be seen in Figure 7, if the student answered correctly, the voice said, “Congratulations! You can pass on to the next question” together with a smiling face. The student had to give a correct answer in order to be able to answer the next question.

Figure 8 Shall we exercise? (b)

In the "Shall we exercise" section in Figure 8 where the matching questions were, the student could pass on to the other questions when s/he matched the pairs correctly.

Figure 9 Clues to be taken if wrong answers are given.

If the student could not find the correct answer, up came the page where Figure 9 is and if the student so wished, s/he could take the clue to find the correct answer.

Figure 10 Shall we play?

As can be seen in Figure 10, the "Shall We Play?" section comprised "follow the mouse", "find Earth", "shall we watch an animation?" and "photograph album" activities.

Figure 11 Shall we play? (Let Us Find Earth)

As can be seen in Figure 11, when the student clicked the red button to reach the information on how to play the "Find Earth" game, s/he saw the following text: "There are some planets and the sun in our game. What you have to do is to find Earth among these planets. When you find Earth, it stops. If you have stopped it, a little surprise will be awaiting you in the blue button on the game page. Don't be a spoiling sport or click the button before you find Earth. Don't forget that none of the planets will stop if you click the wrong one. OK! Have fun! Find Earth and the surprise is yours".

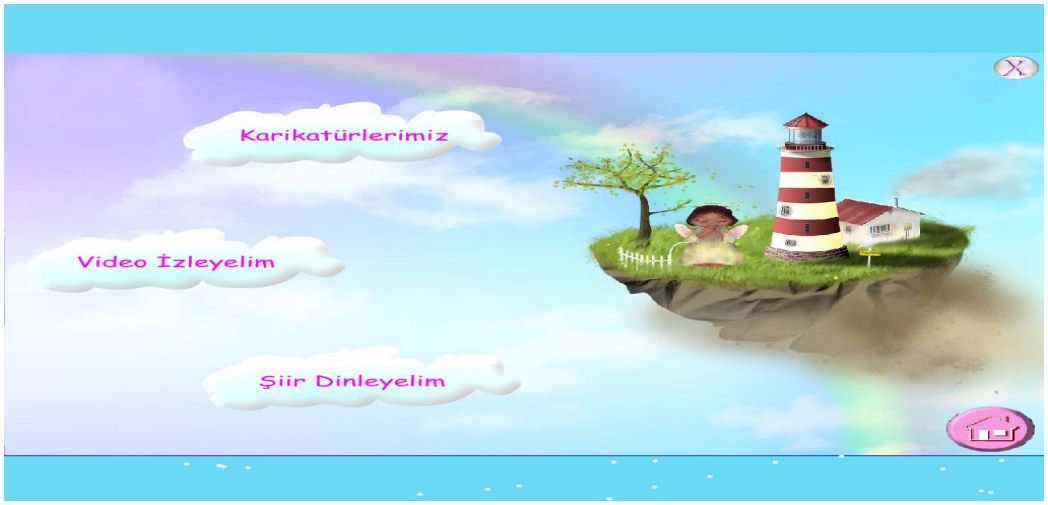

Figure 12 Ready to have fun?

The section "Ready to Have fun?" on the page in Figure 12 comprised "our comic strips", "shall we watch a video?" and "shall we listen to a poem?" activities.

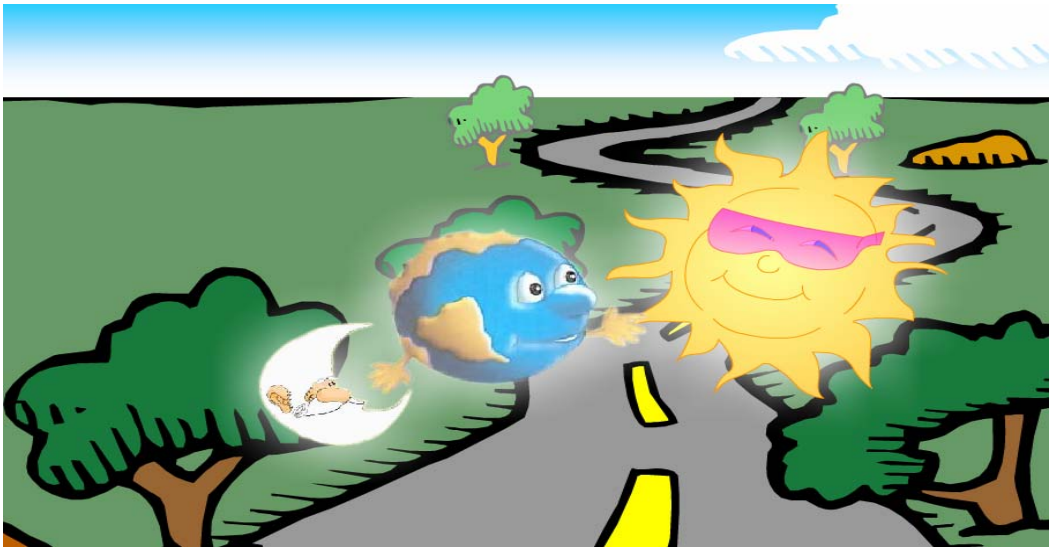

Figure 13 Exit page of the software.

The Experimental Process and Collecting Data

The "computer-based science and technology teaching program" was applied to the experimental group and not to the control group. The t-test results of the pre-test points related to the achievements and problem solving skills of the experimental and control groups are given in Table 2. As can be seen in Table 2 there was not a statistically significant difference between the pre-test means of the experimental and control groups. Accordingly, it can be said that there is no significant difference between the "Earth, Sun and Moon Achievements Test" and "Problem Solving Inventory for Children" pre-test means of the experimental and control groups. In this case, it can be assumed that the levels of the achievements and problem solving skills of the control and experimental groups were equivalent before the experiment began.

Tablo 2 The t-test results of the "achievements and problem solving skills" pre-test scores of the experimental and control groups

Measurements	Groups	N	$\bar{x}$	s.d.	df	t	p
Achievements Pre-test	Experimental	26	24.000	7.244	50	.076	.940
	Control	26	23.846	8.117			
Problem Solving Skill Pre-test	Experimental	26	72.230	13.360	50	.072	.943
	Control	26	72.538	15.687			

For the experimental group the white board was not used while studying the "Earth, Sun and Moon" unit in the science and technology class. Instead, the interactive computer-based "learning package" consisting of educational games that could be played when connected to the internet, which was prepared with the Macromedia Flash 8 program.

The control and experimental groups were balanced gender wise. Furthermore, care was taken that the individuals in control and experimental groups did not interact with each other. Six sessions of teaching-time was allocated equally to both groups (12 hours). At the end of the three-week computer based science and technology program, the experimental and control groups were again administered the "Earth, Sun and Moon Achievements Test" and the "Problem Solving Inventory for Children" on the same date.

Analysis of Data

In the analysis of data, the Kolmogorov-Simirnov single sample test was used to see if the data were suitable for normal distribution and the "independent groups t-test" was used to test the equivalence of the achievements and problem solving skills of the experimental and control groups at the beginning of the study. At the end of the experimental process, in order to test the effectiveness of the experimental process the co-variance analysis technique (ANCOVA) was used to see whether there was a significant difference between the post-test score averages which were corrected according to the pre-test results of the experimental and control groups (Bonate, 2000; Büyüköztürk, 2006). The significance level was taken as .05 in the study.

Findings

Kolmogorov-Simirnov Z was used to find out whether the scores of the dependent variables followed a normal distribution within each subgroup and whether the variances were equal in order to measure whether there was a significant difference between the means of the pre test and post test results of the control and experimental groups' achievements and problem solving skills by means of ANCOVA.

As is seen in Table 3 and Table 4, the measurements related to the experimental and control groups follow a normal distribution and the variances are equal. In addition, when studied the correlations between the measurements related to the groups, it can be seen that there is a correlation at .49 (the lowest) between the pre test and post test scores of the experimental group's problem solving skills and there is a correlation at .52 (the highest) between the pre test and post test scores of the experimental group's problem solving skill. All of the correlations are significant at the .05 level. The results can provide evidence for the fact that there is a linear correlation between the pre and post test scores. With respect to these results, the covariance analysis was used to determine whether there was a significant difference between the means of the corrected post test scores according to the control and experimental groups' achievements and problem solving skills.

Table 3 Descriptive statistics of experimental and control groups and normality test results with Kolmogorov-Simirnov Z

Groups	Measurements	N	$\bar{x}$	s.d.	KS-Z	p
Experimental	Achievements Pre-test	26	24.000	7.244	.981	.291
	Achievements Post-test	26	66.461	10.187	.858	.454
	Problem Solving Skills Pre-test	26	72.692	13.768	1.074	.199
	Problem Solving Skills Post-test	26	83.576	15.150	.986	.285
Control	Achievements Pre-test	26	23.846	8.117	.823	.507
	Achievements Post-test	26	58.307	8.629	.780	.577
	Problem Solving Skills Pre-test	26	72.538	15.687	1.222	.101
	Problem Solving Skills Post-test	26	71.730	14.387	.964	.311

Table 4 Test results of homogeneity related to the variance measurements of experimental and control groups

	Levene Statistics	Sd 1	Sd 2	p
Achievements Pre-test	.686	1	50	.412
Achievements Post-test	1.369	1	50	.248
Problem Solving Skills Pre-test	1.615	1	50	.210
Problem Solving Skills Post-test	.747	1	50	.392

The following is the first sub research question:

"Is there a significant difference between the means of the post test achievements scores corrected with respect to the pre-test achievements scores of the control group taught according to the traditional method and the experimental group taught according to the computer-based science and technology program?" As is seen in

Table 4, there is a statistically significant difference between the means of the post test achievements scores of the pupils in the control and the experimental groups corrected according to the pre test ($F_{(1,49)}$=10.312; p<.05). It can be seen that there is a significant difference between the means of the achievements post test scores ($\bar{x}_{Experimental}$ =66.433; $\bar{x}_{Control}$=58.336) corrected according to the pre test in favour of the experimental group. It has been found out that the program (computer-based science and technology teaching package) used with the experimental group had an effect on the success in the science and technology course according to the research findings. When the eta-square values of the dependent variable are examined, it will be seen that the amount of effect is high and the 17.4 % of the variations in the achievements post tests can be accounted for due to being in different process groups.

The following is the second sub research question:
"Is there a significant difference between the means of the problem solving post test scores corrected with respect to the pre test scores of the control group taught according to the traditional method and the experimental group taught according to the computer-based science and technology program?" As is seen in Table 4, there is a statistically significant difference between the means of the problem solving post test scores corrected with respect to the pre test scores of the control group taught according to the traditional method and the experimental group taught according to the computer-based science and technology program ($F_{(1,49)}$=22.891; p<.05).). It can be seen that there is a significant difference in favour of the experimental group between the means of the problem solving post test scores ($\bar{x}_{Experimental}$=86.361; $\bar{x}_{Control}$ =74.524) corrected according to the pre test. It has been found out that the program (computer-based science and technology teaching package) used with the experimental group had an effect on the problem solving skills in the science and technology course according to the research findings. When the eta-square values of the dependent variable are examined, it will be seen that the amount of effect is high and the 31.8 % of the variances in the achievements post tests can be attributed to being in different process groups.

It can be stated that the F values and significance levels related to the models are significant both from the perspective of the achievements post test scores and from the perspective of the problem solving post test scores and the 23.9 % of the variances in the achievements post tests can be attributed to being in different process groups whereas the 58.7 % of the variances in the achievements post tests can be attributed to being in different process groups.

Table 5 The Achievements and problem solving skills of the pupils in the experimental and control groups, pre test, post test, corrected means, values of standard deviations

Dependent Variable	Groups	N	PRETEST		POSTTEST		CORRECTED MEAN	
			$\bar{x}$	s.d.	$\bar{x}$	s.d.	$\bar{x}$	s.d.
Achievements	Experimental	26	24.000	7.244	66.461	10.187	66.433	1.783
	Control	26	23.846	8.117	58.307	8.629	58.336	1.783
Problem Solving Skills	Experimental	26	72.230	13.360	86.269	13.183	86.361	1.749
	Control	26	72.538	15.687	74.615	11.548	74.524	1.749

Table 4 The Analysis results of ANCOVA about the differences between the means of the post-test scores of the achievements and the problem solving skills corrected according to pre-test scores

Dependent Variable	Source	Sum of Squares	df	Mean Square	F-Value	p-value	Eta Squared
Achievements	Model	1271.120	2	635.560	7.691**	.001	.239
	Pre-test (reg.)	406.813	1	406.813	4.923**	.031	.091
	Grup	852.169	1	852.169	10.312**	.002	.174
	Error	4049.187	49	82.636			
	Total	5320.308	51				
Problem Solving Skills	Model	5545.964	2	2772.982	34.850**	.000	.587
	Pre-test (reg.)	3780.406	1	3780.406	47.511**	.000	.492
	Grup	1821.422	1	1821.422	22.891**	.000	.318
	Error	3898.863	49	79.569			
	Total	9444.827	51				

**p<.05

DISCUSSIONS AND SUGGESTIONS

The fundamental aim of this study was to investigate the effects of the computer-based Instruction on the achievements and problem solving skills on the science and technology students. To this end, the scores obtained from the "Earth, Sun and Moon" Achievements Test and "the Problem Solving Inventory for Children" administered to the experimental and control groups were compared. It was revealed that the findings obtained from the results of the pre and post tests administered at the end of the computer-based science and technology instruction program revealed that there was a significant difference between the achievements and problem solving post test scores corrected according to the pre test scores of the experimental and control groups. It was found out the use of the computer and the teaching package with the materials such as videos, slides, CD's, sounds and animations in the science and technology course makes it possible to have an interactive lesson. Moreover, the presentations of topics by means of rich visual materials increase the achievements of the students. It can also be stated that the use of CBI has positive effects on the learners' problem solving skills. The high eta-square values obtained from the study indicate that the group and pre test variables can provide an explanation for the variances in the scores of the post test. The results of the research indicate that the use of the interactive learning package assists the learners in increasing their achievements and developing their problem solving skills in the fifth year science and technology course.

The significant increase in learners' achievements in this study can also be seen in Olgun's study entitled "The effect of the computer assisted instruction given to 6th grade primary school students on the students' attitude toward science and their metacognitive skills and their achievement" showed that computer-assisted science instruction positively affected the attitude of the students toward science and their metacognitive skills; in Demirer's study entitled "The effect of the computer assisted teaching method and the traditional teaching method on students' academic achievement and their attitude toward science and the permanence of the acquired behaviors", determined that the CAT method significantly affected the attitude of the students; in Tekmen's study entitled "The effect of computer assisted instruction given in the physics lesson in the 9th grade on the achievement of the students, their attitude toward the lesson and its retention", Tekmen (2006) determined that the effect of the CAT method on the attitude of the students was significantly higher in comparison to the traditional methods; Pektaş (2008), in his study entitled "The effect of the constructivist approach and computer-assisted instruction on students' achievement and attitude in biology" determined that the attitude of the experimental and control groups toward biology and the computer differed significantly in the positive direction; Tavukcu (2008), in her study entitled "The effect of a computer-assisted instruction environment in science instruction on the students' academic achievement, scientific process skills, and the use of the computer" determined that computer-assisted instruction positively affected the attitude toward the computer; Pilli (2008) found that there was a significant difference in the attitude of the students toward computer-assisted learning in favor of the experimental group in his study entitled "The effects of computer-assisted instruction on the achievement, attitudes and retention of 4th grade mathematics course"; Yıldız (2009), in her study entitled "The effect of computer-assisted instruction on the attitude and achievement of 8th grade primary school children in the subjects of geometric objects' surface areas and their volume", reached the conclusion that computer-assisted instruction positively affected the attitudes of the students, and in the experimental study entitled "The effect web-based science instruction on students' achievement and attitude" Şengel & Özden (2009) determined that web-based 7th grade science instruction had a statistically significant effect on the students' attitude toward science. In this study it was also determined that the attitude of primary school 6th grade students toward science and the computer differed significantly in favor of the experimental group.

The findings are in agreement with the results obtained by Geban, Aşkar, & Özkan (1992), Geban et al. (1994), Dinçer (1995), Demircioğlu & Geban (1996), Meyveci (1997), İbiş (1999), Sezgin (2002), Feyzioğlu (2002), Sezgin & Köymen (2002), Akçay (2002), Bayraktar (2002), Bozkuş (2002), Yiğit (2003), Yiğit & Akdeniz (2003), Akçay, Tüysüz, & Feyzioğlu (2003), Çekbaş et al. (2003), Carter (2004), Bussell (2004), Kert (2004), Kıyıcı & Yumuşak (2005), Akgün (2005), Yakar (2005), Başaran (2005), Atam (2006), Olgun (2006), Karataş (2006), Aydoğdu (2006), Demirer (2006), Gönen, Kocakaya & İnan (2006), Bodur (2006), Tekmen (2006), Saka & Akdeniz (2006), Keleş (2007), Akpınar & Ergin (2007), Liao (2007), Sarıçayır (2007), Kara & Kahraman (2008), Akıllı (2008), Kara, Kahraman, & Baştürk (2008), Yakışan (2008), Özel (2008), Pektaş (2008), Pilli (2008), Tavukcu (2008), Birgin, Kutluca, & Gürbüz (2008), Imhanlahimi & Imhanlahimi (2008), Özmen (2008), Teyfur (2009), Yıldız (2009), Karaçöp, Doymuş, Doğan, & Koç (2009), Doğan (2010), Güneş & Çelikler (2010), Emrahoğlu & Sağlıker (2010). On the other hand, the findings of this research partially or completely contradict the results of the studies carried out by Bayraktar (2001), Güler & Sağlam (2002), Alacapınar (2003), Çetin (2007), and Owusu et al. (2010).

Finally, the suggestions deriving from the findings of this research can be presented as follows: This study is limited to the study of "Earth, Sun, Moon" in the science and technology course. Similar research can be carried

out on different topics in different classes. Quantitative and qualitative studies can be carried out on the achievements and problem solving skills of high achievers and low achievers in the other school subjects. The duration of this research was limited to three weeks. In another study, more time should be spared to find out the effectiveness of the experiment. Qualitative studies can be carried with the students who have weak problem solving skills and with those who have strong problem solving skills. Considering the effectiveness of the teaching package used with the experimental group, teachers can be asked to take part in-service training and can be taught how to use the programs such as Macromedia Flash, Macromedia Authorware, Adobe Photoshop. They can be encouraged to develop the computer-based science and technology software. Similar research can be conducted in different primary and secondary classes.

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THE IMPACT OF KNOWLEDGE MANAGEMENT AND TECHNOLOGY: AN ANALYSIS OF ADMINISTRATIVE BEHAVIOURS

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ABSTRACT
Knowledge management is crucial in higher education practices that refer knowledge sharing, feedback and communication process as part of the quality improvements. In this process, technology has a role to diffuse knowledge and create a link for sharing within the knowledge management process. In this respect, this research study aims to examine the perceptions of 199 academicians from different higher education institutions towards administrative behaviours regarding reasoned action theory framework. The likert scale was conducted to volunteer participants in respect to survey approach. The research results exhibited that almost all items within the scale remarked that academic behaviours such as establishing teams, team inspiration, communication practices and feedback have practiced in higher education administration.
Keywords: administration, behaviours, knowledge management, perception, survey

INTRODUCTION

Knowledge management is an integration of management and information science that has works with the impact of technology for the competitive advantage of the organizations and education institutions (Su, Lin, 2006). It is an amended approach to analyze planning, organizing and leadership roles for the construction of knowledge regarding the collective and agreed perceptions of stakeholders who involve in management process (Damodaran, Olphert, 2000; Leung, 2007; Zhao, de Pablos, 2010).

The knowledge management encapsulates gaining, clarification, and communication of professional views for organizational knowledge. In this respect, there is an intensified need to consider the impact of knowledge management and technology for better understanding of sharing, exchanging ideas and the role of leadership behavior for mutual understanding within organizations and institutions (Fawcett, Brau, and Fawcett, 2005; de Lima, 2008; Owlia, 2010).

In today's' context, knowledge is characterized as creating and constructing knowledge regarding the productive influence of shared, agreed perceptions which core members involve and valuable perceptions are taken into account in continuous quality improvement. Higher education institutions are the significant example of how knowledge is managed and constructed within a participative involvement of members from diverse fields. In addition, technology has a great role to diffuse knowledge and create a platform of sharing for collective vision within the frame of continuous quality improvement. In this respect, knowledge management provides knowledge in hand to be operational in within institutions which this situation puts forwards to the institutions to be in the competitive advantage (Pan, Scarbrough, 1999; Grimsæth, Nordvik, and Bergsvik, 2008; Robets, 2010).

In other words, knowledge management exhibits how leadership behaviors are changing and how technology provides enhancement of sharing, communication for the quality. The impact of knowledge management and the technology as dynamic mechanism affects the how knowledge is held, transferred and created within and between institutions for better working practices. Therefore, creative dynamism, widespread diffusion and multiple creation of knowledge as a knowledge intensive business activity are fostered where technology plays a great role as a bridge (Mullen, Jones, 2008; Mangin, and Stoelinga, 2010).

Within a frame of knowledge management and transformation, the term "community of practice" becomes crucial to examine the changing leadership behaviors and the impact of technology to the transformation process. In this respect, higher education institutions need to focus on mutual relationship, doing things together, the rapid flow of information, knowing what others know, what they can do, and how they can contribute, assessing the appropriateness of actions and reflecting in and on actions within administrative processes in order to have success on organizational knowledge and learning thereby success on the managerial implications for quality (Howells and Roberts, 2000; Bouncken, Pyo, 2002; Alazmi and Zairi, 2003; Choo, 2004; Roberts, 2010). In addition, higher education institutions should highly concentrate on the transformation of knowledge with technology as a tool to practice planning, organizing and diffusing knowledge. In other words, technology needs

to be a strategy within the administration to make easy path for knowledge creation and organizational knowledge (Paliszkiewicz, 2004).

Knowledge management refers to the ability to manage "knowledge". It is a holistic view of mechanisms and processes that is based on the creation, collection, storage, retrieval, dissemination and utilization of organization knowledge that is an inter-disciplinary amendment in the academic world especially in the administration (Cabrera and Cabrera, 2005; Paliszkiewicz, Joanna, 2007).

The theory of "reasoned action" is the framework of this study which it covers the intention to engage in a specific behavior is determined by attitudes towards that behavior as well as by perceptions of social norms (Fishbein and Ajzen, 1975). The literature considered the success of this theory by providing evidence of the bridge between attitudes and perceived norms, intentions and the behaviors (Kim and Hunter, 1993). Within the implementation on knowledge sharing as regards the knowledge management, this theory practices how intentions are transformed to sharing knowledge with an actual experience. This theory suggests that the first step is to identify the factors that affect people's attitudes towards sharing and their perception of norms for sharing in order to influence intentions to share knowledge within the organizations. Regarding this framework, this study exhibits that technology in a conceptual manner and the administrative behaviors in relation to academicians' perceptions as interconnected factors influence knowledge sharing and logical actions for doing better within the higher education institutions (Mullen and Graves 2000; Engwall, Kipping, 2004; Su, Lin, Yichen, 2006).

The intention of this study here is to contribute to research focused on how academicians perceive administrative behaviors which leadership capacity and performance is grounded on construction of organizational knowledge as regards the impact of technology and reasoned actions within participative management.

In this respect, the research process reveals the following research questions that these questions provide a concrete map for the process throughout the research.

Q1. How do academicians from different higher education institutions perceive administrative behaviours?

Q2. Which factors effect the perceptions of the academicians towards administrative behaviours within the frame of knowledge sharing and management?

METHOD

Contextualization

Conducting a research in a large spectrum in relation to leadership capacity and performance based on perceptions in higher education practices is challenging process. Significantly, living in a small community, de-centralized perspective on administrative practices within the research context exhibit how carrying out research is a challenge and how this study is a valuable to serve as a guide to higher education practices regarding the understanding of participative management and technology integration to the practice for knowledge management in continuous quality improvements.

Research Design and Procedures

In this research, quantitative research design was employed to examine the perceptions of academic staff towards administrative behaviours in different higher education institutions (Cohen Manion, Morrison, 2000; Cresswell, 2003).

Instrumentation

Survey was used as a research approach that academic staff from Northern Cyprus universities which are Near East Univeristy, Eastern Mediterranean University, Lefke European University, academic staff from Konya Selçuk University and Abant İzzet Baysal University in Turkey were selected as research particpants to the research. Purposive sampling was used that 199 academic staff voluntarily participated to the research. In this respect, likert scale based on seventy items was conducted to academic staff from different universities to examine the perceptions towards administrative behaviours as regards the impact of knowledge management and technology.

The following Table I detailed participants in this research study.

Table I

		Eastern Mediterranean University	İzzet Baysal University	Lefke European University	Konya Selçuk University	Near East University	Total
1	Research Assistant	14	24	22	26	9	95
2	Specialist	18	1	8	8	22	57
3	Dr.	5	3	1	-	3	12
4	Assist Prof. Dr.	2	8	7	-	4	21
5	Assoc. Prof. Dr.	1	1	1	5	-	8
6	Prof.	-	3	1	1	1	6
Total		**40**	**40**	**40**	**40**	**39**	**199**

RESULTS AND DISCUSSION

In respect to questionnaire results of the academicians from different higher education institutions, here is an intention to open an academic debate on the role of the theory of reasoned action within knowledge management and the impact of technology integration to smooth this process for the quality improvement. In this respect, the following research results are revealed as regards the research focus and results are discussed based on the perceptions of the academicians.

This study covered the survey results on a seventy itemed likert scale in order to reveal the perceptions of academicians towards administrative behaviours from various higher education institutions at the same time factors influencing the perceptions as regards the knowledge management process.

Demographic information of the participants

In this research study, the following Table II summarized the numbers of academic staff as research participants. In respect to following table, a hundred ninety nine participants become part of this process.

Table II

University	Near East University	Eastern Mediterranean University	Lefke European University	İzzet Baysal University	Konya Selcuk University
Numbers of Academicians	39	40	40	40	40

In this research, the following Table III summarized gender of research participants. In this respect, a hundred eight female and ninety one male participants involved research.

Table III

Gender	**N**	$\overline{X}$	**SS**	**Sd**	**T**	**P**
Female	108	288.14	60.86	197	10.491	0.001
Male	91	283.26	46.17			

In this research study, the following Table IV summarized the role in management process.

Table IV

Administrative Duties	**N**	$\overline{X}$	**SS**	**Sd**	**T**	**P**
Yes	64	284.85	57.16	197	0.745	0.389
No	135	286.41	53.49			

Perceptions of academicians towards administrative behaviours

In here, a seventy items of the scale were exhibited and discussed inline with the perceptions of academicians towards administrative behaviours and factors that influence these perceptions within a frame of knowledge management as following.

The following Table V illustrates the ANOVA test results on different variables.

Table V

Higher Education Institutions	Variables	Sum of Squared Error	N	Mean Square	F
Eastern Mediterranean University	Academic Title	32.179.298	4	8.044.825	1.708
	Age	51.126.003	4	12.781.501	3.066**
	Period of Working	89.591.694	4	22.397.924	7.296***
	Period of Administrative Duties	24.642.125	4	6.160.531	1.251
Lefke European University	Academic Title	44.956.892	5	8.991.378	4.506***
	Age	10.590.260	4	2.647.565.907	
	Period of Working	10.698.733	4	2.674.683.917	
	Period of Administrative Duties	25.360.475	5	5.072.095	1.972*
Near East University	Academic Title	9.333.567	4	2.333.392	1.499
	Age	4.771.433	4	1.192.858.705	
	Period of Working	2.302.048	3	767.349.448	
	Period of Administrative Duties	4.452.294	5	890.459.508	
Konya Selçuk University	Academic Title	3.102.415	3	1.034.138.678	
	Age	4.792.169	4	1.198.042.788	
	Period of Working	8.439.933	4	2.109.983	1.489
	Period of Administrative Duties	1.899.642	4	474.910.296	
İzzet Baysal University	Academic Title	11.385.250	5	2.277.050.942	
	Age	7.293.327	4	1.823.332.740	
	Period of Working	4.077.768	4	1.019.442.399	
	Period of Administrative Duties	8.662.415	5	1.732.483.694	

*p<0.05, **p<0.01, ***p<0.001

Between groups ANOVA test results are as shown in Table V. Based on academic titles, the perceptions of academicians towards administrative behaviours were evaluated through using t-test. Regarding t-test results, there was a significant difference in the perceptions of the research assistants and professors ($p<0.001$) in Lefke European University. When the academic titles increase, the perceptions towards administrative behaviours were highly affected. In addition, there was a significant difference in perceptions of academic personnel who experienced administrative duties ($p<0.05$). The main significant difference was observed who experienced administrative duties between 3-4 years and 0-2 years. In this respect, when the year of administrative duties increase, the perceptions towards administrative behaviours had positive influence and direction to intention.

The period of working is a significant factor that affected the perceptions of academic personnel in Eastern Mediterranean University ($p<0.001$). When age increases, the perceptions towards administrative behaviours were highly affected ($p<0.01$). The t-test research results confirmed ANOVA results that the above variables are significant to reveal the various perceptions of the academicians from different university regarding administrative behaviours. Significantly, these variables could not be observed with a meaningful difference for the other universities within the research process.

The following Table VI indicated perceptions of academicians towards administrative behaviours. The items that academic staff preferred to response as "Always" are given below.

Table VI

	Average
Self-confident	4.22
Spends most of his time at work	4.20

The following Table VII indicated perceptions of academicians towards administrative behaviours. The items that academic staff preferred to response as "Frequently" are given below.

Table VII

	Average
Don't respect to the staff who are not in higher position	3.13
Trains the one to replace him while moving to a higher position	3.334
Apologize in case of mistake	3.30
Transfer authority to his personnel	2.90
Open for criticism	3.31

The following Table VIII indicated perceptions of academicians towards administrative behaviours. The items that academic staff preferred to response as "Sometimes" are given below.

Table VIII

	Average
Determines which roads to be followed to realize the objective	3.90
Makes the planning of progress on the basis of time	3.75
Makes financial plans for progression	3.65
Forms the appropriate working team while choosing the roadmap	3.81
Knows the people working with him well and treats them accordingly	3.88
Make good use of practical intelligence during the implementation	3.79
Has no indication of boredom while working	3.82
Forms well-matched working teams while choosing the roadmap	3.66
Forms the appropriate working team for the objective while choosing the roadmap	3.71
Creates a highly-motivated personnel in each working team	3.62
Includes experts in staff	3.70
Sets experience as a priority while forming teams	3.67
Coordinates his working team harmoniously	3.60
Includes staff who has the power of internal inspection	3.58
Includes staff who has good skills in establishing relations	3.67
A good instructor	3.95
Pays particular attention to the human element	3.94
Motivates individuals	3.50
He is aware of the fact that every individual has accomplishments of his own	3.71
Uses the body language well	3.70
Considers others' views in a reasonable manner	3.71
Gains the respect of others who join him in the way towards the objective	3.82
Can perceive events as a whole	3.80
Makes a balance between emotion and the reason	3.68
Owns the power of thinking	4.04
Inspires trust instead of fear	3.70
Shows respect to the individual's personality	3.88
Prefers using the method of persuasion instead of punishment	3.73
Allows personal initiatives	3.64
Knowledge and experience have equal importance for him	3.69
Ensures motivation in the institution he works in	3.75
Pays attention to communication with people	3.98
Coherent	3.79
Has the style of an administrator and practises the democratic way of administration	3.73
Makes empathy during the communication process	3.61
Protects the rights of his workers	3.70
Good at time control	3.79
Has the ability to make self-criticism	3.45
Uses feedback	3.60
Works to leave a good heritage for future generations	3.68
Capable of handling	3.97
Has good speaking skills	4.11

Always cautious	3.91
Persuades people through request, not through order	3.73
Passes on excitement to others working with him	3.48
Careful	4.05
Delightful but firm	3.60
Makes a balance between stinginess and lavishness	3.59
Makes a balance between impatience and imperturbability	3.68
Spends most of his time at work	3.89
Keeps his promises	3.84
Receives everyone at work in his office	3.86
Sees silence as a virtue when necessary	3.51
Always works to realize himself	4.07
Has a strong personality	4.03
Sensitive towards social problems	3.81
Work has the priority	3.78
Gives very much importance to love in his job	3.64
Mobilizes people in line with a mission	3.75
Establishes emotional ties and creates harmony	3.43
Works with determination until realizing the objective	3.93
Determines the strategy	3.91
Creates culture	3.71

Regarding items evaluation, the perceptions of academicians towards administrative behaviours reflected that each item within the scale underlines the current practices of administrative behaviours in higher education institutions. Significantly, administrative behaviours regarding perceptions of academicians such as communication sensitivity on human nature and problems, empathy within communication practices, team inspiration and knowledge sharing exhibited cues how knowledge sharing and management works in higher education practices, although impact of technology in this process stays partial.

CONCLUSION AND RECOMMENDATIONS

In higher education practices, knowledge management becomes a significant part of the quality improvement that leads collaborative effort of the professionals to share knowledge, construct knowledge in order to improve the efficiency for better working practice (Yang, 2007). Significantly, reasoned action theory underlined that agreed perception and the intention by humans are the critical starting points for the knowledge sharing process. In addition, technology has a role to facilitate the process. In particular, the role of technology reflects active feedback, knowledge sharing, and alternative path way to negotiate and discuss on issues in utilizing organizational knowledge and culture (Lee, Lu, Yang, Hou, 2009).

In this study, the perceptions of academicians from different higher education institutions towards administrative behaviours remarked that examined items within the scale as administrative behaviours have been practiced in higher education. In addition, these items have potential influence to reveal the perception, intention and human factor in knowledge management, although the technology factor stays partial in this study that needs to be investigated in a larger spectrum.

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THE ORTHOPAEDICALLY HANDICAPPED AND COMPUTER USAGE: THE CASE OF TRNC

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ABSTRACT
Although various studies have been conducted in the field of orthopaedic impairment, research regarding computer education for orthopaedically impaired individuals remains insufficient. This study aimed to evaluate the use of computers by orthopaedically impaired individuals from a wider perspective. The findings of the study emphasise the importance of computer use by orthopaedically impaired individuals for enhanced improvement of their condition. In addition, the findings stress the need for training well-educated experts who can use technology effectively to enable adaptations for individuals who need special education in the European Union.
Keywords: Computer education, orthopaedically handicapped, special education, services for orthopaedically handicapped individuals.

INTRODUCTION

Individuals in the 21st century are expected to be open to technological developments and to communicate with their environment by using technology. Significant developments in this respect are taking place for individuals who need special education. Our country has been restructured socially, economically and legally and has been improved by accepting the norms of developed countries. These improvements and restructuring have significantly contributed to protecting the rights of the individuals who need special education.

Although various studies have been conducted in the field of orthopaedic impairment, research regarding the education of computer use by orthopaedically impaired individuals remains insufficient. This study aimed to evaluate the use of computers by orthopaedically impaired individuals from a wider perspective using a case study. The findings of the study emphasise the importance of computer use by orthopaedically impaired individuals for enhanced improvement of their condition. In addition, the findings stress the need for training well-educated experts who can use technology effectively to enable adaptations for individuals who need special education in the European Union.

Education is a systematic process that serves to improve the thoughts, attitudes, behaviours and lives of people in line with predetermined objectives (Barutçugil, 2002, p.18). The education system consists of schools established for the purpose of meeting the education needs of all individuals of the nation and realizing the educational objectives of the government (Başaran, 2000, p. 12). Institutions that educate individuals who need special education constitute an important part of this system.

Science and technology have important impacts on the lives of individuals and of society as a whole, and they change the structure and functions of social institutions. Parallel to these changes, change and improvement are also needed in education institutions (Yetim and Göktaş, 2000, p. 56).

Like other educational tools, computers are multi-faceted devices that provide unique benefits in the teaching experience (Yalın, 2002, p. 162). Various studies have been launched based on the opinion that computers should be used in education and, in particular, that teachers should be able to use computers effectively in the education training process (Erçelik, 2004, p. 2).

Computers are being used as both a means and an end in education. As technology advances, computers, which are used in every field of daily life, have a considerably important potential role in the field of education. Thus, the impact of computers is being researched, and efforts are being made to improve the facilities provided to children for computer usage (Sevinç, 1996, p.8).

Goldman and Pelligrino (1987, p.144-154) emphasised that computer technology has a considerably important potential role in improving educational experiences and facilitating the learning of handicapped children. They stated that such technological innovations provide a teaching environment that responds to the needs of handicapped children once the educator and computers complement each other. Various factors prevent the active participation of handicapped children in education. The most important of these factors is the difference in the comprehension levels of such children. Computers that establish one-on-one contact with children, thus providing a type of individual-based education, can ensure that every handicapped child actively participates in the education process. Handicapped children must receive an individualised education with the help of education materials and methods that best suit their situations and skills. Individual education is more important in special education because the differences in the levels of handicapped children are greater (Sevinç, 1996, p.12).

In special education, computers are used to improve the academic skills of handicapped children; in particular, they are used to enhance hand-eye coordination, small-muscle motor skills, imitation and language development and many similar developmental areas. Computer education programs aimed at general problem-solving skills such as mathematics and reading-writing skills are frequently used by educators of handicapped children. Many studies show that computerised education programs have positive impacts on the academic, language, mathematic and reading-writing skills of handicapped children; such programs improve the concentration period and learning performance (Sevinç, 1996, p.12).

The concept of "education technology" must be defined to ensure the effective use of information technologies. Education technology is the whole academic system that effectively designs teaching and learning environments, solves problems that occur during teaching and learning and improves the quality and permanence of the learning output. Thus, the basic purpose of education technologies is to effectively and permanently ensure learning (İşman, 2002).

Education technologies are essential in today's education system. Schools that do not employ education technologies cannot keep pace with the society, which is progressing with incredible speed and becoming technology-intense. Most of our schools still do not request education technologies. Some of our schools, on the other hand, have managed to effectively employ education technologies with the following benefits: rapid dissemination of knowledge, individual learning environments, permanent learning, project works and global education opportunity (İşman, 2001).

Although education technologies can provide the necessary facilities, the most important role is undertaken by teachers, who must be able to effectively use education technologies. However, teachers around the world do not use education technologies in teaching-learning environments (İşman, 2002). This is also the case in our country. Although education technologies can be found in schools within the Turkish education system, the funding for institutions, teachers and administrators of special education is not at the desired level.

For technology, especially in education using computers and computer-based systems, it is most important to determine how students can learn and use it effectively. The internet and its numerous functions can be used to gather and deliver information through easy navigation. Technology and the internet represent a new dimension in the perspective of education, especially in the student learning-teaching cycle (Forcier, 1996).

The internet is a part of educational technology. Educational technology is the process of visualising, simulating and solving educational problems by integrating software and hardware. Educational technology includes the computer and internet as hardware. It is a whole process that makes the learning environment constructive with new, creative educational activities for delivering information in an interactive way through the internet. Technology is a way of communicating with students and increasing their motivation. Educational technology has an internet-based side as well. Educational technology is a tool to increase the quality of learning through the integration of technology, content and learning strategies. In addition, implementation of educational technology and its main tool, the internet, requires that educators be more productive, willing to add new developments, creative during learning, willing to let individuals have their own learning with cooperative and shared intelligence, and ready to promote meaningful learning based on a constructivist approach (Maddux, et al., 1997).

This study aimed to examine the attitudes of orthopaedically disabled persons regarding the use of computers in Cyprus and to identify the attitudes of those who serve orthopaedically disabled persons, using different variables to characterise the environment in terms of the provided opportunities.

METHOD

In this study, a mixed model was applied because of the use of both quantitative and qualitative methods. The quantitative data consisted of the measurements of orthopaedically disabled persons' attitudes towards computers. The participants voluntarily involved in the research study included 175 male (N=100) and female (N=75) orthopaedically disabled individuals.

The Computer Attitude Scale-Marmara was developed by Deniz (1994) to measure attitudes towards computer use. The scale consists of three separate subscales: showing interest in computers (SIC: 12 items), computer anxiety (CA: 15 items) and the use of computers in education (UCE: 13 items). In addition, the combination of all the scales (42 items) can be used to determine the overall computer attitude. The concurrent validity (r=.63, p<.01) was computed with the Computer Attitude Scale (Aşkar, 1987). For the reliability of the instrument, the test-retest reliability and inter-scale reliability were computed. The test-retest reliability was .82, and the inter-scale reliability of the subscales was between .81- .92.

The BTO-M was prepared as a Likert-type attitude scale with five options. It was designed to determine the intensity of the attitudes by rating among the following options: "totally agree", "strongly agree", "agree", "disagree" and "totally disagree". Also, at the beginning of the scale, various questions relating to the personal information of the orthopaedically handicapped participants were asked.

The instruments used in the study were applied to orthopaedically disabled persons in a centre for the orthopaedically disabled and impaired. Each interview lasted for approximately ten minutes. The quantitative data were analysed with descriptive statistics and a MANOVA. For the qualitative analyses, two dimensions were used. In the first stage, in the 2009 spring semester, four people who serve orthopaedically disabled individuals in Cyprus were selected randomly. For the second stage, semi-structured questions were asked to 14 disabled people in order to support the findings of the attitudes towards computers. To analyse the qualitative data, a qualitative descriptive analysis was used.

RESULTS

The MANOVA statistical technique was applied to the data to determine the orthopaedically disabled individuals' attitudes towards computers (Table 1). Significant differences existed between male and female orthopaedically disabled individuals [Wilk's Lambda .869, F (3,168) = 6.34, p = .000, eta .131]. Also, significant differences were found between orthopaedically disabled individuals who use and do not use the internet [Wilk's Lambda .924, F (3,168) = 3.44, p = .010, eta .076]. The interaction between gender and internet usage produced significant differences in the orthopaedically disabled individuals' attitudes towards computers [Wilk's Lambda .897, F (3,168) = 4.84, p = .001, Eta = .103].

Table 1:*Orthopaedically Disabled Individuals' Attitudes towards Computers According to Their Gender and Internet Usage (MANOVA Results)*

	Wilk's λ	**F**	**p**	**Hypothesis SD**	**Error SD**	**Eta**
Gender	.869	6.34	.000	3	168	.131
Internet use	.924	3.44	.010	3	168	.076
Gender*Internet use	.897	4.84	.001	3	168	.103

The analyses revealed significant differences between the attitudes of male and female orthopaedically disabled individuals (Table 2).

Table 2: *F, P and Eta Square Values for Male and Female Orthopaedically Disabled Individuals' Attitudes towards Computers*

Subscales	**Gender**	**N**	$\overline{X}$	**Ss**	**SD**	**F**	**p**	**eta**
Interest towards computers	Female	75	44.40	9.07	3-175	8.980	.003	.050
	Male	100	45.30	9.31				
Computer Anxiety	Female	75	32.72	10.82	3-175	.015	.903	.000
	Male	100	39.11	9.63				
Educational Purposes	Female	75	39.32	6.80	3-175	19.148	.000	.001
	Male	100	43.25	8.67				
Total	Female	75	35.40	7.32	3-175	11.934	.001	.065
	Male	100	39.67	8.18				

As depicted in Table 2, significant differences were found in the interest towards computer subscale ($F_{(3,175)}$ = 8.980, p = .003), the educational purposes subscale ($F_{(3,175)}$ = 19.148, p = .001) and the total attitude score ($F_{(3,175)}$ = 11.934, p = .001). No significant differences were indicated for the orthopaedically disabled individuals' computer anxiety ($F_{(3,175)}$ = .15, p = .903) with respect to gender.

The results of the analyses revealed significant differences in the attitudes of orthopaedically disabled individuals according to their internet usage (Table 3).

Table 3.: *F, P and Eta Square Values of Orthopaedically Disabled Individuals' Attitudes towards Computers According to Internet Usage*

Subscales	Internet Use	N	$\overline{X}$	Ss	SD	F	p	eta
Interest towards computers	Yes	102	46.68	9.04	3-175	6.309	.013	.036
	No	73	42.45	8.88				
Computer Anxiety	Yes	102	38.00	10.69	3-175	8.345	.004	.047
	No	73	34.10	10.14				
Educational Purposes	Yes	102	42.31	8.89	3-175	1.984	.161	.011
	No	73	40.52	6.87				
Total	Yes	102	39.38	8.78	3-175	9.296	.000	.052
	No	73	35.69	6.46				

As shown in Table 3, significant differences were found in the interest towards computer subscale ($F_{(3,175)}$ = 6.309, p = .013), the computer anxiety subscale ($F_{(3,175)}$ = 8.345, p = .004) and the total attitude score ($F_{(3,175)}$ = 9.296, p = .000). No significant differences were indicated for orthopaedically disabled individuals' attitudes towards the use of computers for educational purposes ($F_{(3,175)}$ = 1.984, p = .161).

The analyses revealed significant differences in the attitudes of orthopaedically disabled individuals according to the interaction of gender and internet usage (Table 4).

Table 4: *F, P and Eta Square Values of Orthopaedically Disabled Individuals' Attitudes towards Computers According to Gender and Internet Usage*

Subscales	Gender	Internet Use	n	$\overline{X}$	Ss	SD	F	p	eta
Interest towards computers	Female	Yes	47	43.55	8.88				
		No	28	45.82	9.36	3-175	17.700	.000	.094
	Male	Yes	55	49.35	8.36				
		No	45	40.36	7.98				
Computer Anxiety	Female	Yes	47	34.55	10.52				
		No	28	29.64	10.80	3-175	.071	.790	.000
	Male	Yes	55	40.95	10.01				
		No	45	36.87	8.73				
Educational Purposes	Female	Yes	47	39.11	6.96				
		No	28	39.68	6.64	3-175	3.525	.062	.020
	Male	Yes	55	45.05	9.49				
		No	45	41.04	7.03				
Total	Female	Yes	47	35.64	7.61				
		No	28	35.0	6.92	3-175	6.257	.013	.035
	Male	Yes	55	42.58	8.49				
		No	45	36.11	6.20				

As shown in Table 4, significant differences were found in the interest towards computer subscale ($F_{(3,175)}$ = 17.700, p = .000) and the total attitude score ($F_{(3,175)}$ = 6.257, p = .013). No significant differences were indicated for the orthopaedically disabled individuals' attitudes towards the use of computers for educational purposes ($F_{(3,175)}$ = 0.071, p = .790). Also, no significant differences were found for the computer anxiety subscale ($F_{(3,175)}$ = 3.525, p = .062) based on the interaction of gender and internet usage.

In the qualitative analysis part of the study, semi-structured questions were asked to 14 orthopaedically disabled individuals. All of the participants agreed that computers were useful their lives. Their views related to the question "What are the uses of computer?" are indicated in Table 5.

Table 5: *Benefits of computers*

	F	**%**
Access to information	13	40.6
Communication	6	18.8
Economy of time	4	12.5
Education	3	9.4
Ease of reading and writing	2	6.3
Recreation	2	6.3
Shopping	1	3.1
Financial affairs	1	3.1
Total	**32**	**100**

Of the orthopaedically disabled individuals, 40.6% stated that "access to information" was the most important benefit of computers. Another 18.8% indicated communication, 12.5% indicated economy of time, 9.4% indicated educational facilities, 6.3% indicated the ease of reading-writing tasks and recreational activities and 3.2% indicated shopping and financial affairs as uses of computers.

Their views related to the question "How have computers change your life?" are indicated in Table 6.

Table 6: *Impressions of Orthopaedically Disabled Individuals about Computers*

	F	**%**
Ease of life	9	28.1
Recreational activity	6	18.8
Reduction in job turnaround time	5	15.6
Having various types of information	4	12.5
No impact/nothing changed	3	9.4
Included new groups/new friendships	3	9.4
New perspective on life	1	3.1
Educational opportunity	1	3.1
Total	**32**	**100**

Of the orthopaedically disabled individuals, 28.1% stated that computers brought "an ease to life", 18.8% stated that computers created an option for "recreation", 15.6% indicated that computers "reduced job turnaround", and 12.5% indicated that they had access to various types of information due to computers; in contrast, 9.4% believed that computers did not cause any change in their lives, while 9.4% "included new groups" and 3.1% had a new perspective about life and opportunities for education.

Orthopaedically disabled individuals' views related to the question "Are there any negative effects of computers? If yes, what are these negative effects?" are indicated in Table 7. Six of the fourteen (42.86%) participants believed that computers had negative effects, but eight (57.14%) did not believe that computers had negative effects. The latter group believed that people create negative effects because of the inappropriate usage of computers.

Table 7**:** *Negative Effects of Computers*

	f	**%**
Being asocial	8	47.1
Lack of physical activity	3	17.6
Physical disorders	3	17.6
Access to illegal websites on the internet	1	5.9
Access to incorrect information on the internet	1	5.9
Reduction in school success	1	5.9
Total	**17**	**100**

As stated in Table 7, 47.1% of orthopaedically disabled individuals believed that computers made them asocial because they spent all day in front of a computer. Another 17.6% believed that a lack of physical activity and physical disorders such as back pain, lumbago, neck pain and others were negative effects of computers. In

addition, 5.9% believed that accessing illegal websites and obtaining incorrect information from the internet were other negative effects of computers. Another 5.9% stated that computer usage caused a reduction in school success.

The opinions of an institution director, principal, psychologist and physiotherapist about the negative and positive implications of computers in their institution were queried. People who served orthopaedically disabled individuals stated that computers did have not negative effects. Perceived positive effects included the opportunity to perform searches and homework, the opportunity for social integration and the option for recreational activity.

DISCUSSION

Special education teachers and experts especially emphasise that computers motivate children to learn, affect their attitudes towards class activities in a positive manner, increase their concentration period and provide more frequent opportunities for practicing basic skills (Costen, 1987, p.8).

In this study, which was conducted to determine the attitudes of orthopaedically handicapped people towards technology, it was found that such individuals generally use computers and have an education-oriented attitude regarding technology. In addition, their technology-related attitudes varied significantly according to gender and the interest felt towards computers. Previous studies have addressed gender differences in ICT attitudes (Shapkaa & Ferrarib, 2003). While some studies found no gender differences in attitudes towards computers (Gressard & Loyd, 1986; Woodrow, 1992), other studies found that females manifested higher levels of anxiety related to computers than males (Sadik, 2005; Samak, 2006). According to North & Noyes (2002), the use of ICT tools is widely perceived as a masculine activity, which suggests a link between gender and technophobia (cited in, Samak, 2006). Female teachers have been found to be more anxious and less confident computer users in most studies. In addition, male teachers have been found to have more prior experience with computers and to be much more likely to implement computer use in their classrooms than female teachers.

For the question “Do you use the internet to find the information that you need?” the answers varied significantly according to the interest in computers and the degree of computer anxiety. The answers to the question “Do you use the internet to find the information that you need” depended on gender and also the interest in computers. Orthopaedically handicapped people stated that they used computers to obtain information and for the comfort provided in their lives, but that computer usage also made people more asocial. This study, which was conducted to determine the attitudes of institution employees towards technology, determined that orthopaedically handicapped people generally had a positive attitude towards technology.

CONCLUSION

Education technology and computer-assisted education courses must be added to the undergraduate programs of special education departments of universities that train teachers. A “coordination of computer-assisted education projects in special education” must be established within the Ministry of National Education in the Directorate General of Special Education, Guidance and Counselling. This coordinating group must organise in-service training activities for computer-assisted education programs that will be applied to special education institutions.

In special education institutions, computer-assisted education equipment must be prepared that fits the characteristics of every type of disability, and this equipment must be standardised.

Computer-assisted education software must be prepared that fits the disabilities, needs and curricula of individuals who need special education, and this software must be effectively promoted by the “coordination of computer-assisted education projects in special education” by special education employees. Funding must be provided by the Ministry of National Education so that special education institutions can obtain computer-assisted education equipment and software.

In the light of the research findings, the following can be recommended:

- the organisation of education programs related to technology within continuous education activities in the institution and incentives for employees to participate in these programs;
- the improvement of the technological equipment of government agencies, making computer laboratories more common and creating solutions to issues that prevent the institution’s employees and the handicapped from utilising such equipment;
- the inclusion of publications related to technology in the library of every institution;

- the motivation of handicapped people and institutional employees to utilise contemporary technological tools and devices (computers, projectors, etc.) in their education activities and to seek funding for it from the government;
- the founding of education technology centres within special education centres and the technical support and tools needed by the employees who work at these centres; and
- the repetition of similar studies with different sample groups and the implementation of their results.

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THE RELATION BETWEEN DISTANCE STUDENTS' MOTIVATION, THEIR USE OF LEARNING STRATEGIES, AND ACADEMIC SUCCESS

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ABSTRACT
The aim of this study was to discover possible relationships between self-regulated learning dimensions and students' success in a distance-learning programme. The sample consisted of 319 students: 83 males and 236 females. They completed the 'Motivated Strategies for Learning Questionnaire' (Pintrich, Smith, Garcia & McKeachie, 1991), which was compared to their number of exams written, frequency of exam repetition and average course grade. The results show the importance of motivational factors, such as intrinsic goal orientation, task value and self-efficacy on the one hand, and effort regulation strategies on the other.
Keywords: distance learning, learning strategies, motivation, school achievement, self-regulated learning

Self-regulated Learning and Achievements in Distance Education
Theory and research on self-regulated learning (SRL) extend into the 1980s, when researchers dealt with the issue of how students can self-monitor, guide and manage their learning process. Self-regulated learning is a complex construct located at the intersection of many areas of psychological research, such as motivation, thought processes and metacognition. Over the last three decades, the study of SRL has mostly focused on the impact of learning strategies on learning achievement (Brown & Smiley, 1978; Pask, 1976). These early studies have showed that students who were trained to use learning strategies showed substantial improvement in their academic performance. They also discovered that, soon after the training finished, students stopped using learning strategies. Consequently, researchers realised the necessity to consider other reasons for the failure of pupils in the independent use of these strategies in different situations.

First, theorists began to focus on the concept of metacognition, defining it as the executive control process that includes planning, monitoring and control of cognitive strategies (Brown & Smiley, 1978). Another branch of research focused on a more affective aspect of learning—motivation. They tried to understand why, as opposed to just how, students are engaged in learning and the use of learning strategies. Based on these studies, some theorists realised that reasons for academic failure, besides not using cognitive strategies, may stem from individuals' feelings about themselves as a student or feelings about a particular learning task. In other words, motivation to learn was identified as the most important factor for the interpretation of individual achievement in the learning task. As the knowledge from different research fields and traditions in educational psychology were combined, a 'super theory' began to emerge in the form of the theory of SRL—nowadays, one of the most influential research theories in this field.

Characteristics of Self-regulative Learners
Before focusing further on the individual constituents of SRL, it is first necessary to ask what constitutes SRL and what characteristics are displayed by students who actively regulate their learning. Self-regulated learning is most commonly described as the level of metacognitive, motivational and behavioural activity in an individual's own learning process (Zimmerman, 2002, 1900). Students who actively regulate their learning often use different cognitive and metacognitive strategies that are systematically directed towards the achievement of learning goals (Corno & Mandinach, 1983; Pintrich & De Groot, 1990). They also use strategies to regulate other sources of learning such as adaptation of certain aspects of the physical environment and the organisation of time to learn so that they do become most efficient. Important components of SRL strategies are based on the regulation of learning and teaching environment. This group includes strategies such as organisation of time, effort control and regulation of physical learning environment (Pintrich & Garcia, 1991). It is also more likely that when they will find themselves in learning difficulties that they will seek help from teachers or classmates. (Pintrich & Garcia, 1991; Zimmerman & Martinez-Pons, 1988). Finally, students who self-regulate their learning have higher levels of self-efficacy, are confident in their abilities (positive attributions) and more internally motivated (Pintrich & Garcia, 1991; Zimmerman & Martinez-Pons, 1988).

Zimmerman (1990) claimed that SRL is derived from a student's own thoughts, feelings and behaviour directed towards achieving set targets. Research on SRL confirms that learning achievements are improved when students are active while learning (Ames, 1984; Dweck, 1986). Hence, it can be concluded that students who tend to regulate their learning are usually more successful than those who do not (Zimmerman & Martinez-Pons, 1988).

It was found that students not classified as 'self-regulative' used less cognitive and metacognitive strategies are less self-efficient and have external motivation for learning (Zimmerman, 2002). They are also less persistent in achieving their goals (Wolters, 1998).

Elements of Self-regulated Learning

Since SRL is characterised by its frequent link to various motivational constructs (Pintrich, 2000), the fundamental feature of self-regulation is the integration of cognitive and motivational concepts. Thus, all models of SRL are characterised by the fundamental assumptions of coherence and management of learning despite stemming from different theoretical starting points. Moreover, each model emphasises different arrangements and mechanisms. Zimmerman (1990) mentions three common characteristics of models of SRL. First, all definitions assume students are aware of the usefulness of self-regulatory processes in improving their learning and learning achievements; thus, they deliberately and consciously use the specific processes and strategies to achieve better academic success. Another characteristic common to all definitions of SRL is that the student gives himself or herself feedback during learning (Carver & Scheier, 2000; Zimmerman, 2002). Zimmerman calls this phenomenon a 'self-oriented feedback loop during learning'. This feedback loop concerns the circulation of information—a circular process in which students monitor the effectiveness of their learning methods or strategies and respond differently to these observations—from changes in self-perceptions (e.g., change in self-efficacy beliefs) or changes in behaviour (e.g., replacement of one learning strategy with another, more efficient one). A third common characteristic to all definitions of SRL is a description of how and why students choose different self-regulatory processes, strategies or responses. The opinions of the authors on the motivational dimension of SRL differ significantly from each other. For example, behavioural theorists argue that all responses are under the control of external rewards or penalties (Mace, Belfiore & Hutchinson, 2001), whereas phenomenologists take the view that individuals are motivated primarily by the positive sense of self-confidence or self-image (McCombs, 2001). Somewhere in between these extremes lie authors that highlight motives, such as achievements, in addition to goal attainment and self-efficacy (Zimmerman, 2002).

AIMS OF THIS STUDY

Research undertaken in the last two decades has shown a significant relationship between learning success and SRL in primary, middle, high school and graduate students (Corno & Mandinach, 1983; Pintrich, 1989; Pintrich & De Groot, 1990; Zimmerman & Martinez-Pons, 1990; Peklaj & Pečjak, 2009). However, no or very little research has been conducted on distance learning programmes. This study was designed to explore distance students' perception of motivation and use of SRL strategies and the ways in which SRL influences their academic success. The question guiding the collection of data was mainly focused on what SRL strategies are related to achievement in a distance-learning course.

METHOD

Sample

The sample consisted of 319 university students: 83 males and 236 females between the ages of 20 years to 49 years (M = 29.6 years, SD = 6.5).

Instruments

The Motivated Strategies for Learning Questionnaire (MSLQ), developed by Pintrich and colleagues (Pintrich, Smith, Garcia and McKeachie, 1991), is a self-report, Likert-type (1 = *strongly disagree* to 7 = *strongly agree*) instrument designed to measure students' motivational orientations and their use of different learning strategies. The questionnaire was translated into Slovenian and distributed to students. The MSLQ is based on the social–cognitive approach to motivation and learning, which is characterised by emphasis on the interpenetration of cognitive and emotional components of learning. Compared with other similar instruments in MSLQ, more attention is placed on motivational processes that affect the self-regulation of learning; the contextual nature of motivation and learning strategies are also emphasised. The questionnaire consists of two areas: motivation and learning strategies. The motivation section consists of 31 items and is determined by three sub-areas: (a) task value, (b) expectations and (c) test anxiety. Task value focus on the reasons an individual is engaged in some activity; expectations are based on individual beliefs necessary to undertake the task, and the emotional component reflects an individual's emotional response to test situations.

The area of learning strategies is also divided into three subsections: (a) the use of cognitive strategies (includes use of basic and more complex learning strategies), (b) metacognitive control strategies (that help an individual control and direct learning) and (c) management and organisation learning resources. This section includes regulatory strategy for the control of other sources in addition to cognition (e.g., good use of time, arranging space for learning, etc.) and help seeking (e.g., assistance in finding classmates or teachers when necessary).

Procedure
Surveys lasted an average of 30 minutes. Group interviewing was conducted as scheduled in participating distance education study centres. Researchers informed all subjects that their participation was completely voluntary and their responses would be held in strict confidence.

Statistical analyses
Psychometric characteristics of the instruments were determined with factor analysis (latent structure of the questionnaire) and Cronbach's α (internal reliability assessment). To evaluate our research question, several bivariate and multivariate methods were administered. To determine the relationship measures of academic achievements correlation analysis, the impact of independent variables on dependent variables was measured using multivariate regression.

RESULTS
Psychometric characteristics of the scale
The original version of the questionnaire contains a total of 15 factors (first part six, second part nine factors), although, in the present study, they were not empirically confirmed. We first analysed the main components and consequently wanted to assess the number of factors. Because of the intercorrelations between factors, we used Oblimin rotation. Bartlett's test of sphericity was highly significant ($p < .001$); the Kaiser-Meyer-Olkin rate of sampling adequacy was also suitable (KMO = .851). Factor analysis uncovered (and partly confirmed) six sub-scales in each dimension of SRL.

Motivational factors included:
1. Task value (21% variance; Cronbach's α = .81). Evaluation of the learning subject is closely related to setting internal goals and beliefs about a student's own effectiveness in learning.
2. Extrinsic goals (11% variance; Cronbach's α = .67). External goals indicate the degree to which the student learns for grades, awards, success or competing with others. For students with high external orientation, the aim of learning is only a means to achieve another goal.
3. Self-efficacy (6% variance; Cronbach's α = .76). Sense of self-efficacy consists of opinions of a student's own ability to complete the task, as well as confidence in their own skills.
4. Test anxiety (5% variance; Cronbach's α = .66). This factor indicates an individual's feelings in exam situations. Empirically, this factor is negatively associated with intrinsic goals, self-efficacy and task value.
5. Control beliefs (4% variance; Cronbach's α = .60). Control beliefs concern the expectations of success in certain tasks. They are based on a specific task or learning.
6. Intrinsic goals (4 % variance; Cronbach's α = .71). Intrinsic goal orientation indicates the degree to which a student learns because he or she is interested in substance, mastery and challenge. Learning is an end in itself, and not a means to achieve other objectives.

Learning strategies factors included:
1. Cognitive learning strategies (18 % variance; Cronbach's α = .79). This is a strong factor covering many aspects of learning strategies, namely, cognitive learning strategies (repetition, organisation, elaboration) as well as elements of critical thinking.
2. Help seeking (6 % variance; Cronbach's α = .86). In this factor, the two sets of strategies are combined: help-seeking and peer support strategies.
3. Effort regulation (4 % variance; Cronbach's α = .69). This factor describes students' ability to control their effort and attention when they face difficulties or distractions.
4. Metacognitive strategies (4 % variance; Cronbach's α = .79). This factor consists of variables relating to the use of metacognitive strategies.
5. Elaborative strategies (2 % variance; Cronbach's α = .72). This dimension consists of four items and is correlated to elaborate learning strategies.
6. Management of learning (2 % variance; Cronbach's α = .59). This factor describes a learner's organisation of time and physical environment.

Measures of learning performance
For the criteria of learning performance, we used the following variables: number of finished exams, frequency of exam repetition and average course grade. Table 1 shows descriptive statistics and the correlations between the variables in learning performance.

Table 1: *Descriptive statistics and Pearson correlations coefficients for the variables of learning performance*

	1	2	M	SD	N
1. Number of finished exams	—		12.92	6.63	259
2. Frequency of repetition	–.19**	—	1.47	.67	297
3. Average course grade	.24***	–.49***	7.33	.62	315

** $p < .005$. *** $p < .001$.

The association between learning performance scores is reported in Table 1. The students completed an average of 13 exams, took the same exam an average of 1.5 times, and the average course grade was higher than 7[1]. Correlation analysis revealed two statistically significant associations, one positive and low, the other negative and moderate. The strongest correlation was between the frequency of examinations and average rating. The results of our analysis show these two characteristics are negatively correlated: a greater frequency of exam retakes corresponded to lower average course grades. We found a low relationship between the number of finished exams and course grade. In principle, one could argue that students who took exams regularly and often had a slightly higher average course grade than those who passed examinations less successfully.

Factors influencing academic success

Three multiple regression analyses were conducted to identify the most important SRL characteristics that may predict 'number of passed examinations', 'number of repeated examinations' and 'course grades'. Table 2 lists the regression coefficients that could affect the number of examinations taken during the study. Examining Beta coefficients, goals and task value yielded a significant impact on the number of passed examinations ($R = .309$, $F_{12,249} = 2.157$, $p = .014$).

Table 2: Regression analysis summary for SRL variables predicting the number of passed examinations

Variable	B	SEB	β
Intrinsic goals	1,24	,52	,19*
Extrinsic goals	,83	,39	,15*
Task value	-1,67	,71	-,21*
Control beliefs	-,32	,51	-,05
Self-efficacy	,63	,59	,08
Test anxiety	-,36	,33	-,08
Learning strategies	,81	,63	,11
Elaboration	-,71	,64	-,11
Effort regulation	,12	,39	,02
Metacognition	-,39	,49	-,07
Help seeking	,42	,31	,09
Time organisation	,18	,50	,03

*$p < .05$. **$p < .01$. ***$p < .001$.

As indicated in Table 2, when all variables were included in the equation, only motivational variables were statistically significant in predicting the number of examinations. Both intrinsic and extrinsic goal orientations positively predicted the number of finished exams, while task value negatively predicted it. It seems that students who set strong goals (whether intrinsic or extrinsic) for themselves are more determined and successful at passing exams. Students who value their learning more finished fewer exams. Apparently, they are more focused on the quality of knowledge. Characteristics of cognitive strategies did not help much to further clarify this independent variable. None of the β coefficients were shown to be statistically significant.

Table 3 summarises the hierarchical multiple regression in which we wanted to predict factors affecting the frequency of repetition of tests. Since our evaluation of the independent variable is essentially the reverse—a higher value indicates poor performance—this should be considered in the interpretation of the results. Negative values of the coefficients of each factor thus show the positive effects of this factor on frequency of exam repetition.

[1] Grading system in Slovenian tertiary education: excellent (10), very good (9, 8), good (7), satisfactory (6), failed (5-1). To pass an exam, a student has to achieve a grade from satisfactory (6) to excellent (10).

Table 3: Regression analysis summary for SRL variables predicting the number of repeated examinations

Variable	B	SEB	β
Intrinsic goals	-,12	,05	-,18*
Extrinsic goals	,04	,04	,07
Task value	-,09	,06	-,11
Control beliefs	-,01	,05	-,01
Self-efficacy	-,08	,06	-,10
Test anxiety	,00	,03	-,01
Learning strategies	-,04	,06	-,05
Elaboration	,03	,06	,04
Effort regulation	-,08	,04	-,13*
Metacognition	,08	,05	,13
Help seeking	,01	,03	,01
Time organisation	-,05	,05	-,08

*$p < .05$. **$p < .01$. ***$p < .001$.

This regression model is somewhat 'stronger' than the previous one ($R = .381$, $F_{12, 284} = 4.027$, $p = .000$). There are only two statistically significant coefficients: from the motivational side, intrinsic goal orientation ($\beta = –.13$; $p < .05$) and, from the learning strategies side, effort regulation ($\beta = –.13$; $p < .05$). Direction of both coefficients is negative, and their strength is relatively low, which means that their influence is in fact positive. These findings suggest that students who set intrinsic goals while studying and also try to regulate their effort during learning pass exams much more quickly than those who lack these qualities.

Table 4 summarises results of the last multiple regression analysis, in which we aimed to understand the factors that influence the average course grade during the study. The regression model is the strongest of the three ($R = .411$, $F_{12, 302} = 5.114$, $p = .000$).

Table 4: Regression analysis summary for SRL variables predicting the average course grade

Variable	B	SEB	β
Intrinsic goals	,08	,04	,14*
Extrinsic goals	,00	,03	,00
Task value	-,04	,06	-,05
Control beliefs	-,03	,04	-,04
Self-efficacy	,10	,05	,14*
Test anxiety	,02	,03	,03
Learning strategies	,07	,05	,09
Elaboration	-,03	,05	-,04
Effort regulation	,13	,03	,23***
Metacognition	,01	,04	,01
Help seeking	,00	,03	-,01
Time organisation	,06	,04	,10

*$p < .05$. **$p < .01$. ***$p < .001$.

Two motivational and one learning factor positively influenced the course grade. Among the motivational predictors of course grade, the most important are self-efficacy ($\beta = .147$, $p < .05$) and intrinsic goal orientation ($\beta = .14$, $p < .05$). Students with intrinsic goal orientation and a higher level of self-efficacy scored higher than other students. Among the learning strategies, effort regulation ($\beta = .23$; $p < .001$) is particularly important. Effort regulation is also the strongest predictor in this regression model. Students who are trying to self-motivate and encourage themselves during learning are likely to have a higher average score than those not using these strategies.

DISCUSSION

The goal of this study was to provide some information regarding the influence of dimensions of SRL on academic success in tertiary distance education. We used multiple regression analysis to verify our assumptions. The findings showed that goal setting, task value, self-efficacy and effort regulation were the main strategies that led to better academic achievements in the chosen distance programme.

In general, we can conclude that, when studying in a distance-learning course, students who set themselves more intrinsic goals, value their learning, believe in their ability to successfully accomplish academic demands and can handle distractions and maintain concentration finished more exams, accomplish them faster and achieved higher test scores. Given the characteristics of extrinsic goals, their effect on the number of tests is not surprising. It is interesting that these goals 'work' simultaneously with intrinsic goal orientation. The importance of intrinsic goal orientation for a smaller repeat ratio of exams is easily understandable. Students who set intrinsic goals repeat the tests less often because the very method of learning study materials also changes their strategy for examinations. They come to the exams well prepared and are confident of success. On some occasions, they repeat tests simply to improve their assessment. Effects of self-efficacy can be explained by greater self-confidence in learning and minor problems with concentration or retrieving learning material. The effect of self-efficacy on learning achievement has been shown several times in the past (Peklaj & Pečjak, 2009). Greater success in academic studying also applies to students who use strategies of effort.

Some practical implications can be set out from these results. This study shows that motivational and strategic determinants have a significant impact on academic performance. Given the low use of learning strategies, possibly due to partial ignorance, it would be appropriate to develop short self-regulatory learning courses for students who believe they have this need. One possibility is establishing counselling centres that would deal with—in addition to organisational and administrative problems—the counselling of students with learning disabilities.

We must not forget that the use of study strategies and learning goals often depend on the orientation of the study (Ames & Archer, 1988). When studying is limited to the knowledge of facts, students will surely develop an external motivation and use more simple (reproductive) learning strategies. A study programme and evaluation of knowledge should therefore stimulate the greater development of critical thinking and apply problem-based learning that would deepen the understanding and relevance of learning content. Divergent questions or alternative forms of assessment would certainly contribute to a different motivation and increase students' access to deeper learning strategies.

In the future, MSLQ should be used again to examine further the learning characteristics of students in distance education and non-traditional settings. Exploration of the SRL of students involved in distance education (e-learning) is not widespread in the literature. It would be advisable to check results confirmed in other samples of students at a distance. To determine the characteristics of learning of students in distance education programmes, it would also be worthwhile to examine their learning by using different research methods.

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USING INFORMATION AND COMMUNICATION TECHNOLOGIES IN SCHOOL IMPROVEMENT

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ABSTRACT
Advances in information and communication technologies, shortly called as ICT, require educators to present a more efficient and modern education by using these technologies. Therefore; the role of ICT in the development of education has been a popular research subject nowadays. Even not only education content but it has started to be dwelt on how to develop education documents, education management, school libraries and an entire education institute via ICT as well. In this study, using facilities of ICT in the improvement of a school has been examined. In addition, the materials and equipment necessary for the use of ICT, teaching staff that are capable of using these technologies and difficulties that are met during practices have been discussed. It has been tried to determine what it takes to deal with these hardships. Within the scope of the research, it has been dwelt on how some European countries tackle and practice this subject through data and samples collected in the common-subject study visit to the Estonia, Kohtla-Jarve, in 13-17 October 2008.
Keywords: School improvement, Information and communication technologies, Education technologies.

INTRODUCTION

Using information and communication technologies in education has been continuing about a century. The investments of information and communication technologies which started with radio transmissions in 1920s have developed via television transmissions and investments after 1976s. The planning towards using technology in education in Turkey started with 3rd five year development plan which suggested using radio and television for adult education in 1970s. However; the use of computer and internet, which are products of advanced technology, has become widespread after 1995 (Aziz, 1982).

The ministry of education defined the skills that teachers should have in the area of ICT in the general competencies of teaching in 2006. According to this; teachers must have the competencies of being able to know legal and ethical responsibilities of ICT and teach these to learners, be technology literate, follow the advances in ICT, make use of ICT to support vocational development and increase effectiveness, benefit from ICT to share information (e-magazine, practice software, e-mail), prepare suitable learning environments to learners who have different experiences, features, and skills via ICT, give place to how to use ICT in lesson plan, utilize computer and other technological devices to prepare materials, have an access to sources about teaching and learning in technological environments, assess them in terms of accuracy and suitability, be model in effective use of technological sources, and teach them, use technologies that support learner-centered strategies while taking into consideration different needs of learners, develop and apply strategies for behavior management in densely technological learning environments, analyze data via ICT, inform parents, school management, and other educators about results through ICT (Cüre & Özdener, 2008).

The importance of using ICT in school development can easily be understood from the scope of this notice. In addition to the ICT competencies of the teachers mentioned above, many other parameters play an important role in school improvement. It may be said that the process of school improvement is on the right track when these parameters are provided adequately and on time.

1. PARAMETERS IN SCHOOL IMPROVEMENT

Improvement process of school where our knowledge and skills are started in a planned and controlled way begins with erecting buildings, and providing teaching staff and basic school materials and equipment, and continues. We say it continues since improvement of a school never ends. It should not finish. It is wrong to think the maintenance of improvement in a school just improving its physical, managerial and hardware facilities. If school increases the quality of the education and the success of its learners via these facilities and reaches its aim in education through training individuals who are required by the age to be qualified, it means that the school maintains its improvement.

There are some parameters that play an important role in reaching the mentioned targets for an effective school improvement. These parameters can be summarized as follows:

Building: A school contains many components such as; class, laboratory, gym, or, playing ground, library, dining hall, canteen, dormitory, and garden. As well as the sufficiency of the numbers of the components, their place in the building, colors, lighting and heating systems are also important. The improvements that will be made in all the features that have been mentioned will play a crucial role in school improvement.
Physical Equipment: Providing, reconstructing, and renewing physical equipment needs such as desk, table, and board in the course of time in accordance with the type of school, and the goals and objectives of education will contribute to school improvement.

Technical Equipment: School should have technical materials and equipment (ruler, map, laboratory equipment, computer, internet, data projector, writer, scanner, etc.) compatible with the type of school. Updating and increasing their numbers will contribute to school improvement.
Management and Service Staff: School must have knowledgeable, skillful, and open-minded managers in order to conduct managerial works appropriately. In addition, adequate and qualified service staff is needed in order to create and maintain a suitable learning environment. For example; in all the schools which were visited in Estonia in 2008 it was seen that there were a great number of service and supporting staff. Even in a school where the number of the teachers is 29 it was seen that there were 25 service and supporting staff (cleaning, cloakroom, dining hall, ICT, etc.) (Kılıç, 2008).

Teaching Staff: Having sufficient teaching staff in each subject and keeping them updated through seminars and in-service training will play a crucial role in school improvement.

Information and Communication Technologies (ICT): In our changing and developing world it is very important to use information and communication technologies in education, as with all other areas. ICT are one of the most indispensable parameters in school and increasing the quality of education since they are sources in every aspect of life.

All of these parameters which are necessary for school improvements are very important and each of them is a research subject. In this study, ICT's role on school improvement has been stressed. In developing and globalized world, education models and pedagogical approaches change, as well. Dependably, technologies that are used in education change, too. Using ICT in education has become widespread rapidly and even it has become indispensable. Many people believe that computers make the works easier, more effective and more fun (Seferoğlu, 2002). Taken into consideration these features it might be said that using ICT is a main component in school improvement. Therefore; this point has especially been emphasized in this study.

2. USING THE FACILITIES OF ICT IN SCHOOL IMPROVEMENT

As stated in the previous section, one of the most important parameters in the improvement of a school is using Information and Communication Technologies (ICT). Using ICT should be understood as not only technological development but the development in pedagogical method and the level of education, as well. When ICT is said, not only tools such as telephone, fax, computer, data projector, and smart board come to mind but software such as word processor program (MS Word), calculation and table program (MS Excel), presentation preparing program (MS PowerPoint), website designing programs, and concepts of network such as network, internet, width of band, and sharing information come to mind, too.

ICT has become an indispensable part of our everyday life, which has made both education of ICT inevitable and most effective factor in school improvement. In an environment where almost all houses have computers and internet connection and individuals use the facilities of ICT entirely, using these facilities at school and in education is an expected and necessary process. Using these facilities has led to modernization in schools, development in education, and a change in the profiles of teachers and learners.

Using ICT has brought about some difficulties and costs like every innovation and technology. However; the yields of these hardships and costs are fairly high and effective. As Peter Rudd stated in the conference titled Educational Conference and Education Research in 2000, the role of ICT in its effect on school development and learner performance had been disregarded. In fact, there is a direct relationship between the motivation of learner and his learning.

Researches about school improvement have dwelt on the positive effects of ICT on the effectiveness of teaching and the development of learning. Especially these two questions have been focused (Higgins, 2003):

- What is the evidence that ICT can have a positive impact on pupils' learning in school?
- How can ICT be used effectively in schools to improve pupils' learning?

A great many studies have been undertaken to find answers to these questions. As a result, it was seen that when ICT was integrated in a planned, effective, and structural way it might contribute to the learning and teaching to a great degree. These answers also put forward how effective ICT is in school improvement which is our subject.

2.1. A general view to the ICT used in education

Blackboard that has been used in the schools for years has been replaced by smart board, books and notebooks have been replaced by flash discs, overhead projectors have been replaced by data projectors, and text-based assignments have been replaced by presentations and slide shows. When ICT is said, it is very natural that computer is the first thing that comes to mind. Other concepts have existed and developed depending on computer. Rapidly developing technology and technological services and products which are becoming cheaper day by day have showed their effects on school improvement. There is nearly no school which does not have computer and internet connection. In this section, technologies that are used in the schools will be discussed, and the most important ones among these will be mentioned shortly.

Computer: It is the origin and the main component of ICT. Other technologies have taken shape as hardware and software in accordance with the development of computer. Almost all schools have computer laboratories right now. These laboratories are used for both ICT courses and other courses. In addition, teachers' rooms in schools have computers so that teachers can make preparations for their lessons.

Software: They cost as much as hardware and even cost more than them nowadays. For this reason; many countries have signed agreements with big software companies (Microsoft, Macromedia, etc.). They have aimed at decreasing the cost of licensed software used in schools. Along with licensed software, open source software such as moodle, viko iva, and hot potato are used in schools, as well (Estonia Study Visit Group Report, 2008).
Data Projector: They replace overhead projectors which were used in the past. Data projector is indispensable in computer-based methods or methods where education documents prepared with computers are used as supporting documents. Therefore; it is very important that not only laboratories but also all classes have data projectors so that the quality of education and learner's motivation can increase.

Internet and Web-based Tools: Network technologies have developed rapidly in the last years and depending on this, connection speed and bandwidth have also increased. However, costs have decreased even if not wanted degree (Augar and et al, 2006). This has resulted in using internet in education. The presentations of text-based contents have been replaced by audio-visual contents and animations. In addition, instead of text-based assignments, concepts such as on-line assignments, and project works have become common. Forms of learning and teaching such as distance learning, in-service training, and mobile learning have become rivals with face-to-face education due to the developments in internet and web tools.

2.2. Providing adaptation of learner and teacher in using ICT

Using ICT brings a number of adaptation problems as with other innovations. In the origin of all discussions in recent years such as teacher-learner centered education, class- based, computer-based education, face-to-face, and distance education lies ICT. Therefore; when usage of ICT is mentioned, concepts of education system, form of education, and pedagogical method are also mentioned. Under this heading, the issue of adaptation during using ICT in school improvement will be discussed.

Using ICT might be very beneficial to both learner-centered and teacher-centered education. Many learners can adapt to new technology and using ICT in school more rapidly today on account of their environment. However it is not the same case for teachers. They find it hard to adapt this new system because they have a social background distant from ICT and they have taught for years with traditional methods and deprived of technology. Yet, ICT might be shown as a support to the traditional academic methods, especially problem-based view. For example; for a teacher who has a homepage, the tools that are on his web page are excellent tools for maintaining lesson-based teaching tradition (Notland, Johannesen & Vavik, 2001).

The study titled as Situation of Teachers in the Integration to the Process of Learning and Teaching, conducted by Ass. Prof. Yasemin Koçak Usluel and her colleagues in 2005, 114 teachers who work in schools where ICT are used form the research group. As a result of the research two tables below were obtained.

Table 1*: The percentages about the levels and frequencies of teachers' use of applications of ICT*

	Level of use						Frequency of use					
	Never		Intermediate		Advanced		Never		Sometimes		Often	
	f	%	f	%	f	%	f	%	f	%	f	%
Word Processors	6	5,3	53	46,5	55	48,2	7	6,1	42	36,8	65	57,0
Calculation Tables	40	35,1	56	49,1	18	15,8	45	39,5	50	43,9	19	16,7
Databases	82	71,9	26	22,8	6	5,3	90	78,9	20	17,5	4	3,5
Graphics and Drawing Programs	74	64,9	34	29,8	6	5,3	77	67,5	32	28,1	5	4,4
Desktop Publishing	91	79,8	16	14,0	7	6,14	93	81,6	16	14,0	5	4,4
Presentation Programs	41	36,3	46	40,7	26	23	43	38,1	45	39,8	25	22,1
Education Software CD's	36	31,6	56	49,1	22	19,3	41	36,0	50	43,9	23	20,2
E-mail	41	36,3	34	30,1	38	33,6	40	35,4	30	26,5	43	38,1
www	20	17,5	42	36,8	52	45,6	22	19,3	42	36,8	50	43,9
Internet	53	46,5	37	32,5	24	21,1	59	51,8	36	31,6	19	16,7
Other	0	0,0	1	33,3	2	66,7	0	0,0	0	0,0	4	100,0

Table 2: *The percentages about the situations of teachers in integration of ICT into the process of learning and teaching*

The Situations of Teachers in Integration of ICT into the Process of Learning and Teaching	Never		Sometimes		Always	
	f	%	f	%	f	%
I use traditional methods since I have no information about the integration of ICT into the teaching process.	33	29,7	46	41,4	32	28,8
I look ever internet sources periodically to use them in teaching.	32	28,1	49	43,0	33	28,9
I participate in some on-line projects with my students.	92	80,7	20	17,5	2	1,8
I design and practice lessons via ICT for teaching activities in the class.	59	52,2	44	38,9	10	8,8
I assess the results of the lessons where I use ICT in teaching activities in the class.	69	62,2	26	23,4	16	14,4
I encourage my students in using ICT in communication, problem solving, and data analyzing.	36	34,0	45	42,5	25	23,6
I know how to integrate ICT into teaching in order to increase the success of learners and I am a role model for my students in this issue.	51	51,0	33	33,0	16	16,0

If we consider that this study was conducted five years ago and there has been a considerable increase in the use of ICT in schools in Turkey since that time, it is possible that there have been many changes in these tables. It is possible to say that the support of Ministry of Education to teachers in using ICT via local and national in-service training courses has changed the table positively. All studies conducted about implementation of ICT in schools converge into the condition of teachers' having necessary knowledge and skills for the effective integration of ICT into the process of learning-teaching (Demiraslan & Usluel, 2005).

Setting out from this approach, first of all teachers should be convinced of value of ICT as an educational learning tool and there should be some professional enterprises in order to increase the interest of teachers in ICT. It is beneficial to raise the consciousness of teachers that their duties will never end but will change form, their duty will be leaders in the system, and there will be no education without teacher no matter what the system is in technology-based education (Varol, 2002).

3. INFORMATION OBTAINED IN THE STUDY VISIT

Teacher trainers, education consultants, guidance counselors, school inspectors, and lecturers from faculties of education can participate in study visits activities which are included in the Lifelong Learning Program of the Presidency of European Union Education and Youth Programs Centre. In this section, the information obtained in the study visit hosted by Kothla-Jarve Municipality from Kothla-Jarve city in Estonia in 13-17 October 2008 titled as "Using ICT in School Improvement" will be presented:

- 2 teacher trainers from Turkey
- 1 education consultant from England
- 1 principal, 1 education consultant from Spain

- 1 teacher from Poland
- 1 researcher from Hungary
- 2 lecturers from France
- 1 teacher from Slovakia
- 1 teacher trainer from Germany
- 1 school consultant from Greece

have participated in this visit (totally 12 education specialists).

The study visit included cultural visits, school visits, and the presentations of host Estonia and representatives of other participant countries about their own educational systems and implementation of ICT in education. In all the activities, using ICT has been stressed and successful samples have been presented.

It has been emphasized that there is a high national agenda and a central study so that ICT can acquire a high profile in Estonia. It has been stated that wireless internet connection is highly widespread and provided for free in small towns, airports, public buildings, and even in some rural areas. As it is understood from observations and reports, Estonia has been giving a high priority to education since 1997. Within this scope increased investments have been directed towards establishing ICT and making them common in the name of improving management systems and enriching education-teaching. This national trend has been reflected in policies and implementations in Kothla-Jarve thanks to local government. Both mayor and his assistant display a strong leadership on this issue and education specialists of the host country of this visit develop policies and strategies in order to guarantee that investments of ICT affect the students at schools directly. It was seen that managers, teachers, and supporting staff who work in the schools and institutions that were visited are role models and encourage learners, other staff, and families actively in using ICT as a tool for both increasing the quality of education-teaching and improving the processes of management and communication. This joint approach which was conducted at the levels of national, local and school is assessed as both impressive and an effective model for the successful improvement activities that will take place in the future (2008-218 Group Report).

Schools that are host in this visit have showed their desires in sharing good examples in education including ICT. Staff and even students have displayed a constructive attitude towards finding innovative methods that will improve their learning. It has been stated that the ones who have been in the process and have been successful have been awarded. Even though some restrictions have been experienced, it has been observed that sufficient importance has been given to reading, music, drawing, and other hobbies since it is a balanced approach for educational development. It has been understood from all the observations and statements that ICT are assessed as a "tool of change" in order to realize success. Same statements might also be said easily for other European countries. Estonia is seen as a different country due to its large scale co-operation promise for sharing good examples in education and support for teachers who develop new approaches and curriculums. The schools that we visited utilize e-learning environments that were either established or supported by government or local authorities effectively.

Within the scope of the study visit many good examples have been presented relating to the topic of visit "Using ICT in school improvement" and reconstruction of education. These examples were evaluated in the meetings at the end of every day. Each participant told if there were similar implementations in their countries and if there were any, their similarities and differences were discussed. The most important issue seen during the visits is the success of teachers in preparation for lessons that are presented via smart board or computer. It was seen that they made at least 1 hour preparation for preparing lesson materials. In addition, widespread use of ICT in school-student-parent co-operation, office work, and library were other interesting issues. Correspondences, book registration operations and operations of informing parents are conducted professionally via ICT.

3.1. Examples from applications in different countries

Below, some examples of applications of information and communication technologies during the visit in host and participant countries have been presented as a table.

Table 3: *Good practices of ICT usage in education*

Title of project	Institution where the project is implemented	The ones who benefit from the project	Characteristics of the project
EHIS Education Information System	All educational institutions http://www.ehis.ee/	Workers in central and local institutions	Information and management systems, document registration and tracking procedures
RIKS School libraries program	Tammiku Gymnasium Jarve Russian High School	Students	School libraries and other libraries within the network with (common database)
Miksike E-learning platform http://lefo.net/	Jarve Russian High School http://kjvg.edu.ee	Students and teachers	Interactive learning platform used 50% of schools in Estonia. It has 120,000 registered users.
E-kool Interactive educational environment http://www.ekool.ee	Jarve Russian High School http://kjvg.edu.ee	Information technology training materials developers	Many Estonian schools have been using it. It increased the use of information technology.
Russian (Virtual) Museum	Virtual Musuem (via Google)	Wide audience and students	A virtual presentation of the Russian Museum. 3-dimensional and detailed
Tiger Leap Foundation	Kesklinna Gumnaasium http://www.kjkg.edu.ee	Teachers and trainer formatters	A national project designed to increase the use of information technology in schools
IT Pirates Among Us? http://ppaun.blogspot.com/	Jarve Russian High School http://kjvg.edu.ee	Students	A research project over the use of pirated software and information technology in schools and by students
Curriculum structure: system consists 7-week periods	Jarve Russian High School http://kjvg.edu.ee	Teachers and curriculum preparers	the curriculum is implemented by being divided into from 5 to 7-week periods
An experienced teacher's own web site	Intellekt www.intellekt.ee http://znajka.net/	Teachers and students	Educational materials prepared using open-source programs, e-books prepared for parents
School web site	Ahtme Gymnasium http://www.ahtme.edu.ee/	Parents, students	Designed to keep interaction with students and parents outside the school
School websites	Sukromna jazykova skola RK Centrum Primary school ZS Spojova 14, Banska Bystrica www.zsspojova.edupage.org	Parents, students	Designed to inform parents of the students' development, activities, issues such as food
Primary school website; Radio Station	Carrer Josep Tarradelles sn ES-08232 Viladecavalls http://www.xtec.cat/ceip-rosella	Parents, pupils	Information for parents about children's activities, school information, meals, etc menu. Use of ICT including Radio Station and blogs
Sport / ICT **S**tudy United - sponsored high tech ICT area.	Study United Scunthorpe FA Club www.studyunited.org.uk	Volunteers	It has been presented for information technology sponsorship and to improve students' motivation in sports school
'Discover' project. Information technology-based curriculum	Foxhills Performing Arts & Technology College www.ftconline.org.uk	Teachers and researchers	Supported by local authority and Manchester Metropolitan University, integration of paper-based curriculum with information technology base.
Ministry e-learning platform	Institute of adult education/Lifelong	Adult educators	Environment offered by the Ministry to educate adults for different issues

http://www.keeenap.gr/	Learning / Greek Ministry of Education		
E-school educational materials and interactive document sharing site	http://skoool.meb.gov.tr/	Students and teachers	An interactive web site prepared by the Ministry that students and teachers can make use of
ILSIS Learning Management System of Turkey	http://ilsis.meb.gov.tr	Teachers, schools, the Ministry units	A very comprehensive site regarding the management of the schools and, teachers and entire education system
School web site	Peter Henlein Realschule, Nuremberg www.peter-henlein-realschule.de	Parents, teachers, students	Information for parents about the school. Teachers' access to information and instructional materials' links
State initiations	National Development Agency http://www.nfu.hu/the_new_hungary_development_plan	All training agencies	Information technology-supported environment Hardware, software training
An international conference in Marseille (3 days in Spring 2009)	The Observatoire des Ressources du Multimedia Education http://www.orme-multimedia.org/r2008/index.php	Teachers, researchers and local governments	Education conference on the use of information technology in Marseilles
Pairfom@nce	French Ministry of Education- SDTICE	Teachers	Online courses for teachers to facilitate the use of information technology in their courses
B2i	French Ministry of Education	Students	Use of information technology certificate programs

Similarities between the education systems and applications of host and participant countries and Turkish education system:

- Education information system which is used in Estonia, EHIS, Turkish National Education Ministry system, ILSIS, is quite similar. If you need to make a superficial comparison between ILSIS and EHIS, ILSIS has a more complex structure and has more details.
- Also the ekol.ee which is a student management system includes some similarities with the e-okul.meb.gov.tr.
- In Estonia and other schools, informatics classes, which is supplied with nearly 15 computers, 1 smart board and surrounding devices to be used in informatics technological courses and in leisure time in other courses, have been established.
- In schools, information and communication technologies specialist teachers who have very few courses and help the other branch course teachers in their spare time have been employed...
- Necessity for branch teachers, coming together with the teachers in their own sub branches, to prepare annual activity plan and plan an independent project for each branches.
- Employing a large number of support personnel in educational institutions.
- Academic year consists of 5 periods of 7 weeks in planning.
- Examinations take place within last three days of each semester and the dates of the examinations are certain at the beginning of the courses.
- Thanks to the fact that school web sites are widely published in several languages, more participation and sharing are ensured.
- Money allocated to schools depends on the number of students in the school and when a student move to another school, allocation also goes with the student.
- In Spain, administrators of schools are selected in an election attended by parents and teachers after a nomination period in which nominates campaign the projects they have prepared.

The staffs, who are appointed to management position in Estonia, can start working after completing a 160-day course about management with informatics technology and communication processes, and this is repeated in regular specific time periods (Kılıç, 2008).

4. DISCUSSION AND CONCLUSION

It is inevitable to implement publicities in order to design an education system that enriches the variety of learning opportunities for students and is developed through the use of informatics technologies. It is possible for schools to reach new technologies by purchasing expensive hardware and software. For these, available financial sources and high license prices are common limitations for all countries. In comparison with others, some countries are at a better point in this respect. While all countries have been experiencing a gradual development, some priority order differences can be seen in the supply of the hardware, teacher training, and curriculum content development.

- In European countries, the methods employed to increase school's inventory of computer hardware have common features.
    1. 1 computer and data projector in each classes (for teacher use)
    2. Classes equipped with smart boards
    3. Establishment of, at least, an information technology class (for the use of students in a room separate from the class; 15 computers, which can be allocated for the courses other than informatics technologies courses.)
    4. Also establishment of classrooms with more than one computer to be used in courses other than informatics technologies courses.
    5. Teachers and students are given laptop computers for individual use.
- Although staff training and motivating are the most important investment areas in all countries, integration of information technology as an effective learning tool with the development of teaching methods is a must. In some countries like Estonia, state and local governments conduct regulation and financing of education together. Though this condition is more positive in the other countries, it is witnessed only in local schools. In all countries, teachers are encouraged to improve their informatics technology skills, to be able to use ready programs, to be able to reach open source software, to spend more time in the direction of developing their own materials and web sites. This visit revealed that while communication between the staff helps in the development of trust and support between them, it also encourage individuals to share their good ideas.
- Another important issue is the development of pedagogy .In many examples, it is observed that students use information and communication technologies to gather information and make analyses in individual/group researchers which they conduct in the framework of problem-based learning approaches.
- Learning platforms increasingly make it possible for teacher and students to access and share content and software applications. In countries like Estonia, all schools have orientation toward using this platforms and this orientation encourage cooperation. At the same time, this makes it possible for local and state governments to encourage future cooperation by rewarding contest and projects.
- Innovative methods are employed in curriculum content and software development, and in the spread of staff resources; it is observed that other people are invited make contributions to build their websites and they benefit from open source software.
- Information technology management and its use in communications processes;
    1. Now, many countries tend to have systems that let school information to be used even for very different purposes once they are saved. In this context, the EHIS available in Estonia, because of different levels of details in stored data, has a really impressive way of integrating state, local and school systems.
    2. Reducing paper/ bureaucracy, has made all the schools we have visited compatible with the systems that will minimize the use of papers in correspondences. In addition, in these schools, all the documents of the staff asked to be presented in electronic media in details.
    3. Ability to evaluate success of schools at local level by local and national politicians and determining high quality decisions about teachers' training needs.
    4. Integrated library system of host country, RISK, has connected local, school and the other networks to each other and provides electronic media opportunities of book and literary researches, which can only be seen in higher education institutions in other countries.

Providing effective communication with parents, supplying parents with systems which make it possible to monitor development of their children online, sharing detailed information about activities to be done in the school such as teachers' daily lesson plans and daily food menus. School statistics shows that most of the parents use these systems in order to check status of their children.

As a conclusion, it is observed that the use of ICT not only encourage the students and teachers in terms of education but also they motivate students in a positive direction. In the restoration and development of education, use of ICT which is actively integrated with www (World Wide Web) is a significant catalyst. For the active integration of ICT with education, firstly a good hardware platform must be presented and better training of teachers is required. Finding technical support staff for solving problems which may arise during education is also important. As the use of ICT gets widespread in schools, students will have equal opportunities to access ICT. A situation research, which was conducted in 2001 in the UK, concludes that thanks to use of ICT academic level in the schools has increased. In this respect, although it is more costly and troublesome compared to classical methods, it is suggested that it can or will be preferable due to its positive contribution to education (Kington and et al, 2001).

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WHERE RESEARCH, PRACTICE AND THE AUTHORITY MEET: A COLLABORATIVE INQUIRY FOR DEVELOPMENT OF TECHNOLOGY-ENHANCED CHINESE LANGUAGE CURRICULA

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ABSTRACT
This collaborative inquiry project brought together 14 Chinese Language teachers, 4 researchers and 2 Ministry of Education (MOE) curriculum specialists to co-design the Chinese Language curricula with the integrated use of information and communication technology (ICT). Three qualitative data sources – one-to-one interviews, focus group discussion, and the field notes – were collected and comparatively analyzed. The findings indicate when the participants in the three parties (teachers, researchers and ministry officials) brought their own agendas and interests to the project and this resulted in various tensions initially. The participants experienced gradual changes in knowledge, beliefs, attitudes and practice after coming out of their comfort zones. When they reached a consensus to enhance Chinese learning for primary school students, they actively contributed their respective strengths to the project. The findings indicate that the collaborative inquiry model is one possible way to resolve tensions arising from education reforms and to build-on diverse ideas for contextually viable innovations.
Keywords: Collaborative inquiry, Teacher Professional Development, ICT in Education, Language Learning

INTRODUCTION

Teacher professional development continues to be one key issue in educational reform. There is a growing agreement among educators to change the conventional approach of one-off workshop for teacher professional development (Emihovich & Battaglia, 2000; Moon, 2000). Desimone (2009) proposed the "core conceptual framework" of professional development, which includes: (a) content focus, (b) active learning, (c) coherent, (d) duration, and (e) collective participation (p. 184). This is in line with the assertion that collaborative inquiry (Bray, 2002; Darling-Hammond, 1996); a systematic approach that promotes collaboration between researchers and practitioners to engage in active learning for the advancement of both knowledge and practice (Batliwala, 2003), and to make meaning from their experiences (Yorks & Kasl, 2002); is one of the possible answers to such an issue.

This paper reports on a collaborative inquiry project that aims at co-designing Chinese curricula with the use of ICT in Singapore among 14 classroom teachers, 4 university researchers and 2 Ministry of Education (MOE) officials (who represent the authority). This project was designed to address the two major challenges of Chinese teaching and learning in Singapore. First, there is a decline of the Chinese Language standard (Leong, 2001; Zhang & Liu, 2005). This is partly due to the major revamp of the school curriculum in 1984 that reduced the teaching of the Chinese language to an isolated subject. Concomitantly, there is also a dramatic decline of using Chinese among Singaporean Chinese in home environment (see People's Daily Online, February 22, 2004). Second, there is a lack of the innovative use of ICT in Chinese Language teaching in Singapore. For example, in a national study, Liu, Kotov, Rahim and Goh (2004) reported that ICT was only used in 8.1% of the observed classes, and mostly as a teacher-centered presentation tool. It is hoped that through collaborative inquiry, teachers, researchers and MOE specialists could reach a better understanding of the pedagogical use of ICT to enhance Chinese language learning in one school district in Singapore.

The two main research questions for this study are,

1. How do the participants from the three parties negotiate meaning from the conflicting interest and competing agenda?
2. How do they eventually resolve the tension?

LITERATURE REVIEW

A review of teacher professional development literature indicates the growing popularity of collaborative inquiry (Darling-Hammond, 1996) or collaborative innovation (Randi & Corno, 1997). It was suggested that collaborative inquiry can address the common pitfalls of traditional teacher professional development workshops, which are usually one-off workshops that are designed to transmit expert knowledge to the teachers.

They may not account for teachers' work context and beliefs and are unlikely to encourage critical discussion between researchers and teachers on the challenges that teachers encounter (Chai & Merry, 2006).

Conversely, collaborative inquiry is based on the notion that collaboration between research and practice is likely to advance both knowledge and action (Batliwala, 2003). The rationale behind such collaborations is that that diversity of perspectives and expertise helps the teams to reach better decisions (Surowiecki, 2005). This is congruent to many recent developments in learning sciences which emphasize the situated nature of cognition and the distributed characteristics of expertise in authentic work environments (Fishman & Davis, 2006). Hence, collaborative inquiry could serve as a means of teacher empowerment for teachers to take charge of their own growth and resolve their own problems (Keedy, Winter, Gordon, & Newton, 1999; P. M. Short & Greer, 1997; Walter & Gerson, 2007).

Collaborative inquiry is very much valued in the work environment for its characteristic of not following a fixed agenda or prescribed plan. Berghoff, Egawa, Harste and Hoonan (2000) suggested that such a practice requires respect and the positive use of diversity to achieve the desired "democracy" in which participants are expected to arrive at understandings, rather than at answers. Participants could end up more confused, but their confusion reflects new questions that are more complex and based on deeper insights (K. Short, et al., 1996). Therefore, the participants may agree to change the original agendas, research questions or modify the course of actions as the collaboration progresses. However, it will take time for the group members to adapt to this way of working (Bray, Lee, Smith, & Yorks, 2000).

As collaborative inquiry usually involves multiple parties, tension among the parties are often inevitable (Pomson, 2005). Tension arises mainly due to the different perspectives or mismatched agendas (Alkenbrack, 2009) brought to the inquiry by the different participants. The commonly occurring issue is: Whose research questions are being investigated (Kasl & Yorks, 2010; Sachs, 1999)? The paradoxes of democracy versus authority (Ospina, et al., 2004), democracy versus accountability (Rich & Brazer, 2007), or democracy versus equal share of power (Bell-Angus, Davis, Donoahue, Kowal, & McGlynn-Stewart, 2009), are indeed common challenges to collaborative inquiry groups in any context. Somewhat related is the struggling of the question of how much guidance and structure to bring to the conversations, seeking an appropriate balance between presenting information and facilitating teachers' construction of new practices (Putnam & Borko, 2000).

Some of the previous efforts of collaborative inquiry have involved additional stakeholders other than teachers and researchers (or teacher educators) in the western countries, such as school administrators (Huffman, Lawrenz, Thomas, & Clarkson, 2006), teachers' associations (Miller, McDiarmid, & Luttrell-Montes, 2006), community members (European-American Collaborative Challenging Whiteness, 2002), superintendents and curriculum and assessment coordinators, and even students (Huffman & Kalnin, 2003), and asuperintendent, principals and board members (Rich & Brazer, 2007). Nevertheless, collaborative inquiry has yet to be popularized in most parts of Asia (Batliwala, 2003). Asian working adults tend to be more "accustomed" to be submissive toward their leaders' policies and are shy away from making their own decisions (Batliwala, 2003). As such, there seems to be a paucity of research on involving classroom teachers, researchers and educational officers in a collaborative inquiry in the Asian context. This study has the potential to contribute to understanding among researchers who are challenged to work with teachers and officials from diverse backgrounds.

RESEARCH DESIGN

Context and Participants

This study was situated in the context of Singapore's second Masterplan for Information Technology in Education (MP2), which could be summarized in the concept of "Engaged Learning" (Olson, 2008) – to cultivate learners who can manage their own learning strategically, who are self-motivated and who can work collaboratively with others to solve problems (Chai & Merry, 2006). Embracing constructivist learning implies that teachers need to be practical intellectuals, curriculum developers, and generators of knowledge in practice (Feiman-Nemser, 2001). In Singapore, most experienced teachers were educated in the didactic teaching tradition, and are accustomed to teaching to examinations rather than facilitating the process of knowledge construction and innovative pedagogy (Koh, 2004; Looi, Hung, Chen, & Wong, 2006). In addition, teachers' annual appraisal and promotion are closely tied to their performances, which include the examination outcomes of their students. In such an environment, it is relatively difficult to change practices that teachers believe in student-centering learning. This study posits that Singapore teachers need to experience some form of first hand Engaged Learning experiences, reflect upon what it means, and then experiment it in their classroom practice so as to develop the capability that will enable them to achieve the vision of MP2.

The participants of this study consisted of 14 teachers representing 12 primary schools (i.e., 3 teachers came from the same school) in the same school district. The four researchers were from two different departments – Learning Sciences & Technologies (LST), and Asian Language and Culture (ALC) at the National Institute of Education (NIE). There were two representatives from the Ministry of Education (MOE); a curriculum specialist from the Curriculum Planning and Development Division and a technology specialist from the Educational Technology Division respectively.

This half-year study commenced in January 2007 and ended in July 2007. Six face to face meetings with intervals of 2-3 weeks were conducted for the team to co-design ICT-enhanced Chinese Language curricula. The 14 teachers were gradually split into three groups to develop a "radio drama" curriculum (by 3 teachers from the same school), a writing curriculum with peer critiques, and another writing curriculum without peer critiques, respectively. More details about how these three groups were formed will be presented in section 2.1.1.

Data Collection and Analysis

Several data sources were collected: audio recording and field notes of the six face-to-face sessions as well as the focus group interviews took place after each session that involved all the participants. In addition, the two MOE specialists, together with two teachers whom were randomly chosen from each of the three groups, were involved in one-to-one semi-structured interviews at the end of the collaborative inquiry. To protect their identities, we identify the eight interviewees by pseudonyms, which are depicted in Table 1.

Table 1: The pseudonyms of the interviewees

Organization or Collaborative Inquiry (CI) Group	Curriculum project	Pseudonyms
Ministry of Education	-	Celine (curriculum specialist) & Elaine (technology specialist)
CI Group 1	Radio drama	James & Marvin
CI Group 2	Writing with peer critique	Holly & Paul
CI Group 3	Wiring without peer critique	Denise & May

Each interview lasted about 45 minutes and was subsequently verbatim transcribed. Teachers who were not interviewed will simply be identified in the subsequent text as Teacher A, B, C, and so on, in this paper.

The data were then analyzed through the constant comparative method (Strauss & Corbin, 1990). Two of the researchers in the team open-coded the interview data independently, then identified emerging themes, formed categories by grouping the themes, and compared and contrasted the categories to reach an agreement. The field notes and the transcript of the focus group discussions were also analyzed to find the explicate relationships among the data. The qualitative data were triangulated to seek instances of similar input from more than one account to develop categories, before new categories were added when necessary (Marshall & Rossman, 1989). The themes of the interview and observation data are summarized and presented in Table 2.

To establish confidence in the trustworthiness of the findings, the findings reported in this paper were sent to all the interviewees for member checking.

Table 2: Learning gained from the Collaborative Inquiry

	Teachers	Researchers	MOE Specialists
• Gain an understanding of curriculum design principles	□		
• Changes of beliefs in teaching and learning	□		
• Changes of roles in the collaborative inquiry	□	□	□
• Changes of views on using ICT for Chinese teaching	□		
• Extension of the collaborative inquiry beyond the project	□	□	□

FINDINGS

In essence, two major findings are reported in this paper to answer the above-stated research questions. These findings are: 1) Negotiating competing agendas and tensions among the three parties; 2) Resolving the tensions base on common value of enhancing students learning.

Negotiating competing agenda and tensions among the three parties

As the participants of three parties brought their interest and agenda to the project, there were competing demands and tensions at the initial phase of the project, namely, research and practice, process and product, ideals and reality. It was an on-going process to balance the multiple demands and tensions.

For example, the four researchers brought a research agenda into the project with an emphasis on examining the process and viability of co-designing a curriculum through collaborative inquiry in Singapore context. Therefore, they allowed the participants to change the original agendas, research questions or modify the course of actions as the collaboration progresses. However, the two MOE specialists wanted to use this opportunity to design a technology-enhanced national writing curriculum to address the practical challenges of Chinese writing from a macro perspective. This is reflected in the following excerpts:

> We want to design a technology-enhanced writing curriculum which our teachers all over Singapore can '*directly* bring it back to their classes" to deploy. (*Elaine, 25 June 2007 – Interview*).
>
> Very excited about incorporating ICT into teaching of Chinese. We lack this piece in Chinese teaching. ... In primary schools, writing is a big problem. Children do not like to write and don't write well. We have put in a lot of effort in trying to improve the situation. You came in at this time. *(Celine, 25 June 2007 - Interview)*

Nevertheless, the two specialists were not comfortable with the emergent nature of collaborative inquiry. They expected the team to adhere to the initial agenda proposed by the researchers that focused on writing. They were uncomfortable to giving the teachers freedom to design a curriculum that move beyond the framework of the original proposal.

Although all participating teachers showed great interest in "practice" and "product" (i.e., the curricula), their focus was on the micro perspective to meet their local needs, that is, to teach diverse learners across the grade levels. They were interested in implementing prescribed curriculum packages that could make an immediate impact on their students' learning. Since they were required to teach the content determined by the national curriculum, they saw little value in co-designing and implementing their own curriculum prior to the study.

Resolving the tensions by reaching a consensus on promoting student learning

The interview and observational data revealed that the participants of the three parties: the classroom teachers, MOE specialists and the researchers experienced a certain degree of changes in their views and actions in the process of Collaborative Inquiry. They established a "shared ordeal" (Lortie, 1975) in which all members were empowered to struggle with and construct a better understanding in the effective use of ICT to enhance student learning through collaboratively working as a partner.

The following sections of the paper document the learning gained from the collaborative inquiry from the perspectives of teachers, researchers and specialists on co-constructing a better understanding of ICT integration for Chinese learning through collaborative inquiry.

Teachers' perspectives: 'Climbing up the well'

Since teachers are the most important agents in changing classroom practices, the reported Collaborative Inquiry was intended to actively involve the participating teachers in the entire process of curriculum co-design. It was hoped that the involvement of teachers as part of the design team could transform them into knowledge creators for new practices and curricula in school (Gan, 2007). The teachers seemed to demonstrate a change in the level of the participation in the project and their views on using ICT for Chinese learning.

Teachers' perspective I: Learning about co-designing the curricula

Analysis of the field notes revealed that at the first three sessions of the project, the teachers experienced certain degrees of doubt and uneasiness about the nature of the ill-structured, exploratory and generative nature of collaborative inquiry. They expected to receive traditional professional development with focused agendas. They posed as passive information receivers to attentively absorb the knowledge presented by the researchers who had the expertise in a particular topic (e.g., collaborative inquiry, pedagogy for mother tongue teaching, and learning technologies). When they split into small groups to discuss the innovative use of ICT, varied levels of participation were observed among them.

Eleven teachers representing the 11 schools showed a lack of ownership by following the lead of the researcher who facilitated the group discussion. The discussion between them and the researchers focused on articulating the teaching problems that they were facing: students' low interest in language learning, the inadequacy of technology facilities (e.g., for some schools, there were only one or two computer labs shared by more than 30 classes and all subjects within the same school), the pressure to completely cover the standard curriculum, and so on. The focus of their discussions was primarily on how to use ICT to enhance teachers' instruction and address students' learning needs.

The researchers decided to change the structure of the face-to-face meeting from Session 4, in which they intentionally directed the group discussion toward epistemological issue: teachers' cognition of what it means for student to understand (Bereiter, 2002; Bransford, Brown, & Cocking, 2000). The teachers were asked to design the curriculum to match their epistemological beliefs.

From Session 4, the eleven teachers began to demonstrate more active participation in the project. For example, they expressed an interest and urgency to develop a technology-enhanced composition curriculum. After sharing their respective pupils' diversified Chinese Language competency and challenges, they gradually self-organized into two groups. Five of the teachers who were teaching students with relatively high and medium level of competency decided to introduce online peer reviews as a teaching strategy to enhance students' writing performances using wiki. The other teachers who were more worried about their pupils' lower language skills preferred not to include a peer review component in their design. All teachers began to contribute their strengths and provide support to their group. Particularly, they began to develop a sense of ownership and were willing to take responsibility for co-designing and leading the curriculum design. This is reflected in Frances' words, "We design it, and then we implement and define it."

The repeated wordings of 'I' and 'we' signify such ownership and authority as illustrated in the following quotes,

> Originally, I thought this was just a traditional writing workshop. Now I know that collaborative inquiry is the effort of building a group and establishing the team spirit. Rather than focusing on a problem, we seek a solution…It helps us to upgrade. The atmosphere is good. There are no restraints in voicing our opinion… *(Paul, 21 June 2007 - Interview)*

> I didn't expect much in the beginning because I wasn't sure about the aim and the activity. I wasn't sure who the project would benefit. NIE? Our school? Later, I found out that collaborative inquiry is about sharing – we voice our views and we design a plan within the group. *(James, 21 June 2007 - Interview)*

The other group consisted of three teachers who were from the same school and decided to develop a school-based curriculum on creating "radio dramas". They insisted in the importance of using podcasts to address their students' challenge in the fluency in speaking Chinese. Rather than succumbing to MOE officials' advocate of focusing on writing instruction, these three teachers developed a strong sense of teachers' agency. This is reflected in James' argument, "We believe that the verbal skills are more important for our students. If they couldn't even speak well, how could we expect them to write well?" *(James, 21 June 2007 – Interview).* These three teachers began to discuss how to set the instructional goals, choose the topics, and design learning activities, technologies and the instructional strategies to support student activities from Session 2 with the facilitation of one researcher.

After benefiting from the first-hand experience of the collaborative inquiry, the majority of the teachers developed a sense of responsibility to help their colleagues in their own schools by organizing their own collaborative inquiry activities. For example, Frances, a new teacher with less than one year's teaching experience, expressed her interest influencing teaching practice in her school, "I plan to bring collaborative inquiry back to my school. I can lead and organize it in the school." *(Frances, 18 May 2007 – Focus Group).*

MOE specialist Celine's observation summarized and affirmed the process of changes that we observed among the teachers,

> At first, the teachers were not sure at all. Through the early discussions, they explored and planned how to do it. Then they discussed the difficulties they face. Slowly, they warmed up. Then they found the 'feel'. There were more interactions during the last three times and they

> were very involved. They knew they ought to do it and they have obtained some results from it. They had a sense of achievement. *(Celine, 18 May 2007 – Focus Group)*

Teachers' perspective II: Changing views about using ICT for enhancing student learning

Many studies reported that teachers' beliefs could affect teachers' practice and teachers' learning (e.g., Abdelraheem, 2004; Chai, 2010). As argued by Gök and Erdoğan (2010), teachers should have positive perceptions about technology in order to use it effectively in their class room teaching. In the reported project, the 14 teachers demonstrated different levels of changes either in their views on innovative use of ICT for promoting their students' learning. For example, two classroom teachers, Frank and James, who had already been relatively progressive in using ICT for their teaching prior to the collaborative inquiry project, contributed their strengths in technology integration by leading their groups the design process.

The remaining 12 teachers demonstrated a change in their views on the pedagogical use of ICT, which is reflected in the following excerpts:

> We always use ICT, but just for the sake of using it – no target. Now I have learned to use ICT with an aim. *(Frances, 18 May 2007 – Focus Group*).

> I am a traditional person. I used to think that it takes a lot of time to train my students in using ICT and the benefit is minimal. After the collaborative inquiry, I'm more confident to take the first step. I can plan and conduct it. *(Marvin, 21 June 2007 - Interview)*

> You *(the researchers)* have really changed my belief. When I went back to school and told my colleagues that I was going to train my pupils in Chinese computer input *(see below for more about the lesson design of Chinese computer input)*, they told me it was useless. They had no interest. However, after I implemented the lessons, my pupils were very interested in Chinese computer input … Maybe I can speed up my teaching next term and bring more students to the computer lab to learn it. *(Teacher A, 18 May 2007 – Focus Group)*

> We live in a 'micro world'. Someone has to take us to look at the big picture. Before, we only knew that ICT was used in educational games. Now, we know this is the direction to go. *(Teacher B, May, 18 May 2007 – Focus Group)*

The quotes indicate that the teachers had gradually increased their confidence in technology integration after raising and overcoming their concerns, and obtaining advices. Together with fellow participants of the collaborative inquiry, they co-developed concrete, systematic plans to achieve the stated goals. As Frances put it, 'Before, I felt that there was really no time to teach my students in Chinese input. Now that we have a systematic lesson plan, I have more confidence to try it out.' *(Frances, 18 May 2007 – Focus Group).*

In short, the collaborative inquiry project had become a catalyst in changing most of the teachers' (especially those who used to carry a reserved view in the innovative pedagogy) attitudes toward the incorporation of ICT in their teaching at the positive direction. Apart from receiving systematic preparation for using ICT for classroom teaching and learning during their pre-service education (Gao, Choy, Wong, & Wu, 2009; Teo, Chai, Hung, & Lee, 2008), most of the Singapore teachers had prior experiences in attending multiple one-off courses or workshops on the use of ICT for teaching. However, it was not until their involvement in collaborative inquiry that their mindset was challenged, and their confidence and willingness in ICT integration were increased.

'Expanding the career'- MOE officers' perspectives

The two MOE specialists, who were ex-teachers themselves, were pedagogical experts and designers of the national curriculum. They joined this project not only as 'critical friends' as advocated by Angelides and Gibbs (2007), but also as co-designers of the curriculum. They seemed to experience certain changes during the process of co-constructing the curriculum.

The two specialists were interested in designing a curriculum in the use of ICT for Chinese writing. They decided to join the two writing groups respectively. During Session 3, they were supportive to the teachers' leads in the curriculum design and contributed their expertise in this aspect. Since they knew that that most primary school students lacked Chinese computer input skills, which would hinder the practice of computer-mediated writing, they suggested to develop a Chinese computer input lesson as a supplement to the writing curricula, The teachers agreed with them as they recognized that as an area that they had ignored. As a result, the two groups amended their original agendas by developing a lesson plan for Chinese Input training prior to constructing their

writing curricula. Consequently, the time spent on writing curricula was severely shortened. The two MOE specialists realized such an issue toward the end of the design stage, as they had put it, "We spent a lot of time on input training, which is a very small problem. We missed out on the big picture – writing." *(Elaine, 25 June 2007 – Interview)*. This was identified by the researchers as a tension pertaining to the mismatched agenda – which target "product" (Chinese computer input lesson or writing curriculum) should be given a higher priority?

Nevertheless, similar to the participating teachers, the MOE specialists were new to collaborative inquiry and had also experienced positive *changes* in their attitudes toward the approach. As Celine put it, "Collaborative inquiry is much better than theory-based programs… for upgrading of the teachers." *(Celine, 25 June 2007 – Interview)*. Furthermore, Elaine said,

> I'm new to educational research. I find collaborative inquiry a good avenue to expand my career … Our department will launch a similar collaboration but we haven't chosen any concrete approach. This is a good opportunity for me to accumulate some experience. We may adopt collaborative inquiry. *(Elaine, 25 June 2007 – Interview)*

Celine later informed the researchers *(telephone conversation – 7, July, 2008)* that the Curriculum Planning and Development Division had been conducting several theme-based collaborative inquiry groups to develop new pedagogies or learning resources (e.g., technology game-based Chinese Language learning) that involved teachers from multiple schools in the subsequent year. Before they participated in our project, they involved teachers only at the pilot run stages after their own team had completed the curriculum development. Since early 2008 (after this project had wrapped up), they had been involving in-service teachers working in collaborative inquiry groups to co-construct new lessons or resources.

'Walking out of the Ivory Tower' —Researchers' perspectives

The four researchers from the two NIE departments were also new to conduct an inquiry project as a team. They valued this opportunity for building a cross-disciplinary (LST's technology-enhanced learning and ALC's language education) understandings which would benefit both groups' future research and teaching. For example, one researcher in the Learning Sciences and Technologies Department acknowledged, "I appreciated the opportunity of working with the colleague who had the expertise in Chinese teaching from another department, because we can build on each others' strengths to better address the challenges of effectively using ICT for Chinese teaching and learning in the classroom." *(One-to-one interview)*

The researchers met on a fortnight basis to discuss how to contribute to the project and how to seek an appropriate balance between presenting information and facilitating teachers' construction of new practices (Putnam & Borko, 2000). They posted challenging questions and designed the learning activities during these meetings. They were willing to modify the structure of the face-to-face sessions to meet the needs of teachers, which was discussed in the previous section. They had also changed their roles from initially the content delivers to gradually co-designers, and further into consultants.

For example, during each of the first three sessions, two researchers and the other two working as a team chose to present a topic in their area of expertise, such as using ICT for Chinese learning, the introduction of curriculum design models and how to facilitate student Chinese writing. From Session 4, they chose to work with a particular group and began to adopt a new role in the collaborative inquiry—a facilitator from the fourth face-to-face session onwards. One of them who worked with the three teachers in the "radio drama" group further changed his role into a consultant. Rather than providing the answers to the teachers' question, he kept answering questions, "How can we obtain evidence of student learning?" "Why is it important for students to using podcasting?" to stimulate teachers' thinking. Reflecting on his learning from the collaborative inquiry, he commented:

> This is the first time for me to collaboratively work with classroom teachers and MOE specialists over a prolonged period of time. I have learned the importance of changing my roles from controlling the content of profession development to firstly co-designing and eventually facilitating teachers to take more ownership and authority for their own learning. At the same time, I am a follow learner.

As for the other three researchers, this study gained a better understanding of the challenges and constraints of the teachers in their teaching practice, their students' capacities and attitudes, all situated within the real-life school ecology as one of them had put it, 'It had been a great opportunity for us to walk out of the ivory tower and better appreciate what it takes to conduct effective school-based research." Although the researchers were

under the pressure to follow the proposed timeline to complete the curriculum design, they became comfortable to end up more confused rather than finding a solution, as they began to appreciate that their "confusion reflects new questions that are more complex and based on deeper insights" (Short et al., 1996).

DISCUSSION AND IMPLICATIONS

The tri-party collaborative inquiry that involved researchers (or teacher educators), classroom teachers and government education officials is rarely reported in the literature on teacher professional development. This paper reports that collaborative inquiry can be an effective means for the professional development of the participants in the three parties. The uniqueness of the project provides some insights on the professional development of teachers, researchers and government specialists involving in ongoing efforts for meaning negotiation and the establishment of shared understanding of co-designing the curricula among them. As presented in the previous session, the participants from the three parties involved collaborative problem solving by complementing one another to advance their knowledge and construct a better understanding of integrating technology into Chinese learning. They extended the learning from the project into their future actions. The theoretical meaning of the Collaborative Inquiry can shed insights about how the classroom teachers, researchers and MOE specialists developed their expertise and contributed their strengths into their professional development of the tri-parties. The practical meaning of this project can shed insights about how to deal with tri-party tensions and reach one consensus: to enhance student learning in a collaborative inquiry.

There were some limitations in this project. The researchers initiated and interviewed the teachers and MOE officers, which would possibly have affected some of the participants' thoughts and reports. In addition, due to the time constrains, follow up study on the enactments of the co-designed curricula was not carried out. This is one direction for the future research.

While the joint venture had shown its value in the curriculum co-construction practice due to the synergy of the expert knowledge from the three parties, conflicts and tensions arose from the diverse perspectives and expectations were also inevitable. The researchers' findings echoed the research findings on this issue (Graham, et al., 1997; Pomson, 2005). The participants experienced tensions initially as they encountered fundamental issues such as which party's agenda should take the priority (the products) and what course of action should they embark on (the process). The multiple tensions that the participants experienced reflect the prevailing tensions among the MOE, the schools and the educational researchers in the Singapore context.

Conversely, interacting with members from varying backgrounds, experiences, schools, enabled the participants to appreciate one another's perspectives and their challenges. This led to mutual understanding, reassurance, and increased confidence in designing/ implementing plans.

A model was developed to display the sources of the tensions and multi-directional interrelations of the consensus that may occur in such researcher-teacher-specialist collaborative inquiry (see Figure 1).

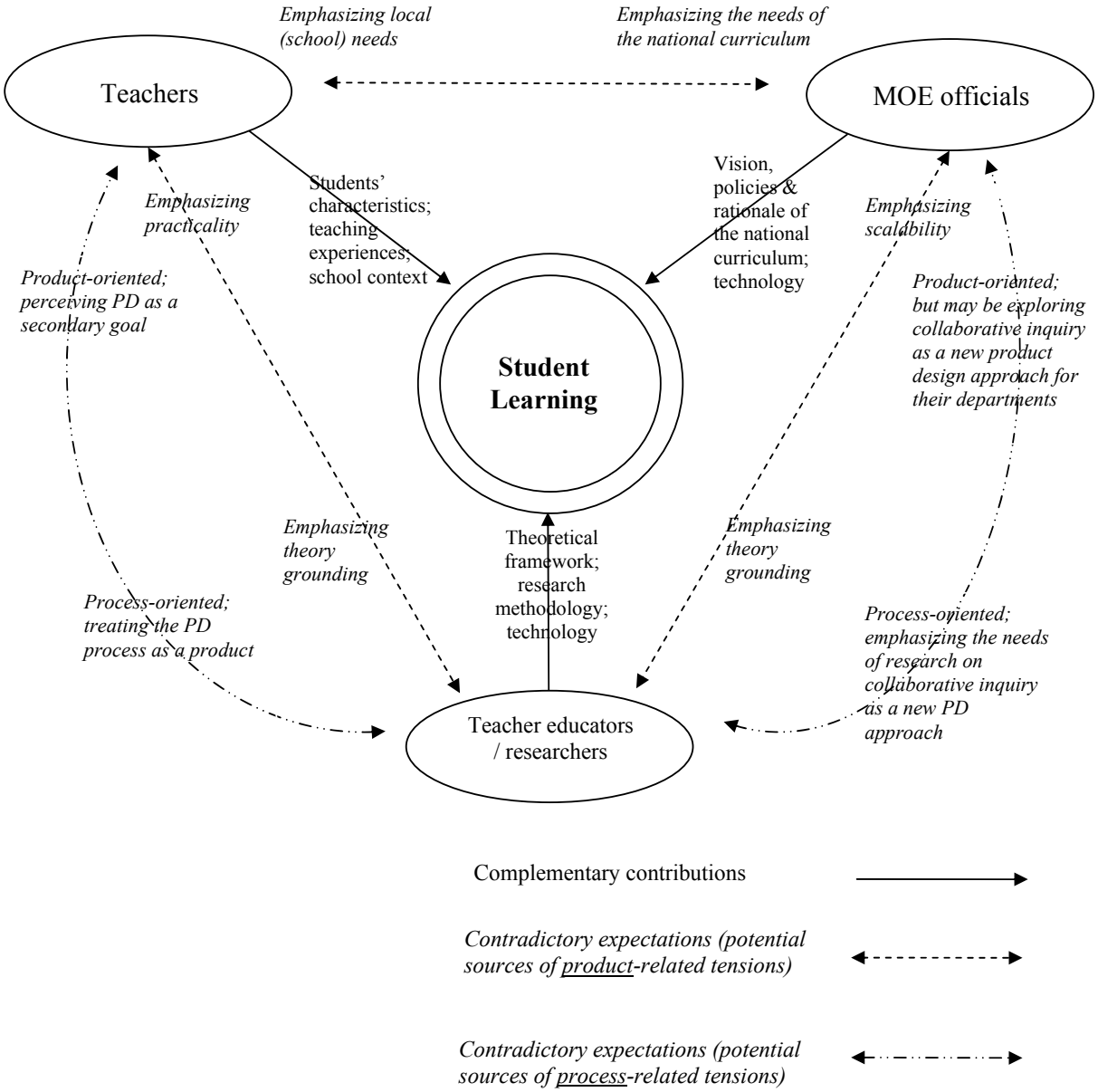

Figure 1: The synergy and the potential sources of tensions in the tri-party collaborative inquiry project

In this model, the researchers outline the *complementary contributions* by individual parties with diverse expertise and experiences that has facilitated a synergy in the inquiry. In addition, *contradictory expectations* among the participants were identified, which were the potential sources of tensions. Such contradictory expectations were classified into two categories – the diverse expectations that may cause product- or process-related tensions.

Product-related tensions are usually the consequences of mismatched emphases of different parties in what and how the project deliverables should be – researchers focusing on theory grounding, teachers stressing practicality and local needs, and MOE officials calling attention to scalability to suit the needs of the development of the national curriculum. In terms of the sources of the process-related tensions, the teachers and the MOE officials initially carried a similar stance – being product-oriented. Although at the personal level, the teachers appreciated the nature of the collaborative inquiry and found it potentially value-adding to their career, most of them had to answer to their school administrators' demand of bringing back a useful curriculum or technology by the end of this project. Therefore, they were inclined to treat the professional development aspect of this

project as a secondary goal. In contrast, the researchers, who were also teacher educators, were keen to explore collaborative inquiry as a new professional development approach for Singapore teachers.

Guided by the model and other challenges that the researchers had experienced in the project, three suggestions were made for the future collaborative inquiry projects.

First, it is important to prepare all the participants for the nature and process of collaborative inquiry approach. Rather than following the researcher's proposed agenda, it is better to empower teachers to choose their own interests and their own inquiry projects. As teachers are the key agents of change, their commitment towards the designed curriculum is the most important factor for the project to be implemented in the classroom.

Second, the collaborative inquiry model may be modified to progressively ease the teachers into an empowerment process. The teacher empowering process can start with relatively well-planned professional development activities such as 'traditional' workshops, and then gradually move to the less-structured domains. This will reduce the teachers' and MOE officials' anxiety and the sense of lack of direction at the early stage of the process as well as equip them with necessary basic skills for subsequent empowerment.

Third, it is advisable for the participants to put away the mindset of 'one-size-fits-all' as the only means to achieve scalability, and instead aim for co-developing point-at-able lesson models that facilitate adaptability as advocated by Learning Sciences literature (e.g., Dede, 2004; Fishman & Krajcik, 2003; Wong, 2009). In turns, teachers would be able to customize the models and design their own customized curriculum to suit the needs of their own students. Therefore, future teachers' professional development-oriented collaborative inquiry projects should play a part in nurturing or enhancing the in-service teachers' adaptability in curriculum design and development, and assessment for learning.

CONCLUSION

This half-year project involved classroom teachers, researchers and MOE specialists in actively co-designing and revising technology-enhanced Chinese curriculum to be coherent and consistent to school, district and national reforms. It shared the features of the effective professional development proposed by (Desimone, 2009) :- (a) content focus, (b) active learning, (c) coherent, (d) duration, and (e) collective participation (p.184). It illustrated a dynamic, on-going, and continuous and embedded nature of professional development for the participants of the three parties to learn from each other. There seems to have a stable change pattern among the participants, showing an increase in all participants learning and potential for changing practices to achieve the ultimately consensus for improving student learning through technology-enhanced solutions. Future research can focus on the longitudinal study on the assessment of and for learning after the revision of the co-designed curriculum.

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