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Message from the Editor-in-Chief

Dear Colleagues,

TOJET welcomes you. TOJET looks for academic articles on the issues 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 discuss the perspectives of students, teachers, school administrators and communities. TOJET contributes to the development of both theory and practice in the field of educational technology. TOJET accepts academically robust papers, topical articles and case studies that contribute to the area of research in educational technology.

The aim of TOJET is to help students, teachers, school administrators and communities better understand how to use technology for learning and teaching activities. The submitted articles should be original, unpublished, and not in consideration for publication elsewhere at the time of submission to TOJET. TOJET provides perspectives on topics relevant to the study, implementation and management of learning with technology.

I am always honored to be the editor in chief of TOJET. Many persons gave their valuable contributions for this issue. I would like to thank the guest editor and the editorial board of this issue.

TOJET, AECT and Istanbul University will organize International Educational Technology Conference-2015 (IETC 2015, http://www.iet-c.net) in May 2015 at Istanbul University in Istanbul - Turkey.

October 01, 2014

Prof. Dr. Aytekin İŞMAN
Sakarya University

Editorial Board

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APPLICATION OF ICT BY STUDENTS AT SELECTED UNIVERSITIES IN POLAND

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ABSTRACT
The aim of the study was to investigate access and use of computers and internet by students during their studies. The results are based on a survey conducted in 2009-2012 on groups of 320 to 405 students (each year) from two universities in eastern Poland. It was concluded that during the period under study access of students to computers and internet was at a relatively high level. In most of the years considered, there were statically significant differences in computer ownership and internet access between students from rural and urban areas. It was revealed that in students' opinion the application of ICT by lecturers in the courses' delivery did not change significantly since 2009.

INTRODUCTION
Computer and online use has increased significantly in the recent years and today it is a major component in modern society. University students all over the world use information communication technology in their studies. It is due not only to the advances in computer technology but also to drastic drop in computers' prices and general use of the computers in everyday life. These technologies have altered the method in which people work, communicate, shop, and even learn. Correspondence courses, the traditional method of distance education, have been replaced almost entirely by e-learning. In fact, e-learning is penetrating all areas of teaching and learning; it comes to academic institutions as well as to corporate training, whether invited or not (Delgado-Almonte at al, 2010).

Almost all of current university students have grown up with computer and internet technology and are well familiar with their advantages. However, students from an underprivileged environment, either school or home, may tend to use computers less frequently due to their limited knowledge, exposure and experience prior to entering university.

There is a considerable variation of computer skills in European Union (EU) countries, both for the general population as well as within students' population (Kiss, 2012). However, Poland is considered to be one of the countries with relatively high level of ICT efficiency despite being one of the less developed EU countries (Aristovnik, 2012). In 2011 66.6% of households in Poland had access to internet with regular use reported at 57.9% (Społeczeństwo informacyjne w Polsce 2012). Not surprisingly it is people between 16 and 24 years of age who use internet most frequently. There is also no doubt that it is the students who most often access internet (Batorski, 2011; Sahin, 2011). It has to be noted that both computer equipment and internet access is still not as common in Poland as in developed countries and is below the EU average. Data for 2011 for Poland indicates that 64% of people at the age between 16 and 74 used computer (EU average – 73%) and 55% internet (EU average – 71%). Within EU, the Scandinavian countries and the Netherlands had the highest indicators (above 90%) and Bulgaria had the lowest (below 50%) (Information sociaty 2012).

However, it is questionable whether computer technology is used properly, which highly depends on level of computer skills. Students are normally regarded as the group with high level of computer abilities nevertheless that may also be an issue with those who do not own a computer and do not have an easy access to internet. There are also reports about very superficial use of IT. The above applies both to students and lecturers (Studenci i Internet, 2012; Dincer et al, 2011; Hong and Songan, 2011). University students tend to use computers for

entertainment and the internet for social communication (Jones, 2002). On the other hand, many teachers do not have all the necessary skills to integrate ICTs in teaching processes and consequently use the technology only as a tool to improve the visualization of their lectures (Andreu & Nussbaum, 2007).

Regarding computer skills, even casual use of technology, not necessarily directed at educational needs, may and should improve users' ability. As stated by Oliver (2002): "The growing use of ICTs as tools of everyday life have seen the pool of generic skills expanded in recent years to include information literacy and it is high probable that future development and technology applications will see this set of skills growing even more".

Advances and prevalence of ICT in the society mean that universities have to adopt and find possible roles of ICT in higher education. The aim of this study was to assess the use of ICT technologies by students during their studies and also the willingness of lecturers to apply such technologies in the educational process.

METHODS

Subjects

The study population consisted of 1,417 students from two universities in eastern part of Poland; the University of Life Sciences in Lublin and the State School of Higher Education in Chełm. Data was collected in the first quarter of 4 consecutive years from 2009 to 2012 with a group of 320 to 405 students each year (Lorencowicz & Kocira, 2009, 2010, 2012). The survey covered undergraduate students registered for the following programmes: education in technology and information technology, agriculture, agriculture and forest engineering, transport, and management, and production engineering. The highest number of participants was Year 1 students and the least – Year 5. In one of the years (2009) there was no data for students from year 2. The study population is presented in Table 1.

Table 1: Study population

Year	2009	2010	2011	2012	Total	Percentage
Number	334	320	358	405	1417	100.0
Institution:						
• University of Life Sciences in Lublin	270	272	260	284	1086	76.6
• State School of Higher Education in Chełm	64	48	98	121	331	23.4
Year of study::						
• Year 1	206	39	131	167	543	38.3
• Year 2	-	160	113	130	403	28.4
• Year 3	18	66	45	43	172	12.1
• Year 4	59	20	26	57	162	11.5
• Year 5	51	35	43	8	137	9.7

Instrument

Data was collected using a pre-tested, semi-structured questionnaire. The questionnaire was developed based on the literature and informal discussion with experts. It was pre-tested on a separate group of students registered on a different programme, hence excluded from the results of the study, and then modified accordingly.

The questionnaire consisted of three sections; (1) – computers usage and frequency of use, (2) - internet access, frequency and type of information sought, and (3) – the use of ICT technology in the educational process by students and lecturers. The survey mainly used closed-ended questions; either polar (i.e. yes-no) or multiple choice. However, for some of the question a 5-point Likert scale was also used.

The first section of the questionnaire included questions related to the place of residence of the student and ownership of a computer with the peripheral computer equipment. Questions related to the place of residence referred to the place of permanent residence (rural or urban area) and place of residence during studies (home, on-campus or off-campus residence).

The computer ownership question use 'yes', 'no' and 'home computer' responses to be selected by students. There were also an additional questions in respect to peripheral computer equipment (such as printer, scanner, etc.) and possible plans to purchase a computer.

The second group of questions was directed towards the internet use. The first issue covered was household internet access (yes-no), with a few options on the access for those with no access at home. Secondly, the students answered questions related to the purpose for internet use with several options to be selected, e.g. e-mail communication,

seeking general information (like timetables, adverts, etc.), entertainment, social networking but also searching for professional information related to their studies. For each option, the respondents also provided information on the frequency of use (*every day*, *few times a week*, *once a week* or *hardly ever*).

There were also questions regarding the use of computers in terms of the application where the respondents had several options with no limit on the number of options selected. The possible answers included: writing and editing of the documents, performing calculations, writing computer programs, making technical drawings, preparing learning materials for classes, and also using computers for entertainment such as listening to music, watching movies or playing games. Once again each answer gave the possibility to indicate the frequency of use.

The usefulness of the computer and internet in learning process was assessed by two separate questions with 5-point Likert scale consisting of the following options: *very useful, useful, sometimes useful, only for entertainment, not useful*.

The way the computer was used in students' learning was evaluated with multiple choice question where the students were allowed to select several answers; there was also a possibility to give a free answer. The choices were: *I cannot use internet, I do not use internet as it is not required, I write my continuous assessment submissions using a computer, I perform calculations, I prepare projects reports, I collect and process information, I exchange information with colleagues through internet, I look up webpages of my university and lecturers* and *Use it for other reasons (specify)*.

The difficulties in access and use of internet and computers were assess in exactly the same way with the following possible answers: *I do not have access to a computer, I do not have access to internet, I do not know how to use a computer in my studies, I do not have enough time to look for information on the internet, I do not like to work on a computer, Using a computer is not safe for my health, Working on a computer tires me, Working on a computer isolates me from other people* and *Other reasons (specify)*.

There was a separate question in respect of students' valuation of quantity and type of educational information available on internet. The quantity was assessed as: *a lot, average, not a lot, not at all, I do not know*; whereas the type of information as: *announcements, timetable, curriculum and syllabi, lectures main points, project titles, lab instructions, source material, previous exam papers, current results, I do not know*.

The last two questions interrogated students' perceptions of lecturers' endeavour in application of information technology in teaching and lecturers' appreciation of students' competence in use of ICT.

The data collected was verified and entered in a database and the analysis was done using a standard Excel spreadsheet. Chi-square test (χ^2 test) was used to perform statistical analysis of the data consolidated in a contingency table. The statistical testing was used to establish the relationship between variables, if the relationship was confirmed its strength was evaluated with the help of mean square contingency coefficient (coefficient φ); with the value close to 1 – strong relationship, close to 0 – weak relationship.
Since the sample was relatively large, the weak relationship (i.e. low phi-coefficient) can be statistically significant.
The results of chi-square test were interpreted using p-values; the p-value less than of 0.05 indicates the relationship significant (at the significance level of 0.05)

RESULTS

Computer Ownership

The results regarding the computer ownership (either own – personal computer or sharing it with the family – family computer) indicated that in all the years under investigations at least 97% of students from urban areas did own a computer. Unexpectedly, for students from rural areas this value was not much lower, as it was at least 92%, with maximum at 95.4% in 2012 and minimum – 92% in 2010. The minimum in 2010 was also for the whole population (94.1%). Looking at the results (Table 2), it can be seen that the number of students owning a computer generally increased.

Table 2: Computer ownership (either personal or family) in relation to place of residence

Place of residence	Computer Ownership											
	2009			2010			2011			2012		
	No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Urban Area [number]	2	144	146	3	116	119	3	137	140	5	160	165
[%]	1.4	98.6	100	2.5	97.5	100	2.1	97.9	100	3.0	97.0	100

Rural Area [number]	12	176	188	16	185	201	15	203	218	11	229	240
[%]	6.4	93.6	100	8.0	92.0	100	6.9	93.1	100	4.6	95.4	100
Total [number]	14	320	334	19	301	320	18	340	358	16	389	405
[%]	4.2	95.8	100	5.9	94.1	100	5.0	95.0	100	4.0	96.0	100
Test Statistics for Difference between Urban and Rural Areas	-2.268			-1.990			-2.002			-0.788		
p-values	0.01167			0.0233			0.0226			0.216		

Source: own results

In Table 2 students possessing their own or family computer were combined together into one category "Yes". In such a case the chi-square test is equivalent to the test for equality of two proportions. The last two rows in Table 2 contain the values of test statistic for difference between urban and rural areas and p-values for one sided test. The fraction of students in category "Yes" coming out of the urban areas was significantly higher than the ones coming out of the rural areas in each year except 2012 year. That means that, except year 2012, there was statistically significant difference between computer ownership (either personal or family) between students' from rural and urban areas. However the strength of the relationship is rather low (the φ-coefficient is 0.12, 0.11, 0.11 in years 2009-2011, respectively).

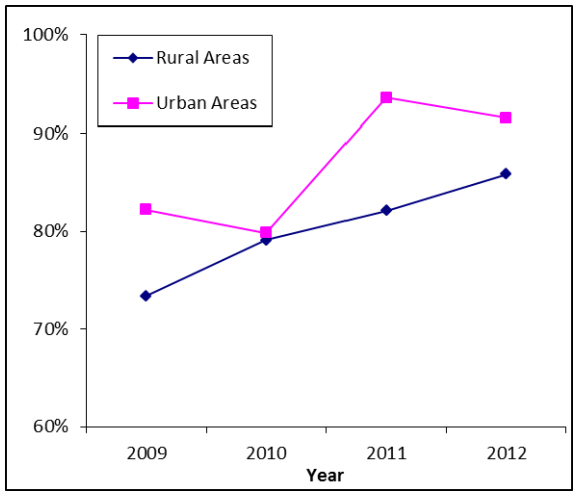

Fig. 1: Personal computer ownership in relation to place of residence

The percentage of students from rural areas owning a personal computer (not a family computer) increased steadily between 2009 and 2012 whereas the data for students from urban areas shows more fluctuation (Fig. 1). However, even for students from urban areas there is an increase in number between 2009, the starting year of collecting data, and 2012, the final year. As expected, the number for students from urban areas is always higher than rural areas.

Table 3: P-values for detailed comparisons for students with personal computers

	P-value	
Year	Rural Areas	Urban Areas
2009-2010	0.0931	0.687
2010-2011	0.218	0.0005
2011-2012	0.138	0.751

Source: own calculations

Table 3 shows p-values calculated for the null hypothesis that fraction of having their own computer students was the same in subsequent years versus alternative hypothesis that the fraction increased. As it can be seen from the results, the significant increase in personal computer ownership was only between years 2010 and 2011 for students from urban areas.

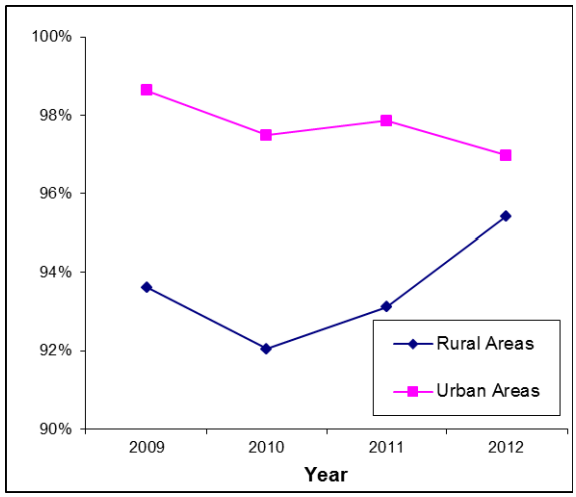

Fig. 2: Computer ownership (either personal or family) in relation to place of residence

Since 2010 the gap between the number of students owing a computer (either personal computer or family computer) from rural and urban areas was reducing (Fig. 2). It is only reasonable to assume that such tendency would continue making no difference between the two groups soon. Statistically, for those two groups there was no significant difference between subsequent years of the study.

Table 4: Internet access in relation to place of residence

Place of residence	Internet Access											
	2009			2010			2011			2012		
	No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
Urban Area [number]	6	138	144	6	110	116	6	131	137	5	155	160
[%]	4.2	95.8	100	5.2	94.8	100	4.4	95.6	100	3.1	96.9	100
Rural Area [number]	18	158	176	22	163	185	13	190	203	8	221	229
[%]	10.2	89.8	100	11.9	88.1	100	6.4	93.6	100	3.5	96.5	100
Total [number]	24	296	320	28	273	301	19	321	340	13	376	389
[%]	7.5	92.5	100	9.3	90.7	100	5.6	94.4	100	3.3	96.7	100
Test statistics		-2.048			-1.953			-0.797			-0.199	
p-values		0.0203			0.0254			0.2127			0.4210	

Source: own results

During the period of the study students from rural areas had lower access to internet than students from urban areas; statistically significant differences in years 2009 and 2010 (Table 4). In 2010, 5.2% of students from urban areas did not have access to internet whereas the same percentage for students from rural areas was almost 12% (Table 4). The percentage of students from rural areas with access to internet increased from 2010 and 2012 reached almost the same number as for students from urban areas. The increase was statistically significant in year 2011 in comparison to year 2010. In 2012 the number (96.5%) almost equalled that for students from urban areas (Fig. 3). Similar results were obtained by the computer manufacturers (Sprzęt IT wykorzystywany przez studentów w Polsce, 2009)

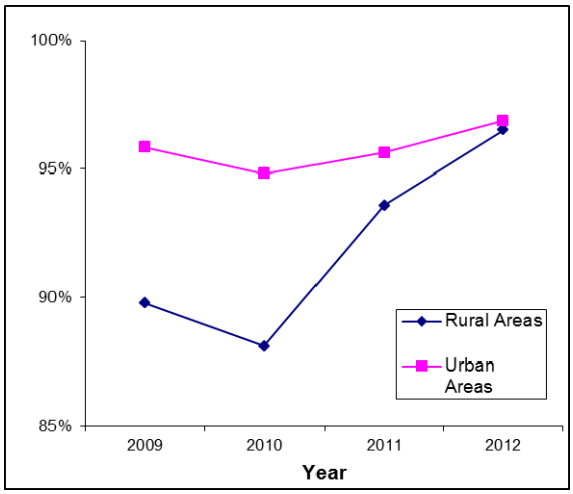

Fig. 3: Internet access in relation to place of residence

Table 5 shows p-values in one-sided test for equality of fractions of having internet access students in subsequent years. The fraction of students from urban areas with internet access is significantly higher than the ones from rural areas only in years 2009 and 2010. However the strength of the relationship is rather weak. The φ-coefficient is approximately 0.11. In 2011 and 2012 the relationship between the place of residence and internet access is statistically not significant.

Table 5: P-values for detailed comparisons for students with internet access students in subsequent years

	P-Value	
Year	Rural Areas	Urban Areas
2009-2010	0.6927	0.6496
2010-2011	0.0297	0.3838
2011-2012	0.0802	0.2841

Source: own calculations

A seperate investigation was done regarding internet access in relation to place of residence during studies (home, on-campus or off-campus residence). Due to low number of cases for on-campus and off-campus residence (much lower than students staying at home) the statistical analysis was done using Fisher's test instead of Chi-squared test. In neither year there was no statistically significant difference for interner access between different places of residence (Table 6)

Table 6: Internet access in relation to place of residence during studies

Place of residence during studies	Internet Access											
	2009			2010			2011			2012		
	No	Yes	Total	No	Yes	Total	No	Yes	Total	No	Yes	Total
On-Campus [number]	6	54	60	2	38	40	3	30	33	2	55	57
[%]	10	90	100	5	95	100	9,1	90,9	100	3,5	96,5	100
Off-Campus [number]	4	81	85	6	48	54	5	85	90	5	124	129
[%]	4,7	95,3	100	11,1	88,9	100	5,6	94,4	100	3,9	96,1	100
Home [number]	14	160	174	19	181	200	11	200	211	6	194	200
[%]	8	92	100	9,5	90,5	100	5,2	94,8	100	3	97	100
Total [number]	24	295	319	27	267	294	19	315	334	13	373	386
[%]	7,5	92,5	100	9,2	90,8	100	5,7	94,3	100	3,4	96,6	100
p-values		0,464			0,6156			0,6221			0,9274	

Source: own calculations

Use of Internet

With regard to the frequency of use of internet, both group of students (with no statistical relation to the place of residence observed) most often looked for the information with respect to their educational programmes on internet, *few times a week* (Table 7). Similarly, both groups of students reported on performing the calculations with the use of a computer (again, no statistical relation to the place of residence observed). Interestingly, the majority of students (irrespective of the place of residence) used ICT every day to prepare for classes. In 2012, the last year of study, 73% and 76% of students from rural areas and from urban areas, respectively used computer and internet every day. That clearly proves that a computer becomes an unavoidable tool in the educational process.

Table 7: Use of ICT for studies (numbers in percentages)

Year	Searching Internet				Performing Calculations				Preparation to Classes			
	Every day	Few times a week	Once a week	Hardly Ever	Every day	Few times a week	Once a week	Hardly Ever	Every day	Few times a week	Once a week	Hardly Ever
Rural Areas												
2009	7.1	44.8	23.1	25	6.7	27.4	20.7	45.2	62.4	21.7	7.6	8.3
2010	12.7	47.8	20.4	19.1	10.5	34.2	22.8	32.5	61.3	25	6.3	7.4
2011	11.8	45.9	24.7	17.6	7.0	33.3	27.2	32.5	70.2	22.5	4.2	3.1
2012	12.5	54.7	20.3	12.5	9.8	31.1	25	34.1	72.6	21.9	2.3	3.2
Urban Areas												
2009	7.0	47.2	25.6	20.2	2.7	20.7	29.8	46.8	76.6	16.8	4.4	2.2
2010	6.9	55.2	23	14.9	9.7	27.8	22.2	40.3	68.7	24.5	2.9	3.9
2011	14.7	45.7	17.2	22.4	15.7	31.3	16.9	36.1	83.2	13.6	1.6	1.6
2012	13.2	51.5	14.7	20.6	13.5	31.3	16.7	38.5	76.0	20.7	1.3	2.0

Source: own results

Great majority of students confirmed that there was enough ready available material for their areas of studies on the internet; close to 92% of students assessed the amount of material as - *a lot* or *average*, 5.5 % as - *not a lot*, 0.4% as - *not at all* and 2.5% indicated *I do not know*. That information confirms a study done 10 years ago (Feiner, 2003) in which 83% of engineering students assessed the amount of internet material as large or average.

Apart from educational purposes, almost half of the students used ICT every day for entertainment (Table 8); irrespective of their residence.

Table 8: Use of ICT for entertainment (numbers in percentages)

Year	Every day	Few times a week	Once a week	Hardly Ever
Rural Areas				
2009	42.4	30.0	11.3	16.3
2010	37.5	36.0	9.9	16.6
2011	44.3	34.3	10.0	11.3
2012	44.3	38.2	9.5	8.1
Urban Areas				
2009	44.7	30.9	11.0	13.4
2010	44.3	29.3	11.5	14.9
2011	44.5	32.1	11.5	12.0
2012	45.3	37.6	6.2	10.9

Source: own results

Usefulness of computers in learning process

For the purpose of the analysis two optional answers of *not useful at all* and *only for entertainment* was combined into one option of *not useful*. From the results (Fig. 4) it can be seen that there was a steady increase in

the number of *very useful* answers; between 2009 and 2012 that increase was significant as p-value in one-sided test comparing two fractions was ca 0.007.

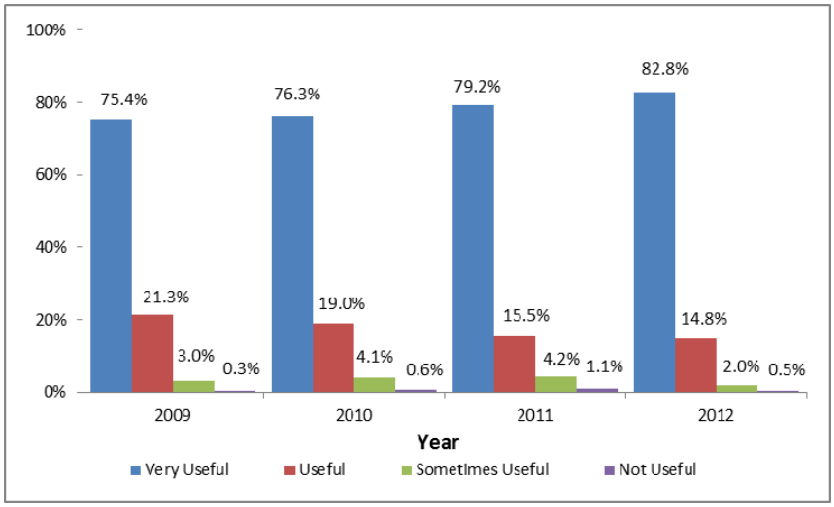

Fig. 4: Usefulness of computers in learning process

Use of information technology in teaching

Students' assessment of the use of ICT in teaching was done by specifying the percentage of lecturers who employ this technology in their classes (that aspect was investigated starting from 2010). The results are shown in Fig. 5, where each bar of the histogram indicates the frequency of answers, e.g. in 2010 44% of students assessed that less than 50% of lecturers used ICT in teaching. As indicated in the figure, there is no much change in the percentage of lecturers applying ICT in their teaching (as seen by the students). The results are indicating not much progress in applying technologies and also quite low level. For three years only around 55% of students indicated that more than half of the lecturers indeed utilized ICT in the teaching process.

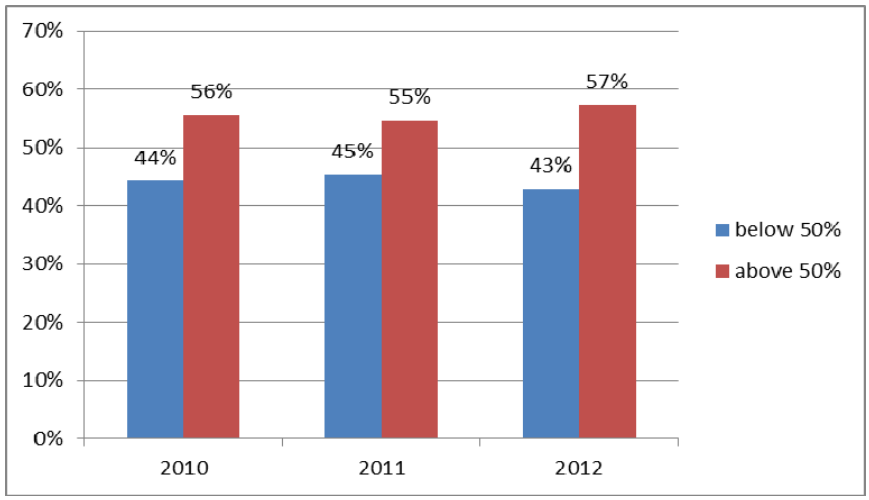

Fig.5: Students assessment of the percentage of lecturers using ICT in teaching

The survey questioned students on their perception of lecturers' appreciation of students' competence in information technology. The students were to indicate the percentage of lecturers who valued students' skills and knowledge in that area. The results are presented in Fig. 6 and show that, according the students lecturers do not much appreciate students' competence in information technology. Consistently over a period of 3 years more than 60% of students were of the opinion than less than half of the lecturers do not value students' ICT skills and knowledge. The weighted average of the percentage of lectures appreciating students' ICT skills was 43.3% in 2010, 41.2% in 2011, and 44.0% in 2012; these differences were not statistically significant.

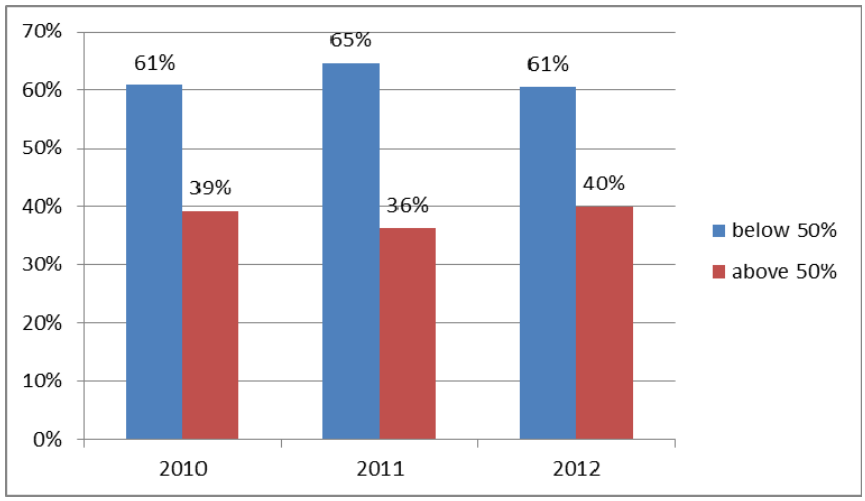

Fig. 6: Students assessment of the lecturers' appreciation of students' competence in information technology

Difficulties in use of ICT

The survey indicated that students were not always enthusiastic about using ICT. Students implied some possible obstacles and difficulties in use and access to internet and computers (Table 9).

Table 9: Difficulties and limitation in internet and computer use during self-study (numbers in percentages)

Year	I do not have access to a computer	I do not have access to internet	I am unable to use a computer in my studies	I do not know how to use a computer in my studies	I do not like to work on a computer	Using a computer is not safe for my health	Working on a computer tires me	Working on a computer isolates me from other people	Others
2010	1.6%	5.0%	2.2%	10.3%	11.3%	15.3%	20.3%	23.1%	0.3%
2011	1.1%	1.7%	0.6%	12.3%	9.2%	12.3%	12.6%	17.0%	1.7%
2012	1.7%	2.7%	1.2%	10.6%	7.2%	17.0%	19.8%	21.5%	1.5%

Source: own results

Since the students participating in the study were registered for engineering programmes it was surprising to find out that in 2012 survey1.7% of answers indicated *I do not know how to use a computer in my studies*, and 7.2% answered *I do not like to work on a computer*. Additionally, 19.8% of participants implied that working on a computer made them tired. The above can bring a serious concern whether those future graduates will be able to execute engineering tasks in their workplaces. On the other hand there are reports on students' internet addiction which may lead to personal, family, academic, financial, and occupational problems (Lis, 2010; Sahin, 2011)

DISCUSSION AND CONCLUSIONS

The results of the study on the use of the ICT for years 2009-2012 indicate changes taking place in the students' population. There was a considerable high level of computer ownership between students; that applies to both personal computers (own by students) and family computers (shared withing family). There was also increase in computer ownership and internet access, however those changes were mostly not statistically significant. In 2012 96% of students had either a personal or family computer, and 97% of students had internet access. Interestingly, there were no significant differences in computer and the internet access between students from rural and urban areas. Also, there was practically no difference in internet access in relation to students' residence during their studies (on-campus, off-campus, and at home).

Although not studies in detailed, the survey, especially in open ended questions, revealed that the application of ICT becomes broader; students search information on internet, use electronic banking, and especially benefit from electronic communication students used ICT in different applications including searching internet, performing calculations, listening to music, playing games but also for class preparation. The application of ICT by university administration (university portals for on-line registration, checking of the grades, class schedules etc) forces students to become more aware of the technology. In that respect, most of the students used the internet a *few times a week* to access information with respect to their educational programme.. The majority of students (irrespective of the place of residence) used ICT every day to prepare for classes. They judged thet there

was enough ready available material for their areas of studies on the internet (92% assessed the material to be *a lot* or *average*). It is expected that in the next 2-3 years all the students will be using technologies. The above conclusion is supported also by other authors (Tutkun, 2011; Kirkup and Kirkwood, 2005).

Quite unexpected results were obtained in terms of the frequency of use of the computer for calculations. It was expected that since all students taking part in the survey were registered for engineering programmes they would spent more time computations. One of the possible reasons for students not actually using computers for calculations may be the lack of knowledge and expertise in both basic and, most likely, professional software. The above may indicates the need to provide more elements of computer applications studies in the curriculum, either as increasing such components in existing, specialized engineering courses or by introducing new courses solely dedicated to computing.

The current study assessed the frequency of students' use of internet but unfortunately did not estimate the time students spend using internet; that aspect will be considered in the next survey. However, it can be only presumed that as similarly to ca 60% of students in Poland the population of study spend 3 hrs. up to even 7 hrs. using internet.

Some of the responses received in the part of survey regarding the difficulty in using the ICT may indicate over use of internet and computers. That may explain considerably high number of answers indicating health (including tiredness) and social issues as limitations in the use of ICT. Such problem has been already noted by other authors (Lis, 2010; Nie & Erbring, 2002) and will be worth investigating in detail in the future. Especially that some other authors concluded that application of computer technology increases communication between internet users and can create social interaction (Ruso, 2012; Szponar 2005). As also reported it is a general trend leading to the formation of interest groups, also within a particular course or educational programme (Oliver, 2002; Patel at al., 2011).

In general, the overwhelming majority of students (average of 96% over a period of 4 years) considered computers to be either *useful* or *very useful* in the learning process. Unfortunately, the opinion of students in terms of number of lecturers using ICT in teaching was below expectations. In three consecutive years (2010-2012), only approximately 55% of students assessed that more than 50% of lecturers indeed use ICT in teaching. It is a worrying finding and it is worth investigating much deeper. There may be several factors contributing to majority of lecturers not applying ICT. Some of the obvious reasons may be lack of knowledge and skills and also the fact that the universities are not trying to improve that aspect of lecturers' preparation for teaching. Neither of the two universities covered by the survey uses any dedicated eLearning software like, proprietary Blackboard (Blackboard, 2013), or, open access, like Moodle (Moodle, 2013). It would be highly recommended that such learning/teaching platforms are used in the pedagogical process. They were proved to be effective in course deliverey and also well accepted by students (Uziak, 2009). Some incentives for lecturers actually using, starting to use or attempting to use ICT in teaching should also be recommended. Additotional resources should be provided for technical support to lecturers.

The current study assesses only the use of computers and internet. However, there is only very limited insight to the actual purpose of internet usage and related practices and habits. Such studies are planned to be conducted in the future. Another aspect which requires further investigations is the application of ICT in the learning process, mainly related to preferences of the students in terms of ICT-based learning material. Also, future investigations should study the implications of increased access to computers and internet.

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DISCOVERING HOW STUDENTS SEARCH A UNIVERSITY WEB SITE: A COMPARATIVE USABILITY CASE STUDY FOR PC AND MOBILE DEVICES

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ABSTRACT
This study aims to investigate the usability level of web site of a university by observing 10 participants who are required to complete 11 tasks, which have been defined by the researchers before to gather data about effectiveness, efficiency and satisfaction. System Usability Scale was used to collect data about satisfaction. The research result, completed by the 10 participations show that the tasks' average completion time is 1614,6 seconds and average success score is 93.36. In addition, most of the participants indicated that it was difficult to use the web site when mobile device is used. All the participants show a positive attitude and belief that this site helps the users about finding information about university.

KEYWORDS: Human Computer Interaction, Usability, Mobile usability, Effectiveness, Efficiency, and Satisfaction.

INTRODUCTION

In the last decade, interactive technologies, especially Internet technologies and mobile devices, are evolving quickly. These rapid growths force us to use them in our daily lives intensely. The population in the World increases every day and the hardware being used in these technologies is getting cheaper. Meanwhile, the size and methods of using these technologies are changing quickly.

The popularities of using mobile devices also increase. Portio Research (2012) predicts that mobile subscribers worldwide will reach 7 billion by the end of 2013 and 8 billion by the end of 2016. Deliotte (2012) announced the results of a research study called "State of the global Mobile Consumer: Connectivity is core". According to result of the study in which data are collected from an online survey applied in 15-country, the proportion of mobile devices that are connected to Internet increases sharply. Although the proportion of smartphones that are Internet-connected is approximately 78 % in developed countries, this proportion in Turkey as a developing country is 91 %. At the same time, The Deloitte Global Mobile Consumer Survey reported that 15 % of the populations in developed countries and 19 % of the developing countries have access to a tablet. The ownership or access to tablets in Turkey is 13 % (Deliotte, 2012). Information & Communication Technologies Authority (ICTA) (2012) announced that the number of Internet subscriptions from tablet is about 2 million with 42% annual growth rate and the number of Internet subscriptions from mobile Handset is about 10 million with 142% annual growth rate in Turkey. Moreover, International Telecommunication Union (ITU) (2011) denotes the latest global ICT facts and trends on Internet use. In this report it is indicated that 45% of Internet users are below the age of 25. 30% of the Internet users are below 25 in developing countries.

The number of student in high schools is approximately 5 million and number of students in higher educational institutions is about 4 million. The number of teaching staff in universities is about 70 thousands and approximately 200 thousands public employees in universities (TSI, 2012). Today, web pages have become an important part of life for people from different regions of the world to share knowledge. Public and special institutions provide some of their services through web pages. Variety of persons, including current studying and graduated students, academics, workers benefit from these services. Therefore the importance of usability in design of universities web page is certain.

The numbers of user use Internet technologies increase. However, the types of people are different. Some users get used to some of the complicated computer related applications because of education level, computer knowledge or just because of interests. However some of them do not have enough knowledge or experience in using computer-mobile devices or using these applications. Even advanced users confuse in using some products that are used with computer. So, the technologies working with computer should be designed in such a way that they will not force users to understand when first interact with it (Şengel, 2013). To have users to access to the technology in an effective and efficient manner, and to be satisfied with them, the usability issue has become an important issue. So that with consideration of the properties of people and machines to be designed in the event more "usable" products could be developed that focus on human-computer interaction is also important (Özdemir, Atasoy & Somyürek, 2007). Human computer interaction is an interdisciplinary study of the design

and use of interactive technologies, which aims to support the development of more usable and humanly acceptable systems.

Various definitions of Human Computer Interaction (HCI) are given. Dix, Finlay, Abowd & Beale (1998) stated that "HCI is the study of people, computer technology and the ways these influence each other" (p. 8). Hewett et al. (2009) stated that; "HCI is defined as a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them." "HCI is emerging as a specialty concern within several disciplines, each with different emphases: computer, psychology, sociology and anthropology, and industrial design "(Hewett, et al. 2009).

Usability

Various definitions of usability have been made. Nielsen (1994) defined usability as "ease of use, learnability, efficiency, recall group, decrease in the number of errors, recovery and user satisfaction." In addition to that Nielsen (2005) described the usability studies as within the context of specific cases of people using technology to uncover their behavior. International Standardization Organization (ISO) is associated usability with the effectiveness, efficiency and satisfaction criteria. Effectiveness, the use of a system is determined by the degree of reaching the goal. Efficiency is a measure of resources, which must be spent to achieve these goals. Satisfaction is the degree of the user's system in finding an acceptable (Bevan, 1995).

A usability test is intended to determine the extent an interface facilitates a user's ability to complete routine tasks. Typically the test is conducted with a group of potential users either in a usability lab, remotely (using e-meeting software and telephone connection), or on-site with portable equipment. Users are asked to complete a series of routine tasks. Sessions are recorded and analyzed to identify potential areas for improvement to the web site.

Today, web pages have become an important part of life for people from different regions of the world to share knowledge. Therefore the importance of usability in design of any web page is certain. When the review of literature is investigated, there is a huge amount of research about usability. But, there is no usability evaluation research in the context of a mobile environment. The present work is a pilot study providing preliminary findings for an impending study aiming to compare the usability of the website of a randomly selected university by using computer and mobile devices. The preliminary study is trying to establish usability testing for university web pages and develop guidelines for university web page designers. In this research, it is tried to find out whether the structure of web site is easy to find any information or not, and find out whether the users are satisfied or not while using the site with different devices. Therefore, this research aims to fill this gap and in doing so will also provide a roadmap for future of relatively new research area, mobile usability studies. The problems of this study are to find out time spent to reach desired page, number of errors made till finding page and the satisfaction rate of users in using web site.

METHOD

Methods of usability testing can be categorized into model/metrics based, inquiry, inspection and testing. In usability inquiry techniques, usability evaluators obtain information about users' experiences with system by interviewing them, observing them while using the system, or having them respond to questions in questionnaires (Zaphiris & Kurniawan, 2007). In a project, web pages of universities in Turkey were searched to develop guidelines for design. In Turkey, there are 109 state universities and 69 private universities. To achieve the desired outcomes, universities were randomly selected to make a usability testing. After selection, an expert evaluation of the chosen web site against established usability guidelines had been carried out before the empirical evaluation and representativeness of the chosen web site was requested. In this study, users were observed while they use the Website of Sakarya University by using PC and smartphone. There are not any differences between the design of the PC/laptop and mobile versions. The present study is not a study conducted to solve the usability problem of a particular website.

Procedure and Instruments

In this research, to measure the learnability, effectiveness and efficiency of the site observation method was used for usability testing. At the beginning of the session, the test administrator explained the test session asked them to use think-loud protocol as they use the site. All the sessions are recorded and analyzed by using Morae 3.2., usability software that offers an all-encompassing testing experience for its users. It records user interactions, efficiently analyzes results, and instantly shares your findings (TechSmith, 2012). Morae contains three different sub-programs namely, Recorder, Manager and Observer. After initial details, task scenarios and settings are calibrated, Morae Recorder captures audio, video (either web cam on the computer or a separate camera), on-screen activity, and keyboard/mouse input during a research session. After records are completed, Morae

Manager is used to view and analyze recordings, automatically calculate metrics, generate graphs, and create highlight videos. With Manager, tasks and markers and all data are marked on time line. Data for usability metrics (effectiveness, efficiency and satisfaction) can be calculated and graphed easily. All results can be transferred to PowerPoint slides to present and share with others. In addition, Morae Observer enables team members to watch the customer's experience, make notes, flag tasks, and chat in real-time by using another computer connected to user's computer. But, in this project, Observer was not used.

By using Recorder, a questioner was applied to collect demographic information about audience and experiences in using Internet. Each of the participants joined to test at different times, alone. Then reviews of participants about the web site were asked. While participants performing 11 tasks given to them, researchers need to collect the data they have made some observations. Tasks were generated from a study, done by Şengel and Öncü (2010), investigated how the university's website has been being used by the students.

Participants read the task scenarios and tried to find the information on the website. During the test, the researchers did not help to the participants to complete the given tasks. Participants end each task session himself if he thinks that he had found what is required. Researcher did not mention whether his claim about finding right page is true or not. Immediately after the experimental procedure for each task a questioner with three questions were asked to confirm whether the participant was lost in the site and whether he found the required page by chance or not.

Satisfaction of individuals' data were collected by using System Usability Scale (SUS) (Bevan, 1995) with choices measured on a 5 point Likert scale (strongly agree (5), slightly agree (4), undecided (3), slightly disagree (2), strongly disagree, (1). SUS includes 10 questions with positive and negative statements. Results of SUS score are between 0 and 100.

After recording sessions, Time spent in completing these tasks and the numbers of errors made were analyzed by using Morea Manager Program. During analyze, markers to inform errors, non-critic errors, observations, comments are inserted on time line with different colors.

The same procedure is applied to participant using mobile devices. In both devices, same types of browsers were used and all devices were connected by Wi-Fi to the Internet to have an equal download rate. There are not any differences between the design of the PC/laptop and mobile versions of the web sites. The difference between using computer and mobile device is that pre-survey, questions asked after completing each tasks and SUS were administered by paper and pencil. Video records were imported to Morae Manager and analyzed in the same manner as in using computer.

Sample of the Study

Nielsen (1993) stated that 10 participants are sufficient for usability testing. It was also stated that 75% of usability problems could be detected with 5 participants. Figure-1 shows the relationship between the number of problems detected and the number of participants used in usability testing (Çağıltay, 2006). In this study, 5 participants used laptop and 5 participants used mobile device in usability testing.

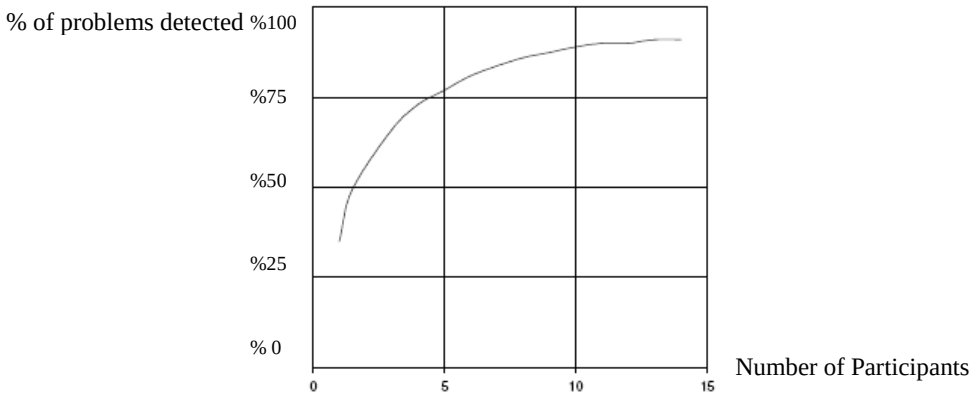

Figure 1: Problems detected vs. Number of participants

The target audience of research consists of people who can use the Internet and are between 18 - 25 years old. % 80 of the participants was studying at a university, two participant were 25 and none of them have ever joined in

usability test applications before. They have own a PC and smartphone and have been using PC and smartphone at least more than 1 year. They do not have any physical disability. Moreover, they had not used or seen the website being studied. The distribution about the amount of time using Internet and daily time spent in Internet are shown in Table-1. Each individual session lasted approximately one hour.

Table 1: How long participants use computer & internet

How many hours do participant use computer weekly?		**How many hours do participant use internet daily?**	
Hours	**# of participant**	**Time**	**# of participant**
0 – 10 hours	2	Less than1hour	1
11 – 25 hours	3	1-3 hours	3
More than 26	5	4-6 hours	4
		7-10 hours	2
Total	10	Total	10

FINDINGS AND RESULTS

Findings for effectiveness and efficiency

Descriptive statistics relating to the research findings and statistics are based on the comments below.

In order to answer the first aim of the research which is to find the time spent for each task and the number of errors done while the participant tries to complete the desired task. For this purpose, the average time spent for each task is recorded as shown in Table-3.

Table 3. **Average Time Spent & Success Rates for Each Task for PC and Smart Phone Users**

	PC		**Smartphone**	
Tasks	**Average Time Spent (s)**	**Success Rates (%)**	**Average Time Spent (s)**	**Success Rates (%)**
Task 1	56,10	100	49,50	100
Task 2	**96,3**	**25**	**127,35**	**75**
Task 3	*126,15 **	87,5	*163,80 **	87,5
Task 4	34,05	100	66,45	100
Task 5	***147,30 ****	**75**	***244,65 ****	**25**
Task 6	*120,60 **	*100*	*124,05 **	100
Task 7	*141,75 **	*80*	*129,45 **	100
Task 8	53,25	100	75,90	100
Task 9	***137,85***	***25***	***279,00 ****	**25**
Task 10	**83,40**	**0**	***225,75 ****	**0**
Task 11	***101,70***	**75**	***291,00 ****	**100**
Average	99, 86		161,54	

(*: time spent more than average, italic and bold faced: distinct in means for mediums)

The chart below displays a summary of the test data. The average time spent for each task for each participant for each group, PC and Smartphone is shown in Figure-2.

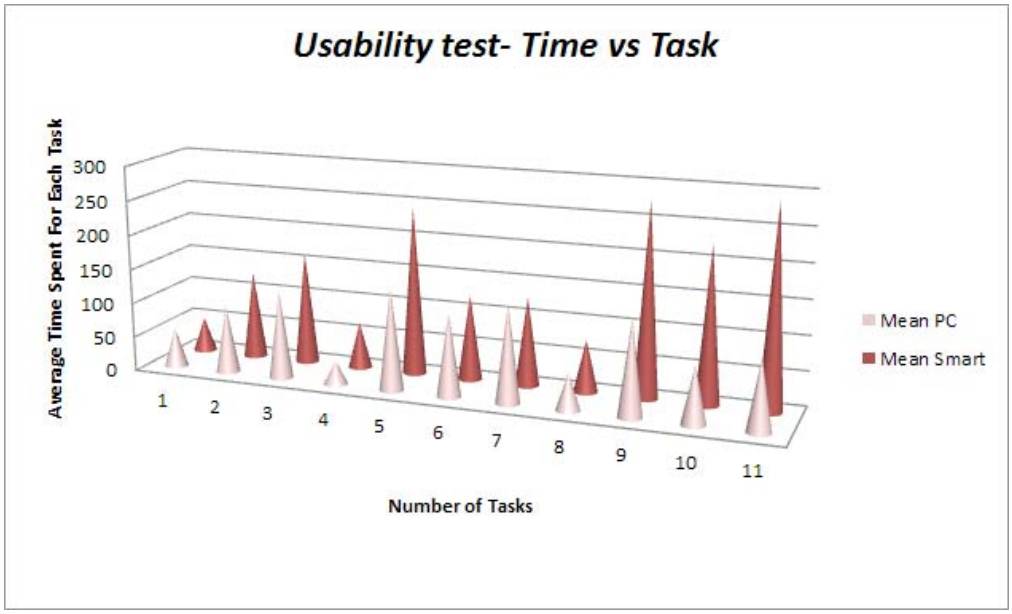

Figure 2: Usability test- Time vs Task for each medium

Average time spent for all sessions is approximately 1614,60 seconds (27 min). However, average time spent just for doing tasks took 1437, 68 seconds (24 min). During the sessions, time spent just for completing tasks are 1098,45 seconds for participants who used PC and 1776,90 seconds for participants who used smartphone. Long time to complete tasks shows that the efficiency of the web site was low. For PC users, the time required to complete tasks numbered **1, 2, 4, 8** and 10 took less than average. However, for tasks 3, **5**, 6, 7, **9** and **11** it was difficult to accomplish the task. Meanwhile, for smartphone users, the time required to achieve desired tasks numbered **1, 2, 4**, 6, 7 and **8** took less than average. However, for tasks **5**, **9**, 10 and **11,** it was difficult to complete the task (Table 3). As shown in table 3, although users in both cases behaved in the same manner for tasks 1, 2, 4, 5, 8, 9 and 11, the time spent for these tasks in smartphone are more than these in PC users. The big difference between the times spent in different devices might be because of the screen size of the smartphones. Not designing the web site compatible for mobile devices might be another reason for this distinction.

The chart (Figure 3) below shows the average number of error done for each task while participants try to accomplish given task successfully. When the error rates for tasks for different devices were compared, the average number of errors was almost the same for some tasks like task numbered with 2, 3 and 8. But, there were differences in other eight tasks in such a way that the average numbers of errors done in using smartphone were almost twice as the number of errors done in using PC.

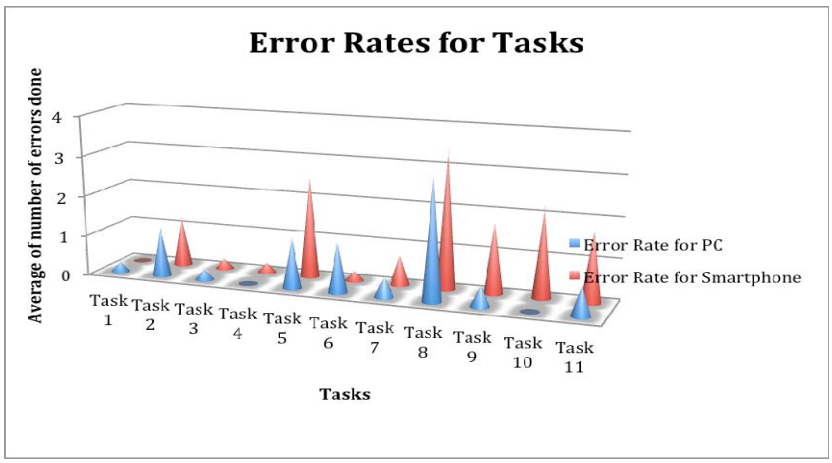

Figure 3: Error Rates for Tasks for different devices

When the time spent for each task in Figure 2 and the average error done for each task in Figure 3 are compared, there was a positive relation between them. As well as spent time for tasks numbered 5, 9 and 11 were longer,

the error rates for the same tasks were also more compared to others. However, the total number of errors was low considering that the participants used this web site for the first time. Because of environmental and psychological factors, users might make some mistakes and errors when they use any system first time, even users are experienced in using the system or even the system or web site is well designed (Özdemir, Atasoy & Somyürek, 2007).

To complete the task-1, participants using PC and smartphone spent an average 56,10 seconds and 49, 50 seconds respectively in order to find student registration. In addition, the success rates were 100 % and 100% respectively. In this task, the average number of errors done to achieve desired page were 0,25 for PC users and 0,00 for smartphone users. It was easiest task for participants to accomplish, because most of them were university students. They get used to registration system. Moreover, the link for system could be found easily. All participants stated that they had estimate where they could find the related information in the site.

For task 2, participants had to find daily or monthly meal list if they would like to have lunch in university cafeteria. The participants in PC group and smartphone had spent average 96,3 seconds and 127,35 seconds (lower than average) respectively and gained 25% and 75% success rates respectively. 25% of the participants could not complete the task. 37,5% of them completed with difficulty and the rest completed in longer time than average. Three of them forced to terminate in finding the meal list because the position of the list's link is placed in the navigation. In navigation menu, there were two menus called as "Life in Campus" and "Links". Users expected to find it in "Life in Campus" and could not find there. But it was placed in "Links" menu and called as "Web Menu – Monthly Food Menu System". Name of the link did not mean anything to some participants. Because of this, the number of errors participants made while trying to complete the task scenarios was high in both users group with an average of 1,25.

To complete the task-3, participants using PC and smartphone spent an average 126,15 seconds and 163,80 seconds respectively in order to find academic calendar. In addition, the success rates were 87,5 % for both PC and smartphone users with 4 errors' in total. One participant could not have completed this task. 3 of them completed with ease, but 4 of them completed with difficult. Main reason for this error was that although link for academic calendar was placed in an appropriate menu, users were directed to another web site called as "Directorate of Student Affairs", and then they searched for the task in the new site opened in new tab. Because of that, participants stated that they lost their position in the site.

The aim of task 4 was to find calendar of events, which could be completed in a single step. The task was accomplished with 100% success rate in both groups. Average of 34,05 seconds in PC application and 66,45 seconds in smartphone application were spent to complete this task. In general, this task seems too easy for participants.
To complete the task-5, participants gained an average 50% success rate by spending an average 147,30 seconds in PC users and 244,65 seconds in smartphone users. In both case times spent to achieve desired outcome were higher than the average values as shown in Table 3. Although achieving the conditions to apply Erasmus program can be done in two steps, two participants in both groups (total five participants) were not able to complete this task. One participant from PC users completed the task with difficulty. Moreover, 3 participants (one from PC users and two from smartphone users) forced too much to accomplish the given task. It was the one of the most difficult duty. After all participants found related link in the web site, the web browser directed to a new web site in a new tab as in task 3. In the new site, there was a menu bar at the top with 9 selections. There was a big picture in the middle. But, such a big picture camouflage local navigation. However, this big picture made user to scroll down. The required information cannot be found in the menu bar. It is placed in local navigation. Because of this, the number of errors participants made while trying to complete the task scenarios was high. In this task, the average number of errors done by PC users was 1,25 and that was 2,5 for smartphone users. The big difference between error rates was because of screen size and the picture and scrolling effect used in the site.

To complete the task-6, participants using PC and smartphone spent an average 120,60 seconds (higher than 99,86, the average) and 124,05 seconds (lower than 161,54 the average) respectively in order to find contact information of Dean of the Faculty of Education. In addition, the success rates were 100% and 100% respectively. In this task, the average number of errors done to achieve desired page were 1,25 for PC users and 0,25 for smartphone users. All of the participants completed this task with a total of 8 errors. 25% of the participants completed with ease and 75% of them forced too much to complete. Most of the participant thought that menu names as "Contact" will give information about detail contact information for all of the faculties and departments in the university. But "Contact" menu gives only contact information about university. To

minimize this problem, web pages of sub-divisions of the university should be designed by using the same template.

When the participants were asked to eligibility conditions to use library to accomplish 7th task, except one of the participant, three of the participant in PC group completed the task with difficulty and one could not complete the given task. Participants in this group spent 141,75 seconds with 80% success rate. The average number of errors done by PC users was 0,5. However, in smartphone group, three of the participant completed the task easily. But, one of them completed the desired task with difficulty. 129,45 seconds was spent by participants using smartphone with 100% success rate. The average number of errors done by smartphone users was slightly higher than done by PC users with a value of 0,75. Although the 7th task could be completed in two steps, participants had difficulty in finding the required link because of font size used in library web site. Again, because of screen size of smartphones, participant had difficulty in achieving the result efficiently and effectively. Participants in both group stated that another reason for low efficiency (spending more time) was the background color of the web site of the library of the university.

In task 8, participants needed to find brief description, opportunities and publicity of the university. Participants gained 100% success rate by spending an average of 53,25 seconds as PC was used and 75,90 seconds as smartphone was used in the study. There was a navigation called as “Our University” in general menu bar. Because of this, it was easy to complete this task.

Universities are, of course, for students. But, academicians also visit web sites of universities as well. Therefore, needs of academicians have to be fulfilled. To test whether the web site supports this aim or not, participants were asked to find out application form for Scientific Research Project department for task 9. It was the task that took the longest time to achieve. Only 20% of participants could complete the task. One participant from each group (PC and smartphone) found the application form after slogging for a long time. Rest of the participants stated that they could not go any further after spending average time. Participants using PC and smartphone spent an average 137,85 seconds and 279,00 seconds respectively in order to achieve the task. In fact, all participants found the link to go to web site of Scientific Research Project department. But, they could not find the required information on that site. The navigation bar is different for some menus. The task 9 can be completed in 6 steps. This results support Porter conclusion stating that users might leave the site unless they can find what they are looking for within three clicks (2003).
In our country, most of the universities have Faculty of Medici and these include Hospital in their structure. Hence, web site of universities might also serve to the public. Because of this reason, participants were asked to expose the phone number to make appointment to any polyclinic. But, none of the participant achieves to find out the number. This was the only task that no body completed. The reason for this is that the web site of the Faculty of Medicine does not include any information about appointment. As in the task 9, the participant left the site after consuming time. Since these pages are also used for public, the communication and contact information should be added.

To complete the task-11, participants using PC and smartphone spent an average 101,70 seconds and 291,00 seconds respectively in order to find tender news. In addition, the success rates were 75 % and 100% respectively. In this task, the average number of errors done to achieve desired page were 0,75 for PC users and 1,25 for smartphone users.

Findings for satisfaction
Satisfaction of individuals' data were collected by using System Usability Scale (SUS) (Bevan, 1995) with choices measured on a 5 point Liker scale (strongly agree, slightly agree, undecided, slightly disagree, strongly disagree). SUS includes 10 questions with positive and negative statements. Bevan (1995) stated that, if the average value taken from SUS score is between 65-70, it could be stated that participants satisfied with the page design. In this study, it was found that, the average SUS score for PC users was 43,75 and the average SUS score for smartphone users was 54,38. In both cases, the participants were not satisfied with the web site. They indicated that there were too many inconsistencies in the web. But, at the same time, they think that various functions in the web were well integrated.

CONCLUSIONS
The objective of the present study is: to compare the usability of the website of the Sakarya University. In this study, when the time spent for each desired task is investigated, it can be realized that the respond time of web site is fast. As indicated in resent study, the respond time of a site affects the usability of this site by users (Polkosky and Lewis, 2002; Krug, 2007).

The highest average time spent and the highest numbers of error done throughout this study are 244,65 seconds and 20 errors respectively for task-5. Participants' had difficulty in gaining access to conditions to Erasmus program, which form the lower section of the guidance corner. This means that using scrolls for a web page decreases the usability of that page. To increase the usability of a site, it is required not to use scrolls, mainly in home pages.

40 % of the participants were not able to complete task-6. The regional navigation was mixed with main navigation. In the searched web page, there is only one main menu navigation. However, if navigations of a site are divided into main navigation, sub navigation and service navigations, users may not be lost while using it (Krug, 2007). Everything will be clear as it is done, for persons who use the site for the first time. Every web page or a program may look like useful as it is used many times. Users get used to using it. But, in this case the efficiency of the site decrease and then persons may not use or visit the site.

As the sticker's names in navigation bars are named accurately, the users may not be lost while using the web site. So the time required reaching to desire outcome decreases and usability of that site increases automatically. For most of the cases in this study, navigations are named correctly. But, in task-3, users reached to desired objective with 25% success rate because of wrong naming in navigation menu bar. So, the names of menu should help users to guest what would be coming tab.

From this study, it is understood that users lost their ways in the site as the link is directed to a new tab. Using new tabs with different page design makes users to think about and try to understand the new features of the site. This creates a conflict in using site. Moreover, in most of mobile devices, it is not as easy to go back the other tab as using in PC. In order to solve such problem, new tab could be opened over old one. So, users could go back to previous page by using back button. In addition, in some smartphones, the number of using new tab was limited to eight tabs as in IPhones. If user had already opened some tabs before, it would be difficult to go forward in the applications. So, in order to not to have such problems, all of the web site of universities should be designed by using templates as created at Atatürk University. Templates for PC and mobile devices should be developed and used.

The web site searched in this study was designed for computer systems with big screen size. Some properties of it are not suitable for mobile phones. Using some photos or pictures with high resolutions in home pages may not create a problem in PC screens. However, having such property in the site causes usability problems in mobile smart phones. Users might not observe local navigation placed at the bottom because of screen size. Font size for mobile device should also be selected according to screen size. When page is designed just according to properties of PC, it would be difficult to use it in small devices like phones or tablets.
Results of this study support the literature in the number of click to achieve desired outcome. If the number of click was more than three, users get bored and leave the site without using. So, tasks should be accomplished maximum in three steps Porter, 2003).

It is cleared that in order to use web sites properly in new generation electronic devices like smartphones and tablet computer, the designers had better take care in designing the web site compatible for mobile devices to avoid distinction in using web site in mobile devices. Websites have to develop alternate mobile designs. Moreover, templates for PC and mobile devices should be developed and used. In addition, font size for mobile device should also be selected according to screen size. Some standards have to be applied in designing web site for mobile devices. These standards could be: using single column layouts work best, presenting navigation differently, reducing the amount of content, minimizing text entry, designing for touchscreen and non-touchscreen users, and taking advantage of inbuilt functionality (Apple, 2013; Sherrett & Terrill, 2012; Webcredible, 2013).

From this study, it is understood that participants could not completed with high success rate, if task is asked to find any information not related with students. Student could not manage the task. Doing research with the same type of participant (being student) was one of the limitations of the study. The same study might be repeated by using different types of mobile devices with more than one university with more participants.

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E-ASSESSMENT OF STUDENT-TEACHERS' COMPETENCE AS NEW TEACHERS

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ABSTRACT
In teacher education programmes, text-based portfolios are generally used to assess student-teachers' competence as new teachers. However, striking discrepancies are known to exist between the competencies reflected in a written portfolio and the competencies observed in actual classroom practice. Multiple assessments should be used to provide a more valid assessment of student-teachers' competence as new teachers. Technology can support this kind of multiple and flexible ways of assessment. In a Research & Development project, four types of e-assessments were designed, implemented and evaluated in 27 interventions in 13 post-graduated teacher education programs in the Netherlands. Teacher educators reported positive outcomes of the interventions in terms of new procedures, materials and tools. No significant effects were found of the implementation of the four types of e-assessments on the evaluation by either teacher educators or student-teachers. A possible explanation for this absence of effects might be teething problems of the interventions implemented.

INTRODUCTION
Assessment and evaluation are increasingly important in all educational sectors. In teacher education programs, text-based self-evaluations are generally used to assess student-teachers' competence as new teachers (Fox, White, & Kidd, 2011; Winsor, Butt, & Reeves, 1999). However, this kind of written self-evaluation does not give valid evidence of teacher competencies that are typically used to guide the curriculum of teacher education programs. Consequently, observation of student-teachers' performance are increasingly used for assessment, such as class observations, teaching materials and tests. Simultaneously, assessment is used for both formative and summative purposes: assessments are not only used to measure student-teachers' competencies, but also to feed back student-teachers which competencies they already possess, in what phase of development they are and how they can acquire teacher competencies. Technology can support this kind of multiple and flexible ways of assessment. The objective of this paper is to provide insight into how multiple e-assessments of student-teachers' competence as new teachers can be designed in an efficient and effective way.

Student-teachers' Competence as New Teachers
In 2005, in response to national and international calls for improved teacher education and greater educational accountability, the Dutch Ministry of Education decided to develop a standard for all teachers in secondary education. Subsequently, a standard was developed resembling the Professional Standards for Teachers in England (http://www.tda.gov.uk/), the National Professional Standard for Teachers in Australia (see http://www.nsw.gov.au/), and the Professional Teaching Standards in the United States (see http://www.nbpts.org/). The Dutch Teacher Standard includes pedagogical, interpersonal, organizational, methodological, relational (colleagues, community), and reflective competencies (see the Association for the Professional Quality of Teachers, http://www.lerarenweb.nl/). The first four competencies (i.e., pedagogical,

interpersonal, organizational, and methodological competencies) can be assessed on the basis of teacher performance in the classroom. While the relational competencies that pertain to colleagues and the community are important, student-teachers usually gain only limited experience with these competencies during their training. All six competencies refer to the professional role of the teacher in three types of situations: working with students, working with colleagues, and working in the school. The seventh competence is reflection, which is seen as important for a teacher's ongoing personal and professional development (Day, 1993; Hatton & Smith, 1995; Korthagen, 1992). All of the seven competencies of the Dutch standard are described according to rubrics of key knowledge, skills and attitudes that teachers must have at various levels. Teacher education programs typically use the competencies outlined in the national standard to guide their curriculum design and assessment. The problem, of course, is how to assess the competencies and thereby demonstrate that teachers meet the required standards.

Assessment of Student-teacher Competence

In the 1980s, written teaching portfolios were introduced into teacher education to stimulate student-teachers to think more carefully about their teaching practices and subject matter (see, for example, Bartell, Kayne, & Morin, 1998; Darling-Hammond & Snyder, 2000; Fox et al., 2011; Winsor et al., 1999; Woodward & Nanlohy, 200a, 2004b). Portfolios are argued to be suited not only for learning purposes but also for assessment purposes as they represent: "a way to define, display, and store evidence of a teacher's knowledge and skills that is based on multiple sources of evidence collected over time in authentic settings" (p. 58) [10]. Student teachers can include, for instance, the following in assessment portfolios: their ideas regarding teaching, summaries of relevant theories, samples of lesson plans, observational notes on their teaching, and reflections upon their teaching practices. While such documents cover a wide range of knowledge and competence, striking discrepancies are known to exist between the competencies reflected in a written portfolio and the competencies observed in actual classroom practice. That is, student-teachers can sometimes present excellent written portfolios while their teaching performance is evaluated by school and university supervisors as rather weak (cf., Darling-Hammond & Snyder, 2001) and (cf., Burroughs, 2001; Uhlenbeck, 2002).

When Delandshere and Arens (2003) analyzed the written portfolios submitted to three teacher education programs in the USA, they encountered major problems with the evidence submitted for assessment purposes. Most of the written portfolios consisted of meta-data (e.g., statements of beliefs, lesson plans, mentor observations, reflections on teaching experiences). In other words, the data was removed from actual practice and thus indirect; the portfolios showed the student teachers' views on classroom events and their beliefs about teaching. As Delandshere and Arens point out, however, the assessment of teaching performance requires direct evidence and thus data on the teacher's actual work in the classroom.

In contrast to such indirect sources of data, video recording allows direct teaching evidence to be included in an assessment portfolio. The use of video recordings allows direct evidence of teaching to be included in a narrative. Compared to written or oral accounts, video narratives are likely to provide information on a wider variety of teacher competencies and more specific information on the contexts in which the competencies are demonstrated. This rich picture of teacher competencies and practices obtained in specific contexts can be assumed not only to provide highly valid information but also can be used for analytic and varied reflection.

There is much empirical work on the use of video for learning, mostly in teacher education (e.g., Bower, Cavanagh, Moloney, & Dao, 2011; Rosaen, Lundeberg, Cooper, Fritzen, & Terpstra, 2009) and in professional development programs with (experienced) teachers (Borko, Jacobs, Eiteljorg, & Pittman, 2008; Rich & Hannafin, 2009). For example, in their evaluation study of the use of video in web-based computer-mediated communication in teacher education, Lee and Wu (2006) found that student-teachers reflect more thoroughly on their teaching, pinpointing the areas of required improvement better, compared to situations in which student-teachers had to rely on their recall of their practices only. Likewise, these authors showed that student-teachers were also willing to share their experiences with and learn from their peers. Moreover, the authors found that – compared to micro-teaching sessions in which student-teachers had to rely on their recall only - peer feedback became more concrete and associated with specific points in the video clips. This feedback was also appreciated more by student-teachers. Finally, watching, analyzing and reflecting upon the video-taped practices of *others* enabled the student-teachers to learn from good teaching models and guard against bad ones. Experiences with how the use of video clips can be further integrated into the professional development of teachers confirm these findings (e.g., Video Clubs in Sherin & Van Es, 2009).

However, due to the lack of empirical studies on video portfolios with teachers or student-teachers for assessment purposes, it is still unclear if the inclusion of direct evidence about the functioning of student-teachers in the classroom facilitates a valid assessment of student-teachers' competence.

e-Assessment of Student-teachers' Competence

The licensing and certification of teachers today is performance-based and thus recognizes teaching as a highly complex, highly contextual, and highly personal activity cf., Darling-Hammond & Snyder, 2000; Moss et al., 2004; Schutz & Moss, 2004). In teacher education programs, performance-based assessment is often supplemented with other information from portfolios, which can include lesson plans, reflections, feedback from students, and feedback from supervisors, superiors and colleagues (Wolf & Dietz, 1998). A portfolio should show not only that the student-teacher knows and understands theory but also that the student-teacher can act in accordance with theory and detect discrepancies between what is taught in theory and what occurs in actual practice.

This complex combination of teacher competencies asks for multiple assessment procedures in teacher education. Technology might support these new, complex ways of assessment. Recent years have been characterized by extensive growth in the use of technology in education, such as virtual learning environments, simulation software, virtual experiments, visualization of complex models as well as tools which enables students and teachers to communicate and collaborate through email, electronic forums, and instant-messaging systems. However, the use of technology in assessment procedure (i.e., e-assessment) is an under-researched area. e-Assessments convey practical benefits such as accessibility of practices, flexibility in updating information, and incorporating multimedia resources (Fill & Ottewil, 2006), in addition to efficiency for both teacher educators and student-teachers. As teaching has been recognized as a highly complex, highly contextual, and highly personal activity, e-assessments might be helpful in order to assess student-teachers' competence as new teachers in an efficient and effective way.

Problem of this Study

The problem of the present study was how multiple e-assessments of student-teachers' competence as new teachers could be designed in such a way that these could be carried out in an efficient and effective way and provide a valid assessment of student-teachers' competence as new teachers. Research questions were:

1. How do interventions on e-assessment affect the use and evaluation of these e-assessments by teacher educators?
2. How do interventions on e-assessment affect the evaluation of these e-assessments by student teachers?
3. How do teacher educators perceive the implementation of the interventions on e-assessment?

METHODS

Research Context

Teacher preparation includes certification at three levels: primary education, lower secondary education (pre-vocational secondary education and the three lower grades of senior general secondary education and pre-university education) and all levels of secondary education. The latter programs are mainly based in research universities and the former two programs are mainly organized by universities of applied sciences.

The context of this study is the post-graduate teaching education program in the Netherlands. Students who graduate are licensed to teach at all levels of secondary education in the Netherlands. Teacher preparation for certification to teach at all levels of secondary education usually takes a one-year full time (or two-years 50% part-time) master program as a follow-up of a master program in a particular school subject (e.g. mathematics or a foreign language). This means that teachers who are licensed to teach at all levels of secondary education have two Masters: one in a school subject or related domain and one in teaching this school subject. The curricula of these teacher education programs exist of 50% courses at the teacher education institution and 50% teaching in school. The common goal of these master programs is to connect theory and practice of teaching in secondary education.

In a Dutch national Research & Development project, Non satis scire (funded by the SURF foundation, http://www.surf.nl/), teacher educators and master students of teacher education programs of all 13 Dutch research universities participated. Teacher educators collaboratively design, implement, and evaluate both formative and summative assessments of student-teachers' competence as new teachers. Four e-assessment types have been addressed: 1) knowledge tests on learning and instruction, 2) providing feedback on students' plans for research on teaching practice, 3) providing feedback on students' web-based video clips of teaching practice and 4) digital self-assessments of student-teachers' reflection.

Design of the Study

In a multiple-case study research design, 27 interventions were carried out, spread over 13 teacher education programs and the four forms of e-assessment (see Table 1). In order to answer research questions 1 and 2, for each type of e-assessment teacher educators and students from the experimental condition (programs that carried

out the particular type of e-assessment) were compared with teacher educators and students from the control condition (i.e., programs that were not part of the experimental conditions). In order to answer research question 3, a multiple case study design was used (Yin, 2014) using multiple data sets about each of the programs.

Table 1. Overview of the design

Intervention	Participating TE programs	
	Experimental condition	Control condition
1. Knowledge tests	4	9
2. Feedback on students' research plans	9	4
3. Feedback on students' video clips	11	2
4. Digital self-assessment	4	9

Data and Procedures

Data were collected of 115 teacher educators and 644 master students from 13 universities. A digital pre-test and post-test questionnaire was administered to teacher educators to evaluate the four interventions on two aspects: 1) the extent to which different forms of e-assessments were used and 2) the extent to which these forms were valued. A similar pre- and post-test questionnaire was administered (on paper) to students from the 13 universities. In addition, observations of work meetings and evaluation reports were used to map teacher-trainers' experiences with the various forms of e-assessment. Finally, all educational materials (study guides, readers, tests, video clips, student reflections, research plan, feedback forms and completed assessment rubrics) were collected and analyzed to support or contradict interpretations from the questionnaire data and work meetings.

Questionnaire for Teacher Educators. In addition to their gender, age, teaching experience and teaching position, teacher educators were asked to evaluate the use of 1) a corpus of shared items of a knowledge test on learning and instruction; 2) digital knowledge tests; 3) peer feedback on research plans; 4) peer assessment on research plans; 5) digital rubrics to support the assessment of research plans; 6) video recording of student-teachers' practices and 7) self-evaluations.

First, we asked teacher educators to indicate the variety of their use of the assessment types. The frequency of use was measured by 2 to 5 yes/no items, with items like, "Did you use the digital corpus of knowledge items?" (Shared test items), "Did students provide written feedback on their research plans?"(Peer feedback) or "Did you provide feedback on the basis of students' video clips of their teaching practice?" (Video).

Second, the evaluation of each of the assessment types was measured using a series of 4 to 7 similar Likert-type scale statements, with *1*= completely disagree to *5*= completely agree. Example items are "The use of digital tests has a positive effect on the time that is needed to feed back the test results (Digital knowledge test), "Peer feedback has a positive effect on the time teachers spend on providing feedback" (Peer feedback), or "The use of web-based video clips of students' teaching practice has a positive effect on students' insight into their own teaching competence" (Video).

In Table 2, the descriptive statistics are presented for the frequency of use and for the evaluation of each of the assessment types. Of the 115 teacher educators, 60 completed both the pre-test and the post-test. The reliability of the seven evaluation scales met our norm of 0.70, for the first scale with only 4 items after using the Spearman-Brown correction for test length.

Table 2. Descriptive statistics teacher-educator questionnaire

	Frequency scale*	Evaluation scale	Cronbach's α	Exp cond N	Contr cond N
Shared test items**	0 – 3	1-5	.58	26	34
Dig. knowl. tests	0 – 2	1-5	.72	26	34
Peer feedback	0 – 5	1-5	.74	52	8
Peer assessment	0 – 3	1-5	.77	52	8
Rubrics	0 – 4	1-5	.82	52	8
Video	0 – 5	1-5	.77	52	8
Self-assessment	0 – 3	1-5	.78	13	37

* 0 = assessment instrument is not used; 2/5 = instrument is used in various ways

** this scale included only 4 items

Questionnaire for Students. In addition to their university, gender and age, students were asked to report their evaluation of 1) digital knowledge tests; 2) peer feedback on research plans; 3) peer assessment on research plans; 4) digital rubrics to support the assessment of research plans; 5) video recording of student-teachers' practices and 6) self-evaluations.

The items of this part of the student questionnaire were similar to those in the teacher questionnaire. For each of the e-assessments types, a series of 4 or 5 statements were used to measure students' evaluation. These statements were answered on a Likert-type scale, with *1*= completely disagree to *5*= completely agree. Example items are "I receive feedback about my test results more timely in the case of a digital test compared to a paper-and-pencil test" (Digital knowledge test), "I can learn a lot from provide providing peer feedback on research proposals" (Peer feedback), or "Supervision using a web-based video clips of my teaching practice is better than supervision on the basis of life observation of my supervisor" (Video).

In Table 3, the descriptive statistics are presented for the evaluation of each of the seven assessment types. The reliability of five evaluation scales met our norm of 0.70. The first scale was excluded from the analyses as the reliability appeared to be low. As shown in Table 2, the distribution of participants in both conditions is strongly skewed, which lowers the chance to find any significant differences between both conditions.

Work Meetings and Evaluation Reports. During the project period of two years two or three teacher educators per teacher education program that participated in the four types of e-assessment interventions attended three work meetings and completed evaluation reports which were used as input for these meetings. The information from the meetings and reports was summarized.

Table 3. Descriptive statistics student questionnaire

	Evaluation scale	Cronbachs α	Exp cond. *N*	Control cond. *N*
Dig. knowl tests*	1-5	--	--	--
Peer feedback	1-5	.79	131	5
Peer assessment	1-5	.76	126	5
Rubrics	1-5	.84	130	5
Video	1-5	.78	109	25
Self-assessment	1-5	.78	5	125

* this scale is excluded because the reliability was too low

Analyses

A mix-method analysis procedure was used. For the questionnaire data, repeated measures analyses were used to examine possible differences in evaluation before and after the interventions. In these analyses, each intervention condition was compared with the three other forms of e-assessment (which form the control condition). The qualitative data in the written protocols of the work meetings and evaluation reports were combined into a thick description (Geertz, 1973) of each of the 27 interventions indicating teacher educators' self-reported experiences with the particular form of e-assessment.

RESULTS

Use and Evaluation by Teacher Educators

The results of the repeated measures analyses of variance for teacher educators are summarized in Table 4 (frequency of use) and Table 5 (evaluation).

Table 4. Results for teacher educators: frequency of use of assessment procedure (means and standard deviations between brackets)

	Experimental condition		Control condition	
	Pre-test	Post-test	Pre-test	Post-test
Shared test items	1.6 (1.4)	1.4 (1.4)	0.8 (1.2)	1.1 (1.4)
Dig. knowl. tests	0.2 (0.5)	0.3 (0.6)	0.1 (0.2)	0.1 (0.2)
Peer feedback	2.2 (1.8)	2.3 (1.8)	0.1 (0.4)	0.6 (1.2)
Peer assessesment	0.4 (0.9)	0.4 (1.0)	0.0 (0.0)	0.0 (0.0)
Rubrics	2.2 (1.7)	2.2 (1.7)	0.1 (0.4)	1.0 (1.9)
Video	1.8 (1.5)	2.0 (1.5)	0.5 (0.5)	1.3 (1.6)
Self-assessment	0.8 (0.4)	0.8 (0.4)	0.8 (0.8)	0.9 (0.7)

Table 5. Results for teacher educators: evaluation of assessment procedure (means and standard deviations between brackets)

	Experimental condition		Control condition	
	Pre-test	Post-test	Pre-test	Post-test
Shared test items	3.6 (0.6)	3.3 (0.6)	3.5 (0.5)	3.2 (0.5)
Dig. knowl. test	3.2 (0.3)	3.1 (0.7)	3.1 (0.6)	3.0 (0.5)
Peer feedback	3.6 (0.5)	3.4 (0.5)	3.8 (0.3)	3.5 (0.5)
Peer assessment	3.2 (0.6)	3.2 (0.4)	3.7 (0.4)	3.5 (0.5)
Rubrics	3.5 (0.5)	3.5 (0.6)	3.9 (0.1)	4.0 (0.3)
Video	3.2 (0.6)	3.2 (0.6)	3.1 (0.4)	3.1 (0.6)
Self-assessment	3.6 (0.4)	3.6 (0.6)	3.4 (0.5)	3.4 (0.5)

Note. Scale is *1* =totally disagree, *5* =totally agree that the particular e-assessment has a beneficial effect

The analyses did not show a significant increase in teacher educators' use of the particular assessment procedure, compared to the control condition (consisting of programs that did not use the particular e-assessment form). As shown in Table 4, teacher educators in the intervention condition did generally differ in their use of the particular assessment form from the control condition, but these differences already existed a priori (with all *F*s< 1.71 and all *p*s>.20). It appears that teacher educators apparently decided to participate in the interventions that included the assessment form they already used in their regular practice. A marginal trend was found for the use of a digital knowledge test ($F(1,58)= 3.50$; $p= 0.06$) indicating that teacher educators in the experimental condition tended to increase their use of a digital knowledge test after the intervention, compared to teacher educators from the control condition.

In Table 5, the results are summarized for the evaluation of the e-assessment types by teacher educators. Again, no differences were found between the experimental and control conditions, indicating that teacher educators from the intervention condition generally did not evaluate the e-assessment forms differently, compared to the other teacher educators (with all *F*s <0.25 and all *p*s >.62). Finally, no significant correlations were found between the use of the assessment types by teacher educators and their evaluations of the particular form of e-assessment (with all *r*s < .25).

Evaluation by Student-teachers

In Table 6, the results of the repeated measures analyses on the data of the master students are summarized. No significant differences were found between students from the experimental and control condition on the evaluation of the e-assessment types (all *F*s < 1.85 and all *p*s >18). A marginal trend was found for the evaluation of peer feedback ($F(1,134)= 3.35$; $p= 0.07$) indicating that students in the experimental condition generally tended to report a negative evaluation of peer feedback after the intervention, compared to students from the control condition. Generally, students from the experimental condition tended to show lower evaluation scores after the intervention with respect to all types of assessment, compared to the pre-test and compared to students from the control condition. It should be noted that the distribution of numbers of students in the experimental and in the control conditions is strongly skewed. In order to decrease this skewedness, students' practice of the particular e-assessment (yes/no) was used to define the experimental en control condition. Although this increased the number of students in the control condition (i.e. students who were part of an intervention, but did not practice the particular assessment), similar results were found as shown in Table 6.

Table 6. Results for master students: evaluation of assessment procedures (means and standard deviations between brackets)

	Experimental condition		Control condition	
	Pre-test	Post-test	Pre-test	Post-test
Peer feedback	3.5 (0.5)	3.3 (0.6)	3.6 (0.3)	3.9 (0.6)
Peer assessment	3.4 (0.6)	3.2 (0.7)	3.3 (0.9)	3.6 (0.7)
Rubrics	3.6 (0.7)	3.4 (0.8)	3.5 (1.1)	3.8 (0.6)
Video	4.0 (0.5)	3.8 (0.7)	3.9 (0.4)	3.7 (0.7)
Self-assessment	3.8 (0.2)	3.6 (1.2)	3.5 (0.6)	3.8 (0.6)

Note. Scale is *1* =totally disagree, *5* =totally agree that instrument has a beneficial effect

Teacher-educators' Perceptions of the e-Assessment Interventions

In Table 7, the results of the qualitative analyses of the work meetings and evaluation reports of the teacher educators are summarized. These analyses show the particularities of using the four forms of assessments. One of the results from the analysis of the educational materials was that teacher educators used the assessments in a formative way, instead of or in addition to summative assessments. This result aligns with observations from

Admiraal, Van Duin, Hoeksma, and Van de Kamp (2011) that teacher educators strongly prefer the role of mentor or coach, guiding students during their learning process, instead of the role of assessor, which includes judging the quality of students' competence. Moreover, many educational and procedural outcomes can be distinguished such as the setup of a digital repository of test items, quality improvement of knowledge tests, and procedures and rubrics for peer feedback on research plans and for feedback and assessment of web-based video of teaching practices.

DISCUSSION AND CONCLUSION

Assessment procedures and criteria were developed and evaluated for testing student-teachers' knowledge of teaching, for assessing a written research proposal using peer feedback, peer assessment and rubrics, for judging video clips of teaching practices and student-teachers' self-evaluations. Although teacher educators reported positive outcomes of the interventions in terms of e-assessment procedures and tools (research question 3), no significant effects were found of the implementation and the evaluation of these procedures and tools (research question 1).

Teacher educators did use a particular type of assessment significantly more in the experimental condition than in the control condition, but these differences already existed a priori. So, it seems that teacher educators participated more in the type of assessment they already used before the intervention started. Student-teachers showed a less positive evaluation of the assessment type after the intervention than at the beginning and compared to the students in the control condition, although differences were not significant (research question 2). It might be that most interventions in the teacher education programs involved in this study were in a so-called experimental phase, showing teething problems in the implementation of the assessment procedures, materials and tools. This would explain why teacher educators are quite positive about the educational outcomes of the study reporting new procedures, materials and tools that were absent before.

Table 7. Results from the qualitative analyses of the work meetings and evaluation reports

Shared tests and test items	Sharing the knowledge tests - used in the various training institutes - was evaluated positively by all participants. Participants reported that they reflected more on good ways of testing and how to improve test items
Digital knowledge tests	Participants indicated that they wished to experiment further with digital testing. Digital testing appeared to be especially advantageous for larger training institutes. However, within these institutes organizational hindrances (i.e. lack of large enough computer rooms) were also reported.
Peer feedback	One participant reported that the developed peer feedback procedure had helped to diminish the workload of teacher-trainers in evaluating research plans written by students. Two other participants indicated that the procedure had a beneficial effect on students' study progress. All participants agreed that peer feedback had an added value for the assessment of research plans.
Peer assessment	Participants agreed that (summative) peer assessment of students' research plans was not feasible, because of the extra workload for students and teacher-trainers. Participants also doubted the quality of students' assessments.
Rubrics	Participants agreed that using rubrics for peer feedback helped to make the assessment criteria more transparent for students and teacher-trainers, and helped to improve the quality of the feedback.
Video	Three findings were reported, on which participants agreed: - Much attention needs to be paid to the technological and organizational aspects before video can be adequately used as an instrument to assess students' classroom practices. - According to participants video cannot replace live observation of classroom practice; rather, video is seen as complementary. Usually, video is used for formative and not for summative assessment. - Discussions of video recordings and feedback on classroom practice should take place in a safe environment (teacher-student, or in small groups)
Self-assessments	According to participants students need help to be able to reflect on their classroom practice and competencies as new teachers. (Digital) self-assessment instruments can be used, but need to be properly "framed" in the curriculum.

Limitations

As this project was carried out as a Research & Development project aimed at the implementation of e-assessments in teacher education, some limitations of the research design should be mentioned here. Firstly,

there might be a bias of self-selection. Teacher education institutes chose to implement two to three interventions with e-assessment in their programs, which means that all teacher educators and students of a particular program participated in the experimental condition that was connected to the particular e-assessment form of their institute. So, the self-selection was on the program level instead of the individual level, and therefore we think that potential confounding effects are quite minimal. Secondly, due to this self-selection of teacher education programs, the distribution of participants in the experimental and control condition was highly skewed, except for the self-assessment intervention. This considerably decreased the power of our analyses and might therefore explain why no significant differences were found between participants of the experimental and control conditions. Thirdly, self-reports of implementations and evaluations were used instead of registration measures such as observation or performance tests. Teacher educators could have under- or over-estimated their use of a particular e-assessment form, although no differences were found in their evaluation of the e-assessment forms. It might be that teacher educators over-estimated their implementation of e-assessment forms as most of them knew they were part of a R&D project that had the aim of stimulating the use of particular e-assessment forms.

Implications for Teacher Education

In the next years, the procedures and criteria that were designed, implemented and evaluated in the current project should be re-designed and re-tested in order to be used as input for curriculum changes in teacher training programs. As we mentioned earlier, teething problems might have explained why the interventions were not evaluated positively. Some interventions were not fully developed at the time of the evaluations and in some programs the infrastructure did not fully support the interventions (absence of a web-video server or no large computer rooms to administer the digital tests). Recent research on the technical infrastructure of teacher education program in the Netherlands (Admiraal, Lockhorst, Smit, & Weijers, 2013) showed a quite conventional picture: basic technology such as computers, WiFi, electronic whiteboards, virtual learning environments and presentation software was available, but not commonly used, and more advanced or innovative technology was less available. So, future pedagogical interventions in the domain of e-assessment in teacher education should concur with a supportive technological infrastructure.

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EFL LEARNERS' PERCEPTIONS OF USING LMS

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ABSTRACT
The purpose of this study is to present the views, attitudes, and perspectives of undergraduate students using Learning Management System (LMS) along with traditional face-to-face learning. It attempts to understand the factors that influence the adoption of LMS based on users' own experience. The samples were 198 undergraduate students enrolled in Fundamental English course at Bangkok University. The instrument in this study was a questionnaire. The results of the study show that the levels of attitudes toward using the Internet as a learning tool and perceptions of using LMS in general were moderate. There were no statistically significant differences at .05 level found in students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS as classified by gender, computer ownership, and monthly allowance. As hypothesised, there was a positive relationship between students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS at .01 level. Students with high attitudes toward using the Internet as a learning tool expressed more positive perceptions of using LMS than those with low attitudes.

KEYWORDS: LMS, e-learning, attitude, perception, EFL students

INTRODUCTION AND THEORETICAL FRAMEWORK

LMS or Learning Management System is a software application or web-based technology which has become a powerful tool for conducting an e-learning environment. The software application provides a delivery infrastructure that enables e-learning to be effective. It can be used to manage curriculum, training materials, and evaluation tools. It can also be extended with modules for tracking learning activities and results such as assignments, quizzes, grading. LMS is showing its potential as a very viable tool in learning inside and outside a classroom. It can either create online courses or support face-to-face teaching and learning in an engaging manner. Typical LMS features include the following (The eLeaP LMS system, 2013).

- create courses
- group courses by category
- set course deadlines, reminder emails, feedback form, white board forum
- set course availability options
- set automatic re-assignment options (great for annual trainings)
- set course-not-completed notification email
- upload attachment files
- upload SCORM files
- upload/embed video files
- upload/embed flash files
- embed external content
- preview/print course
- collaborate with others on course creation
- create and deploy certificates based on rules
- create and deploy quizzes - multiple question formats and retry options
- customize certificates with image background files using custom certificate builder
- advanced course settings to set minimum read time and also pre-set navigation or progressive access
- create course glossary, frequently asked questions and feedback forms
- course duplicator
- course assignment to users and user groups

LMS for learning purposes is growing. It is constantly used in a variety of ways such as commercial products (e.g. WebCT, Blackboard), free open source products (e.g. moodle, claroline), customized software systems that serve the instructional purposes of particular organizations (Kalinga, Burchard & Trojer, 2008). TLTTeam (2011) points out that a learning management system has five advantages for educational institutes.

1. Centralized learning
   All types of content are available to individuals 24/7 from any location with web access. Multiple users can access the LMS at any given point in time.

2. Tracking and reporting for enhanced performance
   The LMS allows organizational users to view a required learning path, track progress against the learning path, review records of success, and register for additional courses.
3. Immediate capabilities evaluation
   The LMS allows users to be evaluated prior to taking a course, while participating in the course, and upon course completion. Students can review their performance based on the tests and quizzes conducted by the professors.
4. Easy upgradation of content, product information to maintain the flow of E-learning
   The LMS provides a central point for organizations to change product descriptions, specifications, requirements, forms, and to allow easy uploading of new product or service information. In institutions, professors can keep upgrading new content on the LMS, for students to read, understand and proceed while learning.
5. LMS – simplifying learning processes
   LMS is easy to use and is instructed very well, a new user is able to use it easily. LMS accommodates various features- documentation and administration, recording and tracking events and programs, classroom learning, to name a few.

There are various aspects to be considered when adopting LMS to introduce e-learning in a traditional course. According to Nanaykkara (2007), e-learning adoption may be framed around three key factors: individual, system, and organization; each key factor subsumes other intertwined sub-factors. Sun, Tsai, Finger, Chen, and Yeh (2008) used six dimensions to assess the adoption's factors, including student dimension, instructor dimension, course dimension, technology dimension, design dimension, and environment dimension.

Nasser, Cherif, and Romanowski (2011) explored the factors that impact student use of the LMS K-Net in Qatari independent schools. The samples were 1,376 students in 37 schools. The instrument in this study was a questionnaire. Semi-structured interviews were used to collect qualitative data that helped to confirm the results of the quantitative data and to provide additional insight on students' perspectives regarding the use of the LMS. The results point to a strong relation between ICT knowledge and LMS usage. They suggest that the more ICT knowledge students have, the less prone they are to using the LMS.

Hirata and Hirata (2012) examined Japanese undergraduate students' perceptions of using LMS in different educational settings and found out the benefits and drawbacks of LMS for students' language studies. The results suggested that the students' perceived benefits and drawbacks with LMS are different depending on individual students' ideas of and attitudes towards education.

In Bangkok University, we use LMS to support face-to-face English courses. We can easily administer, track, search for and add content to our courses. The advantage of having an LMS system is that it gives teachers the ability to process knowledge easier and better. Nevertheless, the knowledge on how students think about using LMS as a learning tool is not very much known. Although students may have contact with the Internet and computers, it doesn't mean that they are really aware of the impact of LMS used to improving their learning performance. Therefore, understanding of users' perceptions of LMS will increase assurance towards its utilization.

PURPOSES OF THE STUDY

- To study students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS.
- To compare students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS with their background.
- To investigate the relationship between students' attitudes toward using the Internet as a learning tool and perceptions of using LMS.

RESEARCH METHODOLOGY

Population and Samples

The participants included in this study were undergraduate students enrolled in Fundamental English course at Bangkok University. These students have studied English as a foreign language. The samples were selected by the use of stratified random sampling technique. As a result, 198 students were participated in the data collection.

Research Instrument

In order to identify students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS, a questionnaire was used to collect the data. The first part gathered personal information from the

respondents who were asked to answer the questions on gender, computer ownership, monthly allowance. The second part was a survey of students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS. The questionnaire was prepared for rating in a form of five-rating scale.

Data Analysis

The acceptable statistical significance level was set at alpha (α) < .05. After the receipt of the completed questionnaires, the data were statistically analyzed by using SPSS/Window 12 through the following steps:

- The data of personal information were brought to calculate for average means.
- The data of students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS were brought to calculate for average means and standard deviation.
- The means of students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS were divided into three levels and interpreted in the form of range based on the criterion of $\overline{X}$±.5SD.

  - The average mean of attitude toward using the Internet as a learning tool was 4.32 and standard deviation was .62.

$$4.32 \pm (.5)(.62) \rightarrow 4.32 \pm 0.31$$

Computer Aptitude	Mean Range
high	4.64 – 5.00
moderate	4.01 – 4.63
low	1.00– 4.00

  - The average mean of perception of using LMS was 3.66 and standard deviation was .54.

$$3.66 \pm (.5)(.54) \rightarrow 3.66 \pm 0.27$$

Attitude toward WebEx	Mean Range
high	3.94 – 5.00
moderate	3.39 – 3.93
low	1.00 – 3.38

- The independent-samples t-test was used to test the mean scores of two groups of subjects concerning students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS
- The One-Way Analysis of Variance (ANOVA) test was used to compare mean scores of three and more groups concerning students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS.
- The Pearson product-moment correlation coefficient test was used to investigate the relationship between students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS.

RESULTS

1. Results of Fundamental Analysis

1.1 Level of attitudes toward using the Internet as a learning tool

The study revealed that the level of students' attitude toward using the Internet as a learning tool in general was moderate ($\overline{X}$ = 4.32). Among four items of attitudes toward using the Internet as a learning tool, the third highest means of attitudes were items no. 3, 4, and 1 respectively ($\overline{X}$ = 4.39, 4.37, 4.31). The lowest mean was item no. 2 ($\overline{X}$ = 4.21). The results were presented in Table 1.

Table 1: Mean and Standard Deviation of Attitudes toward Using the Internet as a Learning Tool

Attitudes toward using the Internet as a learning tool	$\overline{X}$	S.D.	Level
1. The use of the Internet makes learning English more convenient.	4.31	.72	moderate
2. Using the Internet as a learning tool is acceptable now.	4.21	.83	moderate
3. The use of the Internet helps learners get information and news from around the world.	4.39	.79	moderate
4. The use of the Internet makes communication more accessible and convenient	4.37	.81	moderate

5. Using the Internet as a tool for communication is better than using former methods like sending letters, faxing and making calls.	4.30	.87	moderate
Total	4.32	.62	moderate

1.2 Level of perceptions of using LMS

The study revealed that the level of students' perception of using LMS in general was moderate ($\overline{X}$ =3.66). Among twelve items of perceptions of using LMS, the third highest means of opinions were items no. 8, 7 and 6 respectively ($\overline{X}$ = 4.21, 3.91, 3.90). These items were at a high level. The two lowest means which were items no. 11 and 3 ($\overline{X}$ = 3.17, 3.22) were at a low level. The results were presented in Table 2.

Table 2: Mean and Standard Deviation of Perceptions of Using LMS

Perceptions of Using LMS	$\overline{X}$	S.D.	Level
1. LMS requires teachers and students to be more proficient in information technology (IT).	3.88	.80	moderate
2. I am interested in using LMS for an online English class.	3.53	.90	moderate
3. Learning English through LMS is more difficult than learning in a traditional class.	3.22	1.03	low
4. Learning through LMS is acceptable now.	3.50	.83	moderate
5. LMS is becoming more popular in Thailand.	3.39	.88	moderate
6. Learning through LMS makes you realize that you can learn from anywhere in the world.	3.90	1.04	moderate
7. LMS makes it easier for teachers and students to make communication.	3.91	.90	moderate
8. LMS makes it convenient for you to download and upload your classwork and homework files.	4.21	.84	high
9. You don't need to go to the library because LMS helps you find the information you want.	3.86	.84	moderate
10. LMS is useful for learning English.	3.67	.81	moderate
11. Learning English through LMS is more useful than learning in a traditional class.	3.17	.97	low
Total	3.66	.54	moderate

2. Results of Hypothesis Testing

2.1 Hypothesis 1 compared students' attitudes toward using the Internet as a learning tool with different background

Hypothesis 1 was not accepted because none of the variables related to students' background affected their attitude toward using the Internet as a learning tool. There were no statistically significant differences at .05 level found in students' attitude toward using the Internet as a learning tool as classified by gender, computer ownership, and monthly allowance.

The overall mean score of female students' attitude toward using the Internet as a learning tool ($\overline{X}$ = 4.40) was higher than that of male students ($\overline{X}$ = 4.21). Both groups had students' attitude toward using the Internet as a learning tool at a moderate level. Due to the results obtained from the application of the t-test, it was found that there was no statistically significant difference found in students' overall attitude toward using the Internet as a learning tool between two groups (male and female) at level of .05. This means that male and female students were not different in having attitude toward using the Internet as a learning tool.

The overall mean score of attitude toward using the Internet as a learning tool among students who owned a computer was higher than that of students who didn't own a computer ($\overline{X}$ = 4.33, 4.16). Both groups had attitude toward using the Internet as a learning tool at a moderate level. The t-test was employed to examine the significant difference between students who owned a computer and those who didn't own a computer on their attitude toward using the Internet as a learning tool. It was found that there was no statistically significant difference found in students' attitude toward using the Internet as a learning tool between two groups at level of .05. This means students who owned a computer and those who didn't own a computer were not different in having attitude toward using the Internet as a learning tool.

The results obtained from applying the ANOVA revealed that no difference in overall attitude toward using the Internet as a learning tool among three groups of monthly allowance (less than 3,500 baht; 3,501-5,000 baht; and more than 5,000 baht) was found statistically significant at .05 level. This means that allowance received from parents per month had no impact on students' attitude toward using the Internet as a learning tool.

2.2 Hypothesis 2 compared students' perception of using LMS with different background

Hypothesis 2 was not accepted because none of the variables related to students' background affected their perception of using LMS. There were no statistically significant differences at .05 level found in students' perception of using LMS as classified by gender, computer ownership, monthly allowance.

The overall mean score of female students' perception of using LMS ($\overline{X}$ = 3.67) was higher than that of male students ($\overline{X}$ = 3.65). Both groups had students' perception of using LMS at a moderate level. Due to the results obtained from the application of the t-test, it was found that there was no statistically significant difference found in students' overall perception of using LMS between two groups (male and female) at level of .05. This means that male and female students were not different in having students' perception of using LMS.

The overall mean score of perception of using LMS among students who didn't own a computer was higher than that of students who owned a computer ($\overline{X}$ = 3.71, 3.66). Both groups had students' perception of using LMS at a moderate level. The t-test was employed to examine the significant difference between students who owned a computer and those who didn't own a computer on their perception of using LMS. It was found that there was no statistically significant difference found in students' perception of using LMS between two groups at level of .05. This means students who owned a computer and those who didn't own a computer were not different in having students' perception of using LMS.

The results obtained from applying the ANOVA revealed that no difference in overall perception of using LMS among three groups of monthly allowance (less than 3,500 baht; 3,501-5,000 baht; and more than 5,000 baht) was found statistically significant at .05 level. This means that allowance received from parents per month had no impact on students' perception of using LMS.

2.3 Hypothesis 3 investigated the relationship between students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS

The Pearson product-moment correlation coefficient test was used to find out whether there was a statistically significant relationship between attitudes toward using the Internet as a learning tool and their perceptions of using LMS. This hypothesis was accepted. Table 3 shows that there was a positive relationship between students' attitudes toward using the Internet as a learning tool and their perceptions of using LMS at .01 level. In other words, students with high attitudes toward using the Internet as a learning tool expressed more positive students' perceptions of using LMS than those with low attitudes.

Table 3: Correlate Results for the Respondents' Attitudes toward Using the Internet as a Learning Tool and Their Perceptions of Using LMS

VARIABLE	Attitudes toward using the Internet as a learning tool	Perceptions of Using LMS
Attitudes toward using the Internet as a learning tool	1.00	
Perceptions of Using LMS	.42**	1.00

** P < .01

DISCUSSION AND CONCLUSIONS

The results of the research have shown the attitudes and perceptions of Bangkok University students toward using Learning Management System (LMS) along with traditional face-to-face learning. This study provides teachers and institutions with useful information when developing distance learning with LMS.

According to Tables 1 and 2, the students agree that the Internet is useful for receiving news and communicating with people. They seem to understand that the Internet can make English learning more convenient, but they do not totally agree that it has been accepted as a learning tool. They also think that LMS is a useful device that can support their English learning in many ways, but they still resist that traditional face-to-face instruction is more useful. In addition, the results of hypotheses 1 and 2 indicate that gender, computer ownership, and monthly allowance do not affect students' attitudes toward using the Internet and their perceptions of using LMS. Thus, it

is important for institutions that will adopt e-learning to study about other factors that may have the influence on students' perceptions of LMS such as teacher performance, teaching material and technology readiness.

Hypothesis 3 shows that students with high attitudes toward using the Internet as a learning tool express more positive students' perceptions of using LMS than those with low attitudes. However, the levels of attitudes toward using the Internet as a learning tool and their perceptions of using LMS in general are moderate. This can be assumed that the students do not like to use the Internet and LMS to support their English learning as much as we had expected. Therefore, teachers should encourage students to figure out the advantages of using the Internet as a learning tool. Both teachers and students should make the most of LMS applications.

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EXPLORING STUDENTS INTENTIONS TO STUDY COMPUTER SCIENCE AND IDENTIFYING THE DIFFERENCES AMONG ICT AND PROGRAMMING BASED COURSES

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ABSTRACT
Computer Science (CS) courses comprise both Programming and Information and Communication Technology (ICT) issues; however these two areas have substantial differences, inter alia the attitudes and beliefs of the students regarding the intended learning content. In this research, factors from the Social Cognitive Theory and Unified Theory of Acceptance and Use of Technology were selected as important motivating factors in students' behavior and attitude towards CS courses. This hybrid framework aims to a) investigate the influence of these factors on students' intention to study CS and b) identify potential differences on these effects among ICT and Programming based courses. Responses from the total of 126 Greek students, (71 attending ICT courses and 55 attending Programming Courses) were used to measure the variables and to identify the differences between ICT and Programming students. Results revealed the influence of most of the motivating factors, on students' intention to study CS and indicated the moderating effect in the enrolment with ICT or Programming course on the relationship among students' Perceived Behavioral Control and their intention to study CS. The outcomes of this study are expected to open new avenues to understanding students' intentions to pursue computing and IT related careers.

KEYWORDS: Secondary education, Computing education, Student experiments, ICT, Programming.

INTRODUCTION
The comparison of Computer Science Education (CSE) in different countries uncovers substantial disparities regarding the conception as well as the practice (Hubwieser et al., 2011). Some of these disparities are forced by the big differences in the Educational Systems, while others are caused by differences of traditions, national heritage or public opinion. In several countries computer science education (CSE) has been introduced in the curricula as a distinct course, while it was taught across curriculum in others. Generally CSE focuses on basic concepts about the constructional principles of computers and networks (hardware) and the principles of programming, (formal languages and programming), whereas Information and Communication Technology (ICT) is focused on computer uses and how to apply software (The Royal Society, 2012). In many countries (Hubwieser et al., 2011), CSE includes both ICT and programming courses, however, students' sometimes face these courses differently.

Many theories have been employed to understand students' perceptions and attitude towards learning media (Giannakos et al., 2013) and curricula (Chen et al., 2011). The Unified Theory of Acceptance and Use of Technology (UTAUT) and his initial forms are the most widely and successfully used models (Chen et al., 2011). Other researchers have empirically explained (using UTAUT or its initial form of TAM) several issues regarding students' attitude (Hsu and Lin, 2008; Shih, 2008). As successful CS teaching largely depends on students' perception and beliefs, we aim to identify students' differences among programming and ICT courses. In this light, variables related to students' attitude were chosen and applied to programming and ICT courses respectively. Then a between group experiment was conducted among students participating ICT course and students participating programming course. Our empirical research aims to investigate any distinct differences among ICT and programming courses in order to shed a light in the differentiation of educators' attitude in these courses which are mostly (in many countries) treated as a common course.

The focus of this empirical study is to measure students' beliefs and to identify potential differences among ICT and Programming courses. As (1) students' beliefs and attitude are highly correlated with their performance and (2) students' perceptions have an impact on what they have already learned and what they choose to do next (Metcalfe and Finn, 2008). This article describes an attempt to investigate students' motivational factors into a secondary education ICT and Programming courses by quantitatively measuring students' perceptions. Since several differences have been identified among ICT and Programming based courses (Giannakos et al., 2013), with that paper we are going one step ahead by investigating which factors influence students to participate in CS courses and how the nature of these courses (ICT or Programming based) moderates this influence.

In particular, this attempt is undertaken by using a quantitative survey of student perceptions in an ICT and

Programming courses on the Greek educational context. The purpose of the survey was to assess students' perceptions toward a wide variety of behavioral issues in CS, including a number of issues that are related to their beliefs and their intentions. The study itself had the three following goals.

- Measure and understand students' perceptions regarding: usefulness, social impact, satisfaction, self-efficacy and control on the CS courses.
- Investigation of the potential effect of the prior perceptions on students' intention to study CS courses.
- Investigation of the potential differences among programming and ICT courses in the effect of the students perceptions on their intention to study the respective course.

The clarification of these three goals is expected to contribute to the understanding of students' performance and intentions to pursue programming and ICT courses in their future studies.

The paper is organized into six sections. In the next section, the related work and the hypotheses are outlined. In the third section the ICT and Programming courses are presented as they are taught in Greek educational system. The fourth section describes the methodology employed to investigate the effect of some important students' perceptions in their intention to study CS courses and if there is any differentiation on that effect among ICT and Programming courses. The fifth section outlines the empirical results and at the final section, the article concludes with implications, limitations and future work.

RELATED WORK AND RESEARCH HYPOTHESES

Students' perceptions and intentions are important determinants of the learning success (Metcalfe and Finn, 2008). Disinclination towards studying CS disciplines implies that more research is needed to investigate how students could be motivated. Previous studies (Barker et al., 2009; Biggers et al., 2008; Papastergiou, 2008; Akbulut, 2010) have empirically investigated numerous issues related to perceptions and beliefs regards CSE, it is mostly focused on higher education and more specifically on CS departments. As a result, to date, there is lack of empirical studies on students CSE perceptions and the effect of these perceptions into students' intentions to study CS courses.

To date, many theories have been applied to address students' attitude, perceptions and to identify the influence of different factors on the adoption of science education. UTAUT and Social Cognitive Theory (SCT) are some of the most successfully used theories in students' behavior [e.g., (Hsu and Lin, 2008; Lee et al., 2009)]. In addition, Performance Expectancy (PE), Perceive Behavioral Control (PBC), Satisfaction (STF), Social Influence (SI) and Self-Efficacy (SEF) have been verified as important determinants on affecting students' intention to attend a respective course [e.g., [Chen et al., 2011)]. In view of the above we aim to measure these factors and examine the effect of them on students' Intention to Study with CS courses (ISCS); in addition we will identify potential difference of these effects among ICT and Programming courses.

The Unified Theory of Acceptance and Use of Technology (UTAUT)

UTAUT is the successor of Technology Acceptance Model (TAM) and combines a great number of TAM variables (Venkatesh et al., 2003). Perceived Expectancy is based on the traditional construct of "perceived usefulness" from the original (TAM) study. Prior research on systems' adoption has agreed that UTAUT is valid in predicting the individuals' enrolment on various contexts (Hsu and Lin, 2008). In our case high performance expectancy (PE) means that students believe attending CS course is useful for him/her and we assume that positive PE lead them to attend the course. Thus, we hypothesize that:

H1. Students' PE has a significant positive effect on their ISCS.

Student satisfaction (STF) is a measure of subjective evaluation of any outcome or experience associated with the attendance of CS courses. Studies have suggested that individual perceptions of satisfaction influence in a positive way their intentions (Lee and Lin, 2005). In addition, in CSE, satisfaction has been recognized as an important factor for student attitude (Drury, Kay and Losberg, 2003). In that study, we assume an important role of satisfaction, that effect students' Intention to Study CS. Specifically, we argue that, if previous experience is positively evaluated, and hence incurs students' satisfaction, then it has a higher impact on their willingness to study the respective course. Hence, we hypothesize that:

H2. Students' STF has a significant positive effect on their ISCS.

UTAUT (Lee et al., 2009) introduces Social Influence (SI) and explained usage intentions in terms of social influence. SI refers to the degree to which an individual's opinion affected by others (i.e.., friends, relatives). As

the learning/teaching process is negotiated through numerous interactions (e.g., instructor-learner, learner-learner), and its characteristics, in turn, have the socializing factor very intense (Rorty, 1999).In addition, prior studies have showed that Social Influence is a significant predictor of individual's decision (Giannakos and Vlamos, 2013). In view of the above, we assume that SI influence students' Intention to Study CS. Thus, the following hypothesis was proposed.

H3. Students' SI has a significant positive effect on their ISCS.

Social Cognitive Theory (SCT)

SCT (Bandura, 1986) indicates that cognition employs strong influence on the creation of one's beliefs and reality, as it selectively structure and convert information on actions (Jones, 1989). In his attempt to explain how people acquire and maintain certain behavioral patterns, Bandura (1986) defines Self-Efficacy (SEF) as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performance (p. 391)". SEF is important in learning processes because "competent functioning requires both skills and self-beliefs of efficacy to use them effectively" (Bandura, 1986; p. 391). In prior studies (Chang and Tung, 2008), a significant influence of SEF on learners' intention has revealed. SEF is specific to a certain activity and context. Hence, an individual may have high SEF in one course (Algebra), and low SEF in another (CS). However, it is likely that SEF will positively affect students' ISCS. Hence, we assume that:

H4. Students' SEF has a significant positive effect on their ISCS.

Theory of Planned Behavior (TPB)

Another widely used theory is the TPB (Ajzen, 1985); TPB is based on individual's perception of the ease with which the behavior can be performed, or in other words Perceived Behavioral Control (PBC). In particular, PBC refers to a individual's potential to perform the behavior in question, how easy/hard the behavior is perceived to be (Ajzen, 1985). PBC has been widely used to investigate several issues concerning students' use of technological tools (Shih, 2008). In addition, prior research (White et al., 2008) has indicated that attitude and PBC predicted intentions, with intention as the sole predictor of attendance at peer-assisted study sessions. This means that students were more likely to participate on peer-assisted study sessions if they had positive attitudes and believed that they had control over attending them. Hence, in the context of CS it should be investigated if students' PBC affects their ISCS. Therefore, we hypothesize that:

H5. Students' PBC has a significant positive effect on their ISCS.

Differences among ICT and Programming Courses

Students' perceptions regarding CS many times lead their actual behavior (Ruslanov and Yolevich, 2010). In most of the prior research CS has been mostly investigated as a unified (both ICT and Programming) course. However, there are certain differences among these two disciplines and the investigation of these differences is highly important as many countries used a unified curriculum for ICT and Programming (Hubwieser et al., 2011; Ismail et al., 2010). Hence, in the context of CSE, it seems likely that ICT and Programming courses may have important differences in students' perceptions and their attitude. Therefore, the moderating effect of the courses ICT and Programming on the relationships among the motivating factors and ISCS is emerged to be examined. This leads us to the following five hypotheses (see in Figure 1 the visual diagram of the hypotheses):

H6a. ICT or Programming orientation moderates the influence of PE on ISCS.
H6b. ICT or Programming orientation moderates the influence of STF on ISCS.
H6c. ICT or Programming orientation moderates the influence of SI on ISCS.
H6d. ICT or Programming orientation moderates the influence of SEF on ISCS.
H6e. ICT or Programming orientation moderates the influence of PBC on ISCS.

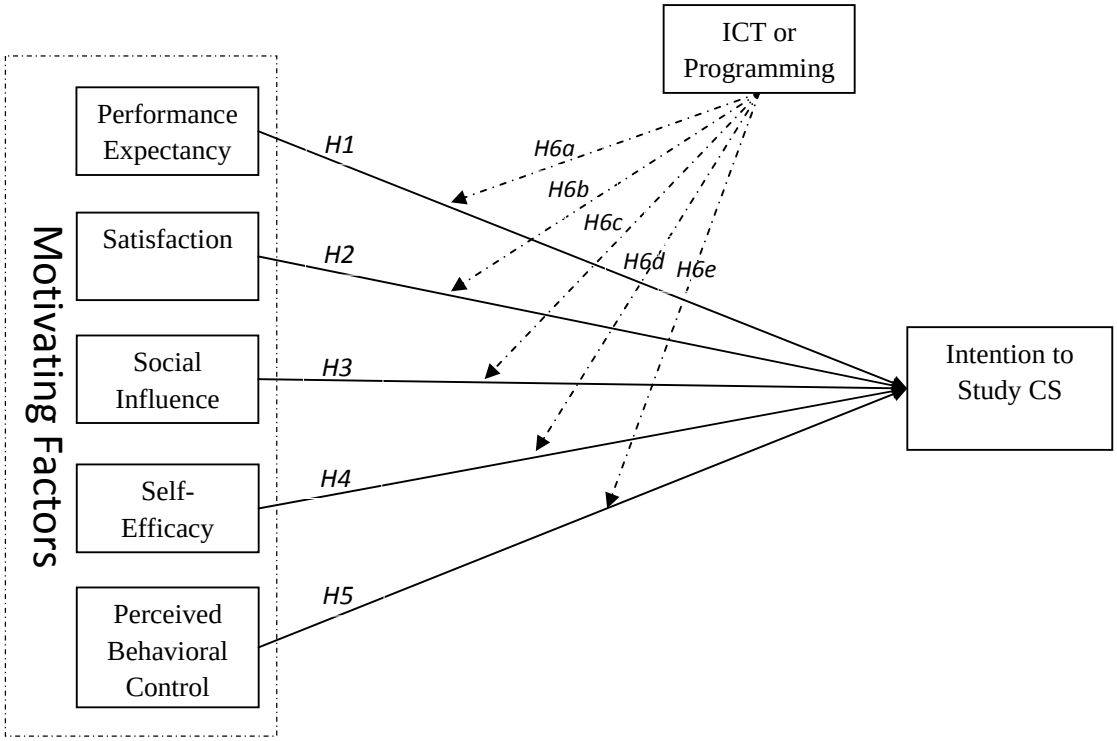

Figure 1: The Visual Diagram of the Hypotheses

ICT AND PROGRAMMING COURSES IN GREECE

The curricula of Secondary Education in Greece, since the school year 1998-1999, included a single philosophy which was based on the Single Curriculum Framework. In 2003, the Interdisciplinary Unified Education Course Framework (IUECF) and the new detailed curricula (NDC), prepared for compulsory education, from which the inter-disciplinary approach of knowledge was adopted. Afterward in the school year 2006-2007 the new books have been introduced to the schools (based on IUECF and NDC).

In these compulsory education Curricula the importance of Information and Communication Technologies and the role these should play is widely recognized. ICT is not seen only as a separate subject of study, absolutely necessary today for students' technological literacy, but also as a multi-tool: cognitive teaching, information seeking, communicating knowledge etc. The theoretical model adopted, for introducing ICT in lower secondary education, is characterized by the teaching of an "informatics" course and the gradual use of computational and networking technologies as a means to support the cognitive process for all subjects of the programme of study.

The Cross-curricular Single Framework for Curricula for the lower secondary education, through the teaching of Informatics, foresees that the student is to (I-Curriculum, 2003):

- Be able to explain and analyze basic notions and terminology of Informatics (i.e. data, information, coding, data handling, file, save, programme, software, etc).
- Be aware of the operations of the main computer units and use with ease a computer system.
- Use generic software tools to record (write down) their ideas, to treat and present them in a variety of ways and means, to resolve simple problems, to use simple projection and control models in order to simulate and test simple problems or results from other cognitive domains.
- Be able to select, choose, analyze and evaluate information through different sources (electronic encyclopedias, electronic dictionaries, www etc) and utilize these for complex projects individual work or teamwork.
- Utilize possibilities offered by ICT to communicate, exchange views, wonder, entertain, present their ideas and opinions (the way they choose) and apply simple knowledge of ICT in everyday life.
- Develop critical skills to be able to address problems using computer and to resolve simple problems in a programming environment.
- Cooperate to perform a given project, develop initiatives, design, set objectives, recognize the importance of teamwork in advancing the project, discuss and assess their work and the work of the others.

- Develop an ethics code in regards to their work in the lab, the respect of the work and differentiation of others.

In addition, Informatics has been introduced as a separate curriculum subject which is taught once a week by specialist IT teachers. In the course of Informatics ICT content dominates the curriculum throughout lower secondary education. By the end of the third Gymnasium (middle school) year the students are introduced into fundamental algorithms and programming using Logo.

In the case of upper secondary education (Lyceum, equal to high school); the 1st grade operates as an orientation year with a general knowledge program. The second grade offers three directions (Scientific, Theoretical and Technological). In the third grade of Lyceum students are following again the same three directions. Students who follow the technological direction are taking a programming course. This course focuses on the development of problem-solving and algorithmic skills through programming.

The overall aim of the programming course is to help students to develop algorithmic thinking and methodological and problem solving skills within a programming environment. This Programming course includes basic algorithmic and programming concepts (conditions, logical expressions). This course is being taught (partially) in school labs. The Ministry of Education has certified specific programming environment to support the lab work, especially for the Lyceum programming course. In addition to the certified programming environment, there are other educational software that have been developed by scholars and educators, and are already in use in many schools, in order to motivate students, and increase the retention (Papastergiou, 2009).

METHODOLOGY

Context

The empirical study was conducted in the context of secondary education in Greece. As we previously mentioned, the relevant curriculum ICT courses (named Informatics) are mandatory during Gymnasium (lower secondary) years and aim to teach students' ICT (e.g., word processing). The first group in our experiment (ICT Group) consisted of students attending the 3rd class of Gymnasium. They have experience on ICT courses and they are asked for their perceptions regarding the ICT curriculum in the under investigation factors.

For the case of Lyceum (high school), ICT is taught as an elective or direction course since 1999. Thus, besides mandatory education (primary, lower secondary), students in all the classes of Lyceum can select certain ICT from a wide range of various subjects. In the last two classes of Lyceum, students select one of three directions, technological, scientific or theoretical). If students in the last grade select the technological direction, they attend the programming course for which they are assessed through national exams. The second group in our experiment (Programming Group) consisted of students attending the 3rd class of Lyceum. They have experience on the programming course and they are asked for their perceptions regarding the programming curriculum in the under investigation factors.

In view of the above, our between group experiment was conducted among students' of 3rd of Gymnasium regarding ICT courses and students of 3rd of Lyceum regarding programming courses.

Sampling

The data collection included a questionnaire composed by questions on the six principal factors. The questionnaire was open during the last ten days of November 2011 at four public Gymnasiums (middle schools) and four public Lyceums (high schools) in the northwestern Greece. The final sample included 126 participants (students). From the total of participants, 71 (56.35%) were 14 years and attended 3rd of Gymnasium (taught ICT course) and 55 (43.65%) were 17 years and attended the 3rd of Lyceum, in addition, 89 were males (70.6%) and 37 (29.4%) females.

Measures

The questionnaire included measures of the principal factors identified in the literature. Appendix lists the survey factors with their items, their operational definition, and the source from the literature review. In all cases, 7-point Likert scales was used (from 1 strongly disagree to 7 strongly agree).

DATA ANALYSIS AND RESEARCH FINDINGS

We followed the three step procedure to assess the convergent validity of any measure in a study (Fornell and Larcker, 1981):

(1) Composite reliability of each construct,

(2) Item reliability of the measure,
(3) The Average Variance Extracted (AVE).

First, we carried out an analysis of composite reliability and dimensionality to check the validity of the scale used in the questionnaire. Regarding the reliability of the scales, Cronbach`s indicator was applied and inter-item correlations statistics for the items of the variable. As Table 1 demonstrates, the result of the test revealed acceptable levels of internal consistency in all the factors.

In the next stage, we proceeded to evaluate the reliability of the measure. The reliability was assessed by calculating the factor loading onto the underlying factor. A factor loading of 0.5 and higher is recommended to be good indicator of validity at the item level (Segars, 1997). Based on the factor analysis we identified 6 distinct factors; a) Performance Expectancy (PE), b) Satisfaction (STF), c) Social Influence (SI), d) Self-Efficacy (SEF), e) Perceived Behavioral Control (PBC) and f) Intention to Study CS (ISCS) (Table 1).

The third step for assessing the convergent validity is the AVE; AVE measures the total variance that is applied to the factor in relation to the amount of variance derivable to measurement error. Convergent validity is found to exceed the recommended thresholds of 0.50 (Segars, 1997).

Table 1: The measurement values

Factors	Items	Mean	S.D.	CR	Loadings	AVE
Performance Expectancy	PE1	4.61	1.81	0.89	0.75	0.65
	PE2	4.48	1.74		0.80	
	PE3	4.76	1.63		0.85	
	PE4	4.83	1.51		0.81	
Satisfaction	STF1	5.21	1.40	0.88	0.63	0.56
	STF2	5.20	1.39		0.66	
	STF3	5.63	1.35		0.85	
	STF4	5.41	1.36		0.83	
Social Influence	SN1	4.32	1.93	0.86	0.79	0.65
	SN2	4.09	1.92		0.82	
Self-Efficacy	SEF1	3.56	1.90	0.71	0.86	0.71
	SEF2	4.04	1.77		0.82	
Perceived Behavioral Control	PBC1	5.01	1.44	0.86	0.85	0.69
	PBC2	4.78	1.49		0.81	
Intention to Study CS	ISCS1	4.63	1.91	0.93	0.83	0.78
	ISCS2	4.56	1.93		0.90	
	ISCS3	4.00	1.91		0.91	

Respondents expressed high STF (5.36/7) with CS courses. In addition, PE (4.67/7), PBC (4.40/7), ISCS (4.40/7) and SI (4.21/7) were slightly lower. These high levels indicate positive insights of students concerning their experience, control, usability, usefulness and intentions to study CS. However, their SEF (3.80/7) with computing is not indicating the same positive view.

Pearson's correlation coefficient between the factors was used, which is about quantifying the strength of the relationship between the variables. By performing Pearson's test we found that some of the factors are correlated relatively strong. In particular, ISCS is related with all factors, except for SEF; in addition SEF has no correlation with SI and STF. Table 2 exhibits the correlations between the factors in detailed.

Table 2: The measurement values

Factors	PE	STF	SI	SEF	PBC	ISCS
PE	1					
STF	**0.55****	1				
SI	**0.52****	**0.59****	1			
SEF	**0.18***	0.05	0.09	1		
PBC	**0.42****	**0.52****	**0.51****	**0.22***	1	
ISCS	**0.42****	**0.49****	**0.42****	0.10	**0.45****	1

Correlation is significant at the* 0.05 level, ** at the 0.01 level.

To examine the research questions regarding the effect of the selected factors on students' ISCS we used Analysis of Variances (ANOVA) including students' ISCS as dependent variables and the five factors (PE, STF, SI, SEF, PBC) as independent variable. As we can see from the outcome data in Table 3, all the selected variables except SEF have indicated an impact on students' ISCS.

Table 3: Hypothesis Testing using Analysis of Variances (ANOVA)

Dependent Variable	**Mean (S.D)**			**F**	**Results**
	Low	**Medium**	**High**		
Intention to Study CS (ISCS)	Performance Expectancy (PE)				
	3.46 (1.93)	4.39 (1.54)	5.21 (1.46)	**11.92***	H1 (Accepted)
	Satisfaction (STF)				
	3.41 (1.68)	3.91 (1.69)	5.48 (1.31)	**21.71***	H2 (Accepted)
	Social Influence (SI)				
	3.64 (1.96)	3.98 (1.61)	5.45 (1.21)	**15.32***	H3 (Accepted)
	Self-Efficacy (SEF)				
	4.13 (1.99)	4.67 (1.45)	4.36 (1.88)	0.93	H4 (Rejected)
	Perceived Behavioral Control (PBC)				
	3.37 (1.84)	4.46 (1.46)	5.28 (1.59)	**13.82***	H5 (Accepted)

*p < 0.05

Observing figure 2, the insignificance of SEF on students ISCS is very obvious. In addition, it can be clearly noticed that students' PE and PBC have the similar influence on students' ISCS in the both shifts from Low to Medium and Medium to High. On the other hand, STF's and SI's shifts are from Medium to High rather than from Low to Medium. Hence, it seems that students' STF and SI in high levels is very helpful for students' ISCS. Overall, in Figure 2 the positive and significant influence of PE, STF, SI and PBC on students' ISCS is exhibited.

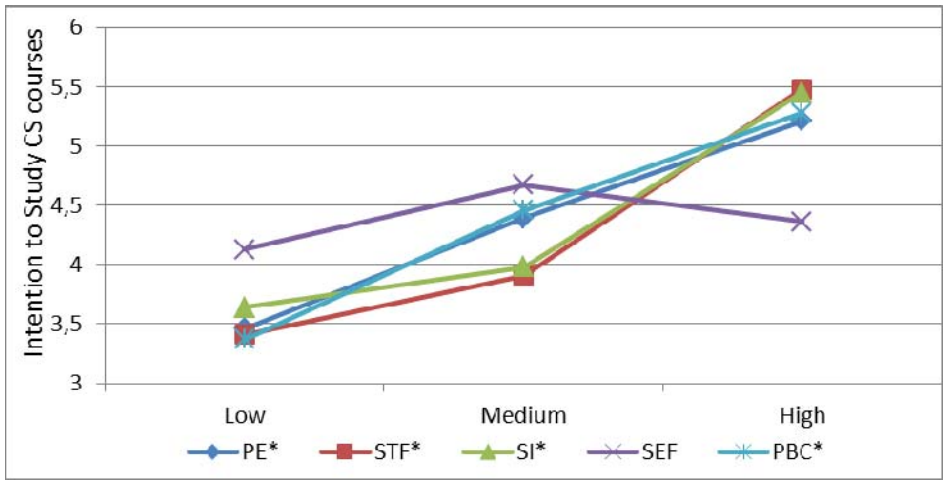

Figure 2: The Influence of the motivating factors in students' ISCS

On that stage we aim to examine if the differentiation of ICT and Programming influence the relationship between motivating factors and ISCS. To examine that effect (H6a–H6e), the correlation coefficient between motivating factors (PE, STF, SI, PBC) and ISCS of the ICT and Programming students was used. Simple regression of ICT and Programming students was conducted among (PE, STF, SI, PBC) and the students ISCS. Firstly, we calculate the R for the ICT students and for the Programming Students at each one of the motivating factors. Afterwards, the coefficient R from the regression analyses and the sampling N was used to conduct a Fisher's Z-transformation analyses (Baron and Kenny, 1986). The results (table 4) mean that the difference among ICT and Programming has a significant moderating effect on the relationship between PBC and ISCS (supporting H6e). For the case of PE STF and SI the results (table 4) revealed that the difference among ICT and Programming does not moderate the relationships between PE and ISCS (rejecting H6a), between STF and ISCS (rejecting H6b) and between SI and ISCS (rejecting H6c). For the case of SEF, it is difficult to have reliable result due to the insignificance of the correlation coefficient of students on ICT course.

Table 4: Testing if the differentiation among ICT or Programming orientation moderates the influence of motivating factors on ISCS using fisher z-transformation analysis

	ICT	Programming	Significance test (<1.96)	Results
PE→ISCS				
Correlation coefficient R (N)	0.323 (71)*	0.417 (55)*	0.59	H6a (Rejected)
Z-transformation coefficient	0.335	0.444		
STF→ISCS				
Correlation coefficient R (N)	0.544 (71)*	0.403 (55)*		H6b (Rejected)
Z-transformation coefficient	0.610	0.427	0.99	
SI→ ISCS				
Correlation coefficient R (N)	0.464 (71)*	0.294 (55)*		H6c (Rejected)
Z-transformation coefficient	0.502	0.303	1.08	
SEF→ ISCS				
Correlation coefficient R (N)	0.027 (71)	0.252 (55)*		H6d (N.S.)
Z-transformation coefficient	0.027	0.258		
PBC→ ISCS				
Correlation coefficient R (N)	0.254 (71)*	0.570 (55)*	2.11[a]	H6e (Accepted)
Z-transformation coefficient	0.260	0.648		

* Coefficients are significant at 0.01; [a] Z is 1.96 for $p < 0.05$.

According to Figure 3, students with low PBC who attending ICT have similar ISCS with students with medium PBC who attending Programming. This means that the influence of PBC on ISCS can be eliminated by the influence of the different content on CS course (ICT or Programming).

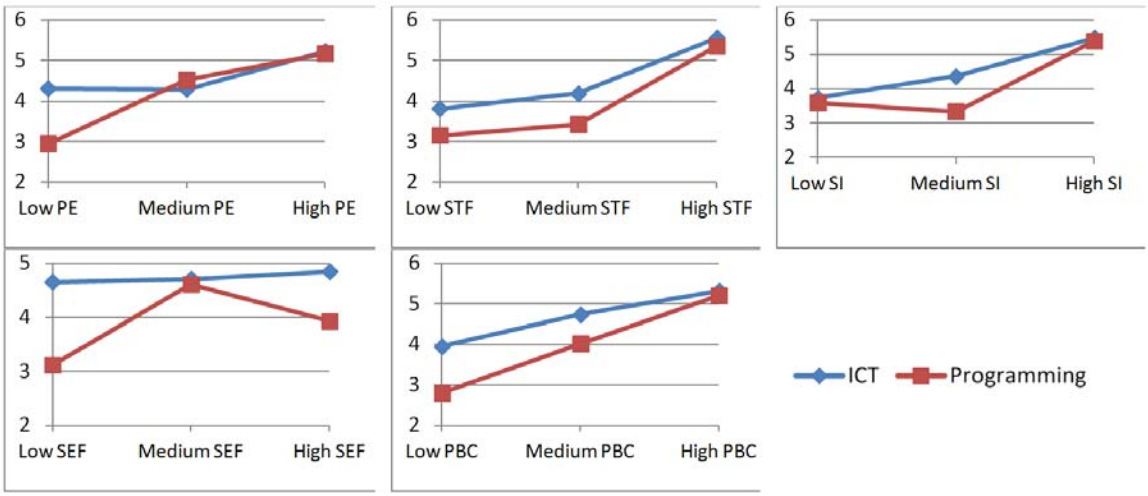

Figure 3: The moderating effect of ICT or Programming orientation

CONCLUSION AND DISCUSSION

In the empirical study, students' intention to study CS was analyzed. In particular, this study measured five motivational factors regarding CS attendance and students' intention to study CS; based on the experience of two groups of students. The first group took a programming course and the second an ICT course during the 2011-2012 school year. Both respondents' groups expressed high satisfaction on ICT and Programming course respectively. Additionally, they expressed slightly lower perceived behavioral control and performance expectancy. High levels of motivating factors exhibit positive insights of students concerning their experience, control, usability and usefulness regarding CS.

Previous studies mainly focused on non-behavioral factors regarding students' likelihood to pursue CSE course, like: Gender, Ethnicity (Barker et al., 2009), Career Opportunities (Masnick et al., 2010), Teaching Methods and the Curriculum Selection (Morrison and Preston, 2009). Hence, our study opens new avenues towards the analysis of students' intention to attend CS courses, which verifies the key role of four of the five motivational factors in the context of CSE.

Especially, the 5 hypotheses (H1-H5) were formulated and the 4 of them were accepted (except H4), which help

in understanding the motivating factors contributing to CS attendance. The results revealed that PE, STF, PBC and SI have a significant positive effect on students' ISCS. In addition, the results indicated that SEF is not influence students' to attend CS courses.

Another aspect of this paper is the moderating effect of Programming or ICT on the effect of PBC on ISCS. An interesting observation was that students with low PBC who attending ICT have the same ISCS with students with medium PBC who attending Programming (H6e). This means that the effect of PBC on ISCS can be eliminated by the effect of the different content on CS course (ICT or Programming).

Overall, this study contributes to the literature with many ways. First, we empirically measure students' perceptions and intentions for CSE, second we identify the effect of the motivational factors on students' intention to study CS and (3) identifies the moderating effect in the enrolment with ICT or Programming course on the relationship among PBC and ISCS. The current study is one of the few so far, where a CSE empirical assessment is employed among students who attend ICT and Programming courses.

Previous studies have shown that students' perceptions of what they learned affect their performance and what they choose to do next (Metcalfe and Finn, 2008); in addition, this study revealed that student intentions to pursue CS courses are highly affected by their beliefs. As such, the conclusions of this study are important as they indicate perceptions which lead students' on their future study and career decisions. Therefore, our findings have important implications for understanding how students perceive their learning and achievement in CSE and by taking care of that, the number of pupils making an educated decision to pursue CS can increase.

As with any empirical study, our study has certain limitations. First, the respondents are Greek students, who had attended the Greek educational system; this may limit the extend of the generalization of the findings. However, another study has been conducted among the secondary education students of Greece and Germany indicates that there is no significant difference on their perceptions regarding CS courses (Giannakos et al., 2012). Secondly, the data are based on self-reported method, other methods such as depth interviews and observations could provide a complimentary picture of the findings through data triangulation. Thirdly, there are numerous factors affecting students' behavior and perceptions (Aypay, 2010), but in our study we used motivating factors raised from prior studies as the most important ones. Last there is an age difference among the two groups (3years), this was made because we want each group to have the same exposure on the respective course, this age difference may have casual effect. However, we know from the literature that age does not impact on students' computers perceptions and anxiety (Gilroy and Desai, 1986). In addition, the results from seventeen studies (Rosen and Maguire, 1990) support the contention that age was not a significant correlate of computer anxiety (p. 181).

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APPENDIX

Factor	Operational Definition	Items*	Source Adopted
Performance Expectancy (PE)	The degree to which an individual believes that attending the respective course is useful for him/her.	Using programming improves my performance in a task. (PE1)	Giannakos et al., 2013
		Programming enhances my effectiveness in tasks progressing. (PE2)	
		Programming would make it easier to complete a task. (PE3)	
		Programming increases productivity in completing tasks. (PE4)	
Satisfaction (STF)	The degree to which a person positively feels with the respective course.	I am satisfied with the programming experience. (STF1)	Giannakos et al., 2013
		I am pleased with the programming experience. (STF2)	
		My decision to use programming was a wise one. (STF3)	
		My feeling to use programming was good. (STF4)	
Self-Efficacy (SEF)	The degree of conviction that one can successfully execute the operation required to produce the outcomes.	**I could complete a programming task …**	Shih, 2008
		if there was no one around to tell me what to do. (SEF1)	
		if I had never used it before. (SEF2)	
Social Influence (SI)	The degree to which an individual perceives that most people who are important to him think he should or should not attend the respective course.	People who are important to me think that I should learn programming. (SI1)	Hsu and Lin, 2008
		People who influence my behavior encourage me to learn programming. (SI2)	
Perceived Behavioral Control (PBC)	The degree to which a person perceives how easy or difficult it would be to perform an operation in the respective course.	I would be able to complete programming tasks (PBC1)	Shih, 2008
		I have the knowledge and the ability to complete programming tasks. (PBC2)	
Intention to Study CS (ISCS)	The degree of students' willingness to attend the respective course	I intend to continue learning programming in the future. (ISCS1)	Hsu and Lin, 2008
		I will continue learning programming in the future. (ISCS2)	
		I will regularly learn programming in the future. (ISCS3)	

EXPLORING THE VALUE OF ANIMATED STORIES WITH YOUNG ENGLISH LANGUAGE LEARNERS

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ABSTRACT
Teaching English to Young Learners (TEYL) through animated stories bears many prospects for an effective and meaningful language instruction as animated stories can help to contextualize the new language providing audio-visual input along with the story narration. In this study, the role of animated stories in teaching EFL (English as a Foreign Language) to Young Learners (YLs) was investigated. The potential role of using such an approach was assessed in terms of students' attitudes towards learning English. Five authentic animated stories were used as overarching themes into which some basic vocabulary, structures, and functions of the target language were integrated. On the whole, the outcome of the study is that students kept their initial positive attitudes towards learning English with animated stories. The study also proved that students' concerns related to learning English decreased through such instruction. The findings of the present research also suggest that animated stories offer teachers opportunities to present and recycle vocabulary, grammar, and functions of the target language in context through integrating many extension activities related to the story theme.

KEYWORDS: Animated stories, Teaching English to Young Learners, English as a Foreign Language

INTRODUCTION
The introduction of English language into primary classrooms has brought about the need for methods and techniques that are appropriate for YLs. Among all the English language learner groups, YLs are assumed to be a special group since they are in a period of their lives in which they go through a constant cognitive, emotional, and social change, and therefore, think and learn in different ways compared to older learners (Ur, 2012; Cameron, 2001; Slatterly & Willis, 2001; Halliwell, 1992). YLs frequently learn indirectly and holistically rather than directly (Cameron, 2001; Halliwell, 1992). In other words, YLs' minds seem to pick up the knowledge embodied in meaningful and purposeful language actively without focusing on the language itself. Therefore, in TEYL, instead of teaching in isolated chunks or breaking the language into its grammatical components; in other words, making use of rigorous grammatical analysis, it is necessary to present and use the language meaningfully and within a context that mirrors the real world discourse (Shin, 2007; Cameron 2001; Keddle 1997; Halliwell, 1992; Rixon, 1991).

Knowledge about the general characteristics of YLs may contribute to our understanding of how they differ from older learners and what type of instructional methods and materials should be involved in TEYL accordingly. First, YLs have short attention span (Brewster et al., 2002; Slatterly & Willis, 2001; Cameron, 2001; Scott & Ytreberg, 1990; Wood, 1988). Put differently, YLs are usually not capable of focusing on one task for long periods of time, and they get distracted quiet easily. Therefore, they need variety in activities and materials in the classroom. Secondly, YLs generally cannot stay inactive for long periods. Brewster et al. (2002) and Brumfit et al. (1991) emphasize that YLs need physical movement in the classroom due to their high levels of energy and it is important to teach them with methods and activities that leave place for physical movement in the classroom. Also, YLs learn by doing Slatterly & Willis 2001; Holderness, 1991; Scott & Ytreberg, 1990). As a result, they need activity based instruction which would involve opportunities for language development while doing tasks and activities. Yet another important characteristic of YLs is that they learn fast and forget fast (Slatterly & Willis, 2001; Scot & Ytreberg, 1990). Therefore, it is often proposed that YLs need a lot of recycling for the consolidation of recently learnt knowledge (Slatterly & Willlis, 2001).

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Another remarkable characteristic of YLs is their great ability to copy or imitate the sounds of the target language (Brewster et al.,2002; Slatterly & Willis, 2001; Scott & Ytreberg, 1990). Listening to stories as well as songs and rhymes is specifically recommended for children to become aware of the rhythm, intonation and pronunciation of language (Brewster et al., 2002). In addition, YLs are enthusiastic and emotionally excitable (Brewster et al., 2002; Cameron, 2001). Children are willing to have a go and experiment in almost every activity which makes them good risk-takers (Brewster et al., 2002). Yet another characteristic that needs to be

mentioned here is the indispensable place of fantasy and imagination in the world of YLs (Slatterly & Willis, 2001; Halliwell, 1992). According to Halliwell (1992) imagination and stories which involve an element of fantasy help children make sense of the real world.

Finally, YLs are good at exploiting the contextual clues for the comprehension and interpretation of new language. To grasp meaning in L1, children make use of a variety of sources including body language, intonation, facial expression, gesture, actions, circumstances and the social context itself (Brewster et al., 2002; Halliwell, 1992). In order to draw on this skill in TEYL, teachers can make use of contextualization. It is essential to address the various senses, make use of non-verbal clues and the surroundings at school in order to contextualize language (Brewster et al., 2002; Scott & Ytreberg, 1990).

In line with the argument developed above, it can be claimed that the type of instruction appropriate for YLs needs to include indirect processes that offer meaningful and contextualized language. Since YLs are disposed to think and learn in ways that would be described as holistic, implicit and indirect, they need to be provided with opportunities that allow for the subconscious acquisition of language while their minds are engaged with the task itself (Halliwell, 1992). Thus, children need extensive and continuous exposure to language contextualized in meaningful and enjoyable ways (Cameron 2001; Halliwell, 1992). With their fun and interesting nature, stories are proposed as important tools to contextualize language instruction for YLs.

CONTEXTUALIZING LANGUAGE TEACHING THROUGH STORIES

Stories can be used as invaluable sources that could support children with contextualization in the language classroom (Brewster et al., 2002; Shrum & Glisan, 1994; Adair-Hauck, Donato & Cumo, 1994; Ellis & Brewster, 1991; Garvie, 1990). They not only provide familiar and comprehensible contexts to present new language but also fit very well in a holistic type of instruction. Stories account for a rich source of vivid language which students can learn subconsciously while pursuing meaning (Brewster et al., 2002; Wright, 2000; Ellis & Brewster, 1991; Garvie, 1990). Besides, with their appealing themes, plots, and characters they have great potential to nourish the linguistic and cognitive growth of YLs. Garvie (1990) indicates that remembering language, thought and experience are inextricably linked, "teachers should be able to offer the kind of experience within the school situation which will stimulate thought and feeling as well as train the skills of listening, speaking, reading, and writing. Story can be that kind of experience" (p.30). Furthermore, stories might constitute the starting point for a range of activities that might be designed. It is possible to incorporate language of the syllabus, follow-up games, songs and activities integrating the four basic language skills around story themes (Brewster et al., 2002; Cameron, 2001; Wright, 2000; Ellis & Brewster, 1991; Garvie, 1990).

Contextualizing language instruction with stories may also bring emotional and social advantages for YLs. The familiarity of students in their first language with the activity of storytelling as well as story themes and structure may help to create a familiar and hence, uninhibited language learning environment. Since listening to a story is not traditionally associated with 'learning', the 'affective filter' level is low, and learners would absorb and assimilate more than they would in a formal learning environment (Krashen, 1982).

Moreover, listening to stories in class is a social experience. A feeling of togetherness, besides a shared response of laughter, sadness, excitement, and anticipation is provoked by stories in classroom (Brewster et al., 2002), and this encourages social and emotional development. In addition, team-spirit and cooperation can be boosted through the follow-up activities based on stories (Zaro & Salaberri, 1995). It is possible to create a warm and happy atmosphere in which the teacher and students enjoy working together by using stories in the language classroom (Moon, 2000). With their fun, challenging and motivating nature, stories can help develop positive attitudes towards language learning and create a desire to continue learning (Brewster et al. 2002).

The numerous benefits of using stories in TEYL can be enhanced by benefiting from technology while presenting them instead of their traditional written and oral presentation. Recently, with the latest technological developments, it has become possible to present children's stories in fully multimedia format, with sound, music, and animation. Animations are a source of attraction especially for children due to the colourful characters and catchy visual presentations accompanied by enjoyable sounds and songs. They are accepted to be more likely to capture attention compared to static messages due to the innate tendency of human to respond to things that move (Schwartz, 2003). In addition animations serve as a mnemonic device and provide a framework for storing the message that is delivered verbally by guiding attention to the important concepts in the message (Chan Lin, 1998).

Using animated stories in TEYL holds potential to enhance language learning in several ways. Animated stories provide highly strong visual support and extra audio stimuli. Also, these stories could be stronger than a written

text or a story told by a non-native speaker teacher especially when they are dubbed by native speakers as they may provide learners with genuine samples of the pronunciation and intonation patterns of the foreign language. Using animated stories to contextualize YL language instruction may offer exciting prospects when they are supported with a variety of interactive, meaningful tasks and activities. In addition, they may contribute to more positive and confident attitudes towards learning English.

Yet research on the outcome of using animated stories in language teaching is rare. In a study conducted by Verdugo and Belmonte (2007), it was found that the participants' listening comprehension skills were improved with the exploitation of digital stories in language instruction. The researchers believed that the visual, interactive and reiterative character of digital stories had crucial effect on this result. In another study conducted on the effectiveness of using a multimedia storytelling website on language learning, it was found that the retention of words, phrases and sentences from storyline and the general story recall of the participants were increased (Tsou, Wang, Tzeng, 2006). The researchers indicated that the extra visual and audio stimuli received through the multimedia storytelling website may have facilitated story recalls and students' creativity in recreating stories.

It is important to note that an essential goal of teaching a foreign language at an early age is to instil in children the idea that language learning is a happy experience (Brewster et al., 2002; Cameron, 2001; Slatterly & Willis, 2001; Rixon, 1991). Animated stories used with enjoyable follow-up activities may create that enjoyable learning environment. However, the potential contributions of animated stories to a more positive learning environment in YL language classes have not been studied thoroughly. This study, therefore, aimed to investigate the effect of using animated stories on the attitudes of young EFL learners towards learning English. The following research questions guided the investigation.

1. What are the attitudes of young EFL learners towards learning English at the beginning of the study?
2. What are the attitudes of young EFL learners towards learning English at the end of the study?
3. Does language teaching through animated stories produce any change in young EFL learners' attitudes towards learning English?
4. What are young EFL learners' perceptions of language teaching through animated stories?

RESEARCH METHOD

Participants

The participants were 31 sixth grade students (14 female and 17 male) aged 11-12 in a rural area in Turkey. They had been learning English for two years in a schedule involving English lessons for two hours per week with their class teachers. The language learning materials they had been using at school comprised course books determined by the Turkish Ministry of National Education. The students' English proficiency level was considered as 'novice high' according to the American Council for the Teaching of Foreign Languages Proficiency Guidelines (2004), which means that students were able to understand short, learned utterances and some sentence length utterances; particularly where context strongly supported understanding and speech was clearly audible. The students could ask questions or make statements involving learned material. They also had sufficient control of the writing system to interpret written language in areas of practical need.

Implementation

As proposed by Brewster et al. (2002), stories can provide the starting point for all kinds of related language learning activities and can be used as short basic syllabuses in their own right. Thus, in this study, animated stories were used as overarching themes into which some basic vocabulary, structures, and functions of the target language were integrated. Five animated stories were used in this study with integrated activities for four English language lessons per week over a ten-week period. The animated stories used in this study, namely, Eeny, meeny, miny, mo, I want to whistle!, The enormous turnip, The three bears, and Where's my hat?, were retrieved from the official website of BBC (2007). The stories were in fully multimedia format, with sound, music, and animation.

While choosing the stories used for the purposes of this study, the criteria proposed by Brewster et al. (2002) as well as Ellis and Brewster (1991) was taken into consideration. A number of characteristics including the level and variety of language in the stories, the suitability and relevancy of their contents, and their authenticity among others were paid special attention. Also, features like whether the texts involved natural repetition, and were interesting and amusing were taken into consideration. Lastly, the researchers tried to select the stories which had potential to help to develop positive attitudes towards the target language, target culture and language learning in general.

Also, while designing and choosing the integrated materials and activities, the objectives of the curriculum and the developmental level of the students were paid special attention. A variety of materials and activities were provided under the story themes in order to make students familiar with the content of the story, concepts in the story or teach and/or revise some of the key language taking the related literature into account (Ellis & Brewster, 1991; Scott & Ytreberg, 1990). The materials and activities included in line with story themes consisted of worksheets, acting out stories, class surveys, preparing food, games, among others. Also, in the implementation, realia, pictures, flashcards, and power point presentations were additionally used to present the main characters, concepts and vocabulary in the stories.

The conditions of the implementation were confined to the physical circumstances of the school. Even though the stories selected for the purposes of this study were originally prepared for a multimedia environment to be used individually by a child, and required interface skills (e.g. listen, watch and react by clicking on arrows; click on the arrows to follow the story; click on parts of picture, etc.), they were shown on a computer with the help of an LCD data projector and a screen by the teacher since the school could not provide computers for each participant. In the implementation, students viewed each story for three times doing related pre-viewing, while-viewing, and post-viewing activities and worksheets. Some of these included retelling the story, acting out the story, TPR activities, songs, interviewing classmates, conducting a survey, and making a poster among others. Students were also introduced to the related vocabulary and structures present in each story. These vocabulary and structures were presented under the story theme and further practiced with extended activities.

Data Collection

A mixed-methods research technique was adopted for the purposes of this study. Thus, qualitative and quantitative data collection instruments were used to acquire a detailed picture of the perceptions of the particular group on language teaching through animated stories. In order to maintain reliability and validity, multiple data collection tools were used to measure the attitudes of the participants. Berg (2001) suggests that triangulation is not the simple combination of different kinds of data but the attempt to relate them. Thus, for triangulation purposes, data were collected using four data collection tools, namely, a structured attitude questionnaire, an open-ended attitude questionnaire, interviews and lesson evaluation forms.

First, to investigate students' attitudes towards learning English at the beginning and the end of the study, and to find out about potential changes in their attitudes, data were acquired from a structured attitude questionnaire developed by Kara (2003). The tool was a structured five point-Likert- type scale which asked the participants to rate the items from 1= strongly disagree, to 5= strongly agree. The reliability of the measuring instrument was high (Cronbach Alpha 0. 71). It consisted of 58 items and was made up of four parts namely, love of English, interest in learning English, desire for and expectations from learning English, and concerns about learning English. The questionnaire was administered at the beginning and at the end of the study.

In addition, an open-ended attitude questionnaire which was designed by the researchers and given at the beginning and at the end of the study helped to search for the attitudes of the participants towards learning English through animated stories. The questionnaire involved open-ended statements inquiring whether students liked or did not like learning English and students' reasons for finding English lessons difficult or easy.

Furthermore, data collected through a semi-structured interview was conducted. Following Patton (2002) who suggests that semi-structured interview helps to inquire about the interviewees' individual perceptions and experiences through their own judgements and terminologies, the interview was conducted at the end of the study so as to investigate the perceptions of students about instruction through animated stories and the potential changes in their perceptions. The interview, prepared by the researchers, comprised 10 questions related to the students' attitudes towards learning English, animated stories, integrated activities and materials, and their concerns about English lessons. The interview questions were piloted, and necessary modifications concerning the clarity and comprehensibility of the questions were made. Nine participants were selected purposively following non-probability sampling described by Merriam (1998). The interview participants were selected from a mixed sex group and comprised three good, three average, and three below average language learners so as to collect data from a range of participants with different experiences. For reliability purposes, the participants were interviewed by a specialist other than the class teacher. The interviewer was a lecturer involved in English language teaching. The interviews were carried out at the end of the study and were audio recorded for analysis purposes.

Lastly, to investigate students' perceptions about the instructions through animated stories, data were acquired from lesson evaluation forms administered to students at the end of each week during the study. The lesson evaluation forms were used to collect detailed information about the process, the perceptions of the students on

instruction through animated stories, activities, materials, as well as their own involvement in the language learning through the implementation. This instrument was prepared by the researchers and inquired what aspects of the lessons the participants liked or did not like. Participants' perceptions of their own learning and possible reasons for failing to learn were also investigated through these forms. 305 lesson evaluation forms in total were collected from the participants through the study.

Data Analysis

To find out about students attitudes towards language teaching through animated stories, descriptive analysis was conducted using SPSS 15.0 for the quantitative data collected via the structured attitude questionnaire. The mean and standard deviation values were analysed for the aforementioned four parts in order to describe the overall picture of how the students rated their perceptions on learning English at the beginning and at the end of the study. Data findings were interpreted on the basis of the maximum and minimum mean values each part in the questionnaire could get.

1. Love of English: In this part there were 10 items that assessed the extent to which participants liked learning English. The part was appointed minimum 10 and maximum 50 points on Likert scale. Higher points indicated a greater degree in students' love of English.

2. Interest in Learning English: This section included 17 items which focused on the extent to which participants were interested in learning English with minimum 17 and maximum 85 points on Likert scale. Higher points indicated a greater interest in learning English.

3. Desire for and Expectations from Learning English: This section consisted of nine items which focused on the participants' desire for and expectations from learning English with minimum nine and maximum 45 points in Likert scale. Higher points indicated greater desire for and expectations from learning English.

4. Concerns about Learning English: This section consisted of 22 items which aimed to identify the participants' concerns about learning English with minimum 22 and maximum 110 points on Likert scale. Higher points indicated greater concern about learning English.

In addition, Paired Samples t-Test was conducted for each part in the structured attitude questionnaire to find out if there were any statistically significant differences between the pre-test, post test mean values; in other words to see whether the students' attitudes towards learning English changed from the beginning to the end of the study.

Data collected through qualitative instruments were analysed and interpreted through qualitative analysis techniques. As suggested by Bogdan and Biklen (1992), the task of qualitative analysis involves "working with data, organizing them, breaking them into manageable units, synthesizing them, searching for patterns, discovering what is important and what is to be learnt and deciding what you will tell others" (p.153). Thus, qualitative data were analysed accordingly.

First, following Berg (2001), data acquired from the open-ended questionnaire was content-analyzed and reappearing themes were identified through repeated readings so as to investigate the students' attitudes towards language teaching with animated stories at the beginning and at the end of the study. The identified themes were rexamined to isolate meaningful patterns and they were tabulated. Likewise, the interview data were transcribed verbatim and codes were analytically developed and transformed into categorical labels as suggested by Bogdan and Biklen (1992). The data were rexamined by the two researchers for interreliability purposes and final decisions were reached for meaningful patterns. The findings were presented by relating it to findings acquired from the other tools used in the study. Furthermore, following Berg (2001), data gathered through the lesson evaluation forms were content analyzed. For this purpose, data were coded and divided into categories. After resorting data by these categories, meaningful patterns were identified and conclusions were drawn in light of the previous research and literature.

FINDINGS AND DISCUSSION

The data acquired from several research tools including a structured five point-Likert- type attitude questionnaire, an open-ended attitude questionnaire, a semi-structured interview, and lesson evaluation forms led to certain findings about students' perceptions of language teaching through animated stories. In this part, the findings and related discussion are presented on the basis of the research questions.

The first and second research questions investigated the attitudes of young EFL learners towards learning English at the beginning and at the end of the study. Also, the third research question investigated whether language teaching through animated stories produced any changes in young EFL learners' attitudes towards learning English. The data acquired from the structured questionnaire led to certain findings related to these questions as presented in Table 1:

Table 1: Students' Attitudes towards Learning English at the Beginning and at the End of the Study

	Pre-test	Post-test			
Category	$\bar{x}$	$\bar{x}$	t	d*f*	*p*
Love of English	45.62 (2.64)	46.31 (2.83)	-1.583	29	0.125
Interest in Learning English	75.26 (7.80)	77.44 (8.11)	-1.638	29	0.114
Desire for and Expectations from Learning English	41.60 (3.85)	43.03 (2.95)	-1.646	29	0.110
Concerns about Learning English	56.11 (28.52)	42.11 (19.08)	3.707	29	0.002*

Note 1. * = $p < .05$, Standard Deviations appear in parentheses below means.
Note 2. N= 30

The data acquired from the structured questionnaire revealed that students had positive attitudes towards learning English at the beginning and at the end of the study. As shown in Table 1, the findings revealed that a considerable majority of students expressed positive perceptions regarding their love of English ($\bar{x}$ = 45.62 at the beginning of the study, $\bar{x}$= 46.31 at the end of the study), interest in learning English ($\bar{x}$= 75.26 at the beginning of the study, $\bar{x}$=77.44 at the end of the study), desire for and expectations from learning English ($\bar{x}$=41.60 at the beginning of the study, $\bar{x}$=43.03 at the end of the study) both at the beginning and at the end of the study. The results indicated that the students kept their positive attitudes with respect to their love of English, interest in learning English, desire for and expectations from learning English.

As mentioned above, the third research question investigated whether language teaching through animated stories produced any changes in young EFL learners' attitudes towards learning English. Paired-samples t-test was conducted for each part in the structured attitude questionnaire to find out whether the differences between the pre-test post-test results were statistically significant. It was found out that language teaching through animated stories produced some changes in students' attitudes towards learning English only with special reference to their concerns about learning English. As Table 1 shows, there was a statistically significant difference between the participants' concerns about learning English at the beginning and at the end of the study ($t_{(29)}$=3,707, $p<0.05$). The mean values show that there was a decrease in students' concerns about learning English. Whereas the mean value of student's' concerns about learning English was $\bar{x}$= 56.11 at the beginning of the study, it dropped to $\bar{x}$= 42.11 after instruction through animated stories.

The decrease in the participants' concerns about learning English is important in that teaching English through animated stories seems to have helped to create a learning environment that is free of imaginary barriers and apprehension for learners. The relationship between anxiety, learning and classroom performance of students have been pointed out several times in teaching EFL. Krashen (1982) in his affective filter hypothesis states that in order to acquire the "comprehensible input", the affective conditions of the learners should be optimal, which means that the acquirers are motivated, they have self-confidence and a good self-image, and their level of anxiety is low. Also, in TEYL, the importance of a supportive and relaxed learning environment and its contribution to the motivation and learning of YLs is frequently emphasized (Cameron 2001; Halliwell, 1992; Rixon 1991; Scott & Ytreberg, 1990). In this study, results seem to indicate that language teaching through animated stories helped to decrease the concerns of most learners in English lessons and thus created a favourable language learning environment for YLs.

Although it was found that students kept their positive attitudes towards learning English and their concerns about learning English decreased at the end of the study, interestingly enough, qualitative findings acquired from the open-ended questionnaire revealed that the number of students who perceived English lessons easy decreased from 24 to 15 at the end of the study. Students' reasons for finding English lessons easy are shown in Table 2.

Table 2: Comparison of the Students' Perceptions of the Easiness of English Lessons at the Beginning and at the End of the Study

I find English lessons easy because…			
At the beginning of the study	f	At the end of the study	f
English classes are fun as songs and games are involved.	5	I understand better when I see images from the story on screen.	3
I love learning English.	4	it is exciting and fun to learn new words.	2
I listen to my teacher carefully, revise, and do homework.	6	stories and acting out the stories are easy.	2
My teacher teaches well.	2	we used the course book last year, but this year we learned by watching stories.	1
		I like English and do my best to learn it.	1
		it is easy when I study.	1
		I like reading and writing in English.	1
		English lessons are fun.	1
		it is easy once you listen carefully.	1
		we hear English from the stories.	1
		I am getting used to pronouncing English words.	1
		we play games and act out stories.	1
		my teacher does revision and I also revise.	1
Total	**17**	**Total**	**17**

As Table 2 shows, while giving reasons why they found English lessons easy, at the beginning of the study, five students cited that English classes were fun as songs and games were involved. Four students stated that they loved learning English that is why they also found it easy. Six students expressed that they listened to the teacher carefully, revised, and did homework that is why English lessons were easy. Lastly, two students cited that their teacher taught well. However, the reasons put forward by the students at the end of the study were different in nature from those stated at the beginning. As indicated in Table 2, at the end of the study, the students' reasons for finding English lessons easy included understanding better through seeing images on screen (cited three times), the excitement of learning new vocabulary (cited twice), the ease of watching and acting out stories (cited twice), learning through watching stories instead of the course book (cited once), finding English lessons fun (cited once) and hearing English from the stories (cited once) among others. It can be stated that, at the end of the study, students' reasons regarding the easiness of English lessons were more related to the method, the activities and materials used in English lessons as compared to those put forward at the beginning of the study. In this respect, findings from the interviews support findings from the open-ended questionnaire. This is clearly illustrated in the following two statements.

Extract 1:
"When I do not understand English in the stories, the pictures make it clear… acting out helps me understand more easily."

Extract 2:
"English lessons this year are so different from those last year. We watch stories, act out and play games this helps me learn and remember vocabulary items better."

Lastly, the fourth research question investigated the perceptions of the participants with regard to language teaching through animated stories. The lesson evaluation forms were especially valuable in providing insight into how exactly students perceived the animated stories, activities, and materials. Data acquired through these forms were also valuable in revealing students' perceptions of their own involvement in the language teaching

contextualized through animated stories. In other words, students' perceptions of their own learning and possible reasons for failing learning were investigated through the lesson evaluation forms.

Table 3 shows students' perceptions with respect to the animated stories used through the implementation. The aspects that the students liked and did not like about the animated stories in particular are presented below.

Table 3: Students' Perceptions of Animated Stories

Aspects that the students liked	f	Aspects that the students did not like	f
Content of the stories	63	Content of the stories	7
Fun element	31	Problem in the sound quality	3
Audio-visual features	23	Speedy narration	2
Vocabulary	8	Vocabulary	2
Learning a lot from the story	4	Boring elements	1
Interesting elements	4		
Total :	**133**	**Total :**	**15**

As Table 3 shows, students had positive perceptions about the animated stories. The aspects that they liked were cited a total of 133 times compared to the aspects that they did not like (cited 15 times). While expressing their perceptions of animated stories, the most frequently favoured aspect was the content of the stories (cited 63 times). When the students referred to the content of the stories they mentioned for example, characters, important events, elements and objects, themes, conversations, or happy endings in the stories. Another significant feature of animated stories emphasized by students was the fun element they involved (cited 31 times). Furthermore, the audio-visual features of the stories were cited for 23 times. Other aspects that the students liked involved the vocabulary in the stories (cited eight times), learning a lot from the stories (cited four times), and interesting elements in the stories (cited four times). As for the aspects that the students did not like, the content of the stories (cited seven times), problem in sound quality (cited three times), the speedy narration (cited twice), the vocabulary in the stories (cited twice), and boring elements (cited once) were noted in the lesson evaluation forms.

As revealed above, the aspect of the stories that the students liked the most is their content. This finding is congruent with what Ellis and Brewster (1991) point out related to the features of stories that should be used in YL classes. According to Ellis and Brewster (1991), the content and subject matter of stories that we use in TEYL is very important in that the story should interest pupils and should be relevant to their needs. In this respect, the reactions of a great majority of students to animated stories show that stories used in this study were appropriate in terms of the content and amusing elements they involved. However, it should also be noted that a comparatively small number of students cited the content as a point that they did not like about the stories. Even though very few students expressed their dislike of the content of the stories, these remarks may be important in showing that individual differences need to be taken into consideration in YL classes. Each language class involves students with different interests, needs and expectations as frequently suggested in literature (Cameron, 2001; Slatterly & Willis, 2001; Halliwell, 1992). It is possible to identify these differences by conducting short surveys or small conversations with children and make adaptations in the design and selection of the materials accordingly.

As revealed by the findings, the fun element involved in the animated stories was ranked the second by the students while expressing their positive perceptions of the stories. This finding is also favourable in that the animated stories selected for the purposes of this study were appropriate for the particular learner group as they were amusing and motivated students by appealing to their sense of humour as suggested by Ellis and Brewster (1991). Data acquired from lesson evaluation forms also revealed that the fun element in the lessons was perceived favourable by most students. In the lesson evaluation forms, when asked to specify what they liked about the particular lessons of that week, students cited a total of 102 times in 305 forms that they liked the lessons because they were fun. These findings consolidate the importance of fun in TEYL. It has been frequently emphasized that YLs take great pleasure in finding and creating fun in what they do (Scott & Ytreberg, 1990; Cameron, 2001; Slatterly & Willis, 2001). Hence, results in our case support the general view that fun is an important component of children's lives and needs to be involved in YL language lessons.

Students' perceptions of language teaching through animated stories were further investigated with specific reference to the activities. Data acquired from the lesson evaluation forms are shown in Table 4.

Table 4: Students' Perceptions of the Activities

Things that the students liked	f	Things that the students did not like	f
Completing worksheets	89	The lesson was noisy.	2
Acting out stories	71	I could not follow because my friend talked too much.	2
Singing songs	50	We did not spend enough time.	1
Competitions, races and games	46	I'd rather act out the story than sing.	1
Watching stories on the screen	39		
Presentation of vocabulary through PowerPoint presentation	34		
All the activities	29		
Matching pictures to sentences.	18		
Fun	3		
Total :	**379**	**Total :**	**6**

As Table 4 presents, the students' perceptions of the activities were quite positive. The aspects that the students liked about the activities were cited a total of 379 times compared to the aspects that they did not like (cited six times). The most frequently favoured activity was completing worksheets (cited 89 times). The other most favoured activities were ranked as acting out the stories (cited 71 times), singing songs (cited 50 times), competitions and games (cited 46 times), and watching stories on the screen (cited 39 times). The participants also cited that they liked watching PowerPoint presentations, which were used to present and practice vocabulary and structures, 34 times. Students stated that they liked all the activities 29 times. Also a total of 18 times, students expressed that they liked matching pictures to sentences. Students mentioned three times that activities were fun. As for the aspects of activities that students did not like, twice, students expressed that the lessons were noisy, and twice, they could not follow them because their friends talked too much and once that more time is necessary for the activities. Lastly, a student stated his/her preference for acting out the story rather than singing a song.

While expressing their perceptions about the activities, students cited completing worksheets as their favourite. When the students referred to the activity of completing worksheets, they cited listening to the stories or songs and completing the related worksheets, matching the vocabulary and pictures in the worksheets as well as doing exercises related to the target structure in the worksheets. Students' interest in doing worksheets might indicate that they felt more active with worksheets as they received them step by step with integrated extension activities that were related to the story theme. Furthermore, when compared to compulsory course books, students might have found completing worksheets given as hand-outs for each story more enjoyable as it may have provided hands-on experience.

Findings from the interviews also revealed that students felt positive about the activities involved in the language teaching through animated stories. In the interviews, five out of nine participants pointed out that activities related to the stories like acting out, working with worksheets, working with pictures, singing, playing games were sources of fun and facilitated their learning. The following extracts illustrate some students' perceptions with respect to activities.

Extract 3:
"We do a lot of activities, I like acting out the stories best, because acting out the stories helps me learn better, and after I study my part, I keep those words better in my memory."

Extract 4:
"Activities are very good. Acting out helps us understand the story better. Once we played a game and glued pictures, it was really fun."
In addition to the participants' perceptions of the animated stories and activities, their perception of the materials and aids used with the animated stories was also investigated. Data acquired revealed through the lesson evaluation forms are presented in Table 5.

Table 5: Students' Perceptions of the Materials and Aids

Things that the students liked	f	Things that the students did not like	f
Audio-visual aids	187	The volume is too loud.	4
Worksheets	133	The screen is too high.	1
Materials used for drama	100		
Realia	64		
Materials used for vocabulary / grammar teaching	62		
Pictures	54		
Board	45		
Materials used for games	11		
Total :	**656**	**Total :**	**5**

The overall results indicate that students generally had positive perceptions related to the materials and aids used in the language instruction through animated stories. As Table 5 shows, the aspects that the students liked were cited a total of 656 times compared to the aspects that they did not like (cited five times). The audio-visual aids were the most favoured materials and aids by the students (cited 187 times). Other materials and aids favoured by the students were worksheets (cited 133 times), and materials used for drama (cited 100 times), which involved crowns, jewellery, costumes, masks, hats, all kinds of toys used for drama activities. These were followed by realia (cited 64 times), materials used for vocabulary and grammar teaching (cited 62 times). Also, pictures (cited 54 times), the board (cited 45 times) and the materials used for games (cited 11 times) were noted by the students as favourable aspects. As for the aspects that the students did not like, only two aspects, the loudness of volume (cited four times) and the height orientation of the screen (cited once) were noted by the students.

Among the materials and aids used through the implementation, audio-visual materials and aids, namely, the computer, screen, projector and speakers, were the most favoured ones. It has been frequently emphasized that audio-visual materials and aids are not sufficiently used in language classes in Turkish primary schools; however learners express desire for their use (Aküzel, 2006; Atak Damar, 2004; Mersinligil, 2002). In our case, many activities like viewing stories, learning songs from the video clips, viewing and practicing vocabulary and structures through power point presentations among others brought about the involvement of audio-visual features in the English lessons, and it is clear that using audio visual-aids in English language classes was greatly favoured by YLs.

The audio-visual aspect of the lessons was also a frequent theme raised by the students in the interviews. Six students out of nine referred to the audio-visual aspect while explaining the improved gains and learning outcomes in English lessons. Students expressed their contentment with the use audio-visual materials and aids in English lessons and explained how it improved their understanding of English as in the extracts below.

Extract 5:
"Last year English lessons were not so much fun. We didn't have stories, we mostly learned from the book. This year, we learn better. Seeing everything on the screen is better and I can understand more easily."

Extract 6:

"I like English lessons more this year. We did not watch anything on the screen last year; we followed the course book. That is why this year is better….I understand better through stories than books. I can see stories on the screen but there are not many visuals in the course books …. I did not understand much English last year. This year the teacher teaches through stories. That is why I understand much better."

As revealed through the findings reported above, while explaining the improved gains and learning outcomes students frequently referred to the visual aspects of the lessons. The visual aspects involved activities like viewing stories, learning songs from the video clips, viewing and practicing vocabulary and grammar through power point presentations. The perceptions of students verify the importance of seeing for understanding and learning as emphasized by Halliwell (1992), who pointed out that "seeing as a source of understanding is central to language work" (p. 132).

This result further seems to support the idea that contextualisation through the visual clues provided by animations can facilitate the comprehension of stories. Animated stories provide YLs with an integration of two basic senses; seeing and listening, which results in improved understanding of the spoken language. As Halliwell (1992) states the integration of seeing and listening can be a basic source for indirect learning. Also Pinter (2006) suggests that incorporating various senses makes learning memorable. Especially the data acquired through the interviews show that animated stories increased students listening comprehension and story retention. Other studies conducted in second language comprehension in listening also show that appropriate digital stories can prove to be very useful in developing children's listening skills and comprehension, due to their visual, interactive, and reiterative features (Verdugo & Belmonte, 2007; Tsou, Wang & Tzeng, 2006).

Lastly, the participants' perceptions of their own learning in the language teaching with animated stories were investigated. Students' perceptions acquired from lesson evaluation forms are presented in Table 6.

Table 6: Students' Perceptions of What they Learned in English Lessons

I believe that I have learned something this week, for example	f	I do not believe that I have learned something this week because	f
Vocabulary	240	my classmates made a lot of noise.	6
Structure	159	it was boring.	2
Listening skills	14	the vocabulary was difficult.	2
Singing in English	13	I could not concentrate on lessons.	1
Culture	5		
Speaking	4		
Total :	**435**	**Total :**	**11**

As Table 6 shows, the students' perception of their learning outcomes is very positive. The items that the students claimed to have learned were cited 435 times. On the other hand, students expressed that they did not learn anything during that week and cited reasons for that for 11 times. The most frequently cited aspect of language that the students claimed to have learned was vocabulary (cited 240 times). Also, students cited 159 times that they believed they had learned particular structures, noting down, for example, "My favourite colour is yellow"," He likes cherries", "I can run" among others. In addition, the participants referred to improving their listening skills 14 times. They used expressions like, "I understood what I listened to" or "I listened to and learned stories". In addition, students expressed 13 times that they learned singing in English. The least frequently cited aspects were culture (five times) and speaking (four times). On the other hand, some students also gave reasons for failing learning in these lessons. The noise created by the classmates (cited six times), finding the lesson boring (cited twice), finding the vocabulary difficult (cited twice), and being unable to concentrate were raised as the reasons why some students failed to learn in the lessons.

As revealed through the lesson evaluation forms, students noted down many vocabulary items, structures or other aspects of the language that were targeted in language teaching contextualized through animated stories. Obviously, the learning outcomes can best be evaluated through testing procedures. As the students' language proficiency was not assessed in the study, the findings do not necessarily indicate that the course objectives were

completely reached. Yet, it might imply that students believed they comprehended and learned a lot during the contextualized language instruction through animated stories.

Data gathered through the interviews also indicated that the participants perceived that they learned a lot more and comprehended much better in language instruction through animated stories compared to the previous year's English lessons. Five students out of nine referred to increased learning outcomes in English compared to the previous year. They relate their reasons for increased comprehension and retention to the elements involved in language teaching through animated stories. For example:

Extract 7:
"Last year we mostly used the course book. The teacher very rarely brought different things to class. This year we do not use the course book at all but we use the computer…. Watching on the screen is better because we can understand by seeing pictures….We also act out. I learned a lot more this year."

Extract 8:
"We did not watch stories in English lessons last year but we do now. It is better because we can keep the things we learned in our minds easily…. When the teacher does exams and asks about the stories we can tell about them and even rewrite them. My exam results are better this year."

CONCLUSION

The overall findings have shown that animated stories may serve as important tools to contextualize the target items of language in natural and meaningful ways not only with their strong text structures but also with the visual and audio stimuli they provide. In addition, they could serve as a background and starting point for the follow up activities, giving children the chance to practice language in contexts linked to the story themes. Last but not least, they could help to create a more relaxed and enjoyable learning environment. The study appears to prove that students' concerns related to learning English decreased with language teaching contextualized through animated stories. Rixon (1991) proposes that one of the main objectives of primary school language learning should be to "promote the formation of a positive attitude to language learning in general" (p.35) and language instruction through animated stories seem to have helped in fostering and maintaining such positive attitudes.

This particular study has certain limitations. First, it should be noted that the study was conducted with a group of sixth grade students of a primary school in Adana, Turkey. Therefore, conclusions need to be verified by conducting similar studies with students from different grades, across different countries with different cultural backgrounds. Also, the study aimed to investigate the role of animated stories on the attitudes of students. The language development of the students was not within the scope of the study. Thus, a further study that aims to investigate the effect of language teaching through animated stories on learners' language proficiency would be beneficial.

Despite these limitations, some implications for practice can still be drawn from the results of this study. First, the necessity to create a learning environment in which children get both aural and visual support in meaningful contexts should be emphasized in TEYL. Animated stories offer an invaluable way of contextualizing and introducing new language by providing audio-visual input and authentic story narration. These stories offer teachers opportunities to present and recycle vocabulary and grammar in context as well as integrating many extension activities related to the story theme. Thus, curriculum developers and teachers should remember that with animated stories, they can exploit audio visual clues and advantages of story narrative for contextualizing target language effectively.

Lastly, variety in materials and activities is crucial to increase and maintain the interest of YLs throughout English language lessons. Rather than relying on the course book as the sole teaching material, teachers should supplement and enrich their classroom practices by using materials appropriate for YLs. Materials such as pictures and realia help not only to attract students' attention but also to make learning contextualized. Moreover, incorporation of technological devices, like computers and projectors, for viewing stories, as well as activities like learning songs from the video clips, viewing vocabulary and grammar power point presentations not only maintain contextualization and variety but also help to support and facilitate comprehension.

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IDENTIFYING PROFESSIONAL COMPETENCIES OF THE FLIP-CHIP PACKAGING ENGINEER IN TAIWAN

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ABSTRACT
This study employed a literature review, expert interviews, and a questionnaire survey to construct a set of two-tier competencies for a flip-chip packaging engineer. The fuzzy Delphi questionnaire was sent to 12 flip-chip engineering experts to identify professional competencies that a flip-chip packaging engineer must have. Four competencies, including flip-chip technology, bumping process, stress analysis, and reliability testing, and their subordinate 15 competency indicators were developed. The results serve as a reference for designing or assessing curricula or programs for preparing a quality flip-chip packaging engineer and to be used as a guideline to recruit and select a flip-chip packaging engineer.

KEYWORDS: Professional competency, Packaging engineer, Flip-chip, Fuzzy Delphi

INTRODUCTION
Semiconductor technology has progressed from micrometers to nanometers, and wafer size has increased from 6 in. to 8 in. to 12 in. Each wafer contains several million electronic components. Environmental dust and humidity negatively affect the operation of these electronic components. Therefore, effective packaging protects the inner components. With increases in the functionality of electronic products, and the movement of integrated circuit (IC) fabrication toward high-end fields, the traditional wire bonding packaging technique is unable to satisfy the current demands of IC products. This has resulted in significant growth in the electronic packaging industry, which has subsequently generated the flip-chip packaging technology, a back-end processing in the IC manufacturing process.

In a globalized competitive environment, the life span of high-tech products has increasingly declined. Fostering the professional competencies of a flip-chip packaging engineer has become highly crucial for enabling the industry to respond to aggressive market competition and to create new fields and prospects (Williams, 2004). Ensuring that engineer and technician competencies correspond to industry requirements for innovation is the only way to respond rapidly to the following market changes, to master key production technologies, to shorten manufacturing time, to control product yield, and to reduce production cost (Cheng and Lin, 2003; Lin and Gary Hu, 2001).

Electronic devices consistently require high-density I/O connections, excellent electrical characteristics, and high transfer speeds. These demands present increasing challenges for engineers (Datta *et al.*, 2005; Lau, 2000). In globalized industrial competition, company advantages are only created through the quality of human resources contained within the enterprise (Nijkamp *et al.*, 2011). With the arrival of the knowledge and innovation economy generation, how educational institutions provide quality education to meet the demand side is a critical issue (Ministry of education, 2009). The rapid development of the electronic industry poses a simultaneous challenge for university and college education, who confront the dilemma of amending current curricula/programs to provide quality engineers for the electronic industry (Yang *et al.*, 2007). Universities and colleges must regularly update their curricula/programs to provide students with the latest knowledge and technology relevant to industry demands. This enables establishing a solid foundation for students that satisfies industry requirements (Chandran *et al.*, 2010). Mutual cooperation and exchange are required among industry, government, and universities/colleges to train quality engineers (Pan *et al.*, 2008).

Flip-chip packaging is currently used in high-end electronic devices, and its industry requires a quality engineer to ensure competitive advantage. A set of competencies can serve as a base to measure the overall balance of knowledge and skill, which a flip-chip packaging engineer must have. The professional competencies of a high-tech flip-chip packaging engineer lead industries in their future development. Establishing professional

competencies for the flip-chip packaging industry is imperative for students to acquire the knowledge and skills of the industry requisiteness and to ensure the immediate entrance of graduates into the workplace.

PURPOSE OF THIS STUDY

To reduce discrepancies between the supply side in universities/colleges and the demand side in industries requires identifying the professional competencies of a flip-chip engineer. Therefore, the purposes of this study are as follows:

- To identify professional competencies for a flip-chip packaging engineer.
- To identify competency indicators for a flip-chip packaging engineer.

The results serve as a reference among industry, government, and universities/colleges for fostering a quality flip-chip packaging engineer.

LITERATURE REVIEW

Professional competency

Professional competency (or competence) refers to substantial knowledge and skills gained following professional education or training and professionals who undertake a specific paid job or self-employment duties (Shyr, 2012; Spencer and Spencer, 1993). Professional competencies are the core of education. The goal of professional competency is to apply effectively the knowledge and skills that students learn at school to industry. The emphasis of professional education or training relates to enriching people's capabilities (Yan, 2005). Competencies are the collective learning in organizations, and involve how to coordinate diverse production skills and integrate multiple streams of technologies (Wikipedia, 2012). Competencies are identified behaviors, knowledge, skills, and abilities that definitely affect the achievement of employees and the success of industries (Chen, 2010; Rychen and Salganik, 2003).

Industrial developments change according to technological innovations, and the professional competencies acquire in universities/colleges should be updated regularly. The key to fostering quality engineers is mainly related to higher education. Therefore, training quality engineers at universities/colleges must be more actively implemented to improve the professional competencies of students, narrow the gap between academic and practical application, enhance work efficiency, and benefit the economy (Ministry of education, 2010).

Flip-chip packaging development for new products requires innovative engineering techniques. Although flip-chip packaging technology is continually evolving and the market offers unlimited business opportunities, it is also replete with challenges. The electronic packaging industry requires that students possess fundamental knowledge and professional skills in advanced packaging. Therefore, greater industry demand-oriented practical knowledge and skills should be integrated into university and college courses (Evans *et al.*, 2008).

Students with sufficient electronic packaging skills and reliability knowledge are received well by the electronic industry, and typically obtain excellent employment opportunities following graduation (Joshi *et al.*, 1997). In the rapidly developing electronic industry, flip-chip packaging technology faces new challenges. Analysis of the professional competencies required for flip-chip packaging assists in understanding industry demands and enables the planning of professional education or training curricula/programs in universities/colleges to increase competitiveness of the packaging industry.

Flip-chip packaging

Flip-chip packaging is a mainstream technology used in IC packaging that creates solder bumping on the I/O metal pad of the wafer (Orii *et al.*, 2009). The chips are cut from the wafer and rotated 180° for flux adhesion, and the substrate is aligned for die attachment. The telecommunications link is established through the reflow to join the bond pad of the substrate. Flip-chip packaging has the following three advantages, compared to the traditional wire bonding technique: (1) the ability to provide a higher I/O connection in the area array that satisfies the demands of high-end products; (2) using the solder ball to connect directly with the substrate, thereby reducing post-packaging volume; and (3) a short bonding wire in the packaged structure with low capacitance characteristics, and low inductance consequently enhances electrical characteristics and reduces signal delay or noise, achieving excellent heat dissipation performance (Lo and Tung, 1997; Yu *et al.*, 2007).

Earlier flip-chip packaging has been used primarily for packaging CPUs. Packaging technology was subsequently used for packaging high-end graphic chips, high-end chip sets, programmable logic chips, high-frequency network communication class chips, and high-speed ASIC. The coefficients of thermal expansion (CTE) of the substrate, chip, and bump differ from each other. After repeated cycles of heat expansion and cold contraction, cracks develop in proximity to the joint, thereby influencing interconnection reliability. The underfill process between the chip and the substrate is necessary. The spaces underneath the chip are filled through

capillary action, and the dispersed stress effectively strengthens the structure. The greatest difficulty for flip-chip packaging is that the chips, tin/lead bumps, and substrate cause damage or defects because of the CTE mismatch, and consequently reduce its reliability.

The design of the flip-chip packaging structure has a profound influence on reliability. Therefore, the structure design plays a critical role in flip-chip packaging (Zhang *et al.*, 2010). To accommodate market needs and improve competitiveness, the packaging structural design, raw materials, and manufacturing processes must be able to rapidly change and innovate to meet new challenges (Lay Yeap, 2010; Yang *et al.*, 2010). Flip-chip packaging industry-based education/training refers to the planning of curricula/programs according to the demands of the packaging industry. This could narrow the gap between education/training and industry, and therefore assist students in obtaining relevant professional knowledge and skills required in the workplace.

METHODOLOGY

Fuzzy Delphi technique

The Delphi technique employs a series of questionnaires in repeated surveys to collect expert opinions on specialized subjects until decision-makers agree on a unanimous conclusion and achieve an accurate, logical result. This method is an effective technique for gathering and obtaining expert opinions to solve specific issues. The primary advantage of this technique is the flexible and effective collation of opinions and perspectives from an expert panel to conclude an expert consensus for decision-making (Skulmoski *et al.*, 2007). The Delphi technique is a method for group decisions and is employed in evaluating, assessing, and predicting events and their development for decision-making consideration. Areas such as developing core competencies (Kuo *et al.*, 2011; Olson *et al.*, 2005; Shyr, 2012), engineering (Chang *et al.*, 2011; Xia and Chan, 2012), and management (Imanova, 2009; Mallen *et al.*, 2010) currently use it widely.

The Delphi method primarily employs expert knowledge as its base and collects expert perspectives on specific problems through multiple questionnaire surveys. Personal subjective prejudice is placed aside until experts reach a consensus (Okoli and Pawlowski, 2004). Expert opinions may vary when striving for conformity, producing divergent views that cannot be integrated. The convergence of topics is poor, and therefore, increased numbers of questionnaire surveys are necessary. This increases manpower consumption, and budget expenditure, and may be inconvenient for interviewees (Nworie, 2011). Dalkey (1969) showed that when employing the Delphi method to investigate a problem, if the number of experts involved is greater than 11, the group error minimizes and yields reasonable results. For statistical calculations, the Delphi method uses average values as a selection basis. This implies that the statistical results are easily influenced by outliers and potentially result in misrepresenting the original meanings of experts (Hartman and Baldwin, 1995).

Murry et al. (1985) integrated the traditional Delphi method and fuzzy theory to establish the fuzzy Delphi technique and improve the shortcomings of the traditional Delphi technique. Fuzzy expert questionnaires are designed for the investigated topic and assemble a suitable expert panel. All experts are requested to evaluate each assessment item for the topic and assign possible interval values. The smallest value from this interval represents the most conservative cognitive value of an assessment item as evaluated by the expert, whereas the largest value from this interval represents the most optimistic cognitive value. The fuzzy Delphi technique emphasizes the fuzzy processing of expert messages and adopts and integrates the opinions of individual experts.

Compared to the traditional Delphi technique, this method reaches an expert consensus in a shorter time and facilitates the group decision-making goal (Hsu *et al.*, 2010). The fuzzy Delphi method enables fewer questionnaire surveys, avoids frequent investigations, and obtains an objective and logical conclusion. This method enables participating experts to fully and completely express their views and solves the problem of linguistic fuzziness in expert opinions (Chang *et al.*, 1995). Kaufmann and Gupta (1988) confirmed that the fuzzy Delphi technique requires the participation of only 12 experts to obtain a valid analytical result. The traditional Delphi technique has the problem of experts not reaching a consensus because of diverging opinions, which leads to increased survey cost and a probable scenario where the data integrator rejects the exceptional opinion of a specific expert. Advantages of the fuzzy Delphi technique include the ease of integrating expert advice to form a consensus for decision-making (Hsu, 2011; Kuo and Chen, 2008). Therefore, this study employs the fuzzy Delphi technique to solicit and integrate the opinions of experts in the flip-chip packaging industry and to identify the required professional competencies for a flip-chip packaging engineer.

Research procedure

The study procedure involves the following steps: (1) Drafting professional competencies for a flip-chip packaging engineer. Literature related to the required professional competencies of a flip-chip packaging engineer was collected, synthesized, and summarized into a preliminary draft, which served as a blue

print for developing fuzzy Delphi questionnaires; (2) interviewing experts to assess the aforementioned professional competencies draft. Flip-chip experts were interviewed to assess the drafted professional competencies to examine their correctness and appropriateness, and to make necessary amendments, deletions, and revisions; and (3) conducting the fuzzy Delphi survey. The professional competencies and competency indicators listed on the fuzzy Delphi questionnaire were assessed and confirmed.

Survey participants

Twelve experts with practical experience were invited to participate in the fuzzy Delphi expert survey questionnaire to identify the required professional competencies for a flip-chip packaging engineer. The selection criteria for the 12 experts were as follows: (1) currently employed professional personnel specializing in in-depth understanding of the flip-chip packaging industry; (2) over 5 years of practical experience in flip-chip packaging; and (3) in possession of sufficient professional knowledge with excellent research and development results.

Research instrument

Industry technologies change rapidly, and professional knowledge is updated on a daily basis. The professional competencies for a flip-chip packaging engineer must conform to the current demands of the flip-chip packaging industry. Spencer and Spencer (1993) stated that any specific work competency should be confirmed and designated according to the following three steps: (1) recruit experts in the relevant field and establish a focus group; (2) analyze work competency content through a literature review and expert consultation; and (3) establish work competency based on the consensus of the recruited expert team.

After a literature review and industry expert interviews, the required professional competencies for a flip-chip packaging engineer are identified to include the following four domains: flip-chip technology, bump process, stress analysis, reliability testing, and 20 professional competency indicators, as shown in Table 1. The competencies in flip-chip technology contain six indicators, the bump process contains five indicators, stress analysis contains four indicators, and reliability testing contains five indicators. The fuzzy Delphi questionnaire survey of professional competencies for a flip-chip packaging engineer developed in this study conforms to academic theoretical foundations, and 12 experts verified the questionnaire items. Therefore, the questionnaire serves as the research instrument and is valid and reliable.

Table 1: Identified competencies of the flip-chip packaging engineer

Competencies Items
1. Flip-chip technology
1.1 Understand the evolutionary and developmental trends of packaging technology and the role Taiwan plays in these trends
1.2 Understand the application of flip-chip packaging technology
1.3 Possess flip-chip packaging process knowledge
1.4 Understand the structure of flip-chip packaging
1.5 Possess the ability to design a flip-chip packaging structure
1.6 Understand the items that require preparation prior to flip-chip packaging
2. Bump process
2.1 Possess knowledge on bump chemical composition and the ability to select bump configuration
2.2 Understand the influence of solder bump density and bump configuration on filling flow
2.3 Understand the characteristics and manufacturing process of different bump materials
2.4 Understand the bump quality assessment items and inspection standards
2.5 Possess the ability on the influence of bump array and density on reliability
3. Stress analysis
3.1 Understand the relationship among thermal stress, temperature distribution, and warping
3.2 Possess knowledge on the influence of different structures and materials on heat dissipation
3.3 Understand the parameters that influence packaging stress
3.4 Possess the ability to conduct a heat resistance assessment of flip-chip packaging
4. Reliability testing
4.1 Familiarity with reliability inspection methods for flip-chip packaging
4.2 Understand the reliability standard, demand, and current industry situation
4.3 Possess quality control concepts
4.4 Understand the cause of flip-chip packaging structural deformation and improvement

	strategies
4.5	Understand the characteristics of underfill and its influence on reliability

RESULTS AND DISCUSSION

The data collected from fuzzy Delphi questionnaires were analyzed primarily using triangular fuzzy numbers. The analytic process involves the following five steps: (1) establishing triangular fuzzy numbers; (2) defuzzification; (3) obtain the right boundary value; (4) obtain the left boundary value; and (5) calculate the total utility of the fuzzy numbers. During triangular fuzzy number calculation, Microsoft Excel statistical software was used to convert expert opinions to triangular fuzzy numbers. The defuzzification results are shown in Table 2. The criteria for professional competencies were as follows: If the total utility of the assessment item is greater than 0.6 (Threshold value), it is considered a required professional competency for a flip-chip packaging engineer. Conversely, if the total utility is less than or equal to 0.6, the assessment item is rejected as a professional competence for a flip-chip packaging engineer.

According to the statistical results of fuzzy Delphi analysis shown in Table 2, Items "1.1 Understand the evolutionary and developmental trends of packaging technology and the role Taiwan plays in these trends," "1.6 Understand the items that require preparation prior to flip-chip packaging," "2.5 Possess the ability on the influence of bump array and density on reliability," "3.3 Understand the parameters that influence packaging stress," and "3.4 Possess the ability to conduct heat resistance assessment of flip-chip packaging," obtained a total utility of less than 0.6, and were thus rejected and deleted. Consequently, the professional competencies for a flip-chip packaging engineer include four professional competencies and 15 indicators.

Table 2: Statistical results obtained by analyzing each item in the official questionnaire using the fuzzy Delphi method

Aspect	Item	a_k, b_k, c_k	μ_R, μ_L, μ_T	Total utility	Threshold value (0.6)
1. Flip-chip technology	1.1	(0.3, 0.63, 0.9)	(0.711, 0.524, 0.593)	0.593	×
	1.2	(0.3, 0.69, 1)	(0.766, 0.501, 0.632)	0.632	ˇ
	1.3	(0.3, 0.75, 1)	(0.801, 0.482, 0.659)	0.659	ˇ
	1.4	(0.4, 0.76, 1)	(0.810, 0.439, 0.685)	0.685	ˇ
	1.5	(0.4, 0.68, 1)	(0.763, 0.465, 0.648)	0.648	ˇ
	1.6	(0.2, 0.59, 0.9)	(0.689, 0.573, 0.557)	0.557	×
2. Bump process	2.1	(0.3, 0.66, 1)	(0.751, 0.511, 0.619)	0.619	ˇ
	2.2	(0.3, 0.66, 0.9)	(0.727, 0.513, 0.606)	0.606	ˇ
	2.3	(0.4, 0.67, 1)	(0.752, 0.472, 0.639)	0.639	ˇ
	2.4	(0.4, 0.61, 0.9)	(0.700, 0.493, 0.603)	0.603	ˇ
	2.5	(0.3, 0.64, 0.9)	(0.718, 0.519, 0.599)	0.599	×
3. Stress analysis	3.1	(0.3, 0.64, 1)	(0.736, 0.521, 0.607)	0.607	ˇ
	3.2	(0.3, 0.65, 0.9)	(0.721, 0.517, 0.602)	0.602	ˇ
	3.3	(0.3, 0.61, 1)	(0.721, 0.532, 0.594)	0.594	×
	3.4	(0.2, 0.55, 0.9)	(0.668, 0.591, 0.538)	0.538	×
4. Reliability testing	4.1	(0.2, 0.67, 1)	(0.757, 0.540, 0.608)	0.608	ˇ
	4.2	(0.4, 0.70, 1)	(0.769, 0.461, 0.653)	0.653	ˇ
	4.3	(0.4, 0.72, 1)	(0.755, 0.471, 0.641)	0.641	ˇ
	4.4	(0.4, 0.71, 1)	(0.779, 0.455, 0.661)	0.661	ˇ
	4.5	(0.5, 0.68, 0.9)	(0.740, 0.421, 0.659)	0.659	ˇ

Notes : (a_k, b_k, c_k) denote the triangular fuzzy numbers; (μ_R, μ_L, μ_T) represent the right boundary value, left boundary value, and total utility, respectively. "×" represents "should be deleted."

Competency in flip-chip technology
Flip-chip packaging technology involves the direct assembly of chips on circuit boards (COB). The solder bump where the flip-chip is connected exhibits characteristics of high-density packaging and small-signal delays. Flip-chip packaging provides an IC component with a comprehensive structure that prevents component damage caused by external forces, deters corrosion caused by environmental factors, and ensures the standard transmission of signals to enable components to perform their designated functions. The applications of flip-chip packaging are described in Section 3.2 and are thus not reiterated here.

Numerous in-depth studies (Amalu and Ekere, 2012; Jen *et al.*, 2011; Lu *et al.*, 2012) have investigated the structural design of flip-chip packaging and analyzed its characteristics. Related studies have shown that a difference in the design of flip-chip packaging alters the product characteristics. The flip-chip packaging engineer who plans to innovate and create new products should begin by understanding structure to develop competence in packaging design. Therefore, Items 1.2 to 1.5 in flip-chip technology that describe the indices of professional competence are crucial to a flip-chip packaging engineer.

Competency in bump process
The bump is a crucial element in flip-chip connection. Flip-chip packaging differs from the wire bonding process that employs metal wires to connect the chip and the substrate. The solder bumps are made on the bond pads that then connect with the substrate. As an IC component, the primary function of the solder bump is signal transmission. The solder bump creates a fine-pitch interconnection and reduces signal transmission time. Based on the type of material used, the solder bump can be divided into the following three categories: high-lead solder bump, eutectic solder bump, and lead-free solder bump.

The material used currently for bump is lead-free solder (Lee *et al.*, 2009). Tin-lead materials have been used to connect the chip to the substrate. The main advantages of tin-lead are low production cost, excellent resistance to thermal fatigue, strong mechanical properties, and good reliability. However, lead is a heavy metal that pollutes the soil and underground water systems. Lead poisoning in humans occurs when the amount of lead in the blood exceeds a certain value, eventually damaging the nervous and reproductive systems as well as the brain. Lead is a chemical that is severely hazardous to human health and the natural environment. Considering environmental awareness and human health, the European Union announced the Restriction of the Use of Hazardous Substances (RoHS) directive, which prohibits electronic products and electronic equipment that contain the following six substances from being commercially available: lead (Pb), mercury (Hg), cadmium (Cd), hexavalent chromium (Cr^{6+}), polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs) (WEEE, 2000).

The materials used for the lead-free solder bump include Sn/Ag, Sn/Cu, and Sn/Ag/Cu. However, compared to lead-containing materials, lead-free materials have a higher Young's modulus and lower CTE, rendering lead-free materials more fragile, and increasing their reflow temperature. The packaging process produces a greater amount of thermal stress, leading to solder bump cracking that reduces electronic component effectiveness. Therefore, a flip-chip packaging engineer should have adequate knowledge of solder material composition to enable them to respond to the current environmental awareness trend while maintaining product quality.

Numerous studies have investigated optimizing various solder bump structures and materials. The results show that the choice of solder bump structure and material effectively influences the stress and quality of the eventual product (Chen and Lin, 2010; Zhang *et al.*, 2010). The solder bump is commonly damaged by thermal stress resulting from incompatible CTEs of packaging materials under TC conditions, which causes the solder bump to lose its signal transmission function. Therefore, a flip-chip packaging engineer should possess the occupational standard requirements listed in Item 2.1 to respond to bump structure changes and to develop new technologies for bump manufacturing. For the occupational standards listed in Item 2.2, numerous reports published by electronic packaging research and development personnel have investigated the influence of solder ball density and solder bump configuration on the underfill flow (Lee *et al.*, 2011; Lin *et al.*, 2008). Increased bump density obstructed liquid flow, which increased resistance flow of the underfill, causing liquid flow at a slower speed, and increasing the time required for filling. To reduce production time and packaging cost, a flip-chip packaging engineer must have in-depth knowledge of the influence of solder ball density and bump arrangement on underfill flow. Bump quality is determined by the competencies of a flip-chip packaging engineer in areas such as bump materials, bump geometric structure, bump density, and bump arrangement. Item 2.3 of the occupational standards is the most important step in the flip-chip packaging process for electronic components. A flip-chip packaging engineer should be aware of the required inspections and relative standards of bump height, diameter, coplanarity, shearing stress, voids, undercut of the under bump metallurgy (UBM), resistance, and leakage. The occupational standards listed in Item 2.4 must be achieved, and the most current knowledge and

technologies should be employed to ensure that solder bump quality adheres to industrial demands.

Competency in stress analysis

Increased packaging density of the IC chip has raised the working temperature of the packaged body that potentially results in failure. Heat is a main factor in causing thermal stress in electronic products. In the development of new-generation IC packages, heat-analysis is an essential technology (Yuan *et al.*, 2007; Zhang *et al.*, 2008). The incompatibility between the CTEs of materials in different structural layers produces thermal stress because of temperature changes. This stress causes deformation or warpage of the packaged structure. In severe cases, it can disrupt the packaging components and damage the chip, resulting in functional failure. Suzuki et al. (2007) stated warpage to be a problem of flip-chip packaging that urgently requires a solution. The thermal stress created by temperature loading is one of the main causes of deformation, warpage, and failure of flip-chip packaging (Tsai *et al.*, 2009).

The mechanical behavior of flip-chip packaging closely correlated with the reliability of electronic devices. Stress or deformation measurement for packaged products is difficult and cumbersome. Therefore, to gain information on the mechanical behavior of flip-chip packaging, engineers must be competent in computer-aided engineering to analyze the mechanical behavior of the packaged structure (Cho *et al.*, 2008; Tsai and Chang, 2008). The flip-chip packaging engineer must possess Items 3.1 and 3.2 of the occupational standards to alter the sizes and material properties appropriately in each layer of the packaged structure to reduce structural stress and improve packaging quality.

Competency in reliability testing

To understand product behavior in physical environments, and its stress toleration and life span, products must undergo Joint Electron Device Engineering Council (JEDEC) reliability tests. The primary tests are the moisture sensitivity level test (MSLT), the temperature cycling test (TCT), the high-temperature storage test (HTST), and the highly accelerated stress test (HAST). The flip-chip packaging engineer must be familiar with these test methods and understand their standards, requirements, and current situations to conform to the occupational standards listed in Items 4.1 and 4.2. Quality testing of the packaged product includes tests of electrical characteristics, mechanical properties, the environment, and reliability. The flip-chip packaging engineer must have the quality control occupational standards listed in Item 4.3 to produce packaged products that meet desired specifications and standards and possess excellent performances. The extent of deformation is one of the key indices in evaluating the quality of flip-chip packaged products. Therefore, Item 4.4 of the occupational standards has attracted the concern and attention of the flip-chip packaging industry. Thermal stress causes deformation of the flip-chip packaging structure.

Selecting appropriate packaging material, altering manufacturing parameters, and modifying the packaged product type achieves improved deformation of the flip-chip packaging structures. From a material selection viewpoint, reducing material shrinkage, lowering CTE, and increasing the elastic modulus mitigates deformation. Packaged product configuration, such as packaging material thickness, substrate thickness and material type, chip size, and product structure symmetry, are all critical factors that result in deformation. From a manufacturing parameter perspective, the pressure, temperature, and duration of packaged molds are important factors that cause deformation of the packaged structure when using thermosetting material or epoxy molding compounds (EMCs).

The flip-chip packaging engineer who adequately understands the relationship between the manufacturing conditions and the deformation of the packaged structure provides the most favorable packaged parameters, thus improving the reliability of flip-chip packaging. In Item 4.5 of the occupational standards, the underfill process is crucial to flip-chip packaging. This process exhibits a significant influence on the package reliability of integrated circuits (Huang *et al.*, 2011; Wan *et al.*, 2007). Underfills can also be used as a buffering layer for thermal stress to insulate the chip from the outside environment (Yang and Young, 2012). This prevents circuit corrosion caused by moisture, leading to signal interruption. Therefore, to increase the reliability of flip-chip packaging, a packaging engineer must possess Item 4.5 of the occupational standards to ensure that the products correspond to the demands of the flip-chip packaging industry.

CONCLUSION

We developed and identified the professional competencies of a flip-chip packaging engineer by using the fuzzy Delphi technique. This method was used to analyze the opinions of experts and to confirm the professional competencies for a flip-chip packaging engineer. The final results include competencies in the following four domains: flip-chip packaging technology, bump process, stress analysis, and reliability testing. Their subordinate 15 professional competency indicators were also identified.

The flip-chip packaging technology domain is composed of four necessary indicators. Indicator 1.4, "Understand the structure of flip-chip packaging," is the most necessary professional competency indicator for an engineer in the flip-chip packaging technology domain. The bump process domain consists of four necessary indicators. Indicator 2.3, "Understand the characteristics and manufacturing process of different bump materials," is the most important professional competence indicator for a flip-chip packaging engineer in the bump process domain. The stress analysis domain is composed of two necessary indicators, and the reliability testing aspect consists of six necessary indicators. Indicator 4.4, "Understand the cause of flip-chip packaging structural deformation and improvement strategies," is the most vital professional competency indicator for a flip-chip packaging engineer in the reliability testing domain.

Selecting appropriate materials, optimizing the packaged structure design, environmental testing, and reliability assessments are critical aspects of flip-chip packaging. The flip-chip packaging engineer who possesses the competencies identified in this study will be able to explore the causes of problems and find solutions to solve these problems. The packaging engineer can also propose prevention strategies and improve production capacity and the quality of flip-chip packaged products.

The required professional competencies of a flip-chip packaging engineer include knowledge and skills. Professional competencies can be attained through professional education and training to enable engineers to resolve difficulties encountered at work. Related curricular or programs should include the four domains and 15 professional competency indictors for a flip-chip packaging engineer, to provide students with clear learning goals, increase their employment competitiveness, and cultivate talented people who can satisfy the demands of the flip-chip packaging industry.

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IMPROVING THE LEARNING DESIGN OF MASSIVE OPEN ONLINE COURSES

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ABSTRACT
Massive Open Online Courses (MOOCs) can be regarded as a promising next step in the evolution of distance education. However, they have been criticised for their poor learning design. This article describes the development of an adequate learning design in a series of nineteen MOOCs (called online master classes). A formative evaluation focuses on participation and user satisfaction. A total amount of 2083 individual learners enrolled in online master classes. Overall the user satisfaction is positive and stable. Thirteen pedagogical requirements for MOOCs form the output of this evaluation. It is concluded that the learning design that has been developed, matches with the pedagogical principles of distance education for adult learners. The format has proven to support more a diverse group of learners than the still dominant MOOC formats.

INTRODUCTION
Distance education allows learners and instructors to maintain communication although they are physically apart (Keegan, 1986). It has emerged from correspondence education, teaching by technical media (mass media radio and television) to digitized education (Peters, 2010).

Massive Open Online Courses (MOOCs) can be regarded as a promising next step in the evolution of distance education. Gaebel (2013) describes MOOCs as online courses with no formal entry requirement, no participation limit, free of charge, but for which the learners do not earn credits. Originally MOOCs have their roots in the Open Education Movement that aims to enable education and knowledge development at no costs while the content can be reused and modified (Yuan & Powell, 2013).

Despite of the potential, MOOCs have been criticised for their poor learning design (Cooper & Sahami, 2013; Gaebel, 2013; Yuan & Powell, 2013). Kalz and Specht (2013) have summarized that the current learning design of the two major design approaches is for the one format too open and unstructured and might therefore be only suited for a very self-directed population of learners with high media literacy (the so-called cMOOC). The other format is reproducing a classical lecture oriented approach without exploiting interaction and feedback opportunities (the so-called xMOOC). The Open University of the Netherlands (OU) has recently developed an approach to MOOCs that aims to improve the learning design. These MOOCs are offered to the learners as 'online master classes'. They are aimed at adult learners whose primary objective is to keep up-to-date in their profession.

The main characteristics of these online master classes are:

- There is no limit to the number of learners.
- Learners can participate at various levels of intensity.
- It is an online format.
- Every master class has a turn-around time (of a week) and learning goals.
- They are freely accessible. Learners who want to receive a certificate pay a fee. They have access to additional resources.

In this article we present the learning design that has been developed for these online master classes. In the next part we briefly discuss the state-of-the-art of the design and development of MOOCs in respect of pedagogical principles of distance education. Based on this discussion we describe the learning design of the online master classes. Furthermore we report about a formative evaluation. A list of 13 pedagogical requirements forms the result of this evaluation. In the last section conclusions are drawn and suggestions for future work are formulated.

THE PEDAGOGICAL QUALITY OF MOOCS
Although the first MOOCs were initiated in 2008, the interest in MOOCs has increased since Ivy League-universities like Stanford and Harvard started to offer online courses for free on a large scale (Sharples et al, 2013). According to Yuan and Powell (2013) MOOCs offer the opportunity for massive up-scaling of course participants and increasing access of education, for example to reach working professionals as a new target group (Gaebel, 2013). However, Yuan and Powell (2013) stress concerns about the pedagogy and quality of

current MOOCs, mainly due to their poor learning design. The question is if the learning design of these MOOCs matches with the pedagogical principles of distance education for adult learners.

According to Holmberg (2003) distance education does not only imply non-contiguous teaching and learning, it also includes mediated interaction between learners and instructors (two-way traffic). Additionally, Holmberg (2003) stresses the importance of interaction for supporting learners, and personal relations including feelings of empathy and belonging (to motivate learners). Wagner (1994) defines interaction as “reciprocal events that require at least two objects and two actions. Interactions occur when these objects and events mutually influence one another”. Interaction has been regarded as important for processing information, for learner control, for the adaption of learning programs based on learners’ input, for constructing knowledge and for the creation of learning communities (Anderson, 2003).

Rhode (2009) concludes that engagement in interaction can lead to enrichments of learning, while it can be identified as a central element and catalyst of engaging learning experiences. According to Khalil and Ebner (2013) the interaction quality and quantity in online learning environments are important factors that influence learner satisfaction and indirectly influence dropout rates.

In education three types of interactions can be distinguished: student-content, student-instructor and student-student. Student-student interaction is the exchange of information and ideas amongst learners. Real-time presence of an instructor is not necessary to facilitate this. Student-instructor interaction is interaction between learner and expert to foster improved understanding of the content by learners, such as student guidance or feedback. Alexander (2003) emphasizes the importance to acknowledge that there is a difference between experts and professionals who are competent but not experts. Therefore these so-called ‘non-experts’ should be able to learn from experts. Moore (1989) described student-content interaction as "a defining characteristic of education”. Processing tasks like assignments and tests are examples of student-content interaction. This third type of interaction facilitates processing and internalization of information students encounter in learning. Student-content interaction results in improved understanding, changed perceptions and changes in cognitive structures of the mind of the learner (Moore, 1989).

In his theory of transactional distance (TD), Moore (1997, 2007) claims that in distance education the essential distance is a pedagogical one between teacher and learner and not a time- and space-dependent distance. Psychological and communication distance creates the transactional distance, which may lead to insufficient reciprocal understanding. According to Moore (2007) this distance needs to be reduced to facilitate learning. The key components to minimize transactional distance are dialogue between learners and teachers to support learning, flexibility of structure of the educational program (e.g. learning goals and meeting individual learning needs) and autonomy of the learner over the learning process. If dialogue, flexibility of structure and learner’s autonomy are decreasing, the transactional distance will increase.

Vaughan and Carlson (1992) and Jansen (2004) underline that structuring education improves study progress. Although this requirement is developed on basis of research on curricula, one could argue that structure supports learning in other learning activities as well.

Hrastinski (2007) emphasized the different purposes of asynchronous and synchronous communication. He concludes that synchronous communication supports a more intense interaction that stimulates personal participation and motivation, while asynchronous communication facilitates cognitive and reflective types of participation. Both forms of communication complement each other.

According to Merrill (2002) learning takes place when learners have to cope with real-world problems, when relevant previous experience is activated, when instruction demonstrates what has to be learned, when learners are required to apply new knowledge to solve problems, and when learners are encouraged to integrate new knowledge in their daily practice. This implies more learner control.

Clark and Mayer (2011) discern three domains of learner control (content sequencing, pacing and access to learning support). According to Clark and Mayer (2011) there is evidence that dynamic adaptive control on learning by experienced learners leads to better learning results than program control by the provider. Additionally, they conclude that learners should have pacing control and that navigational support has to be offered.

Roediger and Karpicke (2006) conclude that testing is a powerful way of improving memorization of learning content. In fact, tests enhance later retention more than additional study of the material. Moreover, feedback is

not a necessity to foster retentions. They conclude that self-tests, which can be done recurrently, can be used to improve retrieval of information. This phenomenon is known as the testing effect (Roediger & Karpicke 2006). This implies that tests not only can be used for assessment or explicit activation of prior knowledge, but also as a learning activity on its own.

Currently from the perspective of theories on distance education, the learning design of the dominant format of xMOOCs can be compared with the e-learning courses of the beginning of the 21st century:

- Fixed design with repeated activities.
- Focus on learner-content interaction and learner-learner interaction (not embedded in the curriculum of the course).
- Assessments with multiple-choice questions.
- Focus on instruction.
- No adaption of the content of the course is possible during runtime (for example based on the feedback of learners).

Thus our aim was to develop a new learning design for MOOCs, based on theories of distance education. A secondary goal was to attract a group of learners that did not participate in learning activities of the Open University of the Netherlands before.

DEVELOPMENT PROCESS

For the development of the online master classes we applied an iterative process that was oriented at principles of agile software development (see Beck et al. 2001). According to agile software development requirements can change during the development process in which 'business people' and developers collaborate together. Changes to the format are delivered frequently (e.g. in a timescale of a couple of weeks) while there is always a working solution in use.

Three teams worked together during the reflective development process. A technical development team has been responsible for delivery platform, technical functionalities and the design of the template, used for online master classes. A pedagogical development team has been responsible for the development of a pedagogical approach. The third team has been responsible for efficient process for the organization and realization of online master classes.

The first three online master classes were exploratory in nature: the pedagogical concept and the different technologies were explored and tested. After each run of an online master class we evaluated all its aspects: technically, content, format, experiences of learners, and the contribution of experts, moderator and session leader. Based on this qualitative assessment we proposed and implemented improvements. After the third online master class we used an online questionnaire for the learners to assess their opinions about the online master class. The results of these evaluations were used as one of the inputs for improvements of the design.

THE LEARNING DESIGN OF THE ONLINE MASTER CLASSES

The pedagogical development team developed the setup of the learning design of online master classes, based on distance education theory (described above). In doing so the pedagogical development team was confronted with an important design challenge: realizing a balance between flexibility and the three types of interaction. Flexibility and freedom of choice for learners on one hand, and coherent activities (like related instructions, interactions and processing tasks) for the benefit of learning on the other hand are correlated. Thus it is important to find the right balance for the target group of online master classes.

The setup of the learning design of the online master classes is presented in figure 1.

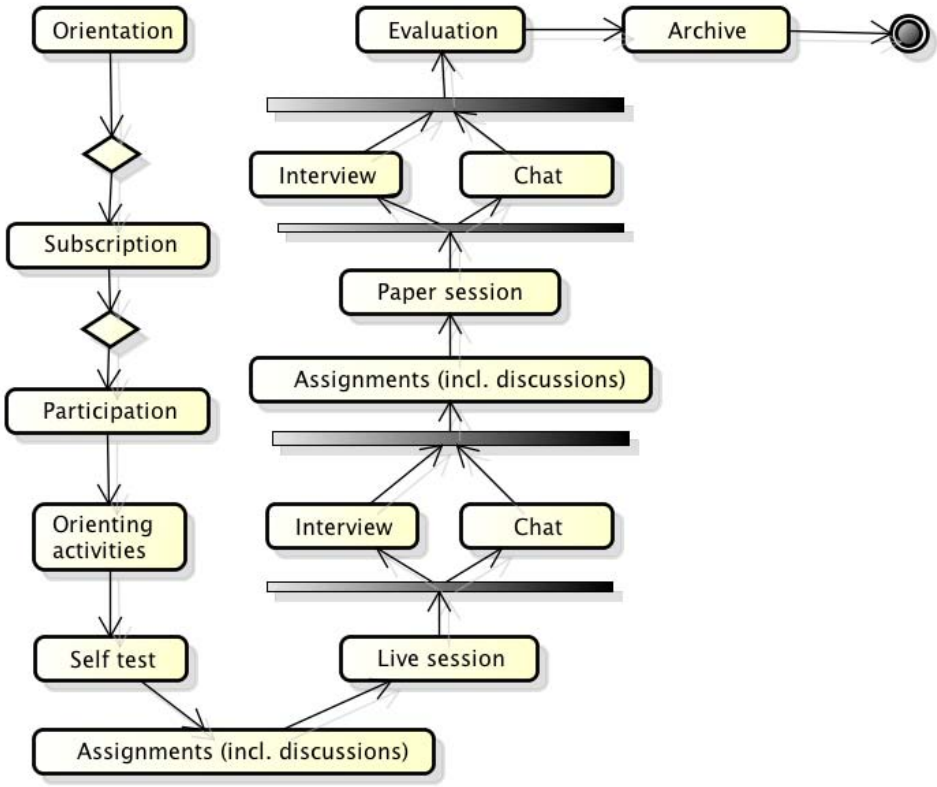

Figure 1: Activity diagram of the learning design of online master classes

In this figure the flow starts at ‘orientation’ and end with ‘archive’. In the first step learners orientate themselves on the content and procedure of the online master class. After enrolment, they are able to view additional information about the subscribed learners, and the preparatory learning activities. At the start of the online master class, the first additional learning activities are provided to the learners. They can access different learning activities each day. A variety of learning activities have been included into the learning design to stimulate active participation, like asynchronous and synchronous discussion and reflection. Learners are stimulated to demonstrate their knowledge in the group, apply the knowledge on challenging problems/cases, and are challenged to provide examples of the application of the knowledge in their practice. The first day is focused on orientation and activation of prior knowledge. An orientation test and self-test are used for these purposes. Moreover, the self-test is used for improving memorization of learning content. An asynchronous discussion in an available group-wall is used for orientation as well. During the second day learners are able to make assignments to deepen their theoretical insights on the topic of the online master class and to apply relevant theories in their daily practice. Learners study resources like articles and papers to conduct this assignment. An example of a theoretical assignment is: "Study the Horizon report on higher education. Choose one of the described six trends, and describe this trend using the presented theoretical framework of Sharples (page 17-21). Please focus on the level of the learning activity".

The third day is dedicated to the live session. The discussion assignments provide input for the live session. During a live session learners view a live stream video and have the possibility to use a chat. Learners make remarks or ask questions. Other learners can respond. A moderator (backstage) selects questions and submits these questions by a separate chat channel to the session leader. During the live session the session leader asks these questions to the expert, who responds.

When the live session is over, the recording and the chat discussion are made available for learners. Moreover, learners have the opportunity to continue working on the assignments of the first two days. At day 6 of the week-long format the paper presentation of the PhD students takes place to stimulate theoretical depth. Again, live video streaming in combination with the chat box is used. The online master class is concluded with an online evaluation.

FORMATIVE EVALUATION

The first three online master classes (October 2011-December 2011) were considered as a pilot and were not evaluated with a questionnaire.

Between January 2012 and March 2013 nineteen online master classes were organized, with a diverse set of topics. Twelve topics were related to the field of technology-enhanced learning (such as 'Tablet computers in education' or 'The future of the virtual learning environment'). The other seven subjects were related to learning sciences in general (e.g. 'Effective learning strategies' or 'Education for highly gifted students').
This section provides an overview of the learners, the user satisfaction and a list of pedagogical requirements that are the result of the formative evaluation.

Overview learners

Table 1 provides an overview about the total number of learners, the mean number of learners, the ratio between OU-employees, OU-students and external learners and the ratio between male and female learners. The number of learners ranged from 91 learners to 448 learners. Seventy one per cent of the learners did not take part in any educational activity of the organization previously. The gender ratio was balanced. Since we did not know in advance which target group would be attracted by the educational format we have also analysed the age range of learners as depicted in figure 2.

Table 1: Learner details online master classes

Total number of learners	Mean number of learners per online master class	Ratio OU-employees/OU-students/ External learners	Percentage Female/Male
2083	180	OU-employees: 6% OU-students: 23% External registered learners: 71%	Female: 54% Male: 44%

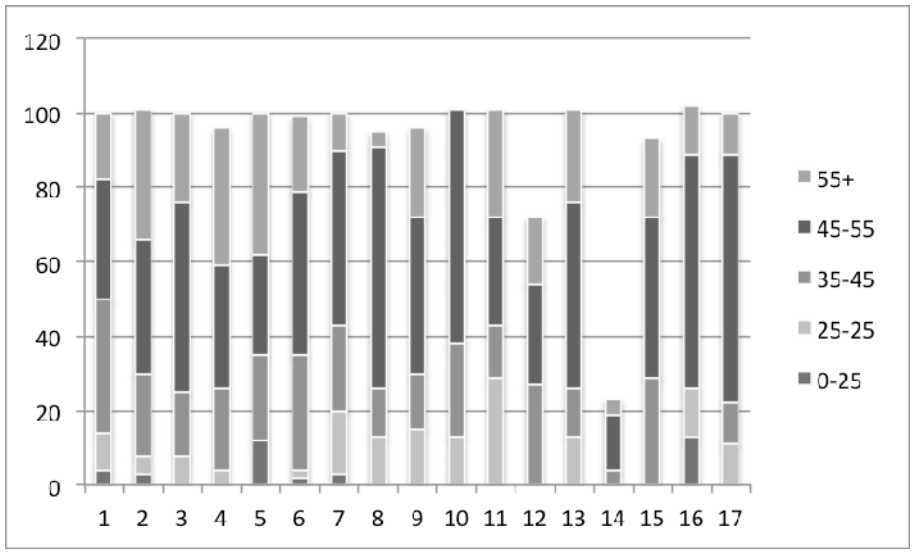

Figure 2: Age learners per online master class

In fourteen online master classes the largest group of learners was 45-55 years old. In some cases the largest group was older than 55 years. Hardly anyone younger than 25 years joined the online master classes. 89% of the learners were older than 35 years.

The majority of learners only visited one online master class (63 %). 17% attended two online master classes, while 11% participated in three online master classes. The rest of the learners visited four or more online master classes (1,7% of the learners joined 16 or more online master classes).

User satisfaction

In the evaluation of online master class 4-7 five questions were asked related to satisfaction (5-Point Likert scale). Table 2 presents an overview of these questions, including the scores (mean of the ratings of the four online master classes, range of standard deviation).

Table 2: Satisfaction master classes 4-7

	Mean	Range SD
The online master class has motivated me from the beginning to the end	3,01	0,9337-1,0787
The online master class has provided new insights	2,88	0,8771-1,1430
The online master class inspired me to do things differently	2,73	0,9258-1,1260
The online master class was useful time spent	3.31	0,9134-1,1364
The online master class inspired me to further thought	3,49	0,8732-1,1162

The learners were satisfied with three of four online master classes. One online master class received on every question a score lower than 3. A qualitative analysis of the open questions indicated that there were technical issues during the fifth online master class that might have influenced the score.

Moreover, the following open question was asked: Did you find the content of the online master class sufficiently practical or did you prefer a more scientific approach to the subject? The answers showed that learners had different expectations about the online master classes. An analysis of the response to this question showed that in general, there was a group of learners that did prefer a more scientific approach, while another group wanted to learn about practical guidelines. A third group believed that there was a sufficient balance between theory and practice.

In the evaluation of online master class 8-22 learners were asked to grade the online master class on an ordinal scale from 1-10. Table 3 presents the outcomes:

Table 3: User satisfaction online master classes nr. 8-22.

Online master class nr.	Mean	SD
08	6.87	1,01
09	7,32	1,03
10	6,85	1,26
11	7,00	0,66
12	6,65	1,58
13	6,60	1,23
14	7,10	1,18
15	7,57	0,53
16	7,50	0,55
17	7,86	0,69
18	6,87	0,78
19	6,20	1,09
20	5,75	2,63
21	7,00	1,15
22	7,50	0,52

Based on internal evaluations and user feedback it was concluded that online master classes should increase their scientific depth. Moreover, it was concluded that online master classes should have additional possibilities for activation of prior knowledge and enhancing retrieval of information. From the ninth online master class an online paper presentation by PHD-students was added. The intention of this online paper session was to provide learners, who were more interested in research and theory, the opportunity to gain more scientific insights. Furthermore, an orientation test was used to activate prior knowledge, while a self-test was used to improve retrieval of information.

Despite the changes in the learning design of the online master classes the satisfaction of learners stayed on a relatively high level. The learners positively reviewed all evaluated online master classes, except three. Five-point Likert scales were used to ask if learners expected to receive practical guidelines and to identify if learners expected to hear new theoretical views. The average scores of the first question ranged from 3,16 to 4,6 (SD: 0,53-1,72), while the average scores of the second question ranged from 3,78 to 4,91 (SD: 0,35-1,30). Learners still expect to receive practical guidelines and scientific insights in an online master class.

Pedagogical requirements

The following pedagogical requirements can be regarded as the backbone of a learning design for online master classes for professional development. They are the result of the application of theory on distance education (described previously), and the evaluation of the organized online master classes.

Table 4: Pedagogical requirements learning design online master classes

Nr.	Description requirement	How applied
1	Online master classes should provide learners with knowledge sources and learning activities that keeps them up-to-date in their profession.	The selection of subjects of online master classes is based on emerging educational research and trends. A variety of knowledge sources and learning activities are offered.
2	Online master classes should foster learner-control about the intensity of participation.	Learners are able to spend as much as time in the learning activities as they want. Learners have the flexibility to participate in learning activities. Except the live sessions learners can learn when they want. Recordings of live sessions can be viewed anytime.
3	Online master classes should foster learner-control about selecting learning activities they want to do.	Learners have the freedom to select in which learning activities they want to participate.
4	Online master classes should use the experience of learners as a starting point and input for learning. Learning activities and tools foster sharing experiences.	Learners are able to share their experiences in asynchronous discussions (based on assignments) and in the chat during the live session. Learning task should foster application in the context of learners.
5	Online master classes should have a reciprocal design. Experts are able to follow the learner to interactions between learners. If needed -for example in case of misconceptions- the expert will intervene and support the learners. Based on these interactions, the content of the online master class will be adapted.	Experts monitor interactions. They intervene to foster deep learning and to prevent misconceptions. The content of the live sessions is partly based on the asynchronous interactions preceded to the live session. After finishing the live session, the expert reviews and responds to questions that could not be answered during the live session.
6	Online master classes should foster the distinction between experts and non-experts. Non-experts should have the opportunity to interact with experts.	Experts provide live sessions and other learning activities. During live sessions learners are able to interact with experts by a moderated chat. Furthermore, learners interact with experts during asynchronous discussions.
7	Online master classes should stimulate retrieval of information and activation of prior knowledge.	An orientation test has been implemented to activate prior knowledge. A self-test has been implemented to stimulate retrieval of information.
8	Online master classes should foster learner-content interaction, learner-instructor interaction, and learner-learner interaction.	Assignments, the orientation test, the self-test are used for learner-content interaction. Asynchronous discussions and the live session are used for learner-instructor interaction. Learner-learner interaction is facilitated in asynchronous discussions and during the live session.
9	Online master classes should stimulate active participation.	Assignments are used to stimulate active participation.
10	Online master classes should stimulate learners to apply what they have learned, and to integrate the new knowledge in their daily practice.	Assignments are used to foster application of new knowledge.
11	Online master classes should have synchronous sessions that foster the involvement and	The format of online live sessions was an interview. An interviewer interviewed an expert. Questions by learners

	motivation of the learners.	in a moderated chat were used as input for the interview. A live session lasts one hour. The alternation between speaker, interviewer and learners fostered the involvement and motivation of the learners.
12	Online master classes should have an explicit structure of learning activities that are conducted during a defined amount of time.	An explicit structure of learning activities, with a turn-around time of a week, had been applied to stimulate participation. Learners could decide when and how intense they wanted to learn, within the framework of this structure.
13	Online master classes should foster learners to increase scientific depth.	Adding an online paper presentation by PhD-students to the learning design of the online master classes enhanced the balance between the theoretical background and practice-related knowledge. The intention of this online paper session was to provide learners, who were more interested in research and theory, the opportunity to gain more scientific insights. During a separate live session two PhD-students gave a fifteen minutes-presentation about a research paper on the subject of the online master class. At the end of the presentation the PhD-students answered several questions that were asked by learners in the chat. As a consequence student-student and student-instructor interaction were enhanced.

DISCUSSION

This article has described the development of an adequate learning design for MOOCs. Based on theory and experiences we formulated 13 pedagogical requirements that have guided the iterative development of the learning design in the various runs. This educational format did attract a group of learners that previously did not participate in learning activities of the Open University. Seventy one per cent of the learners in online master classes were no employees or current students of our university, and 89% of the learners were older than 35 years.

An important design challenge was to find a balance between flexibility and the three forms of interaction. Our assumption was that, the option to be able to choose the amount of time spent for the new format would contribute to satisfaction of learners. In general, this assumption can be confirmed. The explicit breakdown of the learning activities in a turn-around time of one week led to more structure. Nevertheless, the use of more structure restricts flexibility, while flexibility is seen as an important characteristic of a learning design for distance education. Moreover, more options for interaction might suggest an increased workload for learners. Although learners still are able to decide what they want to learn and how much time they want to invest, the changed structure and possibilities for interaction may indicate that the flexibility to learn 'just in time' and 'just enough' has declined. In addition, synchronous sessions limit the possibility to learn whenever learners want although they can view the recordings in their own time.

With exception of three online master classes, the user satisfaction is positive and stable. The positive and stable user satisfaction can be interpreted as an indication for the learners' appreciation of the learning design, including the pedagogical requirements. Arguably, an explanation is that the balance between easy accessible participation and flexibility for learners and consistent learning activities (including interactions) has been realized. However, user satisfaction is influenced by more factors than the learning design.

The educational format of online master classes complies with important pedagogical principles described in the theory. Arguably, this result combined with the enrolment of hundreds of learners and user satisfaction nourishes the conclusion that online master classes are an appropriate format for distance education for adult learners.

Currently, the learning design of the dominant format of MOOCs (cMOOCs and xMOOCs) is not based on pedagogical principles of distance education for adult learners. Since online master classes have similar characteristics as a MOOC, application of the pedagogical requirements and the learning design of online master classes will improve the learning design of the dominant format of MOOCs and will enhanced the design towards the diverse group of learners that is participating in these open courses. For example live sessions, instead of pre-recorded videos, will enhance learner-instructor interaction. However, the question is if live sessions will foster learner-instructor interaction if thousands of learners participate in these sessions. Such a

large amount of concurrent users would be lead to an unmanageable tsunami of interactions. However, it is questionable if MOOCs are an effective format for distance education when meaningful learner-instructor interactions are impossible to have. While some of the experiences from designing the format of online master classes can inform the design of Massive Open Online Courses, some aspects of the design might have a more limited transferability. A turnaround time of a week was consciously chosen to offer professionals an opportunity to plan and manage their learning activities in a reasonable amount of time. In a classical higher education context these turnaround times could be much longer.

CONCLUSIONS AND FUTURE WORK

We have developed an adequate learning design for MOOCs that is attractive for new groups of learners. The online, accessible and flexible characteristics of the format, combined with expert knowledge and interaction possibilities, provide opportunities for large groups of professionals to keep up with their discipline while the pedagogical requirements and the learning design fit with the characteristics based on distance education theories. Different forms of interaction have been used in the online master classes: synchronous (chat), asynchronous (especially online forums and group-walls), among learners, with content and with instructors/experts. Research underlines the importance of these interactions from the perspective of learning. The developed learning design and pedagogical requirements will lead to stronger design for MOOCs, compared to the current designs. This format is less open and unstructured than the design of the cMOOC format that attracts self-directed learners with high media literacy. Furthermore, the developed learning design and pedagogical requirements will lead to a more learner-controlled and interactive design than the classical lecture oriented xMOOC format (Kalz & Specht, 2013).

However, there are still plenty of questions left for future research. Further improvements and especially further evaluations of the learning design are needed. The user evaluation is now restricted towards satisfaction. This is informative, but not sufficient to access the real fit with the learners needs. Obviously, satisfaction is not an indicator of learning results or improvement of performance. These effects are not evaluated, while they could have an impact on the learning design of online master classes.

Finally, it should be investigated more thoroughly if the learning design of the online master classes is applicable on large-scale courses with thousands of learners. The question is if there is a maximum to the amount of learners that can participate in a MOOC that fosters meaningful learner-instructor interaction.

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INCIDENTAL FOREIGN-LANGUAGE ACQUISITION BY CHILDREN WATCHING SUBTITLED TELEVISION PROGRAMS

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ABSTRACT
Series of international studies have shown that subtitled television programs provide a rich context for foreign language acquisition. This study investigated whether incidental language acquisition occurs from watching a television program with / without subtitles. Children in the experimental conditions watch: (a) a 15 minute snapshot of a well known children's television program in Italian with Greek subtitles, (b) the same program without subtitles and (c) the TV program in Greek (control). The acquisition of vocabulary and the recognition of Italian words were higher in the condition with the subtitles, thus indicating that Greek students of fourth, fifth and sixth grade can incidentally acquire vocabulary in a foreign language through watching subtitled television programs.

KEYWORDS: Incidental language acquisition, Subtitled programs, TV, Italian.

1. INTRODUCTION

Individuals acquire mother tongue naturally, without systematic instruction in a relatively short period of time which spans basically the first five years of his life. In the case of learning a second or foreign language, research confirms that according to the Psychology of Learning a language is acquired from a person mainly through linguistic stimuli provided by the environment [Τριάρχη-Hermann (2000)]. As for the growth and development of children's vocabulary in both mother and foreign language, of great importance is the extensive contact with rich and natural language, as the wider meaning of a word cannot be fully understood unless the word occurs in varied semantic and syntactical contexts [Koolstra & Beentjes (1999)].

Media technologies such as video, audio and computer software, have found more and more their way to foreign language classes, and several studies [Danan (1992); (2004) among others] have certified their value as language learning material [Kuppens (2010)]. Television for example is for speakers (the word speaker is also used with the meaning "those who learn a foreign language,") a valuable source of auditory stimuli in a foreign language, (L2). Research has shown that watching television programs in a foreign language, (L2) can facilitate L2 vocabulary incidental learning. In small language communities, a significant number of television programs are subtitled which creates the opportunity for vocabulary acquisition both in mother tongue and in foreign languages. In many countries, television is a part of children's everyday life from the age of 2 to 7 years, which watch various programs on a daily basis. It is also a leading source of information and acquiring new knowledge for adults as well.

2. SUBTITLED TELEVISION PROGRAMS

Watching television has become a common way of receiving information from all over the world, and ranks high in the preference of children as a source of new knowledge. Drotner (2001) [as cited in Kuppens, (2010)] states that in many western countries English language television programs, movies and music are a considerable part of what the youth monitors in the Media. Moreover, with the availability of programs in many countries one can watch television programs in languages other than their mother tongue. In small European countries like the Netherlands, Belgium (and Greece), foreign television programs are mainly subtitled [Koolstra & Beentjes (1999)].

When a program is subtitled one can hear the original soundtrack while the subtitles in the target language are displayed at the bottom of the screen, whereas when dubbed the original soundtrack is replaced by voices in the target of actors in the target language of the audience. As Koolstra & Beentjes (1999) highlight the most important reason why subtitling is preferred to dubbing in smaller countries is that subtitling is much cheaper that other techniques. As estimated by Luyken et al. (1991) [as cited in Koolstra & Beentjes (1999)] the average cost for dubbing one-hour program is 15 times more than the average cost for subtitling an hour of the same program which means that subtitling is 15 times cheaper than dubbing.

From an aesthetic point of view, an advantage of subtitling is that it maintains the original voices of the actors. A disadvantage however is that it can distract the viewer from watching the actual pictures [Koolstra & Beentjes

(1999)]. In relation to language acquisition, subtitles are accused of encouraging viewers to rely on written text, distracting them from the spoken language, and even that encourage a form of laziness [Kuppens (2010)]. However, as suggested by the present paper, in the case of young students in non-educational settings, they can learn more through watching subtitled television programs rather than watching non-subtitled programs.

An important advantage of subtitling in comparison to dubbing is that learning is likely to occur. With subtitled programs there are at least three different input channels: visual image, the soundtrack (including foreign voices) and subtitles. This multisensory presentation of information motivates viewers to understand what is said and shown on television.

About fifteen years ago Koolstra & Beentjes, (1999) conducted a panel study on television's effects on children's reading skills. The study, which 828 primary school children were followed during three years, showed that the reading of subtitles on television may enhance the development of children's decoding skills, because, as the writers point out, reading subtitles provides extensive practice in decoding words.

The primary question about learning is what is it that makes us have the natural tendency to seek knowledge and to differentiate our behavior? Perhaps, most admissible point of view is that what motivates the person in order to learn is the need to adapt to the environment in order to survive (homeostasis). However, apart from homeostatic motives, there are others that do not relate directly with the need for survival, but also with human nature (e.g. curiosity).

A second possible learning effect of subtitled TV is the acquisition of a foreign language so there is expectation that subtitled television programs may contribute to learning words in a foreign language. We think it seems reasonable since vocabulary learning in such a condition occurs not because the learner is trying to learn words but because the learner is trying to understand what is being said, sung or written on the television screen. Furthermore, the meaning of words is not given but perceived by the context in which they are presented. Rapaport (2000) defines Contextual Vocabulary Acquisition, (CVA) "*as the active, deliberate, acquisition of a meaning for a word in a text by reasoning from context*". Rapaport continues explaining that it is the process that can be used by a reader to figure out a meaning for an unfamiliar word as it occurs in a passage being read. It is what you do when coming across such a word in your reading. As you realize you don't know the meaning of the word and you need to know it in order to understand the passage, you can try to figure out its meaning from the context, i.e., from clues in the co-text together with your prior knowledge (PK).

In his study, Rapaport (2000) focuses only on CVA during reading. However, he underlines that CVA can presumably be used in situations that do not necessarily include text and reading (non-reading, non-textual situations) like for example in ordinary conversations, or when watching TV programs. Besides the fact that firstly context always *determines* the meaning of a word, it does not always *reveal* it [Deighton (1959) cited in Rapaport (2000)] and secondly subtitles don't always provide accurate translations of the original script, as limitations of space and time generally reduce the rate of speech can be represented in subtitles [Rapaport (2000)], however, several experiments have shown that watching foreign language television programs, subtitled (or not), positively affect the ability for foreign language acquisition of children and adolescents [Van Lommel et al (2006) among others].

In a study which examines the vocabulary in 88 television programs, Webb & Rodgers (2009a) report that the understanding of television programs may be easier than understanding the written text or conversation, because the vocabulary "sounds" in television programs is supported by the visual input. On the other hand, in a study which examines the effects of visual stimulus in understanding television news stories in a foreign language, (L2) found that in some parts of a television program visual stimulus may not have any effect on the comprehension or even prevent it [Gruba (2004)]. Learning a foreign language is more effective when it happens in an authentic communicative environment where speakers are exposed to authentic language stimuli that are understandable and attractive. With authentic texts students get a complete picture of the use of words in their natural environment, because such texts show not only grammatically incorrect word usage but also their proper use, according to each communicative circumstance.

Monitoring subtitled Italian television programs may therefore lead to different types of language acquisition since when a student learns the language through realistic situations he/she has to face grammatical phenomena and new vocabulary. Advertisement texts for example are suitable for understanding and learning imperative and subjunctive occlusion. Moreover, apart from the word meanings, one may learn the meaning of expressions or standard sentences (e.g. "Ciao amico!") and in which circumstances these sentences can be used. In addition, as

Koolstra & Beentjes (1999) highlight, there may also be improvement in the ability of the viewer to discern separate words in the flow of spoken language, pronunciation of words, and improve the ability to correct proposals. Finally, viewers can learn to distinguish different accents and different forms of speech (e.g. formal, slang etc.). In the present study we focus on vocabulary acquisition.

3. RESEARCH ON FOREIGN LANGUAGE ACQUISITION THROUGH WATCHING SUBTITLED TELEVISION PROGRAMS

The notion that children's and adults' ability to learn a foreign language is stimulated through watching subtitled television programs is well established. Many studies on the incidental acquisition of a foreign language from the popular media have focused on television programs and have shown that monitoring enhances L2 vocabulary incidental acquisition. Decades ago, Elley (1989) says that children maintain knowledge of the new words they listen in the stories they are read to. In two experiments, primary teachers in New Zealand read stories aloud to children of their class, and through pre-test and post-test measured the extent of children's new vocabulary acquisition through listening to stories.. The results showed that the oral reading of a story is an important source of vocabulary acquisition either reading is accompanied by an explanation of the teacher of the meaning of the words or not.

Also, Koolstra & Beentjes (1999) report that students learned incidentally the meaning of words through academic reading without the explicit intention to learn words. On the other hand Vidal (2003) investigated vocabulary acquisition through academic listening and showed that vocabulary knowledge of students after listening to the lecture was greater than it was before the lecture. These studies have shown that people who learn a second language, (L2) can achieve a small but significant vocabulary acquisition through comprehension - focused listening [Horst (2010)].

In their study Brown et. al (2008) compared incidental vocabulary acquisition from stories read in three different experimental conditions: only read, read while listening to the text, and only heard . The performance in terms of the knowledge of words showed the third condition as the least effective, the acquisition proved to be very small and prone to be lost over time. A series of surveys that attempt to measure incidental acquisition of a foreign language that results from watching subtitled television programs in non-educational conditions [d'Ydewalle et. al (1989); (1995); (1997); Pavakanun et. al (1992); d'Ydewalle et. al (1999) among others] show that there is undoubtedly significant incidental language acquisition simply by watching a short subtitled TV program. In the corresponding Dutch experiment [Koolstra & Beentjes (1999)] children who watched the subtitled version fared significantly better than those who watched the non-subtitled version, whereas control group scored last. Also, older children fared better than the smaller.

4. THE PRESENT STUDY

Whether elementary school children may incidentally acquire elements of a foreign language through watching subtitled foreign television programs in a non-educational setting has been studied less than other age groups internationally. In Greece such studies are still very limited.

The present study is an extension of international experiments subtitling but differentiates from them in its most characteristics (language, age, television program, etc.), it explores the short-term effect of an Italian television program, subtitled and non-subtitled, on the incidental language acquisition of children aged between 9-12 years. The content of the chosen program presents understandable material (comprehensible input) [Krashen (1985)], which means it does not exceed the perceptual ability of the students. Moreover, in the selected program the pronounced language, is clear, understandable Italian. For the purposes of the study is followed the distinction between acquisition and learning. The first is unconscious, incidental, randomly done, without systematic guidance-teaching and in non-educational conditions (for example in the living room of the house watching TV). The second is conscious, intentional, resulted from systematic -instruction and occurs in educational settings (ie an organized learning environment). With Italian children are acquainted for the first time.

In Greece, students are acquainted with foreign language testing in Grade 3 as foreign language lessons in school (English) start in grade 3. Therefore the difference between the three age groups of the sample lies in the familiarity they have with a foreign language in general and the foreign language testing as well (Test: Vocabulary target word recognition, etc.).

4.1 Research Questions

Simultaneous viewing of the subtitles and listening to the soundtrack may be a factor in language acquisition. [D'Ydewalle & Van de Poel, (1999)]. Since both subtitles (in Greek) and sound track (in Italian) are processed

almost at the same time, there may be language acquisition in such context. Subtitles contribute to a richer context in which children may learn Italian words provided that they are able to distinguish the words spoken in the program. Subtitles are not only read mandatorily, but are also processed in detail and remembered quite well [Gielen (1988) as cited in [D'Ydewalle & Van de Poel, (1999)].

Research Question 1: Greek elementary school students, aged 9-12 years, can learn incidentally Italian words from a subtitled Italian-spoken television program.

We assumed that subtitled television programs provide a rich context from which children learn Italian words, so we attempted to answer a secondary hypothesis that the subtitles do *not* distract children during program monitoring thus undermining their understanding.

Also, there is the expectation that older children compared to younger, can learn more Italian words from the subtitled Italian program.

Research Question 2: Greek fifth and sixth graders can learn more Italian words from a subtitled Italian-spoken television program than do Greek fourth graders.

4.2 Design

The present organized intervention is a quasi experimental research modeled on "action research" and was conducted during school year 2010 to 2011. There were three different age groups included in the study, fourth, fifth and sixth graders. From age 8 on, children read subtitles in a similar way as adults [d'Ydewalle & Van Rensbergen (1989) as cited in D'Ydewalle & Van de Poel (1999)]. Participants were between 9-12 years old and were randomly assigned to experimental groups.

One could argue that experimental design with random assignments of students to treatment and control groups would make our findings more generalizable from the point of randomization of individual differences. However, fully randomized experimental designs often lack ecological validity due to the inauthentic environments in which studies are carried out (Snow cited in Borg & Gall, 1989). Because the intention of this study was to provide findings that are closer to authentic condition of watching TV at home, the author selected the design described here.

Table 1. Experimental Design

Grade	Experimental Group 1 Condition 1 (Subtitles)	Experimental Group 2 Condition 2 (No Subtitles)	Control Group Control Condition (Greek)	Total
Grade 6	11 (7g+4b)	12 (7g+5b)	11 (7g+4b)	35 (21g+13b)
Grade 5	8 (5g+3b)	7 (5g+2b)	8 (5g+3b)	23 (15g+8b)
Grade 4	12 (6g+6b)	12 (6g+6b)	12 (6g+6b)	35 (18g+18b)
Total	31 (18g+13b)	31 (18g+13b)	31 (18g+13b)	93 (55g+39b)

4.3 Material

The television program in the three conditions was a 15-minute cartoon in Italian which can entertain the children-students but can also motivate better than anything else.

Italian vocabulary matching test: The acquisition of Italian vocabulary was assessed by means of a multiple choice test asking for the Greek translation of 35 Italian target words that were used in the program. Each of the Italian target words was spoken at least four times in the program whereas its translation was displayed in the subtitles. According to Anderson & Lorch (1983) [cited in d'Ydewalle & Van de Poel (1999)] children generally pay more attention to the female voice therefore the test was presented to the children by playing an audio file on which the words were spoken by an Italian native speaker. Children were required to choose the correct Greek translation of the Italian word choosing from the three written alternatives. All alternatives given were words that appeared in the subtitles, as much as possible, with equal frequency.

Word recognition: Again test was presented to the children by playing an audio file on which the words were spoken by an Italian native speaker. Participants were asked to identify whether the Italian words heard from the audio file were spoken in the Italian television program as well, answering Yes or No accordingly. The word recognition test consisted of 30 Italian target words of which 20 were heard in the program and the other 10 were not heard at all. The words not used in the program were chosen as if they could have been used in the program. The word *nave* (ship) or *fiore* (flower) were not used in the soundtrack, but flowers and a ship were shown in the film footage.

4.4 Procedure

In the experiment, within each condition children participated in groups of seven to twelve students in vacant rooms of their school building. The students in experimental group 1 (Condition 1) watched the Italian television program with subtitles, in experimental group 2 (Condition 2) student watched the program without subtitles and control group (control condition) they watched the same program in Greek. The program last 15 minutes and was projected twice successively in all three conditions. Immediately after the end of the screening there followed the assessment of the acquisition of the Italian words resulting from monitoring the program. As for the instructions given to the children, we prepared a series of simple, instructions, which included a clear description of what they had to do. Children were explained that the activity concerns the way children watch TV, that the test does not concern their lesson and that there is no score. Children were encouraged to answer all questions and not to be intimidated to answer even those that they were not sure of the correct answer.

The Condition, Class and Gender are the independent variables whose values were encoded. The control of the statistical significance of differences in the averages among the three groups of the intervention was done by analysis of variance. The analysis is per-score, per scale (where score_1, score_2 are the dependent variables. Dependent variable (score_final) was measured by the total of score_1 in vocabulary acquisition and score_2 recognition of Italian target words). The three scales were analyzed and discussed with three factors: Conditions, Class and Gender as fixed independent variables. With the Full factorial model were controlled the main effects and interactions of all possible combinations of the independent variables.

5. RESULTS-DISCUSSION-CONCLUSION

The purpose of this intervention was to explore the short term effects on incidental language acquisition of children aged 9 to 12 years of age through watching an Italian television program, subtitled or not. Overall, it appears that we have evidence of language acquisition in both experimental conditions. The results (estimated in the context of quasi-experimental design) confirm the corresponding research hypotheses and highlight the positive correlation between monitoring the Italian television program, language acquisition, vocabulary acquisition and Grade.

In accordance with Research Question 1, children of Experimental 1 achieved higher vocabulary acquisition M = 25.58, than the children of Experimental 2 M = 22.39 who fared better than the children of Control Condition M = 19.65. The effect of the Condition was found statistically significant p = 0,000 in overall incidental language acquisition and vocabulary acquisition. The overall incidental language acquisition is higher in the condition with the subtitles, followed by the Condition 2 without subtitles and finally the Control Condition. Therefore, we can conclude that the information on the story that takes place in the Italian subtitled television program which consist of a) the Italian target words that are heard in the program, b) their Greek translation that can be read in the subtitles, and c) the importance of words supported by visual images on the television program, provide a framework from which Greek students can "catch" the importance of some of the Italian target words.

In addition, findings do not indicated that subtitles distract the attention of children. The Research Question 2 is also verified as the older children had greater overall language acquisition than what the younger ones. The effect of the Grade-age on vocabulary acquisition and overall language acquisition was statistically significant (p = 0,004, p = 0,001 respectively). It does not though appear to have any statistically significant effect on vocabulary recognition (p = 0,144). This means that language acquisition coincides here with vocabulary acquisition. The older children learned more words from the program than the younger ones and overall had greater language acquisition.

Neuman & Koskinen (1992) [cited in Koolstra & Beentjes (1999)] report that the ability of children to acquire vocabulary within a context is affected by the level of their linguistic competence. The averages of the scores in the control test were higher for students of 5th '(M = 41.87) and 6th (M = 42.62) than it was for students of the 4th (M = 39.44), which does support the hypothesis that older children benefit more from the context of spoken language in the Italian television program compared to the younger and achieve greater language acquisition.

Overall there was not indicated any systematic correlation between Gender and Condition. The t-test of independent samples was not significant for any of the three scales indicating that neither girls excel boys, nor vice versa.

Language acquisition of a foreign language is stimulated by monitoring subtitled or not television programs. In real life, Greek students spend enough time watching television programs which means that they come in contact daily with a foreign language (mainly English) . According to Webb & Rodgers (2009a) if speakers regularly watched TV, this could have a significant effect on the amount of vocabulary acquired. Therefore, the effect of watching subtitled television programs at home could well be stronger and cumulative. Research has also shown that increasing the number of times a word appears in a context (e.g. a television program) increases the possibility for vocabulary acquisition [Webb (2010)]. However, learning a foreign language cannot of course be limited in passive knowledge.

Speakers of a language may be particularly motivated to watch TV programs and movies for learning. Gieve and Clark (2005) found that television viewing was the second most common way used by European speakers as a strategic self-directed learning of a foreign language and the fourth most common way used by speakers of Chinese language [Webb (2010)]. However, can these findings support the (further) introduction of television and subtitled television programs in the foreign language classroom? The greatest benefit of using subtitled television programs for guided language learning is that they entertain children-students and motivate better than anything else so students put more effort to understand the teaching material. Nevertheless, in relation with the conclusions of this study, the fact that children acquire incidentally elements in Italian language from a subtitled Italian television program, should not automatically lead to the conclusion that generally subtitled television programs are therefore a more efficient means for guided language learning and one has to be careful in transferring conclusions of a study of incidental language acquisition in situations of guided language learning.

Nouns, are the simplest structural units in a language, therefore it is not surprising that the first indications of language acquisition found in vocabulary test. In the present study the exclusive evidence of language acquisition is the acquisition of Italian words, by children through watching the program. As shown in the results, Class and Gender have no significant effect on vocabulary recognition $p = 0,466$, $p = 0,144$ respectively. This means that it is not verified that children in Condition 2 pay more attention to the spoken words in the program than the children in Condition 1 and neither is verified the assumption that subtitles can be distracting to children. Therefore we can conclude that the simultaneous monitoring of the subtitles and the language of the program is a factor that favors language acquisition of a foreign language.

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INTEGRATION OF WEB 2.0 TOOLS IN LEARNING A PROGRAMMING COURSE

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ABSTRACT
Web 2.0 tools are expected to assist students to acquire knowledge effectively in their university environment. However, the lack of effort from lecturers in planning the learning process can make it difficult for the students to optimize their learning experiences. The aim of this paper is to integrate Web 2.0 tools with learning strategy in order to enhance the motivation of the students to use the Web 2.0 tools. The integration of the tools in learning a programing course is based on PQR strategy, which includes three components: Preview, Questions and Reflect. The study sample consisted of 39 undergraduate students for identifying their preference towards the use of Web 2.0 tools which include Blog, Youtube, Google Form and Padlet. The results show that the perception of students towards the use web 2.0 tools was positive. Hence, it was possible to integrate a learning strategy with specific Web 2.0 tools, and, thus, facilitate blended learning.

KEYWORDS: Web 2.0 tools, teaching and learning, programming course

INTRODUCTION

Collaboration, social-networking, as well as knowledge generation and sharing have been identified as the key learning technology trends that will reshape the education worldwide (Brown & Adler, 2008; Hargadon, 2008). Higher education is undergoing a major transformation enabled by Information Technology (IT), such as Web 2.0 tools, which support the key learning trends (Grosseck, 2009). Moreover, Web 2.0 tools provide on-demand applications for students in retrieving and sharing knowledge in a distributed environment. This supports the need for a new approach, as suggested by Brown and Adler (2008) who explained:

"We now need a new approach to learning – one characterized by a *demand-pull* rather than the traditional *supply-push* mode of building up an inventory of knowledge in students' heads".

Students treat everything offered by Web 2.0 tools as a service. In fact, this is a concept of cloud computing where applications reside in the cloud (O'Reilly, 2008). Google docs spreadsheets are a cloud application (O'Reilly, 2008) where students from different locations can co-edit the same document simultaneously (Qiyun & Huay Lit, 2009). Moreover, students can share knowledge, give comments, support ideas or retrieve new knowledge whilst networking with their friends at the same time by using a prominent example of social networking services, Facebook (Uzunboylu, Bicen, & Cavus, 2011). Thus, integrating Web 2.0 tools for higher education offers many advantages, as stated by Grosseck (2009), which include: easier and faster access to information, when and where it is needed; sharing accumulated experiences and resources; and compatibility with the elements of the educational field and the existing contextual dynamics.

More and more higher education institutions are taking advantage of Web 2.0 tools, including the University of Leeds, University of Brighton and University of Edinburgh. In the University of Warwick, for example, blogs are being widely used with 4,540 blogs that have changed the social context for students in this university (Franklin & Van Harmelen, 2007). One of the leading universities in Malaysia, Universiti Kebangsaan Malaysia (UKM), is also moving towards implementing the use of Web 2.0 in teaching and learning. Training has been given to the interested staff about Web 2.0, for example, Web 2.0 workshop series concerning presentation tools, content creation tools, research tools, survey/voting tools and collaborative tools. In fact, an e-book entitled 'Web 2.0 Research Tools: A Quick Guide' has been published online by the co-director of the Academic Development Centre in UKM. This e-book is accessible for free at http://www.scribd.com/doc/95039625. This situation, together with the recent progress in many higher institutions, has shown the role of Web 2.0 tools in transforming the teaching and learning environment into a new era.

In the transformation, however, the best way to leverage the use of Web 2.0 tools needs to be found in order to optimize the teaching and learning activity. Since the teaching approaches of the lecturer can influence the attitude of their students, which are now mostly from digital natives (Margaryan, Littlejohn, & Vojt, 2011), some frameworks based on the Web 2.0 learning design have been developed in order to promote more confidence in learning using Web 2.0 tools. Bower et al. (2010), for example, provide a comprehensive list that categorizes the Web 2.0 tools into knowledge types, pedagogies, modalities and synchronicities. In addition, Grosseck (2009) provides a table for integrating Web 2.0 technologies in educational applications in higher education. However, there is still a lack of research that integrates the Web 2.0 tools into the teaching and learning strategy,

particularly in computer science courses. Therefore, the objective of this research is to integrate the Web 2.0 tools with learning strategy in a programming course in a higher education institution, UKM. A blog was used to integrate various education resources from different web 2.0 tools. A questionnaire was given to 39 programming students in order to assess the preference of students towards the use of web 2.0 tools in their learning.

LITERATURE REVIEW

A variety of strategies that integrate Web 2.0 tools in the teaching-learning environment can be found in the literature in this twenty-first century. The movement from conventional teaching methods (supply-pull mode) to service-oriented teaching methods (demand-pull mode) has been inspired by the use of cloud computing applications: Web 2.0 tools. Inspired by the definition of cloud computing by the National Institute of Standards and Technology (NIST)(Mell & Grance, 2009) and cloud manufacturing by Xu (2012), cloud education may be defined as *a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable education resources (e.g., education software tools, education contents and education support) that can be mapped with Web 2.0 tools, and teaching and learning strategy.* In order to develop a teaching plan using web 2.0 tools, three factors should be under considerations. These factors are:

1. Education resources - what resources are used in the learning system using Web 2.0 tools?
2. Strategy selection layer - which learning strategy is selected for planning the teaching and
3. Implementation layer - how frequently can the lecturer monitor the learning process and how is the interaction between lecturers and students during the process?

Education resources layer

The key function of this layer is to identify the education resources required for learning development. The identification of the resources is not only based on the permanent need of the subjects, but also the changing needs of the students. The education contents used in this layer may have been created from information based on the syllabus and course materials, e.g., web (scribd, slideshare), documents (pdf, words), presentation (.ppt), accumulated experiences, pictures and videos. In an object-oriented programming course in UKM, for example, contents in the form of presentation slides is the main content source to cater to the permanent need of the subject. Meanwhile, the changing needs can be catered using other sources of contents, such as discussion, videos and blogs on the web.

Strategy selection layer

The main function of this layer is to select a strategy that is suitable for understanding the course materials using all the identified contents in the education resources layer. In the programming course, the course materials are in a presentation format developed using Microsoft Power Point where most of the contents are presented in text. Many strategies have been developed in order to improve learning from text. Kombartzky et al. (2010) listed some examples including the MURDER-Strategy (Mood, Understanding, Recalling, Digesting, Expanding, Reviewing; Dansereau et al., 1979) and the PQ4R-Strategy (Preview, Question, Read, Reflect, Recite, Review; Thomas & Robinson, 1972). In this paper, a strategy based on PQ4R was used because it can be expanded to not only text, but also other forms of contents. However, the strategy was slightly modified by using only one R, Reflect, instead of 4R in order to use the Web 2.0 tools in a suitable way.

Implementation layer

The key function of this layer is to implement the integration of Web 2.0 tools in learning and teaching. There are three levels of frequency of use in this layer – pre, during and post lecture. In this paper, the interaction between Lecturer-Student happens throughout the framework where the lecturer usually initiates the interaction. For example, for each new chapter, the lecturer provides the intention of each new lesson on a blog page, embeds a video on the blog page for preview and posts a question on a wall and blog before the lecture. The lecturer then uploads the materials for the new chapter in a learning management system and the contents of the new chapter are usually discussed during the lecture. Finally, in order to reflect on their lesson after the class, the lecturer posts information and questions about the new topic on the blog page using Google form.

CASE STUDY

A blog was designed as shown in Figure 1 to integrate various web 2.0 tools to engage students' attention in learning complex materials in a programming course. The integration of Web 2.0 tools was implemented as below:

- Platform- Blog
  A blog entitled Object-oriented programming was created where selected web 2.0 tools were integrated on the blog page (Figure 1).
- Preview – YouTube embedded in Blog

Videos from YouTube were embedded in the blog for students to view before the class (Figure 2).

- Questions – Padlet embedded in Blog
  A wall was created using Padlet so that students can post questions before the class (Figure 3).
- Reflect – Google form embedded in Blog
  An exercise based on a specific topic was created using Google form. Students can reflect their understanding using this exercise after class (Figure 4).

Participants

The study sample consisted of 39 undergraduate students who enrolled for subject OOP from the Information Science programme and Multimedia programme. These students were assumed to have the ability to use Web 2.0 tools because they were doing an information technology course in UKM. In fact, they were second-year students.

Instruments

Data was collected from a questionnaire entitled *The integration of Web 2.0 tools in teaching and learning in object-oriented programming course.* This questionnaire uses a 7 point scale from strongly disagree to strongly agree. Questionnaires were completed by the students in the last week of the semester.

Data analysis

Each student completed the questionnaire that was uploaded online. Analysis of the questionnaire was done by using descriptive statistics.

RESULTS AND DISCUSSION

Table 1's two rightmost columns display descriptive statistics for each item that describe the preference of the students towards the use of web 2.0 tools. The highest mean scores were yielded by item 11 with min 5.36 and frequency of students selected scale 5, 6 and 7 was 29 out of 39. The lowest mean value was obtained by item number 1 with min 4.56 and frequency of students selected scale 5, 6 and 7 was 19 out of 39. Overall, min for every item ranged from 4.56 - 5.36. These results indicate that students were moderately favoured the use of web 2.0 tools in learning the course.

Table 1: Survey statements and the received responses

No	Statement Total response for	Frequency (scale 5-7)	Mean
1	I like to watch related videos on YouTube suggested by lecturers before class	19	4.56
2	Questions posted by the lecturer in the discussion through padlets before the class increase my curiosity	29	4.95
3	I like to receive materials for reading using blogs	29	5.13
4	I like to access the recorded lessons	29	5.26
5	I like to share lesson contents on Facebook/blog	26	5.10
6	Sharing information in web 2.0 tools (e.g., Facebook and blogs) increases my motivation	31	5.31
7	I like to discuss about the lesson using the web 2.0 tools, e.g., Facebook and blogs	25	4.69
8	Being able to connect with the lecturer using web 2.0 tools after class can increase my interest in such lessons.	27	5.13
9	To learn lesson based on PQR using web 2.0 tools make learning more effective and attractive	26	4.90
10	If web 2.0 tools are used for my other lessons, my success will increase.	24	4.64
11	How motivated do you feel towards the use of web 2.0 in your studies now?	29	5.36

The highest mean score corresponds to item 1 which states I am motivated to use web 2.0 tools in my studies now. 29 out of 39 students thought that it was true that they were motivated to use web 2.0 tools in learning this programming course. Since programming language Java is difficult to learn (Pendergast, 2006), the use of web 2.0 tools in learning can help in increasing the students' interest towards the subject. Meanwhile, 31 out 39 of

the respondents agreed that sharing information in web 2.0 tools (e.g., Facebook and blogs) increases their motivation (item 6). This might be because they want a platform to share and discuss the lesson for further understanding.

Since web 2.0 tools are emerging technology in education, further understanding about the preference of the students towards these tools can further help in the learning process. 24 out of 39 students agreed that If Web 2.0 tools are used for my other lessons, my success will increase (item 10). This shows an interesting finding in which the students may want to use Padlets to post their questions, use blog to share information related to the subject or use Youtube to preview the contents of the upcoming class. For example, a student can stick a note on a wall for any questions related to a topic anonymously. The lecturer, then, can discuss every sticky note on the wall during the lecture. The students will be appreciated when the lecturer responds to their questions in this interaction.

Another interesting finding is that 26 out of 39 students agreed that learning based on PQR using web 2.0 tools make learning more effective and attractive. This shows that web 2.0 tools provide an alternative way for the students to discuss the subject with the lecturer other than face-to-face meeting. This is also support the finding that web 2.0 tools can be used for blended learning. Blended learning models stated by Köse (2010) was:

"Blended learning models are formed by combining face to face education and online learning activities mostly. In this case, teachers can use advantages of both face to face education and online learning"

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CONCLUSIONS

A strategy for integrating web 2.0 tool was proposed in order to organize education resources for a specific subject effectively. A learning plan using web 2.0 tools can be developed using a PQR strategy where students can do online learning based on three important components in learning which are: preview, questions and reflect. This can support blended learning where students with different learning style can get benefits from a combination of using on-learning learning and face to face education. Therefore, the learning plan was not only to capture the interest of students for optimizing their learning experience but also to cater to the needs of all students with different levels of thinking.

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FIGURES

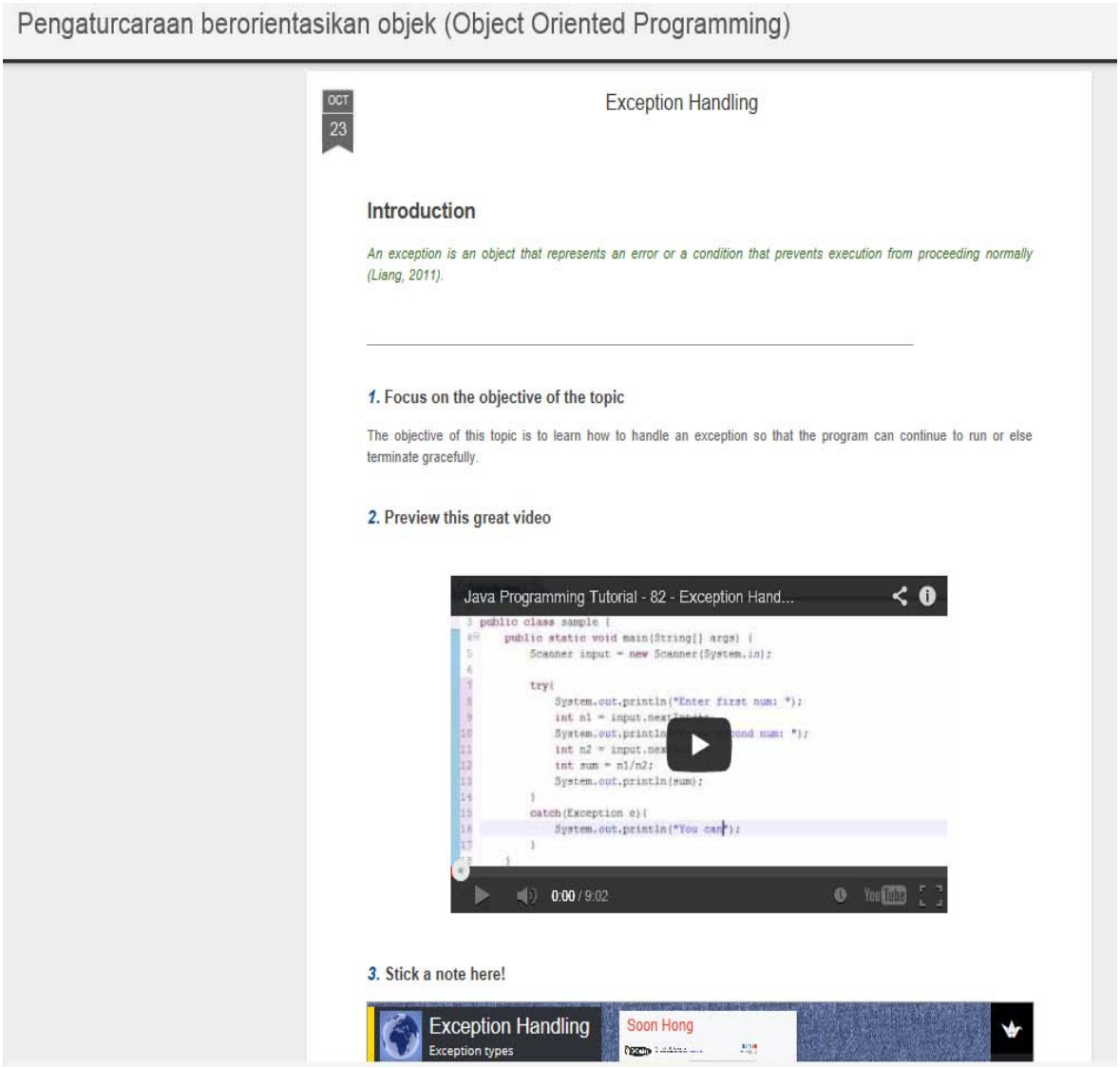

Figure 1: The integration of web 2.0 tools in a learning plan.

Figure 2: Youtube is integrated on a blog for preview item in the learning plan.

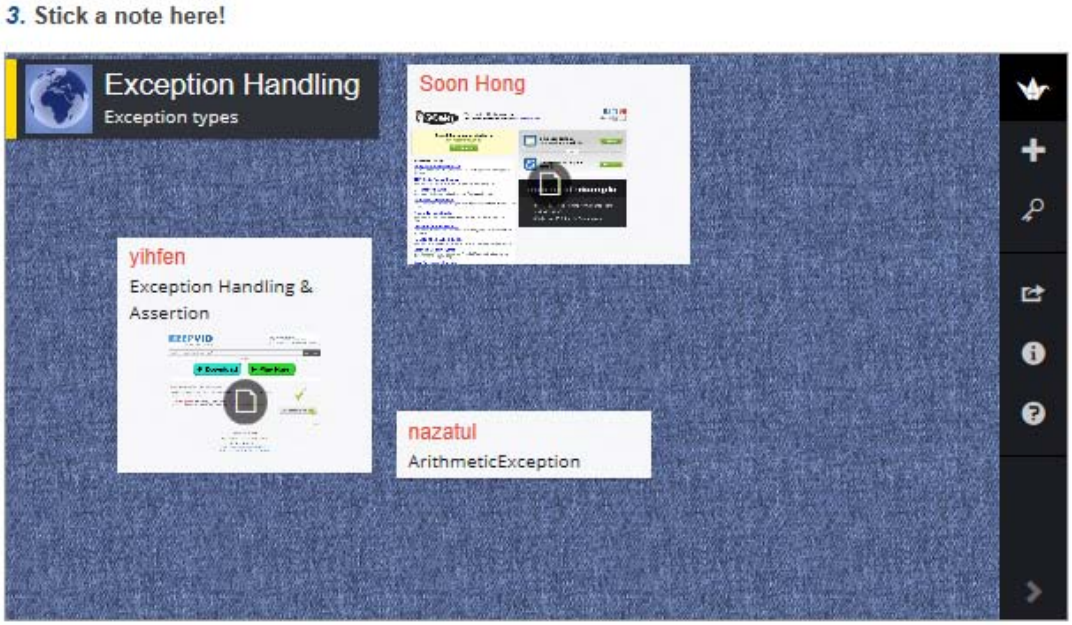

Figure 3: Padlet is integrated on a blog for question item in the learning plan.

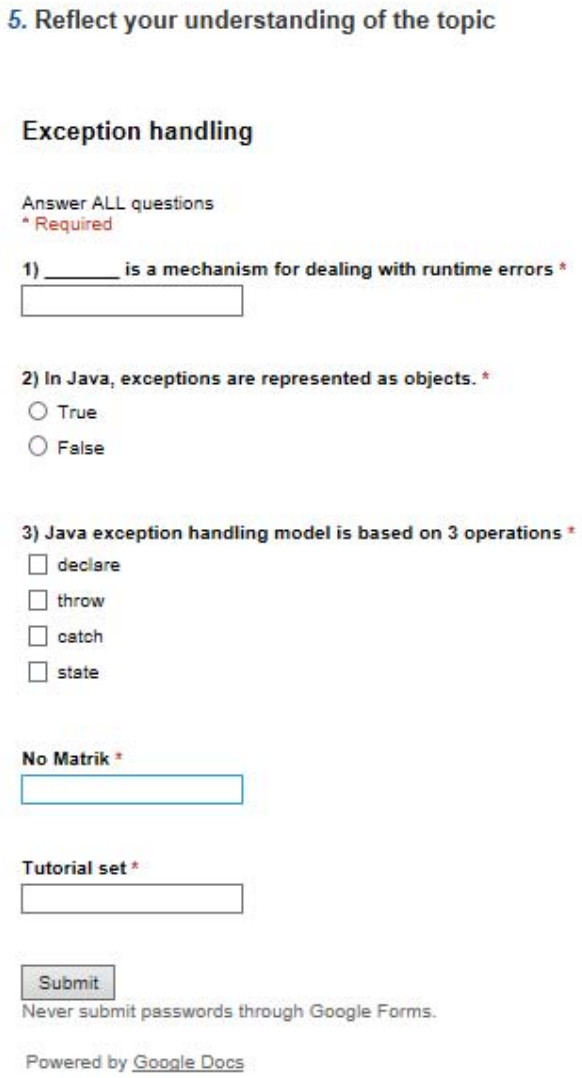

Figure 4: Google form was use for reflect item in the learning plan.

MOVING TOWARDS THE ASSESSMENT OF COLLABORATIVE PROBLEM SOLVING SKILLS WITH A TANGIBLE USER INTERFACE

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ABSTRACT
The research on the assessment of collaborative problem solving (ColPS), as one crucial 21st Century Skill, is still in its beginnings. Using Tangible User Interfaces (TUI) for this purpose has only been marginally investigated in technology-based assessment. Our first empirical studies focused on light-weight performance measurements, usability, user experience, and gesture analysis to increase our understanding of how people interact with TUI in an assessment context. In this paper we propose a research agenda for assessing ColPS of individuals using the Microworlds methodology implemented on TUIs. In a first example item, we use so-called MicroDYN items, which are independent microworld scenarios that rely on structural linear equations as underlying model. As the MicroDYN approach has been thoroughly empirically investigated for the assessment of complex problem solving of individuals, it offers a good basis for a reliable and valid assessment. We describe how this approach was applied to create an assessment item for a collaborative setting. This item described in this paper implements a simplified model of a MicroDYN item related to climate change using knowledge of previous studies. Therefore, the focus of the item's construction lies on meeting the requirements for a standardised high quality assessment. Finally, a research agenda is proposed to sketch the main research issues.

INTRODUCTION
In the last few years the term 21st Century Skill gained substantial visibility in scientific literature, for instance in the latest reports on technology-based assessment (OECD, 2012) as well as in the Digital Agenda published by the European Commission (Ferrari, 2012). These so-called 21st Century Skills refer to skills such as complex problem solving, collaborative problem solving, creativity, critical thinking, learning to learn, decision making, etc. (Binkley et al., 2012). Several researchers have stated that the acquisition of these 21st Century Skills and their development are only marginally investigated (Bennett & Gitomer, 2009) despite their unquestioned importance and relevance. This paper focuses on a particular 21st Century Skill, collaborative problem solving (ColPS), which encompasses the ability to successfully deal with untransparent and dynamically changing problems in a collaborative setting. ColPS is considered an important component for the success in life and for this reason will be included as transversal domain in one of the most prestigious large-scale assessments worldwide, the Programme for International Student Assessment (PISA) in its 2015 cycle (OECD, 2014). As emphasised by educators and policy makers, ColPS plays an important role in different life contexts - at schools, at home, or at work (Rummel & Spada, 2005). Especially on the labour market, the organisational researchers (e.g. (Cannon-Bowers & Salas, 1997; Hellinghausen & Myers, 1998)) emphasise more and more the importance of teamwork for organisational success and continuously look for new ways to assess collaborative skills in a recruitment process and in the course of personnel development.

Despite the apparent importance of ColPS for success in different areas of life, up until now there has not been much progress in its assessment. However, recently, fast development of new technologies for gathering data in real settings allows us to assess specific 21st Century Skills such as ColPS. Due to practical limitations, conventional paper-pencil tests or even the use of desktop applications known from computer-based assessment do not entirely allow for highly dynamic and interactive assessment of 21st Century Skills. More natural forms of inter-

action such as touch, speech, gestures, and handwriting support assessment researchers to explore new approaches to skill assessment. Therefore, the availability of affordable devices that can collect such natural forms of interaction motivated us to develop several so-called tangible user interfaces (TUI) for assessment. ColPS assessment.

The use of TUI in assessment is new and, therefore, knowledge about how to design those systems and how to develop test items for TUI is limited. For this reason, we present the state of the art in related research topics and propose a study that will help us shed light on the use of TUIs for ColPS assessment purposes.

The aim of this article is to summarise open research issues in the domain of complex collaborative problem solving and to motivate the use of tangible user interfaces to assess this 21st Century Skill.

The upcoming section summarises research on relevant topics followed by the description of the overall research methodology. Further, we elaborate how a test item related to climate change has been developed for the TUI to assess collaborative problem solving of individuals. Finally we derive a first research agenda to assess complex collaborative problem solving with TUIs.

BACKGROUND

Collaborative Problem Solving

ColPS is one of the 21st Century Skills that has attracted the most attention from researches in recent years. This comes from the fact that collaborative work is becoming ever more significant in education and in everyday life. For instance, in schools students are often required to work in teams on science tasks; at work people collaborate on common projects; and at home families take household decisions collaboratively. An everyday example of ColPS is students organising a school trip together. They need to consider different factors such as distance, transport, or price, whereby some of factors can change in the course of planning. Students take over specific roles in the process (e.g. a person who finds bus schedules, the one taking care of hotel prices, the one who makes an overview of everything), exchange their knowledge and apply different strategies to find the nearest destination, with the optimal transport and the cheapest price. In theory, ColPS incorporates two dimensions – complex problem solving as the cognitive dimension and collaboration as the interpersonal dimension. However, ColPS is not just the sum of those two dimensions, but represents the interaction of complex problem solving skills and collaboration skills (OECD, 2014).

The first dimension, complex problem solving, is one of the 21st Century Skills that has been extensively investigated. It may be defined as searching for the path from the problem state to the goal state. Its main characteristics are that the problem the person is confronted with is untransparent and the problem situation is dynamic, meaning that it changes, for instance, in the course of time or under the influence of the problem solver (Fischer, Greiff, & Funke, 2011; Lai, 2011).

By adding the collaborative aspects to the complex problem solving construct leads us to the definition by O`Neil et al. (2003), who define ColPS as searching for the path from the initial state to the goal state while interacting with others working on a shared goal. Further, one of the most recognised large-scale assessments worldwide, the Programme for International Student Assessment (PISA) offers a more detailed definition of ColPS describing it as:

> *"…the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution" (OECD, 2013).*

Whereas the dimensions of ColPS, problem solving and collaboration, are well examined as single constructs, the ColPS as a construct that incorporates both of those skills is still insufficiently investigated. Although recently there are initiatives researching the assessment of ColPS, especially in large scale testing context, the progress is still scarce at best. As outlined by Krkovic et al. (Krkovic, Pásztor-Kovács, Molnár, & Greiff, 2014) following aspects need to be considered when constructing the assessment for ColPS - how to create a standardised testing environment, to use computer agents or humans as collaborators, how to assess communication, and how to analyse the collected data. Up until now, there have been two approaches on how to assess ColPS – human-to-agent and human-to-human. The first approach incorporates human-to-agent collaboration, the participant collaborates with a computer-simulated agent to solve a problem collaboratively. The OECD will include the assessment of ColPS in its PISA 2015 cycle uses this approach. The application of human-to-agent approach can be justified by the fact that it offers standardised stimuli to each participant ensuring a standardized testing environment and reasonable scoring procedures (Graesser, Jeon, & Dufty, 2008). Another approach to the assessment of ColPS is to use human-to-human interaction as investigated in the ATC21s project (Griffin, Care, &

McGaw, 2011) which in comparison to the human-to-agent approach offers more face valid situation of two or more individuals working together on a problem, providing more in-depth information about the collaboration process. However, the human-to-human approach has its limitations too, such as unstandardized assessment settings, or large log files coming from open conversations that can hardly be transferred into scoring (O'Neil, et al., 2003).
Considering benefits and limitations of both approaches, researchers need to search for an optimum solution for ColPS assessment that will on one hand offer scenarios that are scoreable and on the other hand be realistic and close to real life situations.

Programs such as PISA aim at large scale assessment, hence, the technology they use must be available in schools and can be implemented in classes. For this reason PISA uses computer-based assessment which allows for the administration in school to use their existing IT infrastructure. Due to the novelty and low deployment rate of TUI, their use for large scale assessment seems unpractical in the near future. As of now, assessment on TUI could be used in scenarios such as personnel selection in human resources management. This scenario is quite probable considering that, at the moment, there is no reliable methodology to assess ColPS skills in the course of the selection process, where skills such as team work play an important role. Moreover , by using innovative user interfaces instead of computer-based testing richer data sets can be collected.

TUI-based assessment

The aim of tangible user interfaces (TUI) is to make computer bits tangible and to allow users to grasp and manipulate them with their hands (Ishii, 2008). This concept has a number of advantages for social and contextual interactions, such as collaboration (Hornecker & Buur, 2006). To date, literature provides first exploratory results on the learning benefits of TUIs, however, in the field of assessment research is still in its infancy. In particular, the additional haptic dimension, the better accessibility (for instance for children), and the shared space that can be used in collaborative situations (Marshall, 2007) are claimed to be beneficial in learning situations. According to Klemmer et al. (2006), the physical objects and actions of TUIs allow using multiple senses of our human bodies and have an essential impact on our understanding of the world. They encourage rapid epistemic actions (i.e. try and error actions)and thus lower cognitive load by simplifying thinking processes (Esteves, Van den Hoven, & Oakley, 2013). Learning and assessment can be supported by representing problems in a new way, using physical and digital elements. Further, the way the users are solving tasks can be detected and feedback can be directly given. Nevertheless, no TUI has been systematically used and evaluated in the context of technology-based assessment (TBA).

Since research on using TUIs for assessment purposes is still at the very beginning, Ras et al. (2013) have conducted a series of empirical studies in order to identify harmonies and tensions concerning the use of TUIs for assessing skills of complex and collaborative problem solving in a low-stake assessment context. The aims were manifold: at a first stage it was interesting to observe how users interact with the table and the tangibles in general and which spaces are used for interaction, communication, and collaboration. Furthermore, each study also assessed the user experience and the usability of the device to ensure a continuous improvement cycle. The figures below show already two different devices.

Several items have been developed, two of which are depicted in Fig. 1 respectively Fig 2. The aim of the matching item was to assign the labels of the planets (put on small tangibles) to the images. The goal of the windmill item was to explore the impact of different variables such as wind speed, number of blades, and height of the windmill on the energy produced by the windmill. The output changed in real-time in response to the manipulations of the input.

Fig. 1. Matching item

Fig. 2. Simulation item

A description of the outcomes of these studies can be found in Ras et al. (2013). In summary, it was interesting to observe that different spaces where used to intensively communicate using gestures, talk, and physically manipulating objects. Besides the interactive surface also the space between participants or even the non-reactive border of the table was used to solve the item (e.g., to sort, group, or even exclude tangibles). The large space of the TUI allows for more than one person to get actively involved. But the position at the table also reveals that a person might feel responsible for a specific space (or even tangibles) or cannot access other spaces because of the distance or the closeness to another participant. We observed that all activities across space support the participants to acquire knowledge about the problem situation and apply the acquired knowledge, which are two important dimensions of ColPS (Funke, 2001; Greiff et al., 2013).

Another requirement for an assessment context is to provide an authentic and intuitive environment. Both the windmill item as well as the climate change item described in the next section represent real-world scenarios. Further, the physical tangibles allow the participants to manipulate the parameters in a natural and simple way. They enable more efficient interactions, such as turning a parameter without looking at it, while another parameter can be observed on the TUI surface. These activities and many others we observed help the participants to acquire knowledge about the problem situation. In addition, during the next step where the participants apply knowledge to solve the problem other patterns have been detected such as: users often hold them in their hands, use them to make gestures and suggestions, or they produced noise with the object to increase awareness in the group. Well-designed tangibles may implement a specific metaphor to increase its understanding but we cannot ensure that users immediately understand how to us or manipulate it. Holding objects in their hand can harm other users to contribute or even impact the complete solving strategy.

During the first step of the problem solving process, knowledge on the problem situation needs to be acquired by all participants. We have observed that, in particular, during a first phase several uncoordinated trial and error manipulations were done, even in parallel by several participants at once, followed by participants suggesting hypotheses of how parameters impact others without any deeper reflection. Hence, the challenge is certainly to distinguish these chaotic, unplanned activities from those that are more systematic and serve to understand the problem or even to solve the problem. For each study we interviewed assessment experts with respect to the item and the usefulness of the table for assessment. One interesting outcome was that they claim that a TUI supports the users in recognizing and understanding the perspectives of others – an important skill of collaborative problem solving. Gestures and spoken communication support them to easily explain hypotheses. Different perspectives of individuals (e.g., a misunderstanding) can be recognized through realising them on the table.

In assessment is it clear that the technology used for assessment can impact test performance. Aspects such as motivation, familiarity with a technology, even anxiety to use a specific technology need to be measured as disturbing variables. User experience is a typical measure to evaluate software and its measurement serves to improve both pragmatic and hedonic goals of the user. Unfortunately, all user experience and usability scales have been developed for classical software but not for applications running on tangible devices. They do not explicitly distinguish between physical and digital characteristics of TUI-based applications. Therefore, a research objective of these studies was also to investigate weaknesses of standardised measurement instruments tailored to evaluate usability and user experience. A first study revealed weaknesses of the Simple Usability scale (Ras & Maquil, 2011) and a new measurement instrument, which combines measures of several existing models, was developed and evaluated with the Windmill example (Ras, et al., 2013).

The windmill item is similar to a simulator: parameters can be manipulated and impacts on other output parameter can be observed. In the following section so-called MicroDYN items have been chosen as a task type for the collaborative problem solving scenario to be implemented on a TUI.

MICRODYN AS TASK FOR COLPS – A CONCRETE EXAMPLE

MicroDYN

This study is the first to suggest implementing so-called MicroDYN items on a TUI and to employ them in a group (i.e., a collaborative) setting in order to assess ColPS. Specifically, MicroDYN tasks are independent microworld items, which are based on structural equations. Until recently, MicroDYN items have only been used as a computer-based assessment approach towards assessing complex problem solving skills in individuals. Such an approach enables very well to control the difficulty and complexity of items, as well as the scoring procedures. In MicroDYN, the problem solver can manipulate a set of input variables, which reflects on specific output variables. Thereby, the problem solver needs to acquire knowledge about input and output variables and detect causal relations between them by representing it in a graphic model (dimension of *knowledge acquisition*, (Mayer & Wittrock, 2006)). In a subsequent step, the problem solver needs to apply the acquired knowledge in order to reach predefined goals (dimension of *knowledge application*, (Novick & Bassok, 2005)). Several studies have shown the validity of MicroDYN with regard to the assessment of complex problem solving (e.g. (Greiff, et al., 2013)).

Recently, MicroDYN items have been implemented into the human-to-agent computer-based ColPS assessment. In such tasks, the participant has limited controls over the input variables and must collaborate with a computer-simulated agent in order to acquire knowledge and apply it in the further step. Thereby, the participant can communicate with the agent by using a chat with predefined messages. In this study we expand this approach by implementing MicroDYN in the collaborative setting by using human-to-human approach, whereby the participants work together on tangible table interface. Moreover, the use of tangible table interface for the first time for ColPS assessment will incorporate triads instead of dyads that are used in computer-based version of collaborative MicroDYN tasks, which will enrich the collaboration aspect.

A tangible climate change item

Climate change as a complex problem

Today, scientists agree that the Earth's climate system is warming up and that a significant cause of the change is due to human activities (IPCC Working Group I, 2013). This is often referred to as *Global Warming*. Global Warming is mainly evidenced by increases in global average air and ocean temperatures resulting in the widespread melting of snow and ice leading to rising global average sea level. The main reason of this warming is caused by increases in concentrations of greenhouse gases, to which the largest contributor is carbon dioxide (CO_2). Certain waste management and agricultural practices aggravate the problem by releasing chemical compounds such as methane and nitrous oxide, which further fuel the warming, trapping ever more heat in the atmosphere.

To allow children to understand the relations between the different variables, as well as to follow the MicroDYN methodology of Greiff et al. (2013), a simplified model of climate change was defined. The model's principle is as follows. The system is configured with eight variables, each with three sub-variables (see Fig. 3) and their respective simplified impact on the total amount of CO_2 (i.e., approximated on the basis of (klimAktiv gemeinnützige Gesellschaft zur Förderung des Klimaschutzes mbH, 2014)). The variables allow children to explore the impact on global CO_2 emissions using examples they are familiar with such as meat consumption, transportation means to school respectively to their vacation destination, or simply the amount of clothing they own. By selecting one of the sub-variables which implement, in various forms, the high, medium, and low choices for the given variable, they express their choice. The system shows the effect on the different outputs as given by the MicroDYN methodology. The feedback is visual and based on a known scenario the children were confronted with prior to the experiment as part of their curriculum on climate change (such as the dire situation of polar bears). Children are then able to freely change their assignment of variables to explore the magnitude of variables on CO_2 emissions.

Collaborative widgets for manipulating variables

To allow for a maximum of simultaneous accessibility and shareability of controls we designed a novel type of widgets: the *Tangible Pie Widget*. Questions are visualized as immutable pie charts (Ø 15cm) with physical borders where each of the sections corresponds to one potential answer. Prior to the solving activity, each of the children gets one token per question. The children can place their token into one of the sections in order to give their personal answer to the provided question. This allows defining the weights of the different sections of the pie widget that can then be translated to the world population (see Fig. 3).

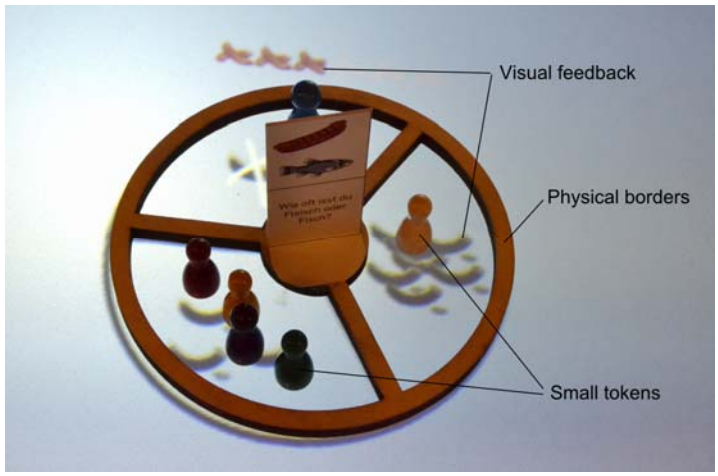

Fig 3. The tangible pie widget allows multiple users to change the weights of the sections by moving small tokens

For each parameter, the system provides feedback by depicting the value (see Figure XY) . Further it calculates and visualises the output of the total amount of CO_2 emissions and global temperature as defined by all pie widgets (see Figure 4).

The pie widgets can be used in two different ways. At the beginning, they are empty. Children place their token into the slices of the pie widget to cast their vote for each question. The system calculates the CO_2 output and the impact on global temperature in real time as votes are cast. This allows them to become familiar with the tool and to define the initial state. Furthermore, children can explore WHAT-IF scenarios, that is, they can change the value of variables by placing the tokens in a different section.

This approach incites all children to actively participate in setting the values and, in the second phase, allows them to collaborate in small groups to simultaneously manipulate the widgets. Exploring different scenarios will allow children to identify what behaviour has the most impact on CO_2 output and hence acquire knowledge about the underlying model.

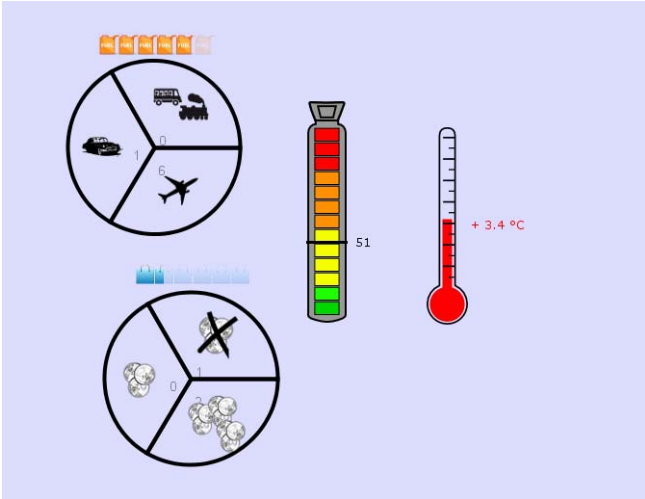

Fig 4. Feedback provided by the system

Fig 5. The system in use by a group of children

System architecture and design

The system features two main components: the TUI library (i.e., TULIP) that allows defining and instantiate all kind of tangibles; and a library that allows for defining complex problems. The TUI library is used to define all feedback and interactive tangibles as shown in Fig. 3 provided to the children. The complex problem solving library provides mathematical models such as linear equations which can be instantiated, for example, as seen in Equation 1 and 2. Each equation of the system is fed by the variables of one question while an instance of Equation 2 is used to provide the global CO_2 output.

$$\begin{aligned} Q_1(t+1) &= w_{X_1} * X_1(t) + w_{Y_1} * Y_1(t) + w_{Z_1} * Z_1(t) \\ Q_2(t+1) &= w_{X_2} * X_2(t) + w_{Y_2} * Y_2(t) + w_{Z_2} * Z_2(t) \\ &\vdots \qquad\quad \vdots \qquad\quad \vdots \qquad\quad \vdots \\ Q_n(t+1) &= w_{X_n} * X_n(t) + w_{Y_n} * Y_n(t) + w_{Z_n} * Z_n(t) \end{aligned} \quad (1)$$

$$CO_2(t+1) = w_{Q_1} * Q_1(t+1) + w_{Q_2} * Q_2(t+1) + \cdots w_{Q_n} * Q_n(t+1) \quad (2)$$

With Q, the question dependent output, t the discrete time steps, w_i the weight of variable i such that $w_i > 0$, and X_i, Y_i, Z_i the input variables for a question i.

This setup allows us to weigh each variable according to their impact on the CO_2 output. While these are all approximations, we believe they are necessary to provide children with interesting questions they can answer based on their experience and their environment and see the effect of their actions even if it would normally be too small to see in a more sophisticated and real life simulation.

Cycle of use and data gathering

The cycle of learning and assessment includes several steps. In a first phase, children are asked to answer questions defined by four widgets lying next to the interactive surface. For each question, the children place one of their tokens into the related area of the widget. The table then provides immediate feedback about the total value of the parameter, as well as the CO_2 emissions they are creating per person, and the effect on temperature.

In a second phase, children can modify the different parameters of the model, in order to explore and understand the impact on CO_2 emissions. I.e., they can freely move the tokens to see how much the CO_2 value is increased or decreased related to each parameter. This phase has unlimited time and ends when the children have specified the model: they are provided with paper clouds of different sizes. They need to identify which parameter generates the high, low, and no CO_2. They place the cloud of the corresponding size next to the parameter. This phase aims at measuring the *knowledge acquisition*, i.e. the amount and correctness of explicit knowledge gathered during the exploration.

In the third phase, all tokens are first replaced according to the As-Is situation. Children are now asked to solve the new task, using the knowledge acquired in the previous phase. This phase aims at measuring *knowledge application*, i.e., the children's capacity of generating and acting out a solution. They are asked to reach a provided level of CO_2 emissions by moving as less tokens as possible.

Data is gathered from 20 groups of children aged 8 to 10. They will explore and solve the presented issues of climate change on the table. Audio and video logs will be recorded of the sessions and children will be asked to provide information by questionnaire to measure their gain in understanding on climate change.

RESEARCH AGENDA AND CONCLUSION

The construct for individual complex problem is well defined. This counts for both, cognitive and collaborative dimension. Nevertheless, assessing complex problem solving in an collaborative setting is new and needs further investigations. In addition, the use of tangible user interfaces for assessment is highly innovative but has only been marginally investigated so far. These research gaps lead to a research agenda with three main axes:

1. *Derive the construct for complex collaborative problem solving*: The interaction between complex problem solving skills and collaboration skills is unknown. Understanding the interplay of both skills requires additional studies. Task, such as those based on Microworlds (e.g. MicroDYN) which are proven to be valid and reliable for individual assessment, need to be adapted and redesigned for collaborative settings.
2. *Develop and evaluate new assessment instrument*: Another challenge is that on the one hand, we need standardised assessment instruments but on the other hand we need to provide enough flexibility to allow human-to-human collaboration processes. Tangible user interfaces have shown that collaborative knowledge acquisition and knowledge application activities are supported, but additional work is necessary to use them as a quality assessment instruments. It is apparent, that TUI cannot be used for large scale studies. Further, studies on usability and user experience are necessary to continuously improve the instrument.
3. *Validate the instrument*: Many dimensions such as gestures, speech, (tangible) interactions and localisation data can be gathered, but, as stated in the assessment literature, the challenge is to relating it to assessing ColPS? Solving strategy patterns need to be extracted to gain understanding about the different phases during knowledge acquisition and application (e.g., experimental units conducted in the simulation environment). Which indicators (e.g., pointing gestures, speech patterns, physical manipulations)are useful? Which qualitative or quantitative analysis should be applied?

By following this research agenda, our research will provide a deeper understanding on the ColPS construct and how TUIs can serve as assessment instrument for assessing 21st Century Skills that are inherently hard to assess using traditional approaches. Besides research on collaboration skills and on individual complex problem solving, the fields of inquiry-based learning and simulation in learning play a major role (Van Joolingen, De Jong, & Dimitrakopoulou, 2007). Outcomes from this research domain can be used to understand the experimentation process in a simulation environment or, for example, to prevent students from engaging in extensive, aimless play sessions on the TUI system. In collaborative testing, factors such as decreased anxiety, rich discussions, supported cognitive processes (e.g. retrieving information, thinking through the information better, etc.) have led to an improvement in test performance (Kapitanoff, 2009). Such indicators will also be of interest in a TUI context in the future.

The definition of a valid and reliable construct for ColPS is new, as is the use of TUI for assessing this skill. Their combination might prove a useful tool for assessing other 21st Century Skills (e.g., creativity, team work etc.) as well due to the novel perspective the system will offer on the domain.

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ONLINE TEACHING EVALUATION FOR HIGHER QUALITY EDUCATION: STRATEGIES TO INCREASE UNIVERSITY STUDENTS' PARTICIPATION

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ABSTRACT
The primary purpose of this study was to uncover determines of students' intention to adopt online teaching evaluation at the end of semester by proposing a research model based on the Theory of Planned Behavior (TPB). The second purpose was to investigate the efficacy of the theory for predicting such intention. Besides users' attitude and perceived behavior control, the study further decomposed the subjective norms into four different categories in order to identify the best practices and strategies that a school can use to promote the intention of participation. Valid questionnaires were collected from university students in Taiwan to test the raised research hypotheses in the paper. The results provide support for using the theory to predict students' intention of usage and many practical implications are thus suggested.

INTRODUCTION
Teaching evaluation by students have long been used as a standard and routine practice in institutions of higher education, for instructional improvement, educational quality advancement, and administrative purposes, such as decisions on faculty salary, promotion, and tenure (Kember & Wong, 2000). They have played a very important role in both students' learning process and teachers' careers. In recent years, due to the advancement of computers and internet technology, many institutions have rapidly replaced traditional student evaluations of teaching at the end of semester with electronic surveys, and adopted online evaluation systems to collect the necessary data from students (Layne et al., 1999; Moss & Hendry, 2002).

While maintaining the comparability of ratings (Leung & Kember, 2005), online evaluations have many advantages over the traditional paper-and-pencil student ratings. Researchers have indicated that traditional ways are time consuming and costly to administer (Yun & Trumbo, 2000). Usually, there is much coordination needed between offices and faculty to distribute and collect the student rating forms at the end of a term. Since manually entering the collected data is another labor- and time-intensive task, rating results tend to be delayed until several weeks after the term has ended (Layne et al., 1999). The value of the evaluation tends to be reduced for all reasons mentioned before. Nevertheless, online evaluations have none of these problems. Data from completed and returned electronic questionnaires can be automatically entered into the assigned database, be analyzed immediately, and further provide timely useful information to the students to make more informed course selections, reflection on learning through regular self-review of their own attitudes and commitment, and to the faculty for course improvement (Tucker, Jones, & Straker, 2008). Moreover, an online evaluation system gives students more opportunities and time to evaluate their instructors or courses after careful consideration, due to the fact that they can use various times during a specified period to finish the process (Layne et al., 1999; Leung & Kember, 2005).

Even though online evaluations offer a number of advantages, repeatedly reports have indicated the most pervasive problem with these electronic surveys is their response rates (Moss & Hendry, 2002; Lefever et al., 2007). Moreover, Mcbean and Lennox (1985) pointed out that to get valid evaluation survey results, a 50% response rate or an 80% return is need to give an acceptable indication of ratings, and if the response rate is very low, then the survey results may be considerably in error. Thus, if an effective and efficient online evaluation is demanded, the priority should be placed on how to increase students' intentions to use the system or participate in the process. Previous studies of online student ratings focus on the benefits and limitations of the new mode of administration (Layne et al., 1999; Moss & Hendry, 2002; Lefever et al., 2007), or the comparability of data gathered from both traditional and online surveys (Leung & Kember, 2005; Layne et al., 1999). Research on how to increase the students' adoption of the new system is still in the preliminary stage, and few studies, especially empirical studies, have discussed the issue (Norris & Conn, 2005).

The present study presents an in-depth understanding of university students' intentions to participate in online teaching evaluations in Taiwan, utilizing Ajzen's (1991) theory of planned behavior as a guide for identifying antecedents to the intentions, and exploring which components are significant predictors of them. Understanding the factors that influence intention will help to create a more favorable environment for greater participation, as well as help to design strategies to promote participation. Instead of simply accepting the common perception that response rates for online teaching evaluations and surveys will always be low, or implementing any possible incentive programs, the present study aims to provide initial empirical evidence for informing policies, strategies, and practices. It is in hope that the results of the study will shed lights for administrators elsewhere on best strategies to increase students' participation of teaching evaluation as then improve the quality of education.

THEORETICAL BACKGROUND AND HYPOTHESES

Theory of planned behavior

As a useful lens to look at user beliefs and behavior, Ajzen's (1991) theory of planned behavior (TPB) stands out as the most preferred model for prediction and understanding of a wide range of human behaviors in various age groups. It explicates relationships between attitudes, norms, perceived behavioral control, intentions, and behavior. According to TPB, the immediate determinant of an individual's behavior is the intention to act or not. In turn, intention is jointly determined by three fundamental concepts of attitude towards the behavior, subjective norms, and perceived behavioral control, while each factor is generated by a number of beliefs and evaluations of the individual (Ajzen, 1991).

The predictiveness of the TPB across numerous behavioral domains is evident from many empirical studies in both naturalistic and experimental settings (Godin & Kok, 1996). Continually, TPB and the three constructs have also been successfully applied and investigated to explain and predict the intention and behavior of adopting various information technologies (Hsu et al., 2006; Taylor & Todd, 1995; Wu & Chen, 2005), but the role each construct plays in terms of its influence on behavioral intentions is dissimilar in different contexts. The present study was conducted to determine whether TPB could be used to predict students' intentions to use online ratings of teaching in Taiwan. In our study the focus was on intentions, since actual usage could not be investigated due to the timescale of our study. Hence four of the constructs were considered, but the actual behavior was omitted. Figure 1 depicts the model of the current study.

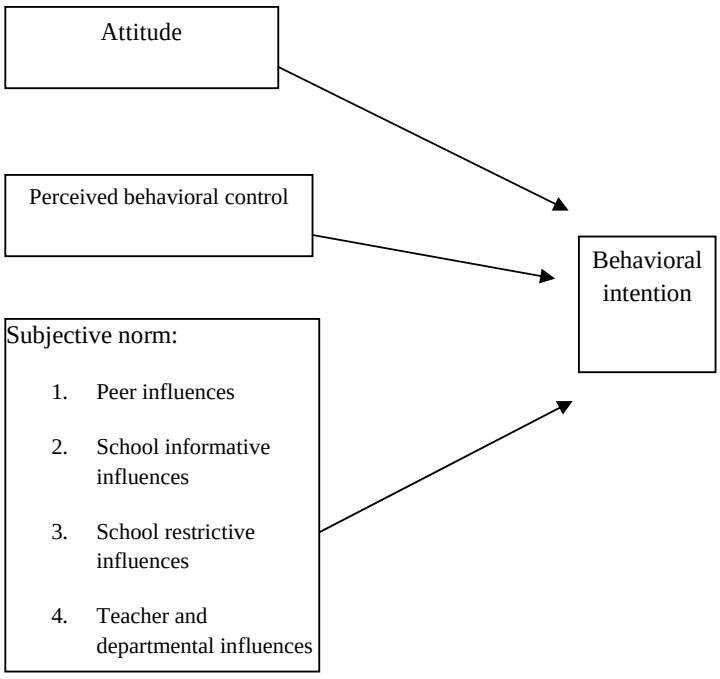

Figure 1. The model of the study

HYPOTHESES

Attitude

Attitude towards a behavior is the degree to which a person has a more or less favorable assessment of the behavior in question. Ajzen (2002) suggested that attitude is comprised of affective (enjoyableness of the behavior) and instrumental (perceived benefits) components. The positive relationship between attitude and behavioral intention has received strong empirical support in previous studies (Ajzen & Fishbein, 1980; Taylor & Todd, 1995). The TPB predicts that the more favorably an individual evaluates a particular behavior, the more likely is his/her intention to perform that behavior (Ajzen, 1991). Therefore, it is expected that students' favorable attitude towards the use of an online evaluation system will positively influence their intention to use it.

Hypothesis 1. Attitude of the students towards using online evaluation of teaching is positively related to the behavioral intention.

Subjective norms

A second antecedent to behavioral intentions is subjective norms which reflect the individual's perception of whether groups or people of importance to oneself will approve or disapprove of the performance of the adopted behavior. The more an individual perceives significant referents think he/she should engage in the behavior, the greater the individual's level of motivation to comply with those others (Ajzen & Fishbein, 1980). Some empirical studies have found that subjective norms or normative pressures positively affect people's intention to adopt innovative products such as newly invented technologies (Taylor & Todd, 1995; Green, 1998). Indeed, meta-analytical research reveals a positive association between subjective norms and behavioral intentions, ranging from .34 to .42 in different studies (Godin & Kok, 1996). Therefore, it is believed that within the context of the present study, subjective norms will reflect the students' perception of whether their behavior of using the online teaching evaluation is encouraged and accepted within their circle of influence. A positive relationship between subjective norms and intention to use an online evaluation system is hypothesized:

Hypothesis 2. Subjective norms of students in relation to usage of online evaluation affect their behavioral intentions positively.

Taylor and Todd (1995) pointed out that different social groups might have different opinions regarding the adoption of a particular technology, and will potentially influence the individual's intention to adopt the behavior. Other studies have further suggested that two types of social influences: interpersonal influence (normative influence) and external environmental influence (informational influence) can be used as determinants of subjective norms. Interpersonal influence indicates word-of-mouth influence by friends, colleagues, family, and superiors, and occurs when the person conforms to the expectations of others. External influence, on the other hand, indicates mass media reports, expert opinions, and other non-personal information considered by the person when performing a behavior, and occurs when the person accepts information as evidence of reality (Bhattacherjee, 2000; Karahanna et al., 1999). Accordingly, in the current study context, measures of subjective norms should also be further decomposed into different types of social influences.

Hypothesis 3. Each decomposed subjective norm also positively affects behavioral intentions.

Perceived behavioral control

Perceived behavioral control reflects an individual's perception of whether he/she has the necessary resources, capability, and a sense of control to successfully perform the behavior. It is the perceptions of internal and external constraints on behaviors. Internal constraints are related to knowledge/self-efficacy, and external constraints to the environment (Ajzen, 1991). Past literature has demonstrated that perceived behavioral control is an important determinant of intention and use of technology (Taylor & Todd, 1995). Norris and Cann (2005) suggested that the reasons for low response rates for online delivered survey instruments are technical problems with the online tool, difficulty accessing open computers in campus laboratories, students' relative level of technological literacy, and slow internet connection rates. Thus, when people feel that they lack the control to accomplish the behavior, they will have less intention to behave (Ajzen, 2002). Therefore, a positive relationship is hypothesized between perceived behavioral control and intention to adopt online teaching evaluation.

Hypothesis 4. Perceived behavioral control of users in relation to usage of online teaching evaluation positively affects behavioral intentions.

METHODOLOGY

Participants and procedures

Data were collected from a convenience sample of university students who are either sophomores or above in Taiwan. Because of its relative speed in data collection, and to minimize the amount of administration required by both the researchers and participants, the authors decided to use a web-based survey. However, to prevent the sampling bias of data collected from online surveys only, paper surveys were also administered for investigation. Students participated voluntarily through either electronic surveys or paper surveys, and a total of 1,217 (779 undergraduate students and 438 graduate students) valid questionnaires were used for analysis here. The invitation letters were first sent out to potential participants via email, while posters and flyers, both electronic and paper, were posted in the hallways and on public bulletin boards on campus or on the announcement page of the school website to welcome and encourage students to participate in the study. Furthermore, an incentive of cash was offered as a lucky draw prize to promote participation. To reduce the possibility that a respondent participated in the survey more than once, each respondent was required to provide part of his/her student identification number in the survey. Later, duplicate numbers were used to filter out multiple responses from the same respondent.

Approximately 76% of the respondents were male and 24% were female. In addition, around 39% of the respondents were from the College of Engineering, 32% from the College of Electrical Engineering and Computer Science, and 20% from the School of Management. About 20% of respondents found in each grade level (sophomore, junior, and senior), and about 36% of the respondents were from graduate programs. Approximately 99% of the respondents indicated that they have computers either at home or in their dormitory, and have access to the internet. Finally, the average online time per day for all the respondents was 5.62 hours with a standard deviation of 4.46.

Measurement development

To meet the purpose of this study, a self-reported questionnaire was developed, consisting of items designed to assess the four major constructs in the theory of planned behavior. Each construct was assessed by means of several direct items which were modeled on previous studies (Ajzen, 1991; Taylor & Todd, 1995; Bhattacherjee, 2000); therefore, most of them are pre-validated measures with minor wording changes to tailor these measures to the context of the current study. With the establishment of content validity, the questionnaire was refined through a pilot study before conducting the main survey. The pilot study focused on instrument clarity, question wording and validity. During the pilot study, five experienced experts in the field were invited to comment on the questions and wording. The comments of these individuals then provided a basis for revisions to the construct measures.

The belief items measuring attitude and intention were modified from the studies of Ajzen (1991; 2002) and Azjen and Fishbein (1980). Items for social influences and perceived behavior control were constructed according to Taylor and Todd (1995), Hsu et al. (2006), and Bhattacherjee (2000). In order to include more detailed determinants of behavioral intentions in the study, a decomposition of subjective norms was used to capture and identify all potential social influences. Responses to questions related to subjective norms were submitted to a principle axis factor analysis, and four sub-categories of subjective norms were found, and Table 1 indicates the factor loading for each question. Scales for each of the constructs were developed by averaging the responses to the individual items. All items were measured using a four-point Likert scale (ranging from 1 = strongly disagree to 4 = strongly agree). Following is a brief discussion of the variable measures derived from the TPB and used in the study.

Table 1. Rotated factor loadings and Cronbach's α values for subjective norms (12items)

Item	Factor 1:	Factor 2	Factor 3	Factor 4
Factor 1: Peer influences α = 0.94				
1	0.90			
2	0.90			
3	0.88			
Factor 2: School restrictive influences α = 0.82				
4		0.90		
5		0.89		
6		0.74		
Factor 3: School informative influences α = 0.62				
7			0.81	
8			0.72	
9			0.62	

Factor 4: teacher and departmental influences α = 0.83	
10	0.87
11	0.86
12	0.66
Total α = 0.85	

Intention

Respondents were asked to complete four questions to measure their level of intention to use the online evaluation of teaching. Factor analysis of the responses to these four items indicated that they depended on a single factor (factor loading of each question is between 0.72 and 0.85), and reliability analysis, using the alpha coefficient, showed the reliability to be 0.76. Therefore these four items were combined to form a single intention measure. Participants responded to the following sample items: "I intend to use the online evaluation of teaching in the future"; "Overall, my intention to use the online evaluations of teaching is pretty high."

Attitude towards the behavior

Respondents' attitudes towards participating in online evaluation of teaching were measured by asking them to indicate to what extent they thought using the online evaluation system would be enjoyable, pleasant, beneficial, or positive in five questions. Factor analysis of these five items indicated that they formed a single factor (factor loading of each question is between 0.78 and 0.82), and reliability analysis produced a good alpha of .86. Therefore, the items were combined to form a single attitude measure. The average overall five scales served as a general measure of direct attitude toward usage. Students indicated their attitudes through the following sample items: "I think using online evaluation of teaching is a valuable thing."; "I like to participate in the online evaluation of teaching"; "Overall, I have a positive opinion of online evaluation of teaching."

Subjective norms

Subjective norms were measured by twelve items each asking the respondents to indicate the extent to which they felt social pressure to use the online evaluation of teaching from others who were important to them. Three social groups were identified in the study, namely, the school, peers, and professors. A factor analysis was then performed which found that under the category of school, there were also two types of normative pressures-restrictive and informational influences. Sample items for each category are as follows. For peer influences, participants responded to the statement, "My classmates think that I should participate in online teaching evaluation."; for school restrictive influences, participants responded to the statement, "Since I know if I don't participate in online teaching evaluation, the school will restrict me on checking my grades, I will participate."; for school informational influences, participants responded to the statement, "I will participate in online evaluation of teaching, because the school sends e-mails to inform me and request me to participate."; for teacher and departmental influences, respondents needed to respond to the statement, "My teacher thinks that I should participate in online teaching evaluation." Summating responses to the twelve scales gave a direct measure of subjective norms as a whole, with a Cronbach's alpha of .85.

According to Table 1, almost all of the measures for the components of the subjective norms showed acceptable to very satisfying internal consistencies. These results further strengthen confidence that the questions were relatively well understood by respondents. Thus, ambiguity of meaning across participants was kept to a minimum. However, the measure of informative influences from school is an exception, with a Cronbach's alpha reliability coefficient of only .62 which is higher than 0.6 the sufficient minimum Cronbach's alpha for the research (Nunnaly, 1967).

Perceived behavioral control

The study used six questions to measure the perceived behavioral control (PBC) that respondents felt over their ability to decide whether to use the online evaluation of teaching. Participants responded to the following sample items: "I think participating in the online evaluation of teaching is an easy thing."; "I have enough time to participate in the online evaluation of teaching." and "I have enough resources including computer and internet facilities to participate in online evaluation of teaching." Factor analysis of the six items indicated a single factor, with a Cronbach's alpha reliability coefficient of 0.87 and factor loading for each question between 0.61 and 0.85. Mean responses to the six scales provided a direct measure of PBC to use the online evaluation of teaching in the future.

RESULTS

After the variables were constructed, correlation tests were performed. The mean values, standard deviations, and Pearson's zero-order correlations for the study variables are summarized in Table 2

Table 2. Means, standard deviations, and correlations for the study

Variable		Mean	SD	Correlations							
				1	2	3	4	5	6	7	8
1.	Behavioral intention	2.93	0.51	1							
2.	Perceived behavioral control	3.20	0.49	0.48**	1						
3.	Attitude	3.07	0.52	0.60**	0.46**	1					
4.	Peer influence	2.64	0.68	0.45**	0.19**	0.32**	1				
5.	School informative influence	2.86	0.49	0.53**	0.34**	0.42**	0.46**	1			
6.	Restrictive influence	2.99	0.65	0.09**	0.15**	0.07**	0.19**	0.29**	1		
7.	Teacher and departmental influence	2.66	0.65	0.32**	0.13**	0.20**	0.56**	0.21**	0.21**	1	
8.	Subjective norms	2.79	0.44	0.47**	0.27**	0.34**	0.79**	0.69**	0.61**	0.76**	1

Notes * p <0.05 ; **p<0.01 ; ***p<0.001。

The correlation matrix shows that all of the variables were significantly correlated with behavioral intentions. All the interrelationships between the variables were significant and substantial, indicating the need for performing a regression analysis of intentions on several predictors so that the unique contribution of each predictor to account for a percentage of the variance of behavioral intentions could be assessed.

To test the hypotheses, two multiple regression analyses were performed: 1). Regress behavioral intentions on common predictors discussed in TPB. 2). Regress behavioral intentions on attitude, perceived behavior control, and the four decomposed subjective norms identified in the previous section. Table 3 and 4 show the results of the two regressions of behavioral intentions.

The results obtained from the first regression analysis are presented in Table 3. Based upon the results, support was found for hypotheses I, II and IV. It can be seen that attitudes, subjective norms, and perceived behavior control made significant and independent contributions to the prediction of college students' intentions to use online teaching evaluations. For hypothesis 1, a higher level of attitude of the students towards using online evaluation of teaching is predicted to be positively associated with the behavioral intentions (β=0.41, p<.0001). For hypothesis II, a higher level of subjective norms perceived by the students towards using online evaluation of teaching is predicted to be positively associated with the behavioral intentions (β=0.28, p<.0001). For hypothesis 4, a higher level of perceived behavior control of the students towards using online evaluation of teaching also positively affects the behavioral intentions (β=0.22, p<.0001). The three TPB components in this proposed model accounted for 48 % (adjusted R^2) of the variance in the intention of students to use online teaching evaluation.

Table 3. Regression of attitude, subjective norms, and perceived behavior control on intention to adopt online teaching evaluation

Dependent variable: Behavioral intention			
Independent Variables	Beta (β)	t	p-value
Constant		0.67	0.51
Attitude	0.41	16.78	0.000***
Perceived behavioral control	0.22	9.33	0.000***
Subjective norms	0.28	12.44	0.000***
	R^2=0.48	adj R^2=0.48 F=372.87	P=0.000

Notes: * p <0.05 ; **p<0.01 ; ***p<0.001

To test out hypothesis III, the second regression analysis was done, with the results shown in Table 4. For hypothesis III, all four kinds of social influences identified under subjective norms were significantly associated with the behavioral intentions. Even though they were all significant predictors of the intention, the effect of school restrictive influence and teacher and departmental influence were diminutive. The values of β for these two variables were in fact very small. Among the four identified subjective norms, school informative influence was the most important determinant, and peer influence was the second. All three variables of peer influence, school informative influence, and teacher and departmental influence have positive βs, which means that a higher level of peer influence, school informative influence, or teacher and departmental influence perceived by students also positively affects behavioral intentions. However, there was a negative standardized beta found for school restrictive influence (β= -0.08, P<0.001). This result shows that the more students believe there are restrictions as a consequence of not participating in online evaluations, the less likely they will have intention to do it. These six variables in the second proposed model accounted for 52 % (adjusted R^2) of the variance in the intention for students to use online teaching evaluations.

Table 4. Regression of decomposed subjective norms, attitude, and perceived behavioral control on intention to adopt online teaching evaluation

Dependent variable: Behavioral intention			
Independent Variables	Beta (β)	t	p-value
Constant		1.94	0.053
Attitude	0.34	14.24	0.000***
Peer influence	0.17	6.58	0.000***
School informative influence	0.24	9.66	0.000***
School restrictive influence	-0.08	-3.66	0.000***
Teacher and departmental influence	0.06	2.53	0.000***
Perceived behavior control	0.21	9.36	0.003**
	R^2=0.523 adj R^2=0.52	F=220.97	P=0.000***

Notes: * p <0.05 ; **p<0.01 ; ***p<0.001。

DISCUSSION AND IMPLICATIONS

As stated previously, the purpose of this study was to explore possible determinants of students' intention to adopt or participate in an online evaluation of teaching through a revised theory of planned behavior approach. The findings provide support for using the theory to predict the intention of students' usage, and suggest that it may be a useful framework to guide strategies or policies aimed at promoting intentions. In the study, attitude, subjective norms, and perceived behavioral control were three positive predictors significantly contributing to intentions to perform the behavior in question, which supports previous research (Ajzen & Fishbein, 1980; Taylor & Todd, 1995). The total variance explained in intentions to adopt online teaching evaluation for both models (adj R^2=0.48 and adj R^2=0.52) was compatible with that in prior research under information and technology product and service contexts (Bhattacherjee, 2000; Bosnjak et al., 2005; Taylor & Todd, 1995), but the relative contribution of the three key determinants was exceedingly different.

Attitude is the most important determinant of intention in both models, as is evident by its values of the standardized regression weights (β) shown in Table 3 and 4. In both models it has the highest value of β, which indicates that among all the constructs we considered in the models, it is the most effective and strongest predictor of all. This is consistent with many previous studies that have stated similar findings which generally support the important motivational influence of attitudes in the prediction of intentions in diverse behavioral domains (Ajzen, 1991; Godin & Kok, 1996; Sheeran & Taylor, 1999; To et al., 2008). This suggests that believing in the importance and value of using online evaluations of teaching, and having overall positive opinions of it will be incentives for students to participate. Schools should therefore emphasize the benefits of the evaluations by stressing the goals of the process, and how meeting the objectives can lead to better personal learning outcomes and overall educational quality.

Contrary to previous studies, the second most important predictor of student's intention is the subjective norm in both models. Several researchers, in their meta-analytical studies on applications of the TPB to different behaviors, have found that subjective norms usually contribute less than attitude and perceived behavioral control in the amount of explained variance in intentions (Pavlou & Fygenson, 2006; Godin & Kok, 1996) and

sometimes do not contribute significantly to the prediction of intentions at all (Bhattacherjee, 2000; Venkatesh et al., 2003; Fang et al., 2009). Bhattacherjee (2000) explained that those results were because subjective norms have been seen as including only the normative influence, and the lack of informational influence in the conceptualization can result in the non-significant effect of subjective norms on intentions. In our first model, the scale for subjective norms included the component of informational influence, so the result showed that subjective norms could also play a relatively important role in predicting behavioral intentions. Another reason for the result was due to the fact that the present study was undertaken in a non-Western (collectivistic) culture where one would expect others' opinions to have a greater impact on the individual because of face saving, group conformity, or a higher power distance. All these would invoke a more influential role for significant others (Schepers & Wetzels, 2007; Steenkamp et al., 1999).

School informational influences stand out among all four categories of subjective norms in the second model. Similar to the external constraint or so-called informational influences in other studies (Bhattacherjee, 2000; Karahanna et al., 1999), the school informational influences in the present study refer to how the students perceive the social norms induced by the school, such as if the school has sent out email reminders, put posters around the campus, or students perceived that the school wishes them to do the evaluations. From Table 4, it shows the second highest beta weight can be found for school informational influences, which indicates its significant effect on behavioral intentions. The results mirror the findings of Norris and Conn's (2005) study. They suggested that schools can increase the participation rate easily by explicitly announcing the availability and location of the evaluation within a few weeks of the course ending. Thus, students tend to conform to school informational influences.

Another important significant predictor found under subjective norms was peer influences. The findings indicate that when a student perceives more of his/her peers' positive opinions about using the system, he/she would be motivated to comply with them. Schepers and Wizels (2007) especially discussed how younger people and students are more easily influenced by peer opinions, so subjective norms can have stronger effects on behavioral intentions among this group. Consistent results were also found by Tucker et al. (2008) that the new system, Course Evaluation on Web, had very high student response rates, since student representatives were always part of the development and promotion of the system to the student body. One implication of this finding is that schools looking to facilitate student participation in evaluation may find it effective to strengthen perceived group norms regarding participation, which might be achieved by extensively publicizing the implementation effort, and ensuring that it is thoroughly discussed among the students, which can be done by the student government association or some other campus organizations.

The negative significant effect of school restrictive influence on students' intention to use the online evaluation was an important and interesting finding. This result shows that the more students perceive that they will be punished if they do not participate in the online evaluations, the less willing they are to participate, implying that schools should not use restrictions to force students to participate, otherwise there will be unintended outcomes. Leung and Kember (2005) have suggested that the method of forcing students to complete surveys may lead to unreliable responses and limited information from open-ended questions.

The least effective predictor among the four types of subjective norm is the influence of teachers and departments, which had very weak significant effects on intentions. This was also a surprising outcome. Normally, in a Confucius society, teachers are regarded as unquestioned authorities, and have traditionally been held in high esteem. Their power and control have been regarded as almost absolute (Cortazzi & Jin, 1997), so teachers' opinions were expected to play a substantial role in students' intentions. However, in the current context, teachers might be in an awkward position to discuss the online evaluation of teaching; as a result, they might not mention their ideas to the students. The minor role of teacher and departmental influences in predicting students' intention can thus be understood.

Finally, the relatively smaller positive significant effect of perceived behavioral control on intention suggests that perceived behavioral control is an input to, but not the most vital motivational force behind adopting online evaluation of teaching. The result is in line with the findings of previous studies (Bhattacherjee, 2000; Taylor & Todd, 1995). Here, perceived behavioral control describes students' perceptions of the availability of the skills, knowledge, resources, and experiences necessary for using or participating in the online teaching evaluation. The results show that perceived behavioral control had a weaker effect on intention due to the fact that most students were experienced users of computers and familiar with the internet, so had easy access to technological resources and infrastructures. To them, using the online evaluation system was fairly simple and easy, resulting in their common higher level of self-efficacy, and thus perceived behavioral control did not have too significant an effect on intentions of adoption.

From the findings and discussions, there are several suggestions that we can conclude with. First, attitude is the most important factor affecting students' intention to participate, so it is suggested that teachers should explain the values of the course evaluation process and student feedback to the students (Norris & Conn, 2005); nevertheless, from our sample we found that the social influences from the teachers and department are not sufficient to accomplish this task, and what really needs to be done is for the schools or the students themselves to promote the benefits and functions of online evaluations. Schools can use really simple and easy strategies to increase the participation rates, such as using many low cost ways to reach the students, reminding them about the time and place to do the evaluations, as well as the value it will have for them personally. In addition, regarding the restrictions currently used as punishment for not participating, it is proved that is not an effective strategy. They are not only ineffective, but also disparaging to the intentions to participate. Lastly, although perceived behavioral control is not as important a predictor as attitude or subjective norms, it also has a significant role. The authors examined the measures composed for perceived behavioral control, and found the average scores for the items regarding whether the students have enough time or can be sure they will not be distracted by others while completing the evaluations were lower, and the standard deviations were higher. These two areas are suspected as being what causes some students to feel they are not in control of the process. Thus, new strategies are suggested to focus on those points to increase students' intention of participation.

CONCLUSION AND LIMITATIONS

Even though research has found that student ratings can be a reliable and valid indicator of effective teaching, most evaluations are performed on a totally voluntary basis. Students can decide whether they want to participate in the evaluation or not; as a result, usually schools struggle with the vital problem of low response rates of online evaluations for teaching. However, research has proved that non-response is particularly important, due to the fact that it can lead to potential bias in the research results (Bosnjak et al., 2005). In the present study, we were able to utilize TPB to test out three key factors, and identify several new determinants (by decomposing subjective norms) of students' intentions to participate in the online evaluation for teaching. According to the specific determinants identified as significant predictors of intention, our study was able to offer suggestions for strategies designed to influence students' intentions, and thus behavior, in the hope that the participation rate will be increased and the goal of teaching evaluation will be achieved.

Despite the significance of the study, several limitations are addressed for future studies. The first limitation is imposed by the nature of the self-reported questionnaires. Honest responses are assumed to be provided by participants, but the accuracy of self reported measures is often considered questionable. However, self-reported survey data is the method most commonly used to obtain information for similar research done in the past. Secondly, with its emphasis on adoption intentions, the study did not include the measure for actual behavior. Although prior research has indicated the significant positive effect of intentions on actual behavior (Ajzen, 1991; Bosnjak et al., 2005), it is necessary for future studies to consider this variable in order to test out the complete theory with some longitudinal designs. Finally, the last concern is the inclusion of data only from university students in Taiwan, resulting in the inability to generalize the research findings to a wider population. These data only provide local-based statistics with a convenience sample, but they suggest important ideas to administrators, educators, and future researchers to better understand students' intention of participating in online evaluations for teaching and how to implement effective teaching evaluations for better educational quality.

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SELF- MOTIVATION AS A MEDIATOR FOR TEACHERS' READINESS IN APPLYING ICT IN TEACHING AND LEARNING

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ABSTRACT
The aim of this study is to examine teachers' motivation as a great mediator for teachers' readiness in applying ICT in their teaching and learning. Apart from that, this study was carried out to differentiate the influence of exsogenous variables from the endogenous variables based on the academic fields (pure science and social science). This is a quantitative study using a survey method, involving a total of 874 high school teachers in Indonesia, including 446 science teachers and 428 social science teachers. Data was analyzed using path analysis (path analysis/ SEM) with AMOS software version 18. The results show that motivation is a significant variable as a mediator between the variables of readiness with ICT application in teaching and learning science and social science. Analysis of structural equation path model (SEM) shows that the data used in this study has a reasonable suitability for the proposed regression model. Thus, it is proved that the two independent variables are linked directly and indirectly to the dependent variable of the study which is the application of ICT in teaching and learning. The implication of this study is that the goverrnments and ministry of educations take into account teachers attitudes and motivations in terms of ICT application and address this issue by providing suffcent infrastructure , equipments, facilities, and training for teachers to develop positive attitudes the towards ICT use in education.

KEYWORDS: Motivation, Readiness, Mediator, Aplication, SEM Analysis

INTRODUCTION
The world is experiencing rapid changes which cause the explosion of ever-changing technologies. These changes are happening all over the globe, including developing countries like Indonesia**.** Therefore, it is inevitable that these changes should be embraced realistically so the developing countries are not to be left behind in improving the quality of education as well as strengthening the implementation of classroom instructional process. The presence of various new means of information has changed the state of thoughts, ideologies and cultures. Apart from that, the world is now borderless; hence, various external elements are invading other countries without border controls. As such, this development of information technology is synonymous with the universal theme as the world without boundaries, which as Davis (2001) stated that one of human tendencies in the early 21st century is the information revolution. This means that information is obtained more rapidly, which put conventional methods, such as going to the library and printed materials are so out of styles.

Now, the education system has fully realised the potential of ICT as a valueable assisting tool in teaching and learning (Drier, 2001). Students are now more interested in using ICT to access information, having personal websites is a current trend where they can easily check their status via social networkings such as myspace, friendster, blogspot, facebook and the list goes on. This phenomenon has become a trend among school students (Youssef et al., 2013; Zhao, et.al, 2002). This new type of students' interests and hobbies should be taken advantaged by teachers and parents to guide the students on the correct use of ICT (Badri et al., 2013). However, the most significant challenges faced by teachers are in handling a paradigm shift towards the ever-changing methods of teaching and learning and how to use computers and ICT as an alternative approach.

According to Baharuddin et al, (2000), for over the last thirty years, most classrooms in the European Countries have integrated ICT in the instructional process by learning how to use technology and ICT competencies also known as ICT literacy, which involve knowledge about the basic concept and operation, computer usage, word processing, spreadsheet, database, file management, documentation, presentation and communication of information. Technology can make our lives easier and everyday tasks are simplified (Brooke, 2013; Holmes, 1999). In the context of teaching and learning, technology can facilitate tasks and improve teachers' performance in creating effective teaching and learning activities. According to Pisapa (1994), the integration of ICT in the instructional process refers to the use of learning technologies to promote, strengthen and enhance skills. Information technology should be used in combination with other teaching methods. Teachers need to integrate ICT to add value to the teaching and learning activities (R & D).

In the Indonesian context, ICT was first developed in 1983 at the University of Indonesia, in the form of University Network (UINet) by Dr.Joseph F.P Luhukay, who at the moment had just completed the Computer Knowledge doctorate program in the United States. The network was developed for over four years. In the same year, Luhukay initiated the establishement of the UlNet at the Department of Culture and Education which was a computer network covering a wider reach of the University of Indonesia, Bandung Institute of Technology, Bogor Institute of Agriculture, Gadjah Mada University, Surabaya Institute of Technology and HasanudinUniversity (Sutedjo, 2002). However, ICT is generally still an exclusive matter for the Indonesian people (Onno, 2003). Internet service in Indonesia is still a cost center and not yet a profit center. This is due to the significant facts of the minimum number of phones available, the uneven distribution of accessible networks (fiber optic cable), and the rental of internet line is still very expensive. In addition, Internet users in Indonesia are mostly among the upper middle social class and consumption patterns are more for educational purposes.

Naidu et al. (2006) stated that attitudes are beliefs, emotional reactions and behavioral tendencies toward an object that induce or inhibit a person to make a choice of action in an activity that is academic or informal. Skills could be considered as the ability or capacity to do something well. According to Wong (2002), information and communication technology skills can be viewed in two dimensions of ICT content skills and the skills of using ICT to complete tasks. ICT is a new mean of technology to access information through an interactive spreadsheet that is more attractive through the integration of audio-visual and multimedia. Hubona and Whisenand (1995) viewed the use of ICT as a combination of traditional computer application and modern communication tools involving electronic mail and websites through communication networks and great access to information through search engines (Google and Mozilla).

Correspondingly, Albirini (2006) highlights the importance of teacher‘s vision of technology itself, his/her experiences with it, as well as the cultural conditions under which ICT is introduced into schools in shaping teacher’s attitudes toward technology and its subsequent diffusion in his/her educational practice.

PROBLEM STATEMENT

Indonesia is still lagging in terms of ICT provision as the usage in Indonesia is still limited and only available in the state of Java, and sadly the areas outside of Java are experiencing limited internet access. Prayitno (2007) stated that the use of internet as a whole is still relatively new to the Indonesian people and the number of users is still slightly lower than the total population and its accessibility is only in the big cities.

Siti Aishah et al. (2002) and Robiah et al. (2003) have found that teachers are comfortable with the conventional aids compared to the use of ICT. Their willingness to improve their knowledge and ICT skills is also very low, with their nonchalant attitude and disregard ICT as an urgent need to improve the quality and standards of their teaching and learning. The majority of teachers do not have good computer skills, which in this context referred to the basic knowledge of using Microsoft Word, Microsoft Excel and Microsoft PowerPoint. This is a clear evident that teachers do need helps. Apart from that, their skills in handling Microsoft Access and multimedia softwares such as Paint and Photoshop are still limited and their ability to use multimedia equipments such as scanners, digital cameras and digital video is very low. Teachers are also weak in electronic communications such as e-mail, chat, and exploring information from CD-ROMs and internet (Abdullah bin Md Yatim, 2002).

The common problem faced by the teachers is the lack of knowledge on how to use the internet to search and identify certain information. This dissuades them to apply it in their teaching and learning (Yunus & Wekke, 2009). They are disheartened with fear that their weaknesses will be known by students .This is consistent with a study by Laurillard (1994) which found that teachers were not competent in the use of technology, especially computers because of a lack of knowledge. For example they took a long time searching for information via the internet; some were unable to search because they did not have the knowledge of internet search (Rye, 2009).

This study was designed to examine the readiness and self-motivation of high schools teachers in Indonesia in the use of ICT and ICT applications in teaching and learning in order to create a meaningful learning experience for students and to improve teaching effectiveness. This study also identified factors which work as mediators on teachers’ willingness to apply ICT in their teaching and learning and to support the optimal use of ICT in teaching and learning activities.

LITERATURE REVIEW

ICT motivation

Motivation includes several factors which drive the selection, the persistence, as well as the engagement in particular activities to achieve an objective (Dweck & Elliott 1983). Besides, motivation is refered to the process in which goal-directed behaviour is prompted and sustained (Schunk 1990). Therefore, motivational factors are

regarded to be part of a person's goal structures and beliefs regarding what is significant (Ames 1992).accordingly, teachers' sufficient levels of motivation are seen to be associated with the innovative role of technology. Likewise, empirical study has effectively linked motivation to teacher's computer use (Sang et al., 2010)

Teacher readiness

Teachers are considred as the main factor that generally determines educational development and innovation since they are the ones to employ the ICT investments for the pupose of educational development. It is argued that Technology has no an educational value in itself (Sang et al., 2010). However, their importance is highly recognized when being used by teachers in the process of teaching and learning.

While some people claim that the presence of technology in the classroom produces a pressure and requires efficient and effective use (Sang et al., 2011), study results display that these are also connected to teachers' attitudes and their levels of knowledge (Badri et al., 2013; Tezci, 2010). Teachers' positive views towards the applications of ICT or rejecting them all together are affected by their attitudes, (Albirini, 2006) as well as other significant factors such as their information about and experience with ICT (Badri et al,. 2013) their experiences in how to utilize these technologies in classroom environment (Keramati, 2011), information and experiences regarding the kinds of applications based on ICT, age, self-confidence (Molnár & Benedek 2013; Reading & Doyle, 2013).

The main issue in teachers' decision to utilize or not to use ICT is related to their attitudes. The results of a study by Badri et al. (2013) show that an individual's attitudes have a significant impact on his/her behaviors in ICT use. Teachers' attitudes (positive or negative) influence how they respond to and employ ICT. Therefore, information is needed about teachers' attitudes for planning about and future investment in ICT (Tezci, 2010). Likewise, Keramati et al. (2011) found that teacher's motivation and training play a substantial role in ICT application in education.

Sang et al. 2011 has emphasized the strong relationships between computer-related attitudes and computer application in education .Attitudes towards computers affect teachers' acceptance of the usefulness of technology, and also affect whether teachers will integrate ICT into their classrooms.

Thus, Teachers' positive attitude can facilitate their use of more instructional technology tools in order to make learning more interesting as well as attractive for their students. However, Teachers who have negative attitudes towards technology application in education cannot benefit in ths area nor efficiently integrate technology into the education system.

In Indonesia, as a developing country, the use of ICT in education by teachers is far from sufficient (Rye, 2009; Yunus & Wekke, 2009).However, very few studies have been reported in this area. Therefore, given the importance of teachers' attitutes and motivation in the application of ICT in education the relationship between motivation and ICT readiness needs to be investigated.

OBJECTIVES OF THE STUDY

The primary objective of this study was to identify self-motivation as a mediator on teachers' willingness to apply ICT in their teaching and learning. The other objective was to determine the influence of the independent variables (exsogenous) on the dependent variables (endogenous) based on the academic fields (pure science and social science teachers).

MATERIALS AND METHODS

Instrument

This is a quantitative study using a survey method.

Population and sample groupA

The study sample was selected using purposive sampling and simple random techniques.A total of 874 high school teachers, including 446 science teachers and 428 social science teachers comprise the study sample.

Data analysis

Data was analyzed using path analysis (path analysis/ SEM) with AMOS software version 18.

Study procedure

The survey method was used to collect data by using questionnaires. A pilot study was conducted involving a total of 200 secondary school teachers for the purpose of determining the validity and reliability of the research instrument. The Cronbach's alpha value for each aspect is as follow: teachers' attitudes towards ICT (0815), the use of ICT (0923), ICT facilities in schools (0888), ICT knowledge (0968), ICT skills (0.970) and the application of ICT in teaching and learning (0943). Every aspect has high reliability and fit to be used in the actual study for all of the instruments for readiness, motivation and application of ICT in teaching and learning. Respondents for the actual study were teachers from secondary schools in Indonesia. A total of 874 teachers were selected using purposive sampling and simple random techniques. Data was analysed by using Structural Equation Model (SEM) with AMOS 18.0 software to test the research hypotheses**.**

Results

Analysis of Structural Equation Model (SEM) with AMOS 18.0 software was used to test motivation as a mediator for teachers' readiness towards the application of ICT in teaching and learning. The results of the SEM analysis are as shown in Figure 1 below.

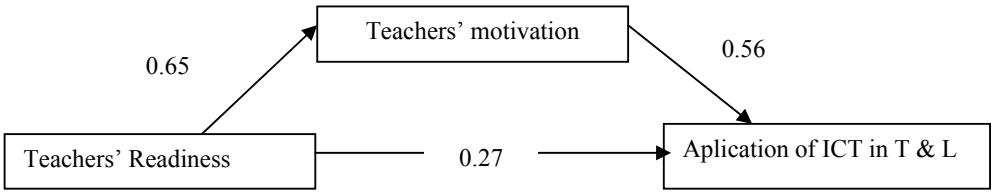

Figure 1: Motivation as a Mediator for Teachers' Readiness towards the Application of ICT in Teaching and Learning

SEM analysis of AMOS 18 software shows that teachers' motivation is a mediator towards teachers' readiness to apply ICT in teaching and learning. The results of the path analysis SEM equations model indicate SEM measurements as the following: Chi Square / df = 0.000, Root Mean Square Error Approximation (RMSEA) = 0:07, Goodness of Fit Index (GFI) = 1.000 and comparative fit index (CFI) = 1.000. All of the measures used show that the data used in this study proved to have reasonable compatibility with the model.

Table1 Goodness of Fit Index (GFI) of the Respondents

Parameter	**Coefficient /Index**	
GFI	>0.9	1.000
NFI	>0.9	1.000
RMSEA	<0.08	0.069
CFI	>0.9	1.000
X^2/df	<0.3	0.000

Path analysis of the structural equation model (SEM) showed that the regression model proposed is compatible, where teachers' motivation is a significant predictor for the variable of readiness (motivation $\beta = 0.65$, $p < 0.000$). Results of the analysis also indicate that variables in term of teachers' readiness and motivation are significant predictors for other variable which is the application of ICT in teaching and learning (readiness $\beta =$ 0:56, $p = 0.000$; motivation $\beta =$ 0:27, $p < 0.000$).

In overall, the results of path analysis structural equation model (SEM) showed the variance in the endogenous variables, the application of ICT in teaching and learning as predicted by exsogenous variables is 0.59. This shows that 59% of the variances of the application of ICT in teaching and learning is predicted by all the independent variables of the study. Thus, this means there is 0:41 or 41% of the variances in the variable of ICT application in teaching and learning can not be predicted by the regression model. Sobel test results show the impact value of motivation as a mediator for teachers readiness in applying ICT in their teaching and learning with the value of z = 19 576 and sig = 0.000 ($p < 0.05$). This shows that motivation is a significant factor which plays as a mediator for the teachers to be ready in applying ICT in their teaching and learning process.

A model was designed and analyzed by using AMOS 18 to show a detailed look of the contribution of each aspect in teachers' motivation as mediator for teachers' readiness in applying ICT in their teaching and learning. The result is shown as in Figure 3 below.

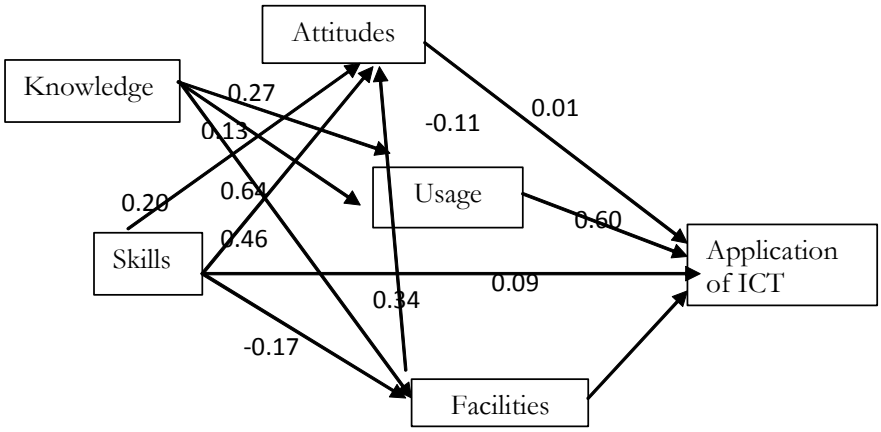

Figure 2 the aspects of motivation as mediator to each aspect of readiness towards the application of ICT in Teaching and Learning

SEM analysis of AMOS 18 software shows that the usage of ICT and ICT facilities are mediators for teachers in terms of ICT knowledge and ICT skills in the application of ICT in teaching and learning. Path analysis of the SEM equations model shows results that indicate the following: measurement of the Chi Square / df = 301 345, Root Mean Square Error Approximation (RMSEA) = 0.059, Goodness of Fit Index (GFI) = 0.972 and comparative fit index (CFI) = 0.906. All of the measures used show that the data used in this study proved to have reasonable suitability for the proposed model.

Table 2 Goodness of Fit Index (GFI) of the respondents

Parameter	**Coefficient /Index**	
GFI	>0.9	0.972
NFI	>0.9	0.906
RMSEA	<0.08	0.059
CFI	>0.9	9.06
X^2/df	<0.3	0.000

The results of structural equation model (SEM) path analysis showed that the regression model is compatible as proposed, where ICT knowledge and ICT skills are significant predictor variables for the attitude variable (knowledge, β = 0:13, p <0.000; skills, β = 0.20, p = 0.000). The analysis also shows ICT knowledge and ICT skills of the teachers are significant predictor variables for the following variables: the use of ICT (knowledge, β = 0:27, p <0.000; skills, β = 0.246, p = 0.000) and ICT knowledge and ICT skills are significant predictor variables for the variable of ICT facilities (knowledge, β = 0.64, p = 0.000; skills, β = -0.17, p = 0.000).

The anaysis shows that the variables of ICT knowledge and ICT skills are significant predictor variables for the variables of ICT application in teaching and learning (knowledge β = -0.11, p <0.000; encouragement β = 0:34, p <0.000). As a result, this shows that the use of ICT is a significant mediator for the teachers to apply ICT in their teaching and learning (use β = 0.60, p <0.000). However, the attitude and ICT facilities are not mediators for the application of ICT (ICT attitude β = 0.01 and p> 0.001; facility β = 0:09, p <0.001).

Sobel test results to see the impact of every aspect of motivation as a mediator in the aspect of teachers support towards ICT applications can be seen in Table 3 below.

Table 3 Sobel test on the effect of Motivation as mediator for teachers' readiness in applying ICT in teaching and learning

Mediated pathway	Z	P
Knowledge → Attitude → ICT Application	8.42	0.00
Skills → Attitude → ICT application	11.28	0.00
Knowledge → Usage → ICT application	19.04	0.00
Skills → Usage → ICT application	20.18	0.00
Knowledge → Facilities → ICT application	11.99	0.00
Skills → Facilities → ICT application	9.85	0.00

Table 3 shows that attitude, usage and facilities are significant mediators for knowledge and skills in the application of ICT ($p < 0.05$). This clearly shows that the elements of teachers' motivation which consists of attitude, usage and facilities, effectively react as mediators for the teachers to be ready. In this context, readiness involves knowledge and skills to apply ICT in teaching and learning.

DISCUSSION

The results showed that motivation is a mediator that help teachers to be ready in applying ICT in their teaching and learning. These findings reaffirm a study by Abdul Wahab (2006) that there is a significant relationship between knowledge, skills and the usage of information and communication technology with the attitude towards information and communication technology. The study result is also consistant with the finding of a study by Aldunate and Nussbaum (2013) as they report that teachers who donot emply technology early in their teaching process and devote a asmall portion of their time to incorporating educational technology are less likely to adopt new echnology.

Attitude is seen as a catalyst in determining whether teachers are willing to use ICT or otherwise. Normally, it is common for teachers to be positive in adapting with changes and accepting new technologies. Hence, their professional attitudes will help them in utilising the technologies as a way to improve the quality of their teaching and learning (Tezci, 2010).

Teachers are professionals who constantly experience changes and face development of new technologies in their lives. As professionals, they understand their roles and functions as a resource and catalyst for learning activities. According to Norton & Willburg (2003), teachers are always keen to have new technologies in the hope that technologies can help them in overcoming problems encountered in the context of teaching and learning. However, there are still teachers who do not realize the importance of ICT and multimedia as teaching and learning aids. Thus, according to Norhayati Abd Mukti (1995), teachers are still not fully ready to use computers in their teaching and learning and such rely more on their usual ways of teaching which normally oral presentations and question and answer with the least emphasis on ICT development.

There are also teachers who do not fully utilize the advantages and capabilities of ICT in their schools, even if the government has supplied complete equipments and ICT facilities (Lim & Pannen, 2012). This occurs due to a number of factors that discourage the teachers. Teachers are actually facing great challenges and problems in the use of ICT in their teaching and learning, especially their negative attitude towards the use of ICT and their lack of the knowledge and skills in using ICT for teaching and learning process. This statement reinforces the study by Newby et al. (2000) which found that technical teachers do not use ICT in their teaching, even though they are given adequate facilities.

Face-to-face teaching is still relevant and seems a common practised. However, it is an added value if teachers are able to integrate ICT in their lesson. This in fact will enhance effectiveness in which teachers are still the most important players, as they are the ones who should know how to integrate ICT in the curriculum content (Konstantinos, Andreas, & Karakiza, 2013; Tezci, 2010). The lesson should be presented in such a way that learning would be fun, more attractive and effective through information management and integration with pedagogical competency and practice methodology. However, Dlodlo (2009) argues that information technology alone will not change anything without great operators and drivers, which in this context refer to the teachers (Badri et al., 2013).

Teachers who regularly use the technologies will have extensive knowledge not only about the content of the subject but also on information and communication technology. Teaching with information and communication technology (ICT) such as the use of blogs, videos, websites, e-mail, etc. will reflect the maturity level of the educators, and level up students' appreciation as teachers are viewed as visionary, advanced and up to date (Sang et al., 2011; Owen et al., 2000).

Teachers' competencies and their knowledge on how to access information via the Internet is also supported by the way they explore the applications through search engines. Lacking of appropriate skills and knowledge, will discourage teachers to use ICT and this will overtime cause desperate fall. Teachers need to get familiar with computers and keep on searching for information via the Internet multi resources. In the long run, they will naturally adapt with the latest technological developments through a variety of devices and networks. Siti Fatimah et al (2005) argues that learning to apply ICT for data presentation such as a power point presentation, Prezi and graphics editor would be a form of improvements, as information is delivered in a more attractive and impressive mannner.

CONTRIBUTION OF THE STUDY

The primary finding of this study is that teachers' motivation is a mediator on their willingness to apply ICT in their teaching and learning. The study found that teachers' motivation is the most important factor in ICT readiness and there is a positive correlation between selfmotivation and ICT readiness.In general, the result of the study can be used for developing and popularizing ICT usage at both school and higher education levels across diciplines. Findings of this study will be valuable for both academics and practitioners of ICT in education.

As technology readiness and adaptation process is positively correlated with the type of teacher's attitude and motivation towards new technology, hence preparing and training teachers in this vein to embrace technology is paramount importance which needs to be taken into account by stakholders.

Furthermore, since the technology adoption process appreas to be qualitatively different for different technologies, in terms of complexity of application, hence, the stakholders and those in charge of ICT use in education need to take this issue into consideration.

As some related studies have been conducted in the other countries and have come up with almost similar results locally, for example, Iran (Keramati et al. 2011), the Emirats (Badri et al., 2013), and Greece (Konstantinos et al., 2013), it can be concluded that the issue is prevailing in developing countries.

The solution for this issue is that the developing countries which have the sufficient infrastructure and facilities to integrate ICT into the education system and curriculum should take efforts to facilitate the introduction of ICT into the education system. To this end, they need to train and educate the teacher to be familiar with the benefits of ICT as well as learn how to employ it in the process of teaching and learning.

Furthermore, since teachers' attitudes and motivation play a key role in the willingness and readiness for ICT application, governments need to address this issue by facilitating the transition from traditional system of education to the modern system where ICT has a leadning part in education. More specifically, in addition to establishing the infrastructure and providing the necessary equipments, the governments should provide sufficient training for teachers.

Thus, In addition to adding to the body of knowledge, this study lays the ground for longtitudinal study to delve into this area and unveil the issues and bariers of ICT usage in developing countries, since the issue of ICT readiness and adoption is a challenge specifically prevailing in the developing countries.

IMPLICATION, SUGGESTION AND CONCLUSION

To effectively integrate technology into education government should provide facilities to train teachers and advocate for technology's advantage to the teachers and students alike, and accordingly develope a positive attitude toward technology in the schools' teaching practices. In addition, feedback needs to be collected for the purpose of integrating technology continuously.

Furthermore, the major problem is teacher's conception of ICT since teacher's attitude toward ICT is not appropriate. Therefore, it is important to first convince managers and second train teachers and elucidate benefits of this new paradigm for teachers.

As this study has demonstrated that teachers' motivation is a mediator on their willingness to apply ICT in their teaching and learning, this is very much associated with knowledge, so, teachers must be able to apply the knowledge to use ICT with their own information technology skills. Frequent use of the applications will in fact improve the skills and capability, which in the long run increase the application of ICT in teaching and learning. Sustainable efforts are required to improve the skills of using ICT. Therefore, the Ministry of Education needs to encourage all teachers especially by providing sufficient trainings and facilities for them to use ICT. Hence, such experiences can lead to more comfort, confidence, acceptance, and eventually development a positive attitude toward ICT integration into curricula and teaching.

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THE IMPACT OF IRANIAN TEACHERS CULTURAL VALUES ON COMPUTER TECHNOLOGY ACCEPTANCE

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ABSTRACT
This study was conducted with the aim of testing the technology acceptance model and the impact of Hofstede cultural values (masculinity/femininity, uncertainty avoidance, individualism/collectivism, and power distance) on computer technology acceptance among teachers at Urmia city (Iran) using the structural equation modeling approach. From among these teachers, 275 were sampled. Research results suggested that masculinity/femininity cultural values have a positive impact on variables of the technology acceptance model (perceived usefulness and perceived ease of use). The effect of uncertainty avoidance on these variables was also negative. Individualism/collectivism produced a positive effect on perceived usefulness but power distance created a negative impact on perceived usefulness and ease of use. Also the effect of individualism/collectivism on perceived ease of use wasn't significant. Research results and implications are discussed in the paper.

KEYWORDS: Technology Acceptance Model, Cultural Values, Hofstede Cultural Dimensions.

INTRODUCTION
Emergence of computers has brought about a change in societies which can be compared to the one produced by the Industrial Revolution. Some sociologists have suggested that what is happening today is a transition to a new society which is no longer based mainly on material production. Various terms have been coined for describing such a new social order, such as 'the age of information' and 'modern economy'; but the most commonly used term is 'information economy'. Information economy is the type of economy in which the majority of workforce works not in production sector or distributing material commodities but in designing and optimizing them, production technology, marketing, sales and after-sales services. The relevant staff can be called 'information staff'. Information economy is influenced by the constant flow of information and ideas as well as by the enormous capacity of science and technology (Giddens, 2007). In keeping with new changes in the age of information, education should also undergo some evolution in order to find its effective place in growth, progress and preparation of pupils and students as the prospective information staff in the information society.

Teachers are the most important human factor to integrate computer and information technology in educational system. As the teacher has his or her own way to use blackboard in instruction, also the use and integration of information technology in instruction depend on his or her attitudes and experiences. The International Society for Technology in Education (ISTE) emphasizes that teachers must ready to prepare technology based learning opportunities for their students. Indeed, teacher is the most important person to help students for access to the capabilities of information technology. Readiness for application of information technology and having the knowledge about how information technology could support students learning must be the one of basic teacher's skills. But Despite research findings showing the capability of information technology to transform teaching and learning processes, the use of computer systems in the classrooms remains peripheral and minimal and teachers do not use technology effectively (Ejei, Amani Sari Baglou, Khezri azar, & Gholami, 2012).

In a comprehensive study, Ayati, Attaran and Mehr Mohammadi (2005) investigated the actions taken to extend the application of information technology in Iran's educational system as well as the associated problems. These actions included creating the Internet network in schools, creating national network of growth in order to facilitate schools' access to a comprehensive bank of educational information, communication-information

literacy training, holding relevant seminars and workshops as well as international collaboration and conducting studies on the acceptance of technology in the educational system. Their findings indicated that there is a big gap between the standard of educational technology used in Iran's educational system and international standards. They categorized the causes of this mismatch and the relevant problems into four classes: The problems associated with information technology's strategic development, infra-structure problems, structural problems and problems associated with human resources.

An in-depth analysis of the problems identified as causes of inappropriate information technology development by these researchers indicates that the main factor leading to such problems is the cultural values dominating Iran's or other developing societies. Because information technology is a culture-dependent phenomenon, following cultural presuppositions of the West or developed countries. Therefore, when this technology enters developing countries, such as Iran, a kind of cultural gap often comes into existence, since these cultures are different in methods of teaching and accepting technology from the methods devised and tested in developed countries (Akour, 2006). Fandy (2000) points to many studies focusing on transfer of computer technology to developing countries, but little research has been carried out to discover how cultural variables and values affect acceptance and use of technologies. Nowadays, information technology researchers pay special attention to culture because neglecting cultural differences can hinder information technology acceptance and raise the level of risk of failure to do so (Akour, 2006).

Information technology had a very slow growth rate in developing and less developed countries like Iran before 1990s. With developments in global trade, these countries recognized the importance of the application of such a technology, which in turn led to its growing use in these countries. However, compared to that in developed countries, this growth has had little effect on the organizational output in these countries. Studies have indicated that the use of information technology in such countries has been very low and without any significant effect on the performance of organizations (Anandarajan, Igbaria & Anakwe, 2002).

Just as culture can be revealed by individuals, research suggests that cultural values shape cognitive processes, thereby influencing people's beliefs about and behaviors toward computers (Kedia & Bhagat, 1998). As regards computer technology, Hofstede's cultural values model (Hofstede, Hofstede & Minkov, 2010) has caught the attention of numerous researchers due to its comprehensiveness and experimental support (Srite, Thatcher & Galy, 2008). This model is used in this study as the underlying theoretical framework and the dimensions examined in this study include masculinity/femininity, uncertainty avoidance, individualism/collectivism, and power distance. These concepts are further explained in the following section.

Culture and Cultural Values

Masculinity/Femininity: This dimension refers to the extent to which one believes in the distinction between gender roles in society. In masculine cultures, people are of the opinion that men's and women's roles should be separated. In such cultures, men are expected to be bold and aggressive and to emphasize material success, whereas women are expected to be demure and sensitive and to care about the quality of life. In contrast, people in feminine cultures believe in overlap and association between gender roles (Hofstede, Hofstede & Minkov, 2010), i.e. both genders are expected to underlie the interpersonal relationships, quality of life, to help others, and to pay less attention to oneself (Hofstede, 1980).

Uncertainty Avoidance: This is concerned with how people face the unknown aspects of the future, referring to the degree to which members of a culture feel danger because of vague and uncertain situations. The cultures scoring high in this dimension are worried about future and avoid danger through developing controlling mechanisms such as religion, rules, social plans, and written and unwritten roles. On the contrary, the cultures feeling secure about their own future avoid uncertainty to a lesser degree (Hofstede, 1980).

Individualism/Collectivism: This deals with the relationship common between an individual and a group in a specific society. In individualistic cultures, people have a fragile relationship with each other, and everyone is expected to consider their own personal interests; but in collectivist cultures, people have a close-knit relationship with members of the society, pursuing collective and group interests (Hofstede, 1980).

Power Distance: This dimension refers to the extent to which less powerful members of institutes and organizations (such as families) accept and expect that power be distributed unequally. People in cultures with large power distance accept dominance and authority more easily than those living in cultures with small power distance, in which equality of classes and people is regarded as a value (Hofstede, 1980). Based on Hofstede's (1980) findings, the Iranian culture is determined by medium-plus power distance, medium-plus uncertainty avoidance, medium collectivism, and femininity. Hedayati (2006), of course, claimed that the Iranian culture has

experienced some changes. In his study, the Iranian culture scored 64 for power distance, indicating vast power distance, 87 for uncertainty avoidance, suggesting high level of uncertainty avoidance, 82 for collectivism/individualism, demonstrating a significant degree of collectivism, and 67 for masculinity/femininity, reflecting tendency toward masculinity. Some researchers have argued that this change has been caused by the difficult economic status following the 8-year-long war with Iraq (Hadizadeh Moghadam & Assar, 2008).

Hofstede (1980) mentions that although these dimensions and the scores achieved by each country show general patterns existing in a particular culture, there are numerous differences between people in terms of each dimension. In other words, no society is entirely collectivist, individualist, or feminist. Hofstede applies the garden metaphor for each culture, treating people as garden flowers. The flower which exists most in number in a garden determines the name of that garden, yet this does not mean that there are not other flowers in the garden. Trandis (2001) also argues that the cultures with appropriate functions enjoy a combination of these dimensions but the cultures placed at the end of the continuum, e.g. individualism/collectivism, suffer dysfunctions. These intracultural differences are significant because they provide the variance required for drawing intracultural comparisons in terms of the extent to which these dimensions influence people's attitudes and beliefs (Srite, 2000).

Iran cultural values may influence on users information technology acceptance in educational setting. For example, the centralization of the educational system (which is the main factor behind the lack of growth and development of new technology in Iran's educational system) indicates the values of power distance and uncertainty avoidance (Srite, 2000). According to Srite (2000), in cultures with high levels of uncertainty avoidance, the members opt for overuse of traditional tools rather than favoring new technologies such as information technology and adapting themselves to the changing environment. Furthermore, a high power distance leads to the creation of a hierarchical and bureaucratic structure in organizations which in turn leads to a strict resistance against change and innovation. In addition, a high collectivism profile also leads to group ideas to be regarded as superior to individual ideas and these results in a lack of attention to the innovative and pioneering ideas of individuals on the applications of new technologies such as information technology. As far as cultural changes in Iran in terms of masculinity/femininity are concerned, with the trend moving towards masculinity, it can be claimed that this change has had a positive influence on the development of information technology (since masculine cultures put more emphasis on development). However, taking the facts in Iran's educational system into account (where this technology does not seem to have been properly developed), it can be concluded that the masculinity/femininity dimension has not been instrumental in affecting development and growth in information technology. Although many studies have been conducted on the impact of cultural values on computer technology acceptance in developed western countries (e.g. Srite, 2000; Thatcher, Srite, Stepina, & Liu, 2003; Srite & Karahanna, 2006; Srite, Thatcher & Galy, 2008), no research, except for one in Jordan, seems to have been carried out in the Middle East, particularly in Iran, with cultural values quite different from those of western countries. In addition, studies have mostly focused on trade organizations, and research into the effect of cultural values on users of educational environments (e.g. teachers) is scarce.

THEORETICAL MODEL OF RESEARCH

The theoretical model of this study is based on the technology acceptance model (Davis, Bagozzi & Warshaw, 1989). This model is shown in Figure 1 below.

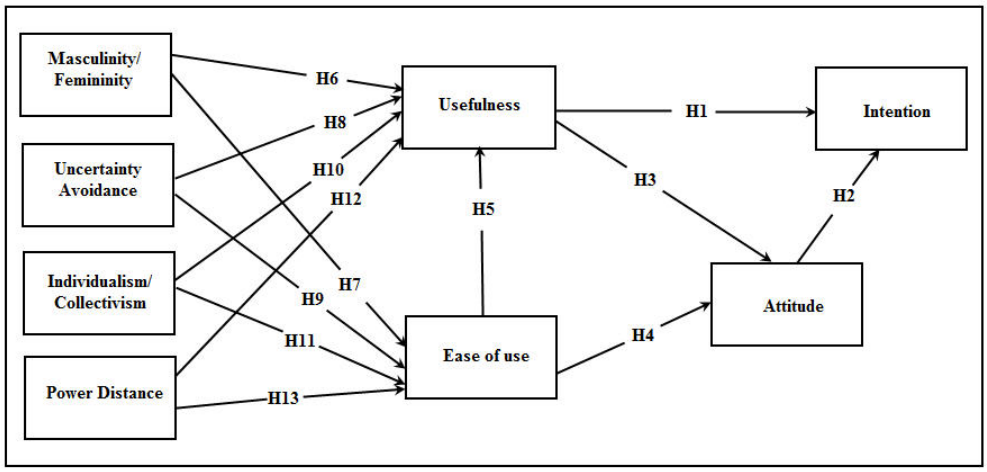

Figure 1: Theoretical Model of Research

The model is founded on the theory of reasoned action, put forward for modeling information technology acceptance by the users (Davis, Bagozzi & Warshaw, 1989). This model is based on two factors, namely perceived usefulness and perceived ease of use. Perceived ease of use refers to the extent to which one believes that using the computer system will not require their physical and mental efforts, and perceived usefulness refers to the extent to which one believes that using computer will enhance their business performance. These two factors influence people's attitudes toward use of the technology, their intentions to use that technology, and eventually, to use it in practice. In the technology acceptance model, the degree of technology acceptance is measured by the intention to use (Teo, 2008). Moreover, perceived ease of use affects perceived usefulness. The studies conducted on the basis of this model both in Iran and in other countries have provided it with much experimental support (Dorani & Rashidi, 2007; Akour, 2006; Teo, 2009; Kim, Chun & Song, 2009, Amani Sari Bagloo, Lavasani, Ejei and Khezri Azar, 2011; Ejei, Amani Sari Baglou, Khezri Azar & Gholami, 2012). Given the foregoing, the following hypotheses are formulated concerning the technology acceptance model.

Hypothesis 1: Perceived usefulness has a direct and positive impact on the intention to use.
Hypothesis 2: Attitudes toward use have a direct and positive impact on the intention to use.
Hypothesis 3: Perceived usefulness has a direct and positive impact on the attitudes toward use.
Hypothesis 4: Perceived ease of use has a direct and positive impact on the attitudes toward use.
Hypothesis 5: Perceived ease of use has a direct and positive impact on perceived usefulness.

1. Predictors of Perceived Usefulness and Perceived Ease of Use: Davis (1989) proposed that external factors such as organizational factors, social factors, mode of education, and other variables should be incorporated into the technology acceptance model and their effects on technology acceptance should be explored. Based on this model, external factors predict perceived usefulness and perceived ease of use. As a mental software which shapes people's understanding and personalities, culture is the most important external factor which may influence people's beliefs and behaviors in terms of information technology (Akour, 2006). Furthermore, Hofstede, Hofstede & Minkov (2010) remarks that major cultural values are shaped in people's minds in childhood. Their beliefs and behaviors are a representation of the culture governing their environments which is rooted in their minds and is transferred from one generation to another over time. This changes culture into a dynamic power (Schien, 1991). Researchers have recently begun to investigate the relationship between values and cultural dimensions and people's personal and organizational beliefs as well as their beliefs about and behaviors toward computers (Srite, 2000; Srite, 2006; Akour, 2006; Srite, Thatcher & Galy, 2008).

2. The Impact of Cultural Values on Technology Acceptance: The Effect of Masculinity/Femininity on Perceived Usefulness and Perceived Ease of Use: A high degree of masculinity may have a positive impact on teachers' beliefs about perceived usefulness and perceived ease of use of computers because this technology is more compatible with masculine values (Akour, 2006). Characteristics of computer technology are correlated with those of masculine cultures, including progress, diligence, high level of performance and purposefulness in tasks, long working hours, and the working environments which lay stress on individualism, competitiveness, and technicality. The study carried out by Akour (2006) showed that there was a relationship between perceived usefulness and masculinity. Considering the foregoing discussion and the fact that the Iranian culture is masculine, the hypotheses below are developed:

Hypothesis 6: Masculinity has a direct and positive effect on perceived usefulness.
Hypothesis 7: Masculinity has a direct and positive effect on perceived ease of use.

The Impact of Uncertainty Avoidance on Perceived Usefulness and Perceived Ease of Use: The effect of uncertainty avoidance on teachers' perception of usefulness and ease of use of computers pertains to how they respond to uncertain and unstructured situations (Hofstede, Hofstede & Minkov, 2010). Research indicates that in cultures with a high level of uncertainty avoidance, information technology is learnt and applied to a lesser degree, since uncertainty and vagueness are correlated with this technology (Hasan & Ditsa, 1998). As a result, even though people regard computers as useful and user-friendly devices, they still may avoid using them due to their vague nature (Veiga, Floyd & Dechant, 2001). Although most teachers learn about capabilities of computers and how to work with them during their studies in university, the tendency toward usefulness and ease of use of computers is influenced by their degree of uncertainty avoidance. The study by Akour (2006) demonstrated that there was a relationship between uncertainty avoidance and perceived usefulness as well as perceived ease of use. Given the foregoing and the fact that there is a high level of uncertainty avoidance in Iran, the following hypotheses are proposed:

Hypothesis 8: High degree of uncertainty avoidance has a direct and negative effect on perceived usefulness.

Hypothesis 9: High degree of uncertainty avoidance has a direct and negative effect on perceived ease of use.

The Impact of Individualism/Collectivism on Perceived Usefulness and Perceived Ease of Use: Although less individualist cultures such as the Iranian culture encourage team work, they may produce a negative impact on people's perception of usefulness and ease of use of computers. Individualist and collectivist cultures differ in the way in which people view themselves in the society (Hofstede, Hofstede & Minkov, 2010), and this eventually brings about differences in modes of information technology acceptance in these two types of culture. One may find that using a particular computer software program raises the level of business output in an organization (Davis, Bagozzi & Warshaw, 1989). Still, they will not apply such a software program because collectivist cultures attach little value to people's computer skills and encourage them to a lesser degree (Hill, Loch, Straub, & El-Sheshai, 1998). In collectivist countries, such as Iran, computer technology is treated as an individualist technology, which may negatively affect social structures and norms (Hill et al., 1998). The impact of individualism on teachers' beliefs about usefulness and ease of use of computers is correlated with their perception of the group and how to respond to the uncertain and unstructured situation (Hofstede, Hofstede & Minkov, 2010). The study by Akour revealed that there was a relationship between individualism and perceived usefulness as well as perceived ease of use. Considering the foregoing and the fact that Iran is a collectivist community, the following hypotheses are put forth:

Hypothesis 10: High level of individualism has a positive impact on perceived usefulness.
Hypothesis 11: High level of individualism has a positive impact on perceived ease of use.

The Effect of Power Distance on Perceived Usefulness and Perceived Ease of Use: Power distance may hinder people's beliefs about and perceptions of usefulness and easy use of computers in cultures with vast power distance, such as Iran. Major values in cultures with large power distance may forge strong connection between current business skills and traditional social relationships (Hofstede, 1980). Thus, arbitrary and typical values of the society hamper acceptance of any technology, which causes fundamental changes in the working environment. Computer technology too has a tendency toward presenting new methods of fulfilling tasks, which makes people in such cultures consider computers as means which negatively affect well-established methods of doing tasks. In addition, even if people regard computers as useful and user-friendly devices, they wait for them to be approved by their chiefs, managers, and role models (Veiga, Floyd & Dechant, 2001). The role models of these people are primarily traditional people, treating computers as the means which interfere with their normal working conditions (Akour, 2006). Given the foregoing and the fact that there is a huge power distance in Iran, the following hypotheses are formed:

Hypothesis 12: Vast power distance has a direct and negative effect on perceived usefulness.
Hypothesis 13: Vast power distance has a direct and negative effect on perceived ease of use.

METHODOLOGY

Research design

This study employs a structural equation modeling (SEM) approach to develop a model that represents the relationships among the eight variables in this study: behavioral intention to use of computer, attitudes towards computer use, perceived usefulness, perceived ease of use, masculinity/ femininity, uncertainty avoidance, individualism/ collectivism and power distance. Data were collected through using a survey questionnaire comprising questions on demographics and multiple items for each variable in current research. Partial Least Squares (PLS) method was used for testing research model. PLS has been regarded as a powerful structural equation tool because of its less dependence on sample size, normal distribution of residuals and interval measurement scales (Chin, Marcolin & Newsted, 1996). In this study, PLS was used for testing the theoretical model since the sample size was low (N = 275) and since there was no strong literature on the relationship between culture values and beliefs about information technology in Middle East countries.

Research participants and data collection

Participants in this study were 275 teachers in Urmia's (Iran) Education District 2. Among the participants, 172 (62.5%) were male and 103 (37.5%) were female, and the mean age of all participants was 34.74 years (SD = 5.21). also the mean work experience was 12.92 (SD= 5.77). 262 (95.3%) had access to a computer at home and 13 (4.7%) hadn't access. The majority of the participants had 4 years and upper computer experience (63.3%). The reported mean hours of daily computer use by teachers was 2.54 (SD = 2.07). In order for the questionnaire to be used in this study, it was first translated into Persian by an experienced English teacher in Tehran. It was then translated back into English by another English teacher and any discrepancies were sorted out so that the translated version was ensured to reflect the original version. The translated version was then given to a psychometric expert in Tehran University to be checked against its suitability for the Iranian culture. The

questionnaire required 5 to 10 minutes time on average for completion. In order to motivate the participants to take part in the research and have their fullest cooperation, small gifts were also given to the participants. Table 1 shows the demographic properties of the participants.

Measures

A survey instrument was designed to measure the eight constructs in this study. Comprising two sections, the first required participants to provide their demographic information and the second contained 29 items on the eight constructs in this study. These constructs are: Intention to Use Computer (BI) (two items), perceived usefulness (PU) (four items), perceived ease of use (PEU) (four items), attitudes towards computer use (ATD) (four items), masculinity/ femininity (MF) (four items), uncertainty avoidance (UIA) (four items), individualism/ collectivism (IDV) (three items) and power distance (PD) (four items). Each item was measured on a seven-point Likert scale with 1 = strongly disagree to 7 = strongly agree. These items were adapted from various articles and these are listed in Appendix 1.

Table 1: Demographic information of the Research Sample (n=275)

Variable	Category	Frequency	Frequency Percentage
Gender	Male	172	62.5
	Female	103	37.5
Age	34.74 (SD= 5.21)		
Work experience	12.92 (SD= 5.77)		
Home computer ownership	Yes	262	95.3
	No	13	4.7
Experience of Working with Computer	Less than one year	29	10.5
	2 to 3 years	72	26.2
	More than 4 years	174	63.3
Mean hours of daily computer usage	2.54 (SD= 2.07)		

RESULTS

The statistical analyses in this section include examining the descriptive statistics and assessing the measurement model (reliability and validity of research constructs) and finally this is followed by assessment of structural model (testing of the hypotheses).

Descriptive statistics of research constructs

The descriptive statistics of the research constructs are reported in Table 2. Except for power distance (mean = 2.23), all means are above the midpoint of 4.00. The standard deviations show a narrow spread around the mean and skewness and kurtosis indices reflect an acceptable degree of normality for applying structural equation modeling (Kline, 2011).

Table 2: Descriptive statistics of study constructs

Construct	item	Mean	S.D	Skewedness	Kurtosis
Masculinity/Femininity	4	4.92	1.36	-0.46	-0.11
Uncertainty Avoidance	4	3.60	1.60	0.01	-0.97
Individualism/Collectivism	3	3.51	1.51	0.56	-0.12
Power Distance	4	2.23	1.11	1.17	1.52
Perceived Usefulness	4	5.71	1.10	-0.74	0.18
Perceived Ease of Use	4	5.48	1.08	-0.87	1.03
Attitudes toward Use of Computer	4	5.98	0.90	-1.16	1.29
Intention to Use Computer	2	6.35	0.94	-2.06	1.25

Examining Measurement Model

In order to test the measurement model, i.e. investigating construct validity and reliability of the measurement tools, Fornell and Larcker (1981) propose three criteria for the study of the reliability of the constructs: 1. reliability for each statement; 2. Composite reliability (CR) for each construct; and 3. Average Variance Extracted (AVE). The factor loading of 0.6 and above for each statement using confirmatory factor analysis indicates a good construct (Gefen & Straub, 2005). In this study, the composite reliability index of Fornell and Larcker (1981) was used to study the composite reliability of each statement. Acceptable level of ρc should be

0.7 or more (Fornell & Larcker, 1981). The third indicator of reliability is AVE (Chin, 1988). Chin suggests that AVE should be 0.5 or higher, which means that the relevant construct explains 50 per cent or more of the variance of its indicators. Tables 3 and 4 indicate information of factor loadings, CR and AVE for each construct. The items which had a lower factor loading than 0.6 (expect for IDV2) have been dropped from the analysis. The figures in these tables indicate that the constructs enjoyed acceptable reliability.

Table 3: Factor Loadings, AVE and Composite Reliability of Cultural Constructs

Masculinity/ Femininity		Uncertainty avoidance		Individualism / collectivism		Power distance	
Item	Loading	Item	Loading	Item	Loading	Item	Loading
MF1	0.87	UA1	0.84	IDV2	0.51	PD1	0.72
MF2	0.60	UA2	0.88	IDV3	0.99	PD2	0.84
MF3	0.83	UA3	0.84			PD3	0.82
		UA4	0.85			PD4	0.79
CR	0.82		0.91		0.75		0.87
AVE	0.61		0.73		0.63		0.63

Table 4: Factor Loadings, AVE and Composite Validity of Structures of Technology Acceptance Model

Perceived Usefulness		Perceived Ease of Use		Attitudes toward Use of Computer		Intention to Use Computer	
Item	Loading	Item	Loading	Item	Loading	Item	Loading
PU1	0.86	PEU1	0.86	ATD1	0.85	BI1	0.81
PU2	0.86	PEU2	0.89	ATD2	0.65	BI2	0.92
PU3	0.92	PEU3	0.84	ATD3	0.79		
PU4	0.91	PEU4	0.89	ATD4	0.83		
CR	0.94		0.92		0.86		0.86
AVE	0.79		0.76		0.62		0.75

For investigating the discriminant validity of the constructs, Fornell and Larcker (1981) suggest that a construct's square of AVE should exceed its correlations with other constructs. This means that the correlation between that construct and its indicators should be more than its correlation with other constructs. Furthermore, Gefen and Struab (2005) suggest that the cross loading of each item on its relevant construct should exceed its loading on other constructs. These scholars propose a factor loading criterion of more than 0.1. Tables 5 and 6 report the relevant information, which show acceptable discriminant validity for the constructs.

Table 5: Matrix of Correlation, mean square root of the average variance extracted (AVE)

No	Variable	1	2	3	4	5	6	7	8
1	Masculinity/Femininity	**0.78**							
2	Uncertainty Avoidance	0.16**	**0.85**						
3	Individualism/Collectivism	-0.07	0.09	**0.79**					
4	Power Distance	-0.11*	-0.33**	0.08	**0.79**				
5	Perceived Usefulness	0.13**	-0.21**	-0.11*	-0.24**	**0.89**			
6	Perceived Ease of Use	0.19**	-0.23**	0.08	-0.21**	0.23**	**0.87**		
7	Attitudes toward Use of Computer	0.13*	-0.13*	-0.03	-0.25**	0.46**	0.35**	**0.79**	
8	Intention to Use of Computer	-0.15**	0.04	-0.03	-0.22**	0.43**	0.19**	0.44**	**0.87**

The numbers on the matrix diameter are the correlation of mean square root of the average variance extracted.* p<0.05 ,**p<0.01

As the correlation matrix in table 5 shows, the relationship between perceived usefulness/attitudes toward use and intention to use is positive and significant at 0.01. Also, the relationship between perceived usefulness/ease of use and attitudes is positive and significant at 0.01. In addition, the relationship between uncertainty avoidance and perceived usefulness and ease of use is negative at 0.01; the relationship between masculinity / femininity and perceived usefulness and ease of use is positive; but the relationship between power distance and perceived usefulness and ease of use is negative at 0.01. Also the relationship between individualism and perceived usefulness is negative at 0.05.

Table 6: Factor Structure Matrix of Loadings and Cross-Loadings

Scale Items	MF	UIA	IDV	PD	PU	PEU	ATD	BI
MF1	**0.88**	0.16	0.12	0.11	0.14	0.17	0.06	0.10
MF2	**0.60**	0.13	0.00	0.10	0.01	0.04	0.03	0.01
MF3	**0.84**	0.11	0.01	0.07	0.10	0.17	0.17	0.19
UA1	0.11	**0.85**	0.04	0.29	-0.19	-0.22	-0.08	-0.01
UA2	0.16	**0.89**	0.08	0.26	-0.19	-0.19	-0.09	-0.07
UA3	0.15	**0.84**	0.12	0.32	-0.18	-0.19	-0.15	-0.08
UA4	0.13	**0.85**	0.08	0.26	-0.16	-0.18	-0.14	0.01
IDV2	0.18	0.22	**0.51**	0.23	0.00	-0.02	-0.03	-0.02
IDV3	0.06	0.08	**1.00**	0.07	0.12	-0.08	0.03	-0.03
PD1	0.13	0.37	0.11	**0.72**	-0.20	-0.19	-0.17	-0.07
PD2	0.09	0.26	0.07	**0.85**	-0.17	-0.16	-0.16	-0.14
PD3	0.08	0.24	0.07	**0.83**	-0.22	-0.17	-0.23	-0.25
PD4	0.04	0.15	0.00	**0.79**	-0.18	-0.14	-0.24	-0.25
PU1	0.15	-0.15	0.13	-0.26	**0.86**	0.24	0.42	0.32
PU2	0.06	-0.26	0.08	-0.18	**0.87**	0.22	0.47	0.41
PU3	0.15	-0.18	0.10	-0.21	**0.92**	0.18	0.39	0.41
PU4	0.12	-0.15	0.10	-0.22	**0.91**	0.20	0.36	0.40
PEU1	0.19	-0.18	-0.06	-0.17	0.22	**0.86**	0.33	0.18
PEU2	0.12	-0.21	-0.13	-0.13	0.16	**0.89**	0.27	0.13
PEU3	0.19	-0.21	-0.07	-0.20	0.21	**0.85**	0.30	0.15
PEU4	0.15	-0.21	-0.03	-0.23	0.22	**0.89**	0.32	0.21
ATD1	0.14	-0.05	0.03	-0.19	0.43	0.30	**0.86**	0.42
ATD2	0.10	-0.01	0.09	-0.06	0.16	0.21	**0.65**	0.26
ATD3	0.08	-0.16	-0.01	-0.25	0.28	0.19	**0.80**	0.32
ATD4	0.08	-0.18	0.01	-0.25	0.49	0.37	**0.83**	0.36
BI1	0.12	0.03	-0.02	-0.12	0.28	0.15	0.31	**0.81**
BI2	0.15	-0.08	-0.03	-0.24	0.45	0.19	0.44	**0.92**

Hypothesis testing

PLS structural modeling and testing research hypotheses are made possible through the study of path coefficients as well as explained R^2variance (Vinzi, Chin, Henseler & Wang, 2010). Since the distribution format of PLS was unknown, the bootstrap method (with 500 sub samples) was used to estimate t statistic in order to indicate the significance of path coefficients. According to Vinzi, et al. (2010), path coefficients are used as criteria to determine the share of each predictor variable in explaining the variable variance and the amount of R^2 is an indicator of the explained variance of criterion variable by predictor variables.

Table 7 shows the results of the hypothesis test and figure 2 shows the tested research model. Twelve out of thirteen hypotheses were supported by the gathered data. All the hypotheses relating to the technology acceptance model (TAM) variables were supported. Among the cultural variables, individualism\ collectivism did not significantly influence perceived ease of use but was a significant and positive influence on perceived usefulness (β=0.14, $p<0.05$). Power distance was a negative significant influence on perceived usefulness (β= -0.19, $p<0.01$) and perceived ease of use (β= -0.17, $p<0.01$). Uncertainty avoidance had a negative significant effect on perceived usefulness (β= -0.15, $p<0.01$) and perceived ease of use (β= -0.21, $p<0.001$). Finally, masculinity / femininity has a significant and positive effect on perceived usefulness (β= 0.14, $p<0.05$) and perceived ease of use (β=0.24, $p<0.001$).

Table 7: Hypothesis testing results

Hypothesis	path	β	standard error	t	p	result
H1	PU->INT	0.29	0.08	3.49	0.001	supported
H2	ATD->INT	0.31	0.08	3.77	0.001	supported
H3	PU->ATD	0.40	0.07	5.97	0.001	supported
H4	PEU->ATD	0.26	0.06	4.05	0.001	supported
H5	PEU->PU	0.14	0.07	1.99	0.05	supported
H6	MF->PU	0.14	0.06	2.16	0.05	supported
H7	MF->PEU	0.25	0.08	3.16	0.001	supported
H8	UIA->PU	-0.15	0.07	-2.16	0.05	supported
H9	UIA->PEU	-0.21	0.06	-3.63	0.001	supported
H10	IDV->PU	0.15	0.06	2.36	0.05	supported
H11	IDV->PEU	-0.06	0.05	-1.27	0.20	not supported
H12	PD->PU	-0.19	0.07	-2.74	0.01	supported
H13	PD->PEU	-0.17	0.06	-2.66	0.01	supported

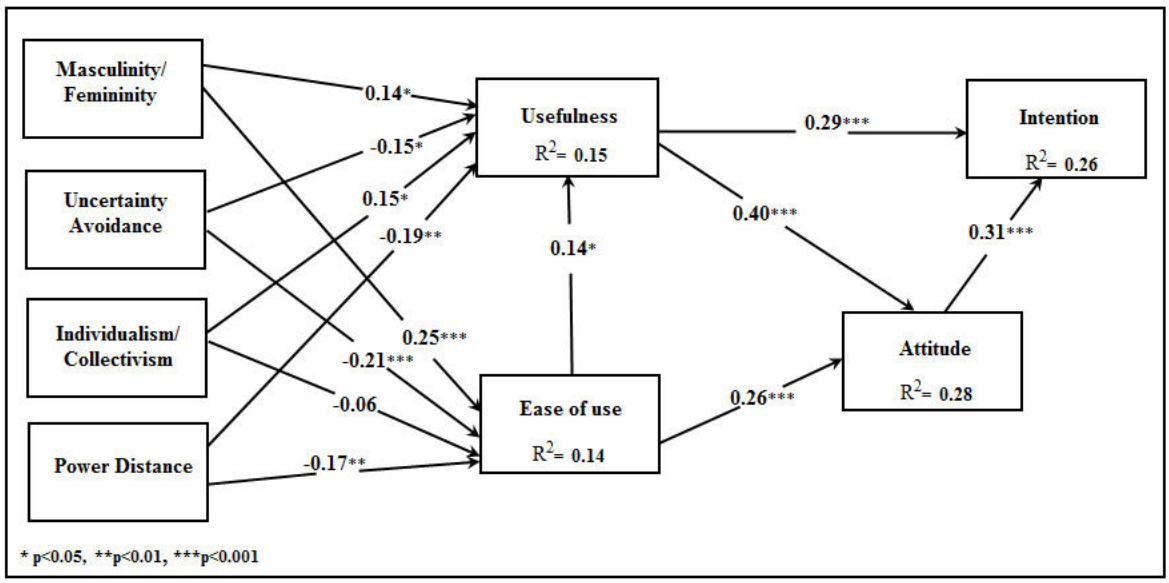

Figure 2: Tested Research Model

In this study four endogenous variables were tested using PLS approach. Intention to use of computer was found to be significantly determined by perceived usefulness and attitude towards use of computer, resulting in squared multiple correlations (R2) of 0.26. This means that perceived usefulness and attitude towards use of computer explained 26% of the variance in intention to use of computer. The other three endogenous variables, attitude towards computer use, perceived usefulness, and perceived ease of use were explained by their determinants in amounts of 28%, 15%, and 14%, respectively. The determinants of Attitude toward use of were perceived usefulness, and perceived ease of use, and the determinants of perceived usefulness, and perceived ease of use were cultural values.

DISCUSSION AND CONCLUSION

Findings of this piece of research suggest that intracultural differences in Iran among teachers at the Urmia city have a significant impact on beliefs about and perceptions of use of the computer technology, particularly perceived ease of use. Masculinity/femininity had positive effects on perceived usefulness and ease of use, and power distance along with uncertainty avoidance had negative impacts on this variables. Also the impact of individualism/collectivism on perceived usefulness was positive.

In addition to these cultural values of Hofstede, results of the test of technology acceptance model showed that this model is substantiated as far as teachers are concerned. Given the findings of the present study, perceived

usefulness had a significant effect on the intention to use. According to the technology acceptance model, teachers decide to make use of computer technology when they regard it as a useful means which enhances their performance output. Increased importance of computers in educational environments in Iran and much attention paid by educational and business environments to computers and computer skills may raise the level of this perception of usefulness of computers. Nowadays in Iran, most job success is available for those who are more fluent in computer skills. This makes people treat computers as useful means. Besides, the significant impact of perceived ease of use on perceived usefulness and, through it, the indirect effect on the intention to use demonstrate that even though computer and its practical software programs are provided with high level of simplicity and user-friendly graphic interface, people apply them only if they promote their working performance (Davis, Bagozzi & Warshaw, 1989). Given the fact that teachers' English language skills are being broadened and some software programs are being translated into Persian, it can be stated that most teachers consider computers user-friendly devices.

Significance of the direct effect of the attitudes toward use of computers on the intention to use is compatible with the theoretical foundation of the theory of reasoned action, proposing that power attitude is among the most important factors affecting people's decision to exhibit specific behaviors. Furthermore, significance of the direct impacts of perceived usefulness and perceived ease of use on attitudes also suggests that people form positive attitudes toward computers when they treat them as useful and easy-to-use tools. It can be said that perceived usefulness and perceived ease of use are among the most important factors in the intention to use and in the development of positive attitudes toward computers. Results of this study match those reported by Dorani and Rashidi (2007), Akour (2006), Teo (2009), Kim, Chun and Song (2009), Amani Sari Bagloo, Lavasani, Ejei and Khezri Azar (2011) and Ejei, Amani Sari Baglou, Khezri Azar and Gholami (2012).

Formation of positive or negative beliefs about computers is influenced by diverse personal and environmental-social factors. Cultural values are among the external factors which may affect emergence of such beliefs. These values are in preference, as Hofstede, Hofstede and Minkov (2010) claims, to people's secondary beliefs about technology in general. Although culture is considered to be an external factor, it can be stated that cultural values are internalized in individuals. These values are deemed external in that they manifest themselves in a particular situation or context, e.g. Iran, and in presence of special stimulators, such as managers or administrators. The cultural values examined in this study were masculinity/femininity, uncertainty avoidance, individualism/collectivism, and power distance.

Masculinity/femininity had a positive and significant effect on perceived usefulness and perceived ease of use. Given cultural changes occurred during the Iran-Iraq war and shifting of the Iranian culture from feminism to masculinity, this culture heavily emphasizes masculine values such as progress-seeking, boldness, competitiveness, and materialism (Hadizadeh Moghadam & Assar, 2008). These values are correlated with features of computer technology. It can therefore be concluded that people who enjoy high degree of masculinity in Iran naturally care more about progress-seeking. Since computer technology is a means for satisfying such desires in this age, these people view computers as useful means. Their boldness and diligence also help them not be afraid of computers and regard computers as easy-to-use tools. Findings of this study match those by Akour (2006).

Uncertainty avoidance also had a significant and negative effect on perceived usefulness and perceived ease of use. The Iranian culture is characterized by high level of uncertainty avoidance. Thus, people who avoid uncertainty to a considerable extent in this country are less willing to treat computers as useful and easy-to-use devices. This may be caused by their fear of uncertain and unfamiliar situations (Hofstede, Hofstede and Minkov, 2010). Computer technology is a fast-changing technology. This technology has undergone many changes during this short period since its advent, which has been continuing at a rapid pace up to now. This raises the uncertainty feature of this technology. People with high degree of uncertainty avoidance do not view it as a useful, easy-to-use means given its feature of variability. As the researchers have observed personally, these people do not even upgrade their operating systems because they fear changes. Findings of this study concur with those by Akour (2006) as far as uncertainty avoidance is concerned.

Individualism/collectivism also had a positive and significant effect on perceived usefulness. The Iranian culture is described as collectivist. Therefore, those who are less collectivist tend more to regard computers as usefulness instruments. Their enjoying freedom of action and less dependence on group and social norms may be the reason. Group and social norms largely represent the past developments of a society. These norms are resistant to change. Computer technology lays the emphasis on individualism, challenging such norms. Those who are dependent on the group are less inclined to abandon group support. They therefore view it as an unnecessary or dangerous technology which challenges the cultural norms. Therefore these beliefs may affect on

teacher perception of computer usefulness. In this study, individualism had no significant impact on perceived ease of use. Existence of social support in collectivist societies may influence on peoples self- efficacy and therefore they be able to see computers as eath instruments.

Power distance too had a negative effect on perceived usefulness and ease of use. The Iranian society is characterized by vast power distance. As a result, those who believe more in existence of power in the society are less willing to consider computers as useful and easy-to-use means. They define their identities within those of greater people who dominate them. Dominating people are, due to their traditional characteristics, afraid to use computers, viewing them as complex tools. Since they do not regard computers as easy-to-use means, their subordinates, as a result of following them, do not approach this technology either and regard it a complicate tool. As mentioned in above paragraph, computer technology challenges the social norms, so people in high power distance cultures tend to see this technology as inadvisable instrument and this beliefs may affect on perceived usefulness.

Geissler (2006) holds that culture and technology are interrelated both in meaning and practice. He further states that technology is basically a form of humans' interaction with their immediate environments -- some sort of manifestation of humans' communication with the world. Technology relates to humans' abilities to put ideas into practice through creating and applying tools for helping them adapt themselves to the environment when necessary. But technology is not separated from social–historical processes; they are embedded in each other, and both are influenced by developing lifestyles of the human society. Cultural nature of information and computer technology reveals the necessity for state managers and planners to take the national cultural infrastructures into consideration in order to accept information technology. One of these factors is the variable nature of this technology, which causes difficulty accepting it in the cultures with high level of uncertainty avoidance. In such cultures as Iran, characterized by collectivism, uncertainty avoidance, and power distance (Hofstede, 1980), which are entirely different from cultures of the western societies from which computer technology has originated, attempts should be made to adapt this technology with local values. According to Hofstede, Hofstede and Minkov (2010), in such cultures as Iran, roles of planners and managers are crystal clear, since they are a powerful source for eliminating uncertainty and leading the group. Although their roles in influencing values are minor due to the fact that they are persistent, have evolved over a long time and are constantly changing, managers and planners can dramatically affect changes in people's beliefs about computers. Therefore, teachers can be encouraged to make more use of computers through providing appropriate incentives, showing people who have achieved success by applying computers, offering training for effective utilization of computer in fulfilling instructional tasks. In addition, we can contribute to the promotion of teachers' beliefs about ease of use of computers through translating software programs into Persian, holding different courses for training on how to apply computers.

The present research indicated that cultural values affect individuals' attitudes toward technology; that is, the perceived usefulness and ease of use. It can be concluded based on the findings reported here that the more control members of a society feel in themselves (i.e., more uncertainty avoidance, collectivism, femininity and power distance), the less positive attitudes they will have toward technology. This can be due to the novel and changeable nature of such technology which threatens the peace a person enjoys because of adhering to traditional values. As it was noted above, in cultures with higher degrees of uncertainty avoidance and power distance, managers play an important role in pushing individuals to accepting new technologies. Further research is called for to reveal whether the organizational support offered to employees by employers and managers can moderate the relationship between cultural values and individuals' attitudes toward using information technology.

This study was also an attempt to clarify the effect of cultural values on a personal level on the individuals' attitudes toward information technology but it is still not clear what the nature of the interaction is between individual values and social values or the cultural values in the organization where individuals work. There is need for further research accordingly to reveal how individual values moderate the relationship between social values or organizational cultural values on individuals' attitudes toward information technology.

Limitations of the research can be discussed in two categories: those affecting the internal validity and the ones influencing external validity (generalizability of results). Questionnaires are part of the tools limiting internal validity of the study. This is more obvious concerning measurement of complex structures, such as culture. It is therefore essential that we should examine the relationship between culture and computer technology using qualitative research traditions as well. On the other hand, in addition to tendency toward innovation, other personality factors such as self-efficiency and computer anxiety also affect people's beliefs about computer, which can be explored in other studies. As for external validity, it can be said that results of this study can only

be generalized to teachers and, more narrowly, those at the Urmia city. It is thus necessary that other studies with other samples such as pupils, employees, etc. should be designed in order to make findings generalizable to more members of Iranian society.

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Appendix1: Questionnaire items (7 point Likert type)

Uncertainty avoidance: (Srite and Karahanna, 2006).
UAI1. When starting a new job, I fear doing it.
UAI2. I fear uncertainty about the future.
UAI3. I fear ambiguous situations and an unfamiliar adventure.
UAI4. It is risky to do something that has never been done before.
Power Distance (Srite and Karahanna, 2006).
PDI1. Teachers afraid to express disagreement with their managers.
PDI2. Teachers should follow their managers' decisions unconditionally.
PDI3. Teachers should make most decisions by themselves.
PDI4. Teachers should not question their managers' decisions.
Collectivism/Individualism (Srite and Karahanna, 2006).
IDV1. Individual rewards are more important than group welfare (Dropped).
IDV2. Individual success is more important than group success.
IDV3. Having autonomy and independence is more important than being accepted as a member of a group.
Masculinity/femininity (srite, 2000)
MF1. It is more important for men to have a professional career than it is for women to have a professional career.
MF2. Women do not value recognition and promotion in their work as much as men do.
MF3. It is preferable to have a man in high level position rather than a woman.
MF4. There are some jobs in which a man can always do better than a woman (Dropped).
Perceived usefulness (Davis, 1989).
PU1. Using computers enhances my productivity in instruction.
PU2. I find computers useful in my instructional activities.
PU3. Using computers enhances my effectiveness in instruction.
PU4. Using computers improves my performance in instruction.
Perceived ease of use (Davis, 1989).
PEU1. It is easy for me to become skillful in using computers.
PEU2. I find computers easy to use.
PEU3. I find it easy to get a computer to do what I want it to do.
PEU4. Learning to operate a computer is easy for me.
Attitude (Agarwal and Prasad, 1999).
ATD1. I like using Computers.
ATD2. Computer is fun to use.
ATD3. I dislike using computer (reversed).
ATD4. Computer provides an attractive working and learning environment.
Behavioral intention to use (srite, 2000)
INT1. I intend to use a computer during my instruction period.
INT2. I plan on using a computer frequently during my instruction period.

THE MEDIATOR EFFECT OF CAREER DEVELOPMENT BETWEEN PERSONALITY TRAITS AND ORGANIZATIONAL COMMITMENT: THE EXAMPLE OF SPORT COMMUNICATION TECHNOLOGY TALENTS

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ABSTRACT
This paper explored the relationships among career development, personality trait, and organizational commitment and examines whether career development mediates the relationship between personality trait and organizational commitment. The sample was 275 sport communication technology talents in Taiwan. The instrument included the Personality Trait Scale, Career Development Scale, and Organizational Commitment Scale. The relationship between personality trait and organizational commitment was mediated by career development. According the findings, some suggestions and recommendations for administration agency, and further researchers were made.

KEYWORDS: Career development theory; Personality trait; Organizational commitment

INTRODUCTION

The management philosophy of school is especially related to this issue because school is most important place of learning. Every student in school has his or her uniqueness and strength. Suitable education is aimed at inspiring the multiple abilities of talents and talents are able to develop their own personality traits and the ability of active learning through this process. However, the cultivation of personality traits and morals has been less emphasized. According to David & Stanle (1989), personality trait is a set of consistent characteristics and tendencies that can express the similarities and difference among individuals. It is a crucial and stable factor that lasts for a lifetime (Costa & McCrae, 1992). To a substantial extent, personality trait can explain the cause of human behavior because the general characteristics of one person always show in specific contexts and one's personality can affect theirs behaviors (Daniel & Timothy, 1996). Therefore, understanding of individual personality and career development belief can be helpful in one's future development. It is also valuable in assisting teachers and coaches to predict the performance of athlete.

However, most talents spend less time considering their career plan and how to face the challenges in life. Most talents are relatively unfamiliar with career planning because they have been included in the concentrated training courses since they were young. The training courses have offered them clear goals of their sports performance.

Through career counseling from school education, talents are able to prepare and develop their future step by step. The objectives of career planning include exploring individual interests, understanding job values and social structure, establishing individual goals, strengthening strategic planning and problem solving ability, improving basic and professional skills, promoting individuals to observe meaning of life, developing individual career and hobbies, and enhancing the adaptation of social transition (Chang, 2007). According to the system of career development (Gutteridge, Leibowitz & Shore, 1993), organizations accounted for career management while individual employees accounted for their own career planning. Although career planning is mainly individual-centered, it is highly related to organizations because the focus of career is occupation. Generally, there are two areas in investigating career development - organizational career management and individual career planning. Hall (1986) has proposed that organizational career development was the process of integrating individual career planning and organizational career management. To implement career development, employees were required well self-understanding and clear career goals; organizations were required better communicate

with employees. The well communication between organizations and employees may reduce the turnover rate of outstanding employees and enhance the satisfaction and performance of employees. Hence, organizational career development not only provided resources for individual career planning, but also improved organizational commitment.

Mowday, Porter and Steers (1982) have considered that there was a mutual relationship between the organizations and employees. When employees were offered sufficient assistance and their specific needs were met by their organizations, they would strengthen their organizational commitments. Therefore, if employees knew their career goals clearly, they would actively search for organizations which can satisfy their needs. Then, these employees would dedicate their knowledge and experiences to their organizations and have higher organizational commitments. On the other hand, if organizations provided career counseling service for their employees with the considerations of the needs of both employees and organizations, the morale and the loyalty of employees could be encouraged (Yeh & Yu, 2000). In conclusion, employees' career planning as well as organizational career management influenced career commitment. Based on the above literature, the first research hypothesis was posited:

H1: Career development positively influenced organizational commitment.

Costa and McCrae (1986) suggested that personality trait was a unique feature among interpersonal relationships and previous behaviors can be a predictor of future behaviors. The current study aimed to address the association between personality trait, career planning and the behaviors of talents. Furthermore, the study was also objected to clarify the impact of personality trait on individual career planning. Huang (1998) has indicated that in career planning, individuals chose their occupation and working organization base on their own ability, interest, and potential working opportunity. Hence, everyone engaged the process of individual development, including evaluating individual personality tendencies, abilities and interests, comparing the directions of future career, setting the future goals and then planning the appropriate activities for development. Therefore, everyone had unique life experiences and handled matters with different attitudes. If people valued the character of justice, they would pursue fairness; if they valued the character of success, they would seek for competition. Similarly, we could apply the concept to the attitude towards career. Some people valued the profession position, so they would work hard for promotion, while others valued self-affirmation and challenged themselves continuously. In conclusion, one's personality trait had a close relationship with career development. Accordingly, the second research hypothesis was posited:

H2: Personality trait positively influenced career development.

Another study by Zsheliaskova-Koynova (1991) analyzed the personality traits of talents participating in orienteering. Besides, a study showed a significant correlation between positive emotions and affective commitment (Williams, Gavin, & Williams, 1996). Chang (2003) reported that the personality traits of undergraduates affected their organizational commitment. Therefore, the third and fourth research hypotheses were posited:

H3: Personality trait positively influenced organizational commitment.

H4: Career development mediated the relationship between personality trait and organizational commitment.

Based on the previous literature, the research framework is listed as following.

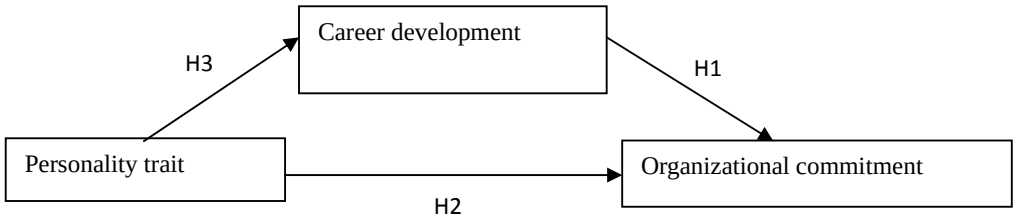

Figure 1. The research framework

METHODOLOGY

1. Participants

This study employed cluster sampling technique (using sports team as the cluster) in order to ensure the representativeness of the sample. The sample comprised of 275 sport information communication talents in Taiwan. The average age of the sample was 21.32 years old.

2. Procedure

The data was collected using survey methodology. Questionnaires and informed consents were distributed on site by the researchers without the presence of participants' coaches in order to enhance the validity of the response. On each questionnaire, there were clear descriptions concerning the purpose of this study and assurance of the anonymity and confidentiality of all responses. After the questionnaires were returned, each question was carefully examined in order to filler incomplete questionnaire. Of the 300 returned questionnaires, 275 valid questionnaires were used for an effective response rate of 91.06%.

3. Instruments

The questionnaire used in this study consisted of three scales, including Personality Inventory Scale, Career Development Scale, and Organizational Commitment Scale.

(1) Personality Trait Scale

This scale is based on Costa and McCrae's (1992) five personalities, inclusive of extraversion, neuroticism, agreeableness, conscientiousness, and openness to experience. Then taking the scale of Yang's (2003) related study as reference, we make some revise to our scale. This scale is mainly surveying the talents' special personality trait. There are 23 examination questions, which can examine the five aspects of personality trait. Six questions are used to measure extraversion, five questions are used to measure neuroticism, five other questions are used to measure agreeableness, four questions are used to measure conscientiousness, and last three questions are used to measure openness to experience. The result of Personality Inventory Scale is presented as six-point scale. In exploratory factor analysis, we found out that the explained variances for extraversion is 12.30%, for neuroticism is 5.50%, for agreeableness is 30.79%, for conscientiousness is 3.94%, and for openness to experience is 4.49%. Overall explained variances of this scale are 57.04%. Regards to reliability, the internal consistency of each dimension is .83 for extraversion, .77 for neuroticism, .78 for agreeableness, .73 for conscientiousness, and .60 for openness to experience. The overall value of Cronbach's α is .81 which shows the internal consistency of the overall scale and each scale of this questionnaire is comparatively good. These all mean that the reliability is acceptable.

(2) Career Development Scale

Take Organizational Career Management and Individual Career Planning from Hall's Career Development Theory as main theoretical framework, and refer to the related literatures from Jin, S. R., Lin, C. S., & Tien, H. L. (1989), Lu, H. F. (2008) , Chen, F. J., Lo, H. J.,& Tsai, J. J. (2012) to revise and finish this Career Development Scale. The results of this scale can divide into two dimensions, organizational career management and individual career planning. There are 11 questions for organizational career management, 12 questions for individual career planning and total 23 questions.

In organizational career management dimension, explained variances of career information are 35.78% and explained variances of career counseling are 28.28%. The overall explained variances are 64.06%. Regards to reliability, the internal consistency of each dimension is .84 in career information and .89 for career counseling. The overall value of Cronbach's α is .83 which shows the internal consistency of the overall scale and each scale of this questionnaire is good. The reliability is good.

In individual career planning dimension, explained variance of career planning is 37.89%, of career tactics is 23.84%. The overall explained variances are 61.73%. Regards to reliability, the internal consistency of each dimension is .88 in career planning and .86 for career tactics. The overall value of Cronbach α is .84 which shows the internal consistency of the overall scale and each scale of this questionnaire is good. The reliability is ensured.

(3) Organizational Commitment Scale

We refer to Wang, M. J.& Cho ,K. H.(2010), and Chang, S. Z. (2007) and modify our Organizational Commitment Scale. The results of this scale can divide into three dimensions, team recognition, willingness to take efforts and decision to stay in the team. There are 5 questions to team recognition, 5 questions to willingness to take efforts, 5 questions to decision to stay in the team and total in 15 questions. The result of Organizational Commitment Scale is presented as six-point scale. In exploratory factor analysis, we found out that the explained variances for team recognition are 9.11%, for willingness to take efforts are 44.97%, and for decision to stay in the team are 6.55%. The overall explained variances are 60.63%. Regards to reliability, the internal consistency of each dimension is .87 in team recognition, .85 for willingness to take efforts, and .61 for decision to stay in the team. The overall value of Cronbach's α is .80 which shows the internal consistency of the overall scale and each scale of this questionnaire is good. The reliability is good.

3. Data analyze

Uses stepwise regression to analyze how personality trait influences and predicts career development and organizational commitment. Test for mediation of career development using Cheung and Lau's (2008) SEM (Structural Equation Modeling) bootstrap procedure.

RESULTS

1. The impacts of personality traits on individual career planning

We can learn from table 1 that four explanatory variables were significant according to their F-statistics, including Agreeableness, Neuroticism, Conscientiousness, and Extraversion. In addition, these four variables had positive β-coefficient. By the magnitude of the β-coefficient, the variable of Agreeableness is the most important one, followed by Neuroticism, Conscientiousness, and Extraversion orderly. Personality traits can explain 41% of the variation of Organization commitment. In particular, Agreeableness has the largest R-square increment, explaining 30% of the variation of Individual career planning.

2. The impacts of Personality trait on Organizational career management

The lower panel of table 1 indicates that three explanatory variables of personality traits have their F-value at the significant level, including Openness to experience, Neuroticism, and Extraversion. These three variables have positive β-coefficient. In particular, Openness to experience has largest β-coefficient and it explain most part of Organizational career management, followed by Neuroticism and Extraversion. In our model, all the explanatory variables can only explain 25% of the Organizational career management. Furthermore, Openness to experience has largest R-square increment, which is 18%.

Table 1. The regression analysis of Personality traits on Individual career planning and Organizational career management.

	Personal career planning					
	(R)	(R-square)	R-square increments	F value	Net F value	(β-coefficient)
Agreeableness	.55	.30	.30	109.84*	109.84	.21
Neuroticism	.59	.35	.05	70.35*	21.99	.32
Conscientiousness	.63	.40	.04	56.25*	18.53	.27
Extraversion	.64	.41	.01	44.29*	5.49	.12
	Organizational career management					
Openness to experience	.42	.18	.18	56.51*	56.51	.41
Neuroticism	.47	.22	.04	37.37*	15.15	.27
Extraversion	.50	.25	.03	28.39*	8.32	.18

*$p < .05$

3. The impacts of Organizational commitment on Personality trait, Individual career planning, and Organizational career management

From table 2, we can see that there are four variables significant with regard to their F-values, including Career planning, Career counseling, Agreeableness and Career tactics. All four β-coefficients are positive. We can infer from the magnitude of β-coefficient that Career planning has the largest impacts, followed by Career counseling, Agreeableness, and Career tactics. In this model, all the variables can explain 47% of the total variation. Among the variables, Career planning itself is responsible for 37% of the variance of Organizational commitment.

Table 2. The regression analysis of Organizational commitment on Personal traits, Personal career planning, and Organizational career management

	Organizational commitment					
	(R)	(R-square)	R-square increments	F value	Net F value	(β-coefficient)
Career planning	.61	.37	.37	155.61*	155.61	.36
Career counselling	.67	.45	.07	103.96*	33.10	.25
Agreeableness	.68	.46	.01	73.15*	6.83	.14
Career tactics	.69	.47	.01	56.66*	4.36	.14

*$p < .05$

4. Test for mediation of career development

Mediation effect is mostly analyzed using Baron and Kenny's (1986) approach. Recently, scholars indicated that the use of SEM bootstrap method can enhance the stability of the test results (Cheung & Lau, 2008; Cheung, 2009; Lau & Cheung, 2012). When using the bootstrap method, the mediation effect exists if the estimate of indirect effect reached statistical significance and confidence intervals (usually 95% CI, Confidence Interval) does not contain zero. The results (shown in Table 3) revealed that the estimate of indirect effect (0.261, 0.424×0.616=0.261) reached the .05 level of significance and the 95 % CI does not contain 0, indicating that moral disengagement demonstrated partial mediation effect between locus of control and rule transgression.

Table 3. Mediation effect analysis

	Estimate	*p* value	Confidence Interval
Indirect effect			
PT→CD→OC	0.261	<0.05	0.162-0.283
Direct effect			
PT→ CD	0.424	<0.05	0.411-0.587
CD→ OC	0.616	<0.05	0.416-0.638
PT → OC	0.173	<0.05	0.057-0.280
total effect			
LC → OC	0.434	<0.05	0.286-0.477

Note: Personality Trait= PT, Career Development=CD, Organizational Commitment=OC

DISCUSSION

1. Discussion

According to our data analysis, our following discussion can be divided into three parts. First of all, we reached the same conclusion on the personality traits of talents as the reviewed literatures (Huang, 1998; Chang, 2003; Lo, 2009; Williams, Gavin, & Williams, 1996). In other words, the better personality traits with the talents, the career development and organizational commitment were shown to be higher. The talents who can well manage and have better planning on their career development resulted in stronger organizational commitment.

Next, the personality traits of talents have significantly explained career development. Among the indicators for personality traits, agreeableness can explain the largest part of the total variance (up to 30%) of individual career planning. The talents who were more easy-going were shown to have better ability in planning individual career in the future. Alternatively, the openness to experience of personality traits has the largest explanatory ability (up to 18%) in organizational career management. The talents who were more curious and imaginative intended to receive the information and counselling service from the university and apply to their career development. This result was consistent with Liu (2002) and Tsai (2004). Apparently, personality traits have significant and positive influence on individual career development (Tokar, 1998).

From our analysis, we can learn that people with different personality traits have different perception and cognition on individual planning and organizational management. Among the five factors of personality traits, agreeableness, conscientiousness, and neuroticism have obvious influences on individual career planning. Similarly, if one person can be more focused and concise on his/her goal and be more conscientious, s/he will have a better understanding of his/her advantage and disadvantages and thus can have clear career tactics. Furthermore, openness to experiences, neuroticism, and extraversion have the largest ability to explain organizational career management. If one person is open-minded, confident, initiative, and not too nervous, s/he would be more active to explore his/her career, collect the useful career tactics and find possible paths to achieve the career goal. In present Taiwan society, individual decision plays an important role. However, the introspection is also a crucial element in individual career planning. One should put it into practice through organizational career management.

As for the analysis of personal traits, individual career planning, and organizational career management of talents on organizational commitment, career planning, career counselling, agreeableness, and career tactics achieve significant level and can explain up to 47% of total variation of organizational commitment. Career planning is the most important factor that can explain 37% of the total variation of organization commitment. We can infer that the students will actively to learn the knowledge and share personal experiences that can satisfy organizational needs when they are clear with the individual career goal. They tend to have high organizational commitment in this case. This inference is similar to the findings in Mowday, Porter, & Steers (1982). Hence, the

talents who are clear with their individual career goal can help increase the satisfaction in their organizational team and establish networks that are helpful for them to obtain more opportunities for their career. The better self-understanding of advantages and disadvantages is also useful to pursue personal career. The organization will development different career counseling and offer relative information to help talents achieve their various life goals. The organization will help its talents to know themselves and cultivate the skills in order to achieve individual goal by the opportunity from the organization.

If the organization can take talents' needs and competence into consideration and help offer talents the career counselling on the team or on campus, then the talents will have sense of belonging and be highly encouraged in the organizational team. In short, once the talents enter any sport organization, they should try to combine individual career and organizational goal together and the organizational team should establish a win-win situation for its talents and the team itself in order to achieve the goal of athlete cultivation and development. Moreover, the sport team on campus should better understand its dilemma and search for proper supports to achieve the goal of whole university. On the other hand, talents should understand their advantages and disadvantages and thus to contribute and grow at the same time within the sports team.

Our research tries to the personal traits' impact on career development with the mediation effect from career development. According to Baron and Kenny (1986), we use regression analysis to test the existence of mediation effect of career development. From our analysis, we know that personal traits have impact on organizational commitment through the mediation effect of career development and the influence is significant. We provide an implication for the teachers and instructors on campus sports team that they can firstly understand the personal traits of talents and offer the service of career planning and career counselling in order to acquire higher organizational commitment from the talents. Conversely, our research also shows that career development will have positive impacts on organizational commitment. The result is similar to Lo（2009）、Wang & Huang (2007). Smooth career development can help to improve the organizational commitment of talents. Our empirical analysis shows that the improvement of organizational commitment can be achieve via personal traits and career development. We will expect our results can raise the awareness of university to provide more career services for the talents and treat their career more seriously. Comparatively, talents will be encouraged and grow sense of belonging in the sports team and hence be willing to make more efforts during their training.

2. Conclusions and Suggestions

Our research aims to study the relation among personal trait, career development and organizational commitment. We find there is consistently positive relation among personal traits, career development, and organizational commitment. First, among the personal traits indicator, agreeableness can explain the largest part of individual career planning. Secondly, openness to experiences can explain the largest part of organizational career management. In addition, career planning, career counselling, agreeableness, and career tactics attain significant level in explaining the organizational commitment. Career planning has the largest impact on organizational commitment, and career development plays an important role in personal traits and organizational commitment. Therefore, if the university, as an organization, can focus more on talents' career planning and counselling, the talents would have sense of belonging in the sport team and in the university.

Our research indicates that personal traits and career development are important deterministic factors on talents' organizational commitment. Therefore, the university can firstly understand the talents' personal traits, provide proper career planning and counselling, and help them make a balanced plan between work and life in the future in order to place every athlete into the right position. The talents will grow sense of belonging for the sport team. Therefore, the sport team will be better off because the perfect integration of individual talents and the improvement of communication among the team members. Talents will grow the sense of recognition for the sport team because of the improvement of the individual skills and team consensus.

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THE SEMANTIC WEB IN TEACHER EDUCATION

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Abstract
The Semantic Web enables increased collaboration among computers and people by organizing unstructured data on the World Wide Web. Rather than a separate body, the Semantic Web is a functional extension of the current Web made possible by defining relationships among websites and other online content. When explicitly defined, these relationships can be interpreted by software including Web applications, online services and intelligent agents. Because it allows computers to understand the 'meaning' of Web-based information, the Semantic Web is sometimes referred to as the 'Intelligent Web'. This paper discusses the potential of the Semantic Web for teacher education.

WHAT IS SEMANTIC WEB?

The increasing availability and accessibility of information through the early years of the 21st century has had obvious benefits, but also poses a challenge to learners and educators. Sorting and evaluating information—rather than locating it—is now frequently a daunting task, requiring strong skills in information literacy and a significant investment of time and effort. The Semantic Web presents one solution to this information overload by organizing information meaningfully so we can retrieve what we want without getting lost on the Web.

Berners-Lee, Hendler and Lassila (2001) define the Semantic Web, also known as Web 3.0, as "not a separate Web but an extension of the current one, in which information is given well-defined meaning, better enabling computers and people to work in cooperation" (para. 8). Their early article drew attention to uses of the World Wide Web that were already a reality a decade ago, but were little understood outside of the computer science field (Czerkawski, 2012). According to Gutierrez (2008) "the difference between the World Wide Web and the Semantic Web relies on the integration and compatibility of information rather than just the interchange of files using the Web as the delivery system." (p.2).

For Maddux and Johnson (2011), the Semantic Web is "a proposal to use the existing Web to move data from place to place as it does today, but the data will be embedded in new and better markup languages" (p. 196). The evolution of markup languages such as HTML or CSS has been driven by the need to display increasingly rich media content to Web users. Newer versions of these languages focus increasingly on the structure, meaning and nature—the semantics—of the content being displayed.

Today, many educators (Maddux & Johnson, 2011; Morris, 2011; Anderson & Whitelock, 2004) are working to understand the significance of the Semantic Web. This paper presents arguments for the potential of the Semantic Web that can be applied to teaching and learning, and particularly to teacher education.

ADVANTAGES OF THE SEMANTIC WEB

Maddux and Johnson (2011) identify four innovative applications of information technology that will profoundly impact education. These are: computer and video gaming; social networking and Web 2.0; mobile and handheld technologies; and the Semantic Web. The first three technologies are increasingly well-understood by educators, but the Semantic Web is still "not well known outside of computer science and artificial intelligence circles" (Maddux & Johnson, 2011, p.195). The 2011 edition of the Horizon Report (Johnson et al., 2011) predicts that the Semantic Web will become more prevalent and prominent in educational settings in the next four to five years (Czerkawski, 2012).

The three advantages of the Semantic Web listed by Maddux, Liu, Li and Sexton (2011) are: "1) an aid to locating information, 2) an aid to data integration, 3) an aid to communicating and collaborating with others" (p. 3090). Anderson and Whitelock (2004) point out three similar affordances: "1) capacity for effective information storage and retrieval, 2) capacity to augment learning and information processing power, and 3) capacity to increase collaboration in multiple formats." The Horizon Report (2011) suggests several ways that the Semantic Web may be used in teaching and learning (Johnson, 2011, para. 2):

- Semantic portals that aggregate information from a variety of sources could facilitate research.
- A fully-developed semantic search tool could return results from a topical search with video, images, text, and other content aggregated and presented in a meaningful way.

- As the amount of available information continues to grow, semantic tools that can deliver context-sensitive information will become key for research and sense-making (as cited in Czerkawski, 2012).

In other words, students will soon be able to locate, evaluate, manipulate, store and retrieve information more efficiently and effectively than ever before. This will in turn enable students to connect and collaborate with others based on shared interests in ways that were not previously possible. These analyses strongly suggest that Semantic Web has the potential to spur, and even require, innovative change in current educational environments (See Appendix for existing tools).

THE SEMANTIC WEB FOR TEACHER EDUCATION

Personalized knowledge retrieving and collaborative knowledge construction

One of the biggest advantages of the Semantic Web is its advanced search capability. The users can search the Web, retrieve easily meaningful information and sort out irrelevant data. This is made possible because the Semantic Web allows "its users to find relationships between tagged information using inference rules and data organizational tools called ontologies that provide logic and structure to the information embedded in web pages" (Ohler, 2008, p. 7). Greater organization of information—whether in simple hierarchies or more complex relational networks—will reduce the time and energy students spend sorting through unwanted information and resources.

The possibility of structuring data in this way does not mean that we are approaching a rigid or monolithic model for human knowledge. Indeed, the organizations most sophisticated with semantic metadata are technology companies like Google, whose business models rely on their ability to make information useful to people—and the clear trend among these companies has been toward personalization and customization (Liu, Yu & Meng, 2004).

Similar tailoring based on learners' interests, strengths and needs could be applied in teaching and learning environments. Teacher candidates arrive at teacher education programs from diverse backgrounds, with varying educational needs and learning capabilities. Semantic Web tools can give each teacher candidate or student the ability to process information at their own pace (Czerkawski, 2012). In this regard, Devedzic (2006) emphasizes that "learning modeling uses the learner's background knowledge, skills, aptitudes, motivations, learning and media preferences, mastery of content being taught, and learning progress to tailor the instruction to the learner" (as cited in Morris, 2011, p. 45).

Table 1: Semantic Web Tools for Teacher Education

Types	Programs	URL
Search Tools	ArnetMiner	http://www.arnetminer.org/
	Watson	http://watson.kmi.open.ac.uk/WatsonWUI/
	Hakia	http://www.hakia.com/
	Evi	http://www.evi.com/
Educational Repositories	Freebase	http://www.freebase.com/
	DBpedia	http://wiki.dbpedia.org/About
	MyExperiment	http://www.myexperiment.org/
	EPrints	http://www.eprints.org/
	DSpace	http://www.dspace.org/
Collaborative Databases		
	Semantic Wiki	http://semantic-mediawiki.org/
Data Visualization		
Social Annotation	Exhibit	http://www.simile-widgets.org/exhibit/
	GroupMe	http://groupme.org/GroupMe/
Scholarship Tools	AceWiki	http://attempto.ifi.uzh.ch/acewiki/
	MyMory	http://www.dfki.uni-kl.de/mymory/
	Talis	http://www.talisaspire.com/
Collaboration Tools	Debategraph	http://debategraph.org/home

Connected Content

The Semantic Web also has implications for what, and how, we teach future teachers. Learning objects are already richly tagged with precisely the kinds of metadata that the Semantic Web exploits. Carvin (2006) offers the example of "embedding metadata to content that connects it to specific education standards" (para. 10). This means that teacher educators or teachers can tag a resource as being connected to a specific academic standard, which itself can exist within one or more comprehensive taxonomies.

The Semantic Web makes it trivial retrieve this information when creating learning materials, enabling educators to find, use and even remix elements of multiple related learning objects. This flexibility can support large-scale repositories of pedagogy and teacher knowledge, as well as informal online spaces where teachers and teacher candidates can share and discuss learning scenarios.

Personal Learning Networks

Personal learning networks provide an entry point or gateway for users to learn from others with whom they share common interests. People connected through such networks point each other to learning opportunities, discuss ideas, and answer questions on an ad hoc basis that can be both synchronous and asynchronous. Participation in multiple overlapping or discrete learning networks frees up learners' time for thinking, creating and using relevant information rather than trying to find it. As Ohler (2008) points out "the objective is to spend less time searching for information and more time trying to understand, critically assess and creatively expand it" (p. 9).

The Semantic Web can facilitate personal learning networks both for students and teacher educators. The current Web is organized around services, rather than professional or learning goals. A teacher candidate who wants to share school-based experiences with his or her peers, or a first year teacher searching for answers to a question, must fit their needs to match the available information sources. The Semantic Web offers the inverse: information sources tailored to educators' needs.

Administrative Use

With the help of Semantic Web teacher educators can free up significant time, which can be used for instructional purposes. Anderson and Whitelock (2004) contend that intelligent agents will help faculty members to "track professional interests of teachers relating to their field of subject expertise, developments in new pedagogies with active evaluation and testing of pedagogical interventions" (p.4). More prosaically, such agents can assist in administrative tasks such as scheduling, student tracking, and advising.

CONCLUSIONS

The Semantic Web is in the early stages of development, and is not yet widely visible in teacher education programs (Czerkawski, 2012). Maddux and Johnson (2011) note that "[the] Semantic Web requires that developers construct Web 'ontologies'" (p.198); Stutt & Motta (2004) add that "[t]he Semantic Web will not be fully realized until a range of applications is built on top of these ontologies" (p. 10). Stutt and Motta go on to predict that the increasing semanticization of the Web will initially result in superficial products that do not reflect the potential of a fully Semantic Web.

Although one of the great promises of the Semantic Web is greater flexibility in identifying and accessing information, the ontologies underlying it are themselves quite inflexible. According to Devedzic (2004), the Semantic Web requires "information in a precise, machine-interpretable form, ready for software agents to process, share, and reuse it, as well as to understand what the terms describing the data mean" (p.40). In other words, "in order for this new technology to work correctly and efficiently, however, current methods of obtaining and structuring information must be standardized and available for access by a multitude of computer agents and people." (Gutierrez, 2008, p.2).

It is unrealistic to expect teacher educators to create time-consuming and highly technical resources, and so we currently exist in a holding pattern: waiting for these tasks to become faster, simpler and more immediately applicable to the needs of ordinary users.

In education, social interactions are critical to the quality of learning and teaching. No matter how promising, a poorly designed or implemented use of the Web will not enjoy an enthusiastic reception from teachers and students. The Semantic Web offers many possibilities, but in the area of teacher education, the path from possibilities to useful implementations can be long and winding. Faculty will wait for the technology and best practices surrounding the Semantic Web to mature before adopting them. On the bright side, as Ohler (2008) points out, for the first time we will see a foundational shift in technology before its actual arrival. "With the

Semantic Web being both inevitable and slow to develop, we can begin discussing possible learning scenarios that might emerge once it arrives" (p.9).

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USING CONFIDENCE AS FEEDBACK IN MULTI-SIZED LEARNING ENVIRONMENTS

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ABSTRACT
This paper describes the use of existing confidence and performance data to provide feedback by first demonstrating the data's fit to a simple linear model. The paper continues by showing how the model's use as a benchmark provides feedback to allow current or future students to infer either the difficulty or the degree of under or over confidence associated with a specific question. Next, the paper introduces Confidence/Performance Indicators as graphical representations of this feedback and concludes with an evaluation of s trial use in an online setting. Findings support the efficacy of using the Indicators to provide feedback to encourage students in multi-sized learning environments to reflect upon and rethink their choices, with future work focusing on the effectiveness of Indicator use on performance.

INTRODUCTION
Confidence provides a means to assess the metacognitive knowledge students have about their performance – in essence, do students know what they know and what they don't know. Darwin Hunt (2003), one of the early researchers in the role of confidence, stated that the importance of having this knowledge is critical, for being misinformed is "much worse than being uninformed". Traditionally, one-dimensional assessment (performance only) supplies very little information about what students know and what they don't know. However, the addition of confidence as a second dimension provides important additional information in assessing students' knowledge of their performance (Adams and Ewen, 2009) while also promoting a potentially deeper level of reflection and self-regulation. Work by Bruno (1993), another early investigator, to measure knowledge quality led to the development of a two-dimensional assessment process which attempts to measure both correctness and confidence by a single quantity. Employed with success in training situations, this methodology, however, involves extensive calculations to implement which limits its potential use in middle to large scale learning situations containing hundreds or thousands of students.
Another approach is the confidence (or certainty) based marking (CBM) scheme developed by Gardner-Medwin and Gahan (2003) which assumes a linear relationship between the confidence (here referred to as certainty) and the mark expected by the students as shown by the left-hand figure in Figure 1.

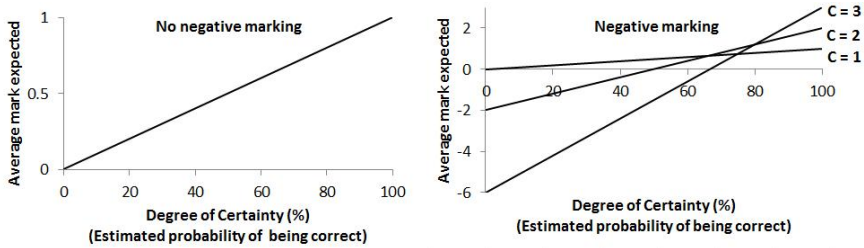

Figure. 1. Confidence-based marking schemes

Building upon this assumed relationship, Gardner-Medwin and Gahan proposed the use of a negative marking scheme (right-hand figure), where students are penalized for under or over estimating confidence and rewarded for reflection and deeper thought before answering. In this scheme, students receive points of 3, 2, or 1 for correct responses and 0, -2, or -6 for incorrect responses, depending on their estimated probability (confidence) of being correct. In essence, the scheme uses confidence as a motivating factor. While results (Schoendorfer and Emmett, 2012) obtained from the use of CBM, primarily in medical school education, yielded positive results in terms of improved performance, the method does not focus specifically on obtaining quantifiable confidence levels. Other research into incorporating confidence into grading utilized methods such as a Problem Solving Inventory (Larson, et. al, 1998) and the calculation of a "confidence score" (Petr, 2000) as ways to achieve what Paul (2007) calls "scoring systems which encourage honesty" and thus reliable measures of confidence. Additionally, recent research describes the use of the difference between confidence and accuracy as part of a "bias score" component of a mark (Michailova and Katter, 2013) and as a measure of a "metacognitive gap" (XXXX, 2012). An important part of these approaches is their use of a quantifiable measure of confidence as a second dimension of assessment in multi-sized (i.e. small, medium, or large) learning environments. However,

the use of confidence as this additional dimension requires knowing the relationship, if any, between confidence and performance. If confidence has no correlation with performance, then its use in assessment becomes unclear. Thus, the research question addressed in this paper is as follows – "What relationship, if any, exists between confidence and performance?" The answer to this question determines whether or not the use of confidence as a second dimension of assessment along with performance is possible.

METHOD

The experimental data gathered to investigate the research question comes from student responses in the author's online Astronomy course over a period of six semesters (September 2010 to December 2013) using the commercially available SurveyMonkey© software linked to the course syllabus. As part of the coursework, each new group of students answered the same baseline set of fifty six multiple choice questions each semester and then indicated either a low, medium, or high confidence level in their answers. Class size varied from 30 to 50 students per semester with the total number of responses per baseline question ranging from N = 170 to 288. Figure 2 shows the overall confidence level distribution and performance for a typical question presented each semester over the period of the study.

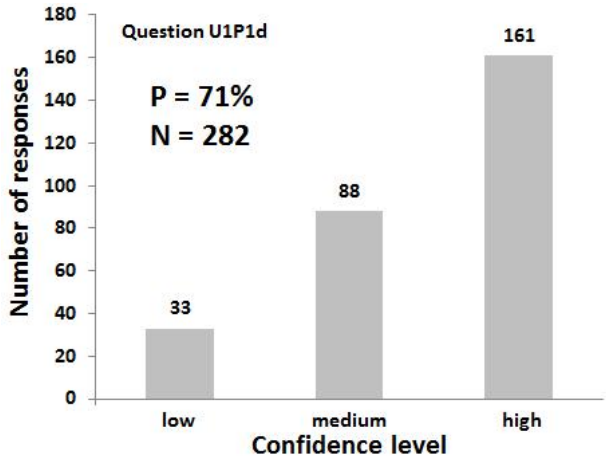

Figure. 2. Survey software output

In addition, Bloom's revised taxonomy (Krathwohl, 2002) permitted critical thinking levels to be assigned to each question. As shown in Figure 3, questions designated as Level I require factual and conceptual knowledge resulting from remembering and understanding to complete, whereas Level II questions need procedural knowledge obtained through the processes of applying and analyzing.

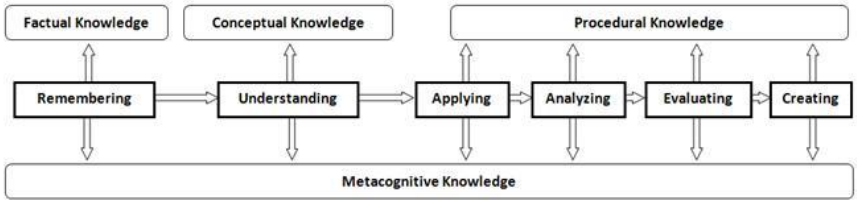

Figure. 3. Bloom's revised taxonomy

The determination of a quantifiable confidence level from student responses employed a physical analogy. The left-hand side of Figure 4 illustrates a confidence level distribution similar to that shown in Figure 2 and displayed as a bar chart with the magnitude of the total low, medium, and high confidence level responses are indicated by l, m, and h.

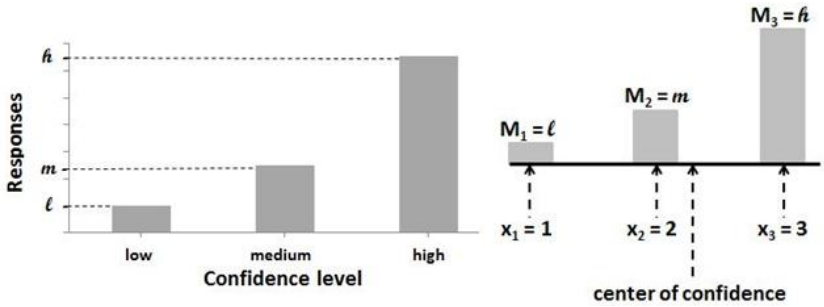

Figure. 4. Bar chart of typical confidence and center of confidence

As noted in the figure, the distribution of the confidence level responses provides an approximate description of the overall level for this particular question, in this case between medium and high. The right-hand side of Figure 4 illustrates another way of viewing this same information. Here the confidence magnitudes (l, m, and h) correspond to masses $\mathbf{M_1}$, $\mathbf{M_2}$, and $\mathbf{M_3}$ distributed at distances along a horizontal axis of $\mathbf{x_1} = 1$ (low confidence), $\mathbf{x_2} = 2$ (medium confidence), and $\mathbf{x_3} = 3$ (high confidence), with the center of mass of this system given by the familiar expression

$$\text{center of mass} = M_i x_i / M_i. \qquad (1)$$

Substituting confidence magnitudes for masses and confidence levels for distances yields an analogous quantity called the center of confidence denoted algebraically as **C**, or

$$\mathbf{C} = (l + 2m + 3h)/(l + m + h). \qquad (2)$$

Applying equation (2) to the data shown in Figure 2 yields a center of confidence value of 2.45, in agreement with a visual estimate of the center of mass of an analogous physical system. Closer inspection of equation (2) reveals this result also corresponds to the expression used to determine the weighted average of the confidence magnitudes shown in the bar graph. Therefore, in addition to providing a visual representation, the center of confidence also provides the confidence level expected for a particular question. Stated in another way, each question has associated with it a center of confidence specific to that question. This result suggests an interpretation of the meaning of confidence based not upon the response given by an individual student after answering a specific question but to the expected response to that specific question before it is answered. It is this latter interpretation which is used as the meaning of confidence in this paper.

Before investigating the relationship between the confidence associated with a question (as represented by the center of confidence) and the performance on that question, the meaning of the latter needs further clarification. For each question, **P** represents the percentage of students who answered a particular question correctly as indicated in Figure 2. Conversely, this percentage also represents the expected or probable performance associated with that specific question. Thus, similarly to the treatment of confidence, each question has associated with it an expected or probable performance. Consequently, the meaning of performance here becomes the expected or probable outcome for a specific question rather than the outcome resulting from the answer given by an individual student to a specific question. This paper employs the probabilistic interpretation for the meaning of performance with the quantity **P** now denoted as the performance probability and expressed as a percentage. In view of the previous discussion, the research question is restated as "What relationship, if any, exists between the center of confidence **C** and performance probability **P**?"

RESULTS

Gardner-Medwin and Gahan's assumed linear "no negative marking" case shown in Figure 1 suggests a possible model for the relationship between **C** and **P**. Specifically, as the confidence level of increases the probability of answering correctly increases in direct proportion. The model as adapted here assumes that if all students answer a question correctly (**P** = 100%), they all would response at the highest confidence level thus yielding a center of confidence of **C** = 3. Similarly, if all students answer incorrectly (**P** = 0%), they do so at the lowest center of confidence level giving a center of confidence of **C** = 1. For the case of **P** = 50%, half of the students answer correctly and select the highest confidence level and the other half answers incorrectly and choses the lowest confidence level, thereby yielding a center of confidence of **C** = 2. A plot of these points results in the modeled performance probability $\mathbf{P_m}$ as a function of the center of confidence **C** (the dashed line and equation in Figure 5).

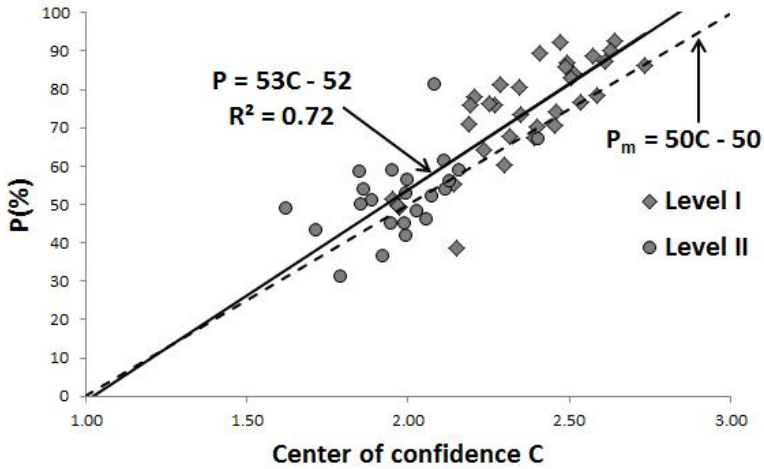

Figure. 5. Performance probability versus center of confidence for all responses

Also included in the figure are the experimental values of **P** and **C** as determined from the data for each baseline question, the accompanying linear regression line (solid line) and best fit equation to these points, the R-squared value, and the question critical thinking level for each question. Included in this plot is the point (71, 2.45) corresponding to the question referenced in Figure 2.

On first inspection, the data appears to be a reasonable fit to the model. To test the validity of the linearity of the model, the four assumptions shown in Table 1 regarding the use of a linear regression to describe the relationship need further examination. The violation of any of these assumptions as indicated by the validity tests calls into question the use of a linear model.

Table 1. Assumptions and validity tests for linear regressions.

Assumption	Validity Test
Linearity – the independent and dependent variables are linearly related to one another	No discernible pattern in the distribution of points about a horizontal line in a standardized residual versus predicted value plot
Homoscedasticity - the variance of values of the dependent variable from the regression line is constant	Approximately constant spread of points about a horizontal line in a standardized residual versus predicted value plot
Independence – the random errors associated with the dependent variable are unrelated to one another	Durbin-Watson statistic of ~ 2.0 with an acceptable range of 1.75 to 2.25
Normality – the residual errors associated with the dependent variable are randomly distributed	Presence of a diagonal line resulting from normal probability plot

Figure 6 shows, on the left, the plot of the standard residual versus predicted performance probability P obtained by an Excel analysis of the data. The apparent linear relationship from Figure 5 and the discernment of no pattern associated with the points in Figure 6 both support the validity of the linearity assumption. In addition, the spread of points above and below the zero line is approximately equal therefore supporting the homoscedasticity of the data. (Possible outliers seen in Figure 6 will be addressed later in the paper). A value for the Durbin-Watson statistic of 1.93, calculated using Excel, supports the independence assumption and Figure 6 shows the diagonal line obtained from the normal probability plot, again obtained via Excel, again lending support of the normality assumption.

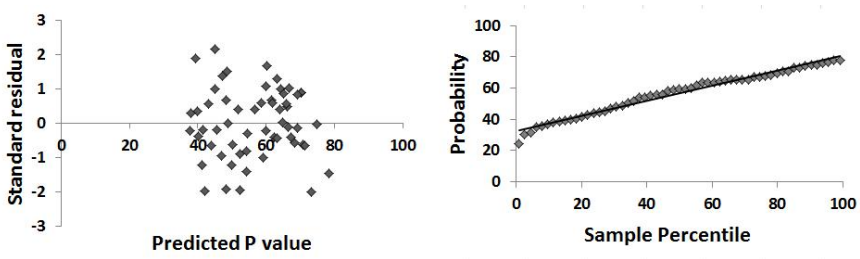

Figure. 6. Standard residual/predicted P plot and normal probability plot

Furthermore, in a normal distribution, 63% of the total residual points fall within plus and minus one standard deviation and 95% between plus and minus two standard deviations. These conditions are also met by the data in Figure 6.

In summary, the validation of the four assumptions stated in Table 1 supports the use of linear relationship to model the behavior between the experimentally determined centers of confidence and the performance probabilities and, as such, provides an answer to the research question posed in the paper.

DISCUSSION

The closeness of agreement between the experimental line and the model line shown in Figure 5 suggests the use of the latter as a benchmark for comparing and interpreting the experimentally determined values of **C** and **P**. To examine this possibility, Figure 7 shows the previously plotted data with only the model line shown.

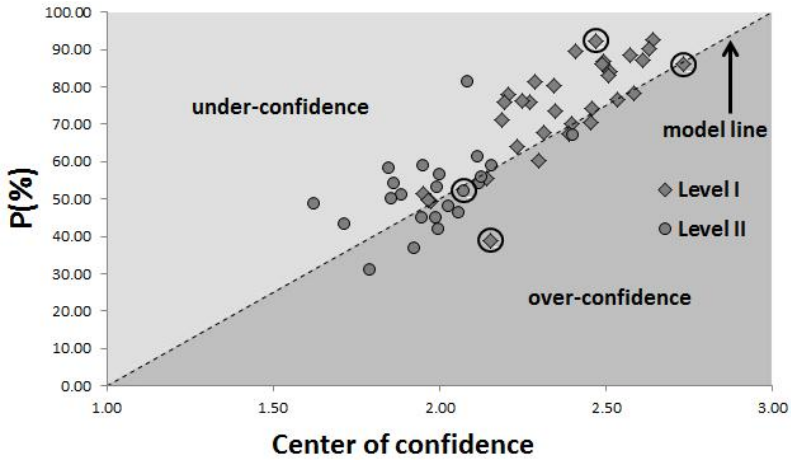

Figure. 7. Confidence regions

Specifically, points lying in the region either above or below the model line indicate situations of under or over confidence For example, the encircled point in the lower center of Figure 7 corresponds to a center of confidence **C** of 2.2 and an actual performance probability **P** of 39%. At this confidence level, the model predicts an expected performance probability of 60%. Thus, this question has associated with it an overestimation of the confidence in performance. For the point in the upper right of the figure given by **C** = 2.5 and **P** = 92%, the model predicts a performance probability of 75%. For this question, an under confidence in performance for that question is expected. For the two other encircled points lying on or close to the model line, **C** = 2.1, **P** = 52% and **C** = 2.7 **P** = 86%, the expected performance probabilities are 55% and 85% respectively. In these two cases, the performance predicted by the centers of confidence is in close agreement with the experimental performance probability. In this case, each question is considered calibrated, the difference between these two calibrated questions possibly attributable to the degree of difficulty of one question compared to the other. Thus, the use of the model line as a benchmark for comparing actual centers of confidence and performance probabilities allows for the identification of relative problem difficulty and the degree of under or over confidence associated with a question. Furthermore, the concept of miscalibration (Klayman, et.al., 1999) offers an explanation for the variation in confidence seen in the Figure 7 by describing how judgment errors result in over confidence on difficult problems and under confidence on less difficult ones. This interpretation is also consistent with the

"hard/easy effect" (Murad, 2014) found in non-incentivized self-reporting of confidence as found in this study. The predominance of Level I questions in the under confidence region and the over confidence associated with some Level II questions supports this explanation.

While this interpretation does not presume the absence of errors in the data which may account for some of the differences shown, it nevertheless offers an alternative explanation for deviations from the model. Indeed, points lying at large distances from the model line possibly result from content or structure differences in questions, with outliers (under and over confidence points) indicating issues as to how the questions were phrased and resulting in a possible misinterpretation of the question and subsequent misplaced confidence. In any case, the deviation from the benchmark model line reveals differences in questions, whether intended or not.

The Confidence/Performance Indicators shown in Figure 8 graphically represent the information previously discussed for the four examples taken from Figure 7. Importantly, the indicators allow for both confidence and performance to be combined in a straightforward manner. In each indicator, the benchmark performance probability predicted by the model for a given center of confidence (top circle) is shown by the position of the arrow on the performance scale. The lower circle indicates the actual performance probability as found from the data.

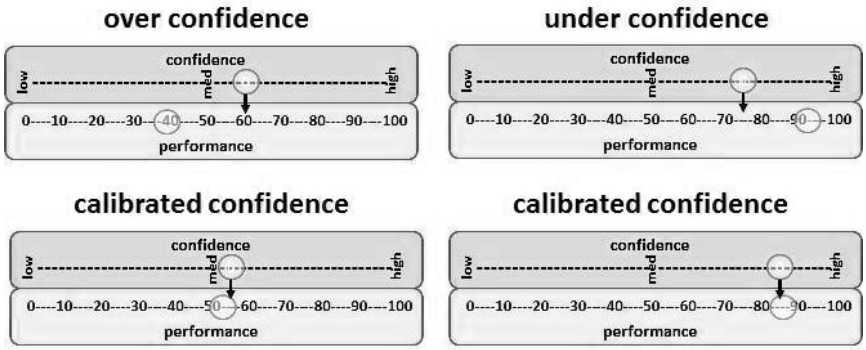

Figure. 8. Confidence/Performance Indicators

When included as part of a question, the indicators provide information which allows students to gauge the relative difficulty of a question as well as checking for any degree of under or over confidence associated with the question. In this sense, the Confidence/Performance Indicators provide a mechanism to deliver feedback by addressing what Glasson (2008) notes as "what has been done well in relation to the success criteria", "what still needs to be done in order to achieve the success criteria", and "advice on how to achieve that improvement". Specifically, the use Confidence/Performance Indicators suggests a means to encourage reflection and rethinking on the part of the student without using negative grading.

The author conducted a trial of the indicators to determine the efficacy to encourage rethinking and reflection on the part of students. Specifically, the indicators, embedded into nineteen of the fifty six baseline questions over the course of eight weeks provided students in an online Introduction to Astronomy class with the option of referring to them as part of the determining an answer. Prior to this, all students completed a tutorial on the concept of the indicators and their use in identifying the relative difficulty of questions and cases of under or over confidence. After answering the questions, students then completed a survey to determine the number who had or had not chosen to use the indicators, their reasons for using or not using them, and their level of helpfulness for those who had used the indicators. The two areas previously mentioned, question difficulty and under/over confidence, and two additional questions regarding rethinking and reflection and the overall helpfulness comprised the four survey questions given to those students who chose to use the indicators. Table 2 shows these questions, along with the rating scale employed. In addition, two open ended questions asked the students to comment about why they did or did not use the indicators. As only those who used the indicators responded to the survey, a forced-choice format provided the possible responses to survey questions. Research (Rasinski, et.al., 1994; Smith, et.al, 2006) which suggests that people who answer forced-choice questions spend more time and invoke deeper processing when answering supports this choice.

Table 2. Survey questions for students using the Confidence/Performance Indicators

Scale → very unhelpful unhelpful helpful very helpful Survey questions ↓	
Question Difficulty	How would you rate the Confidence/Performance Indicators in helping you judge the difficulty of the questions?
Under/Over Confidence	How would you rate the Confidence/Performance Indicators in alerting you to under or over confidence issues with the questions?
Reflect/Rethink	How would you rate the Confidence/Performance Indicators in making you rethink or reflect on your answers?
Overall	Overall, how would you rate the Confidence/Performance Indicators in helping you to answer the follow-up questions?

Of the 47 students answering the nineteen baseline questions containing the indicators, 87% (41) indicated that they referred to the Confidence/Performance Indicator when answering and thus completed the survey questions. Figure 9 shows the distribution of responses to the four survey questions and Table 3 provides an analysis of the three most common areas mentioned in the open-ended questions answered by all students. (Note: Cases of greater than 100% result from rounding errors.)

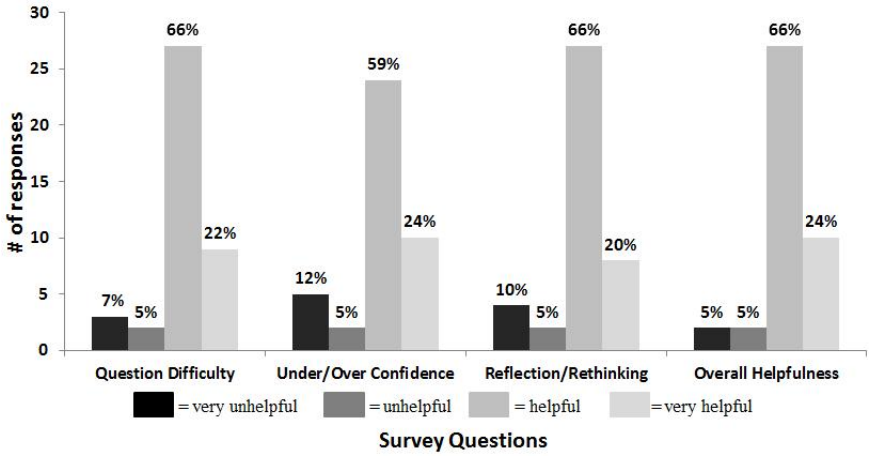

Figure. 9. Survey results of feedback areas

Table 3. Open-ended survey questions and response areas

Students using the indicators: "In the space below, enter any comments (pro or con) about the use of the Confidence/Performance Indicators in answering the follow-up question." Three most common response areas: 1) Rethink, review, recheck, or reflect: 10 occurrences 2) Comparisons: 6 occurrences 3) Usability issues: 5 occurrences
Students not using the indicators: "Briefly list below the reason(s) why you did not use the Confidence/Performance Indicators when answering the follow-up questions." Three most common response areas: 1) Already possess sufficient confidence in answer = 4 occurrences 2) Negative effect on answers (lower confidence) = 2 occurrences 3) No real reason = 2 occurrences

As illustrated in Figure 9, the majority of students (equal to or greater than 83%) selected with either helpful or very helpful responses when responding to the questions shown in Table 2. Additionally, analysis of the open-ended questions indicates that students felt the indicators encouraged rethinking and comparison, a result consistent with the survey results. A sample of comments regarding the use of the indicators include "definitely

helps me rethink and recheck my answer", "make you think before answering questions", "offer a view of how other students are looking at problems and the level of difficulty", "helped me gauge how accurate my questions were and gave me more confidence for each answer I submitted", and "they let me know that the reason I was taking so long to answer was that it was a more difficult question." Important comments regarding the usability of the indicators such as "a better understanding on how to use the indicator, when answering questions will be helpful" and "Only con is it takes some getting used to but once you understand it its useful" suggest that those students finding the indicators unhelpful or very unhelpful need better preparation. Indeed, one student's comment that "I can't see how past students answers can help me, because they could be wrong or right" suggests a lack of understanding of what information the indicators provide.

Comments from those students not using the indicators such as "I wanted to see how much I really new about the questions without using the performance indicators" and "I am not really sure why I do not use them, I just do not" again suggest incomplete knowledge of indicators' function and their use at providing feedback.

In view of the survey results and open-ended responses, the results of the trial use of the Indicators support their efficacy as a feedback mechanism to encourage rethinking and reflection. To address the usability concerns identified in Table 3, the Confidence/Performance Indicator tutorial requires a revision to include more examples and situations of their application with students. Furthermore, the Indicators will be employed in all baseline questions in an online section of ninety to one hundred students. Having demonstrated here their ability to foster rethinking and reflection, the author plans to pursue further research to determine the effectiveness of the use of Confidence/Performance Indicators on student performance.

In summary, using existing data of student responses to a set of fifty-six baseline questions gathered over a period of six consecutive semesters, analysis showed that the calculated centers of confidence and corresponding performance probabilities followed a linear model. This model, in turn, provided a benchmark for interpreting the experimental data which resulted in feedback regarding question difficulty and the degree of under or over confidence associated with a question. The introduction, demonstration, and subsequent positive evaluation of Confidence/Performance Indicators as a graphical means of displaying feedback suggests their continued use as an efficacious method of providing this feedback to encourage rethinking and reflection on the part of students. More specifically, once created and implemented the indicators require no interaction with an instructor and function in small, medium, or large learning situations. Furthermore, generating the data necessary to establish the indicators requires only the addition of low, medium, or high confidence response options as part of formative or summative assessments with data collection and analysis performed electronically. Thus, as a feedback mechanism, Confidence/Performance Indicators provide a quantifiable second dimension to assessment which is adaptable to multi-sized learning environments.

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VIRTUAL LABORATORY AS AN ELEMENT OF VISUALIZATION WHEN TEACHING CHEMICAL CONTENTS IN SCIENCE CLASS

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ABSTRACT
Using a variety of visualization tools for teaching and learning science and chemistry is necessary because pupils better understand chemical phenomena and formulate appropriate mental models. The purpose of the presented study was to determine the importance of a virtual laboratory as a visualization element when addressing chemical contents within science classes. Pupils from five different schools who were attending the seventh grade (N = 109), participated in the survey. The pupils were divided into experimental and control groups. We carried out a teaching experiment in order to assess the effectiveness of using a virtual laboratory. In addition, we asked ourselves two questions: whether the dynamic visualization enabled by the use of a virtual laboratory has a positive effect on the learning outcomes of pupils, and how successful are the pupils when solving tasks that involve visualization elements. The results from the didactic experiment showed, that in terms of knowledge acquisition, the use of a virtual laboratory was more effective than classes without the use of dynamic visualization elements.
Key words: primary school, science, virtual laboratory, dynamic visualization, knowledge

INTRODUCTION
Science teaching in Primary schools (9 year olds) is based on the understanding of physical, chemical, and biological contents. The starting-point for realizing these objectives during the teaching and learning of science is experimental and problem research-based learning. Most of the scientific concepts and their connections, especially chemical because of their triple nature (macroscopic, microscopic, and symbolic levels), can be illustrated or deduced from experimental work (Glažar, Devetak, Strgar & Naji, 2006). Experiments show us the actualities during experimental work. Explanations of scienctific concepts, particularly chemical, present no observable cases within the macroscopic world and are therefore difficult for pupils because they are abstract. Abstract interpretations of experimental observations correlate with the sub-micro level, ending-up with abstract records of events performed during the experiments (Devetak, 2006; Devetak & Glažar, 2007). The complexity of teaching and learning science concepts is reflected in the natures of chemical concepts, which can be described on three levels. The first concrete and actual level is the macroscopic level; the second is the actual phenomenon explaining the submicroscopic level; and the third level is symbolic, which encompasses a range of symbols that are easier to interpret (Devetak, 2012). For science and chemistry it is characteristic to perceive the physical world of matter, phenomena, and processes at the macroscopic level, but for their interpretation and prediction one should use the language of the submicroscopic world (Vrtačnik et al., 2003; Devetak et al., 2009). All three levels should meaningfully overlap during the learning process so that, within the long-term, the pupils' memories develop appropriate mental models that reflect adequate levels of chemical literacy (Devetak & Glažar 2007; Devetak, 2012).

Studies (Devetak et al., 2009; Johnstone, 1982; Williamson & Abraham, 1995; Papageorgiu & Johnson, 2005; Gregorius et al., 2010; deBerg, 2012; Rizman Herga & Dinevski, 2012) have shown that pupils have difficulties describing macro-phenomenon, and thus its interpretation at the submicroscopic level, which is the basis of understanding chemical concepts. Johnstone (1982) was the first to systematically indicate the meaning of the submicroscopic level of scientific concept for better understanding of chemical phenomena. The gaps between the three perceptual levels, as shown in Figure 1, could be overcome to a greater extent by the use of visualization elements (Vrtačnik et al., 2003; Barke & Wirbs, 2002; Dori & Belcher, 2005; Barak et al., 2007; Ferk et al., 2007; Johnstone, 1991).

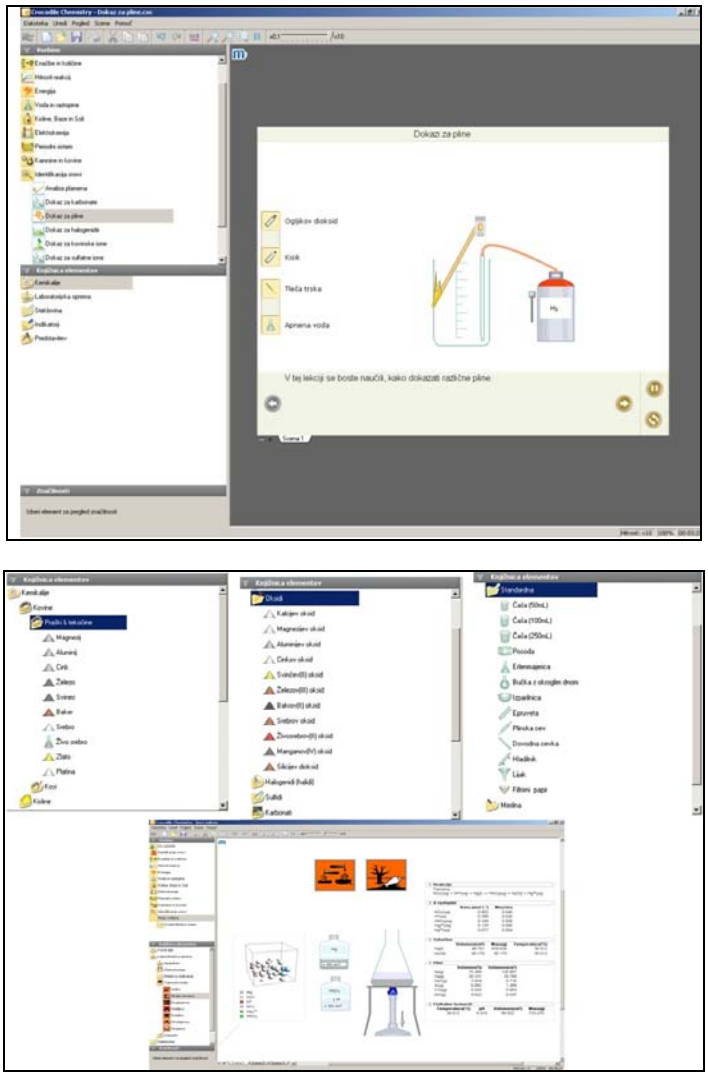


Figure 1: Three levels of scientific concepts' presentation, and the role of virtual laboratory

The visualization of science education is used in its widest sense; from physical models to a variety of images, multimedia and interactive animations, conveying virtual reality (Devetak, 2012). All these modern visualization approaches, enabled due to the rapid development of information - communication technology, have become an increasingly important tool of modern science lessons. Visualization methods and representations of science can be viewed as metaphors, analogies of models or theoretical constructs represented by different symbols, developed within chemisty to explain the real world. Combinations of different visualization elements can be designed in units within which macro, submicro-, and the symbolic components of the multimedia phenomena are intertwined(Devetak, 2012). Some multimedia researchers believe that this contributes to a better understanding of concepts compared to the classical interpretation (Gregorius et al., 2010; Vrtačnik, 1999; Sanger, 2000; Foti & Ring, 2008).

The formation of mental models at the submicroscopic level presents issues for pupils. This is especially true for those models that are dynamic, thus requiring the help of a medium which enables animations of the submicroscopical world of particles. The fact that these animations are statistically more appropriate than static submicro presentations, was demonstrated by the research of Williams and Abraham (1995).

When teaching and learning science, or teaching in general, we should also take into account pupils' different styles of perception. The style of perception is indicated by a perception channel – a sense that an individual takes advantage of when interpreting internal presentations of sensory impressions from the environment (MarentičPožarnik, 2000). Experimentations within schools should be a support for understanding concepts because

of their powerful visualization effects, where pupils with visual styles of perception benefit most. Pupils with kinaesthetic styles of perception will enjoy the laboratory work, and thus develop experimental skills.

A multimedia interactive unit that connects all three levels of the chemical concept on a computer screen or interactive whiteboard, is a virtual laboratory. Virtual laboratories can replace real laboratory work which, for economical or other reasons, cannot be implemented.

The Purpose of this Research, Research Questions and Hypotheses

Virtual laboratories are modern visualization elements with which we bridge the gap between the macro and micro worlds of teaching and learning scientific and chemical concepts. They enable us to implement virtual laboratory work where pupils not only learn about changes at the macroscopic level but also at the dynamic submicroscopic level, leading to a better understanding of the subject matter. With this in mind, we designed a teaching experiment with the aim of verifying the effectiveness of a virtual laboratory in terms of chemical content knowledge by pupils during science classes in the 7th grade of a primary school. We were interested in the effects of classes executed by virtual laboratories, on pupils' knowledge. In doing so, we set the following hypotheses:

H1: We assumed that the experimental group of pupils, in comparison to the other pupils of the control group, would acquire more knowledge of chemical content by the end of the experiment.
H2: We assumed that the experimental group of pupils, in comparison to the pupils of the control group, would solve tasks involving visual elements more successfully after the experiment.

METHODOLOGY

Research method

In order to study the impact of classes executed by virtual laboratories regarding the units "Substances, their properties and changes" and "Pure substances and compounds" within the case-study, we used the experimental method of traditionally empirical-analytical educational research.

Experimental model

We designed a single-factor experiment with classes as compared groups. The research work was conducted by experimental (EG) and control groups (CG). In the classroom with a virtual laboratory, we used the Crocodile Clips Chemistry program. Lessons with the virtual laboratory were performed by an experimental group. The experimental factor had two modalities:

- teaching science according to the standardized curriculum using the approach by teachers in an everyday classroom (CG),
- teaching science according to the standardized method but where the teacher implements a virtual laboratory within the traditional approach (EG).

The study of the effectiveness of both modalities regarding the experimental factor was based on definitions of the following factors:
- factors before the experiment, relating to the pupils as individuals,
- factors relating to the group as a whole,
- indicators of the chemical contents'effects after science within virtual laboratories.

The didactic experiment took place from early March 2011 to the end of May 2011.

Indicators of the effect of the teaching experiment

In order to ensure the internal validity of the experiment (the possibility of attributing the discovered differences in effectiveness regarding these two approaches to the teaching of science and not to any existing initial differences between the compared groups) ,we studied the effects of conditions for controlling certain factors before the introduction of the experiment, relating to the pupils as individuals (pupils'genders, their grades in science before the experiment), and those factors relating to the group as a whole (age, curriculum).

In order to ensure content validity (exhaustive identification and verification of actual performance), we studied the effectiveness of the experiment after teaching the themes "Substances, their properties and changes" and "Pure substances and compounds" from the science knowledge point of view (chemical part), expressed as:
- the total score on the science test and
- the result of science knowledge testing with tasks that had visualization elements incorporated.

Defining the sample

The didactic experiment included 7th grade pupils from five different primary schools. The study involved 109 pupils (N = 109). The pupils were divided into experimental (EG) and control groups (CG). 56.9% of the pupils participated in the experimental group and 43.1% in the control group. A select group of pupils represented, in the context of statistical hypothesis testing, a simple coincidental sample from the hypothetical population. The didactic experiment was conducted within science classes and encompassed the chemical contents of the subject.

Data collection procedures

Data were collected by testing pupils' knowledge of subject matter according to a test created by the authors. Furthermore we carried out a rational and empirical validation of the test. Rational validation was based on assessing the appropriateness of the content and design of the test. For empirical validation we used the factor analysis solution, namely the percentage of explained variation by the first common factor (% ex. var. F1). Given that the first factor explains 30.3% of the variance and is above the limit of the criterion for the lower limit (20%), we estimated that the examination was valid. In order to determine the reliability of the examination we used Cronbach's alpha coefficient ($\alpha = 0.710$). This confirmed whether it was a reliable instrument for assessing knowledge. The objectivity of the knowledge testing was provided by detailed instructions. Many questions on the test were closed-ended. The results for both groups were evaluated by the same teacher according to the same criteria.

In February 2011 we formed the experimental and control groups, and determined the school at which the experiment would eventually be carried out. Following the implementation of the didactic experiment we tested pupils' knowledge by assessing the learning progress of one group compared to the other. The tests were corrected and graded according to the instructions and scale of points.

Knowledge testing

Knowledge testing after the experiment consisted of 14 tasks (maximum 41 points). The test included tasks on the levels of understanding and use of knowledge. The exam consisted of tasks with one correct answer, tasks that required completing, matching tasks, and open-ended tasks. Visualization elements were included within tasks 2, 3, 8, 10, and 11 (see Appendix 1). In these tasks, which we analysed separately, the pupils could achieve 13 possible points.

The tests were corrected and graded according to the instructions and scale of points.
Task samples can be found in Appendix 1.

Data-processing procedures

The data was processed using the SPSS (Statistical Package for the Social Sciences). For the analysis of metric characteristics we used factor analysis and the Cronbach's alpha coefficient (α). The non-parametric test (χ2-test)was used for analysing the differences between the groups before the experiment. After the experiment we used the parametric test (t-test). In this paper, the results of the experiments listed the differences between the groups and the arithmetic means of the pupils' performances in individual visualization tasks.

RESULTS

Statistically important differences between the groups (EG and CG) were tested by the χ^2 – test. The structures of the pupils according to gender were similar in both groups ($\chi^2 = 0.02$; P = 0.887). In addition the groups did not vary according to their marks in their science classes ($\chi^2 = 3.048$; P = 0.384).

a) Pupils' Achievements in the total score regarding knowledge testing after the experiment

After carrying out the experiment we analysed the pupils' knowledge using a test. We analysed the total points score.

Table 1: Results from the t-test regarding the differences between the experimental (EG) and control (CG) groups in the total score on knowledge testing after the experiment.

GROUP	Numerous n	Arithmetic mean $\bar{x}$	Standard deviation	Test of homogeneity of variances		Test of the arithmetic mean difference	
EG	62	32.19	4.62	F	P	t	P
CG	47	23.02	6.20	1.957	0.165	8.850	0.000

The assumption of homogeneity of variance (F = 1.957 P = 0.165) was justified.

As shown by the outcome of the t-test (testing knowledge after the experiment), the experimental group's pupils ($\bar{x}$ = 32. 19) achieved higher scores than the control group's pupils ($\bar{x}$ = 23. 02). We could see that those pupils who had

learned the subject-matter with the help of a virtual laboratory had gained more knowledge in comparison with those pupils who had been taught using no additional explanations at the submicroscopic level.

The difference in the arithmetic mean between the pupils in the experimental and control groups was statistically significant (t = 8.850, P = 0.000). This research **confirmed the hypothesis (H1)** in which we assumed that the experimental group's pupils would have gained more knowledge of chemical concepts at the end of the experiment than the control group's pupils.

b) Individual accomplishments for tasks, including the visualization elements

Table 2 presents the results of the t-tests regarding the differences between the pupils of the experimental and control groups according to the total scores in those tasks that included visualization elements.

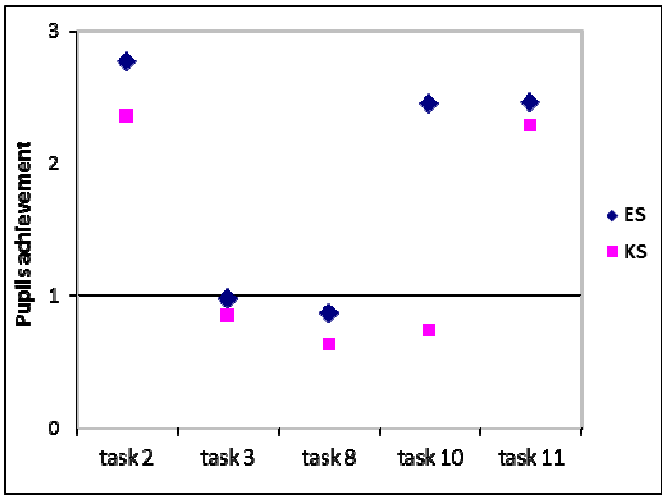
Table 2: Results of t-tests regarding the differences between the experimental group's pupils (EG) and control group's pupils (CG) according to the total scores after the experiment

GROUP	Numerous N	Arithmetic mean $\bar{x}$	Standard deviation	Test of homogeneity of variances		Test of the arithmetic mean difference	
				F	P	t	P
EG	62	9.54	2.19	1.434	0.234	6.455	0.000
CG	47	6.89	2.03				

The assumption regarding homogeneity variance (F = 1.434 P = 0.234) was justified.

The results of the t-tests showed statistically significant differences (P = 0.000) amongst the pupils of the experimental group ($\bar{x}$= 9.54) and the control group ($\bar{x}$= 6.89) when accomplishing tasks that included visualization elements. Those pupils from the experimental group who learned about the chemical content through a virtual laboratory, had an advantage over the pupils in the control group,regarding these tasks. This research confirmed the hypothesis (H2) in which we assumed that the experimental group's pupils would better solve those tasks that included visualization elements, compared to the pupils of the control group, after the experiment.

Analysis of the pupils' achievements in various tasks with visualization elements is clearly shown in Graph 1. This graph shows that the experimental group of pupils was more successful in all five tasks compared to the pupils of the control group.



Graph 1: The arithmetic means of pupils' accomplishments (EG and CG) on the various levels of tasks regarding the testing chemical content, after the experiment.

The detected differences are statistically shown regarding their possible importance, by the results in Table 3.

Table 3: Results of t-test between the experimental (EG) and control groups (CG) regarding accomplishments using individual visualization tasks

	GROUP	Numerous n	Arithmetic mean	Standard deviation	Test of homogeneity of variances		Test of homogeneity of regression coefficients	
Test 2	EG	62	2.77	0.66	F	P	t	P
	CG	47	2.36	1.13	26.018	0.000	2.227	0.029
Test 3	EG	62	0.98	0.12	F	P	t	P
	CG	47	0.85	0.35	36.463	0.000	2.418	0.019
Test 8	EG	62	0.87	0.33	F	P	t	P
	CG	47	0.63	0.48	34.432	0.000	2.809	0.006
Test 10	EG	62	2.45	1.62	F	P	t	P
	CG	47	0.74	0.89	28.394	0.000	6.983	0.000
Test 11	EG	62	2.46	0.67	F	P	t	P
	CG	47	2.29	0.97	6.622	0.011	1.024	0.309

The assumption regarding homogeneity variances in all cases (F = 26,018, P = 0.000, F = 36,463, P = 0.000, F = 34,432, P = 0.000, F = 28,394, P = 0.000 and F = 6622, P = 0.011) was incon clusive.

The results of the t-tests showed that, between the experimental and control groups, when solving the second task (P = 0.029), the third task (P = 0019), the eighth tasks (P = 0006), and the tenth task (P = 0.000), there are statistically significant differences. In the eleventh task, which included visualization elements, the arithmetical mean for accomplishments between the groups was statistically insignificant (0.309).

DISCUSSION AND IMPLICATIONS FOR EDUCATION

In chemistry and natural sciences, in general, experimental laboratory work is one of the most effective methods for acquiring knowledge, which complements other methods and forms of active learning. Experimental work is one of the active forms of teaching, during which pupils learn experimental approaches: from the designing of experiments, the collection; analysis; and presentation of data, independent implementation, and integration with theoretical knowledge and pre-knowledge (Glažar et al., 2006; Pickering, 1993; Hofstein & Lunetta, 2004; Vrtačnik et al., 2011; Logar et al., 2011). Basically, experimental work can be divided into real and virtual. Classical experimental work is the best known form of practical work and is most commonly used when teaching science and chemistry in elementary schools. Pupils are trained in manual skills, develop their abilities to describe chemical changes, learn about the physical and chemical properties of substances, develop abilities to work safely within the school laboratory, consolidate and complement their knowledge and skills, and develop an experimental approach as a form of research work etc. We often ascribe the motivational aspect in order to justify practical work within schools. However, motivation is only one of the reasons why we decide to practise experimental work. We must be aware that experiments are an economic category; the practical execution of an experiment having its own price (Vrtačnik et al., 2005) and that the number of experiments carried out within schools are usually limited for security reasons due to the lack of adequate infrastructure and equipment, limitations of time and space, and also the lack of precision when carrying out laboratory work. As proven, pupils want laboratory work to be instigated more frequently within classical teaching (Šorgo & Špernjak, 2007).

Virtual laboratory practise is held within a virtual world, and a virtual lab brings many advantages. They can perform dangerous experiments without endangering themselves or others. Simulators are affordable. Once developed, they can function at no extra cost as many times as required. The results are always the same. A virtual laboratory provides independent or collaborative work, which is not necessarily related only to school time, school laboratory or available chemicals and laboratory facilities. Educational software for primary and secondary schools is available as a virtual chemistry laboratory called ‘Chemistry Crocodile Clips’ (see Appendix 2). This program also enables pupils to work independently or in groups, where the interface gradually leads them step by step through the virtual experiment.

Pupils or teachers have ready-made collections of experiments at their disposal. They can also use gadgets, glassware, or set a chemical experiment from the beginning. The program has the ability to modify existing experiments. Pupils or teachers can adapt an existing experiment by changing various parameters such as temperature, weight, concentration etc.

A booklet of elements features the extensive equipment available for chemical laboratories and also more than a hundred different chemicals, with which they can carry out experiments, including those that are too dangerous for school laboratories. It is adjusted for working on interactive whiteboards. When using virtual laboratories, the uninteresting and boring parts of the experiments can be removed. It helps pupils achieve higher cognitive levels of analyses, syntheses, and evaluations(Kirscher & Huisman, 1998; Abdulwahed & Nagy, 2009). Studies into the effectiveness of virtual laboratories during e-learning have shown that pupils prefer to use computerized tools whilst learning, and not textbooks(Sun et al., 2008; Rajendran et al., 2010).

Before carrying out this didactic experiment, we set two main hypotheses.
The first hypothesis in which we assumed that the experimental group of pupils compared to the pupils of the control group would gain more knowledge of chemical content, was confirmed. Teaching chemical contents according to the standardized science curriculum, where the teaching approach involved the use of a virtual laboratory, proved to be more successful compared to those classes where the dynamic visualization was excluded from the teaching of science. The differences in the total points scored on the knowledge test was statistically significant.

We can conclude, that the use of a virtual laboratory can affect the formation of mental models at the submicroscopic level. These dynamic models and animations, which are enabled by a virtual laboratory, when compared with the static submicro presentations, proved to be more appropriate for the understanding of chemical concepts, as proven in the study by Williams and Abraham (1995). Devetak and co-authors (2010) noted that even a limited manipulation of models statistically improves pupils' understanding of specific subject matter, such as the building-blocks of solid matter - crystals. Using a virtual laboratory clearly helps pupils to achieve higher cognitive levels (Rizman Herga & Dinevski, 2012; Kirscher &Huisman,.1998; Abdulwahed & Nagy, 2009).
The second hypothesis in which we assumed that the experimental group of pupils would be more successful in solving the tasks after the experiment compared to the pupils of the control group, was confirmed. When teaching and learning we should take into account the different styles of perception that can be achieved by using a virtual laboratory. Pupils in the experimental group better solved statistically those tasks involving the visual element which we specifically analysed in this study. These pupils did not simply verify the performances of visual type pupils, as these tasks also required spatial visualization skills by pupils. As demonstrated by the results from the study, pupils using the virtual laboratory better developed their spatial - visualization skills compared to the pupils who did not have this option. Similar results were obtained in the study of Boats and Engida (2001).

The revised syllabuses for science in Slovenia fairly quickly (from 11 years onwards) incorporates the introduction of particles. It is important that, during this tested primary school period, pupils form appropriate mental models in order in order to deal with any problems throughout subsequent science education. The understanding of science and chemical concepts also depends on visualization. In order to properly integrate new concepts, pupils need a variety of visualization elements. Alongside the development of modern information - communication technologies in this area, virtual laboratories play an important role. Using virtual laboratories for teaching science and chemistry has several strong advantages: 1) they enable experimental work that would otherwise be impossible due to economical, spatial, time, and other reasons. This is contrary to didactic recommendations, as experimental work is one of the most effective methods for acquiring knowledge. 2) they enable visualization at the macroscopic, submicroscopic, and symbolic levels, and 3) provide dynamic presentations of the submicro world of particles. 4) this then contributes to a better understanding of the chemical content. 5) their use of advanced information and communication technology is familiar to pupils, and serves as a powerful motivational tool.

Advanced information and communication technologies are increasingly coming to the forefront and we will need to change the methods of teaching. The presented findings regarding virtual laboratories empirically verifies the need for educational strategy changes regarding science and chemistry didactics.

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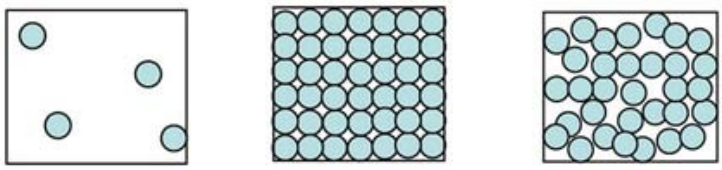
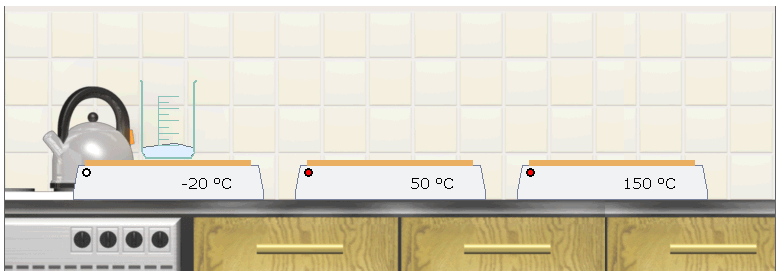
APPENDIX 1
Sample items from the test

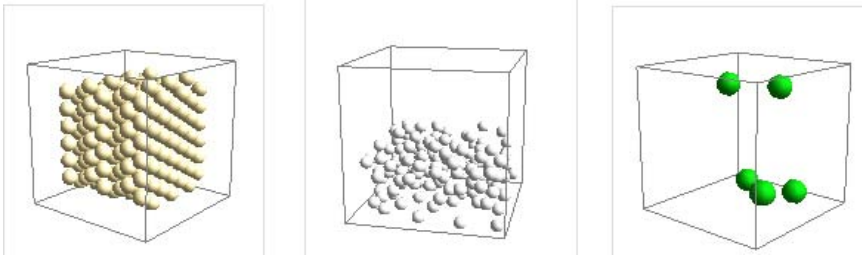
2. How does the structure of water change from ice to water vapor? Use lines to connect boxes with heaters so that the aggregatic state complies with the temperature shown by the heater!





__/3

3. Which model shows the building blocks of a golden ring? Circle the correct letter.



A B C

__/1

8. This sketch shows the process of:

A chromatography
B decanting
C distillation
D filtering
E separation by a funnel

__/1