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Message from the Editor-in-Chief

Dear Readers,

Definition and analysis of technology, its history as well as its role in human life…. to us that there is a relationship among technology, society, culture, organization, machines, technical operation, and technical phenomenon. Educators are increasingly using technology in all aspects of their profession (e.g., creating curricula, classroom instruction, and work assignments). This trend can be enhanced by educating the educator about cultural and cognitive aspects of technology and technikos, as well as the associated advantages and disadvantages related to educational and human development goals.

Since the Renaissance, modern everyday attitudes tend to freely accept and use new technologies. Technology is usually comprehended in terms of hardware and the end experience it produces (good and bad) or its material benefits (profitable or unprofitable), rather than understanding deeper relationships between technology, human nature, and culture. What produces technology – cultural organizations, human values, research and development, and so on – is less obvious and less interesting than experiencing its products and benefits.

TOJET is interested in academic articles on the adoption and abandonment of educational technology in education. The articles should be touched on why teachers and school districts resist technology and give some solutions for the diffusion of educational technology. These articles will aid teachers and school districts to diffuse technology in education.

The guest editor of this issue is Assoc. Prof. Dr. Nejdet OSAM. The quest editor has been a great success in reviewing a number of valuable articles for this issue. TOJET thanks Dr. Nejdet OSAM for his valuable contributions.

Prof. Dr. Aytekin İŞMAN
Sakarya University

Message from the Guest Editor

Dear Academics and Authors,

I am happy to inform you that the summer issue of TOJET has been a great success in receiving a number of valuable articles. As the guest editor of the issue, I need to inform you that there is a very significant interest of authors from many different scholarships in submitting their studies with specific reference to education and technology . In this respect, for the July issue we have received 29 articles ranging from engineering to history all of which are related to the use of technology for the betterment of learning.

In this issue, we have followed the regular rules of evaluation of the articles. Here I have to express my gratitude to the scientists and educaters for working precisely and helping the issue editor on the basis of academic quality for the July issue.

We may give some hints about the articles which are present in this issue: Stavros Kammas in his researh study focussed on the dissemination of cultural heritage through the mobile technology.

Günel and Aşılayan in their interesting study developed a special tutoring system by the name of MatITS to be used for improving learning in the domain.

Fevzi Baba and his colleagues developed a system which would be used for performance evaluation of the research assistants at universities.

Kazancı and Okan evaluated a specific software which is used in language teaching-English Language Teaching- and they tried to find out if the software was reinforcing learning on the basis of entertainment or education or both.

Bülent Akbaba in his study reflected the benefits of using photographs in history education.

Finally, in their study Dr. Hussein and Dr. Adeep in their challenging study demonstrated how campus-wide learning environment can be established for the beterment of learning.

As the issue editor , I hope the articles of the July 2009 issue are of great interest and great value for your further research studies and we are looking forward to disseminating academic knowledge in our future issues as well.

Wish you all the best,

Necdet OSAM
Issue Editor

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A MOBILE TECHNOLOGY FRAMEWORK FOR THE DISSEMINATION OF CULTURAL MEMORY

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ABSTRACT
The current research proposes a mobile technology framework in cultural heritage setting for the dissemination of cultural memory among its visitors. The framework studies the complex concept of human memory and attempts to adopt the human information perception, as a learning process, on a mobile framework that will allow their users to interact and share common knowledge concerning their personal knowledge and experience of the certain cultural setting.

1. INTRODUCTION

Human brain is quite complex mechanism. It absorbs information from the environment and recalls this information whenever becomes necessary. In a cultural heritage site there is information that is provided only by the observation of just the monuments and information that becomes available by the curators of the site. The progress of technology has allowed for visitors in museums and cultural heritage sites to access electronic information relevant to the site and to the monuments. Moreover it allows the communication between the various visitors either at the same time or on different time of visit in order to exchange thoughts and ideas on the specific cultural elements. The information on the monuments accompanied with the individual information and experience on the monuments is what forms the cultural memory of the monuments. There are various factors need to be considered in order to be able to capture and disseminate the cultural memory of the heritage setting which relate not only to the potentials of technology but also the limitations and possibilities of human cognition.

2. MEMORY

For more than 2.500 years, philosophers and scientists have been concerned with the issue of memory. In 350 B.C. Aristotle, defined memory in his work on Memory and Recollection (Aristotle, 1935) as *"the recreation of past experience accompanied by the consciousness that this experience existed beforehand"*. He also argues that *"there is no such thing as memory of the present while present, for the present is object only of perception, and the future, of expectation, but the object of memory is the past."* Therefore, for the memory to be meaningful, time elapsed is presumed. Memory, based on Freud (1900), is developed in the form of fading traces as it is mainly perceived, stored and erased. Psychology defines memory as the ability of an organism to store, retain and retrieve information which may have the form of ideas or even personal experiences. Memory processes can be explained in terms of information processing. The perceiving process of memory includes the combination of information that has been received through human sensations. The storing and retaining processes of memory create a permanent record in one's mind. Finally the retrieving process of memory recalls the stored elements as a result of an external or internal trigger or to be used in a certain situation. Marcel Proust (1913) argues that the retrieving or recalling process of memory may happen due to unconscious cues and not necessarily intentional purposes. This is, what he calls, involuntary memory.

Memory can be declarative or procedural depending on the type of creation source. The first is the feature of the human memory to store facts. This type of memory can be explicitly shared with others and is related to the typical learning from resources process and to flash-back situations. Procedural memory resembles with Proust's involuntary memory. It is the implicit and unconscious long-term memory of one's skills and internal learning procedures. Declarative memory can be either episodic or semantic depending on the nature of the information to be remembered. Episodic is the memory of events, places, times and related emotions and experiences based on conceptions. Episodic can be either scenic memory if it is organised in visual terms or narrative if it is organised with verbal means. Semantic is the memory of meanings, understandings and concepts unrelated to experiences. Therefore, memory, apart from being a process of reconstructing elements from past experiences in one's mind, is directly connected with the sensations and the perceptions of the human body. This type of physical and conceptual experience in a specific setting can be delimited as someone's context.

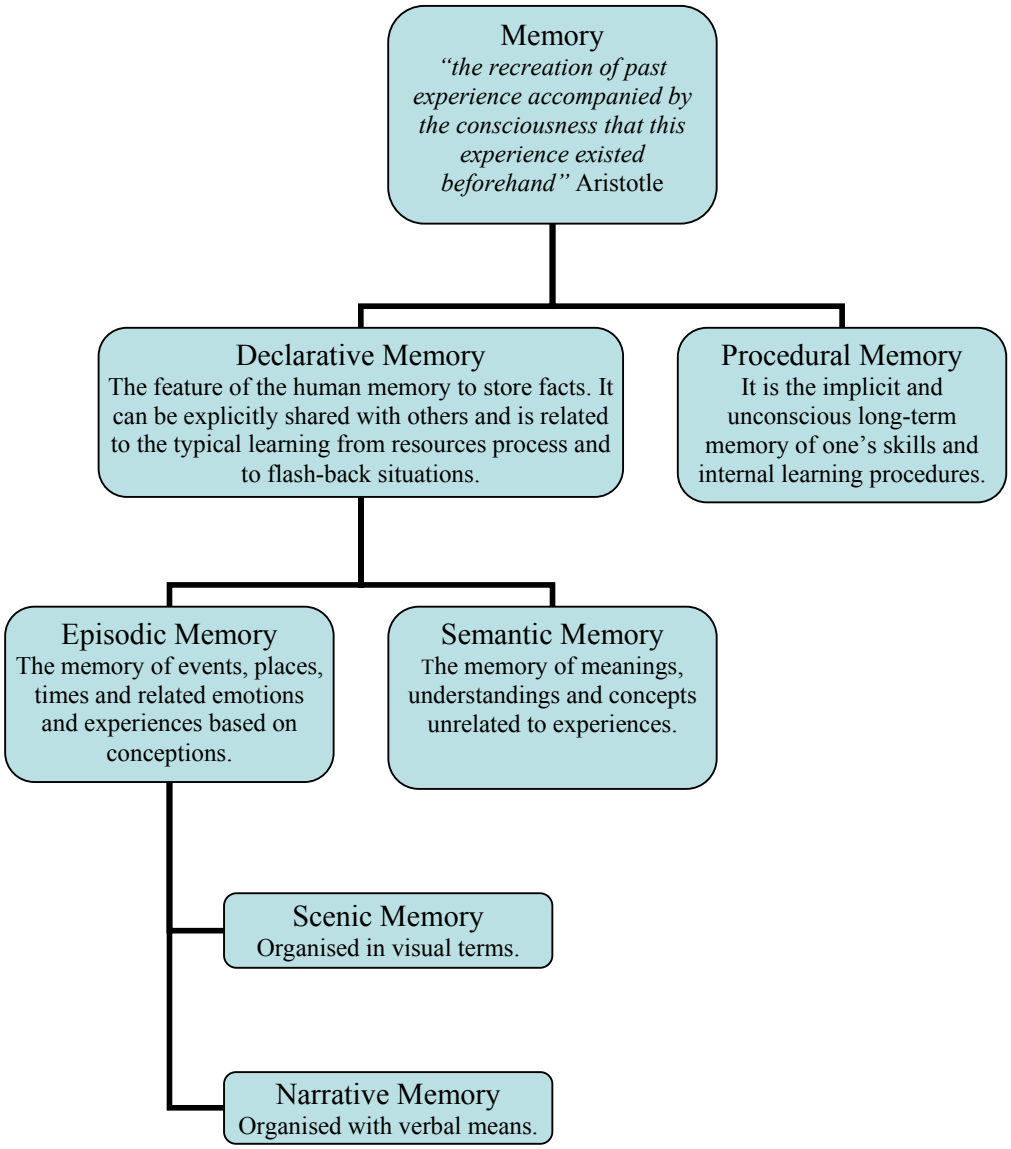

Fig.1 Memory classification by information type

3. CONTEXT

The term of context has been used in various scientific disciplines such as linguistics, pragmatics, ontology, sociology, architecture, knowledge representation, computer science and others. It is difficult to provide an accurate definition of context as most of the times it is defined in relation to examples for a specific situation or through synonyms. There is not a single definition of context (Finkelstein et al., 2002) as, while it is something that is usually understood, it is difficult to be explained. Oxford English Dictionary (2008) provides two definitions for context. The first one is a linguistic definition and defines context as the parts that immediately precede and follow a word or passage and clarify its meaning. The second one, more general, defines context as the circumstances that form the setting for an event, statement, or idea. In order to be able to manipulate the contextual information so that they could develop context awareness devices, computer scientists have done a great attempt in giving accurate definitions of context. Focused on an example-based definition, Schilit *et al.* (1994) identify as the three most important aspects of context to be where someone is, who is this person with, and what resources are nearby. In addition, Schilit and Theimer (1994) define context as the location, the identities of people and objects nearby and the changes that are happening on them. Ryan *et al.* (1997) adds the concept of time to the above mentioned definition of context. Day (1998) defines context as not only someone's location, time and the people and objects of the environment but also the emotional condition, the orientation and the attention of the person. Day *et al.* (2001) define context as the location, identity and state of people, groups and computational and physical objects. On the other hand, in terms of synonyms, context is the environment

(Hull *et al.*, 1997), the setting (Rodden *et al.*, 1998), the current situation (Franklin & Flaschbart, 1998), or even the elements of someone's environment that the person is aware of (Brown, 1996). Based on the definitions provided, we will attempt to determine context in our case.

4. MEMORY AND CONTEXT

In an archaeological site, an individual is moving around various locations, watching the monuments or the artefacts of the place. The items the individual perceives with the various sensations are becoming knowledge through the direct relation to its memory. That is the process of conceptualisation which is entirely personal and unique. Any object is observed, is analysed through memory and is stored as a new piece of memory. The result of the analysis might cause specific emotions to the individual. The individual might use a mobile device (e.g. PDA) which brings up multimedia information regarding the site or a specific monument or artefact of the place. The information provided from the mobile device is also conceptualised, after filtered through individual's memory. There might be other people on the site with whom the individual either directly (e.g. friends or family members) or indirectly (e.g. foreign visitors who the individual is following or attending) interact. Interaction with other people is also a conceptualisation process. The result of information conceptualisation may be the creation of new beliefs and thoughts, the impact on the emotional status of an individual, trigger specific behaviour in the physical environment, motivate specific social interaction, or even initiate a new interaction task with the electronic resources. We could say that each individual in an archaeological site, has in internal and external environment. The internal environment consists of the individual's conception which we call Conceptual Context (e.g. memories, thoughts, believes, etc.) and emotional situation which we name Emotional Context (e.g. emotions, feelings, etc.). The individual's external environment consists of the physical setting and objects that is the Physical Context (e.g. archaeological site, location, monuments, artefacts, etc.), its relation to the others which is the Social Context (e.g. other people, social situation, etc.) and the available electronic resources that is the E-Context (e.g. electronic equipment, mobile devices, multimedia applications, available information, interaction style, etc.). Therefore, for the purpose of our study we define the individual's context as the information that characterises the conceptual, emotional, environmental, social and digital information accessibility situation of an individual as the accumulation of the Conceptual, Emotional, Physical, Social and E-Context respectively.

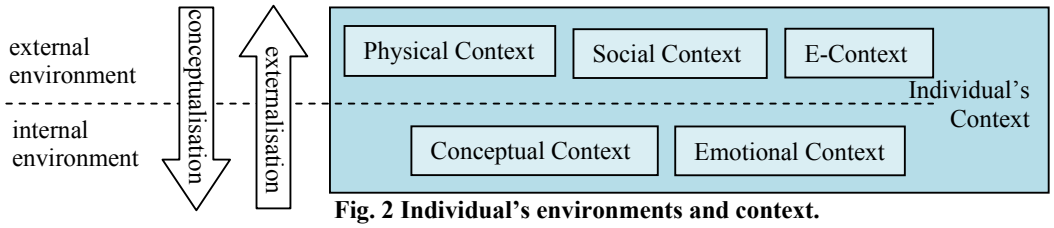

Fig. 2 Individual's environments and context.

An individual's interaction with its external environment is therefore a continuous process of conceptualisation of information and externalisation upon the result of the information analysis. The externalisation could have the form of emotional expression, thought verbalisation, physical movement or action, social intervention, device interaction, etc. Therefore the relation between memory and context is like a continuous pendulum among them where the one side feeds the other as an exchange between the internal and external environment of an individual. Within an archaeological site, the development of memory therefore, depends on the various physical, social and electronic resource factors of an individual.

5. INDIVIDUAL AND COLLECTIVE MEMORY

This perspective of memory has an externally emphasised focus which Halbwachs (1980) supports, contradicting Freud on the nature of memory. He argues that, even if memory has obviously an internal nature, it develops only through social interaction with collective narratives. This is, what he calls, collective memory. This social aspect of individual memory was defined by Aleida and Jan Assman (2006) as communicative memory which develops during contextually and emotionally depended interaction among people. Emotions provide with better storing of memories in human minds and better definitions in the relevant social and cultural settings. Both narrative and scenic memories benefit from the emotional features of human communication. The experience that is derived from this interaction or through stimulus effects during this interaction (imagination) relates mutually to culture and memory. The relationship between experience and culture is bidirectional. Culture affects experience by providing intermediate perceptions on specific contexts. On the other hand, experience influences culture, as a collective force of individual shared experiences. The impact of memory is by turning the past into a present experience.

6. ABOUT CULTURAL MEMORY

Jan Assman (1992) was the first who defined cultural memory as the "outer dimension of human memory". This would include the potentials of a society to preserve its collective memory from one generation to another with the use of cultural artefacts, and its capability to reconstruct a cultural identity from this collective memory. Holtorf (1996) also defined cultural memory as the collective understandings of the past in a certain social and cultural setting. Cultural memory is therefore a subset of the collective memory of two random individuals. For a great number of individuals, their collective memory tends to receive its minimum size that is their cultural memory. Therefore, cultural memory is not history but it is about understanding the past in a present cultural setting (Friedman, 1992). Places like national cultural monuments and sites which tend to have a vast amount of multicultural visitors every year are these which tend to necessitate more a meaningful collective understanding of the past culture within a contemporary setting. With this focus, our research investigates the capabilities of potential technologies to support the dissemination of cultural memory in such environments.

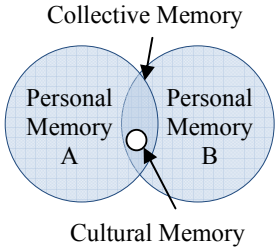

Fig. 3 The relation between collective and cultural memory

7. THE GROUNDING PROCESS OF CULTURAL MEMORY

Friedman's definition on cultural memory reminds us of Clark's Common Ground Theory. Clark argues that the background and previous knowledge of the individuals, the assumptions and various information, relevant to a joint activity, that people bring in is part of their common ground, the process of establishing a common understanding (Clark, 1996). The coordination process, which is a repetitive and emerging process, aims at increasing the common ground among individuals. This observation divides the common ground into three main parts at any time of a joint activity: the initial common ground, the current state of joint activity, and, the public events so far.

For the purpose of cultural memory, individuals enter an archaeological site having individual memory on the site. This is the initial cultural memory which is the personal interpretation of cultural memory. At each stage of interacting with their external environment, they conceptualise the information perceived from the physical, social and electronic context maintaining an understanding by identifying and recognising the external cultural representations, which is the current state of individual's context. Finally, the events that have happened since the entry of an individual in the current context are the public events so far (Kammas *et al.*, 2003).

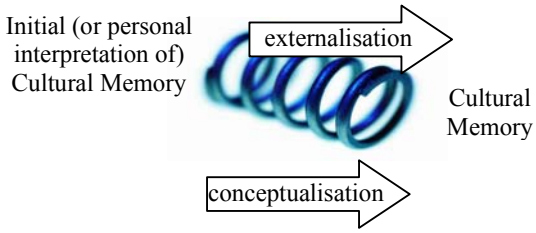

Fig. 4 The process of maintenance and development of cultural memory

This process is an endless loop of conceptualisation of perceptions that individuals receive and respond through externalisation of actions. Their actions depend on their initial cultural memory which is their background knowledge and beliefs about the common culture. These actions have an impact on the current state of individual's actions, something that may return as a new perception to other people in the social context of the individual. Furthermore, the individuals' actions change their perceptions on the public events of the situation.

8. MOBILE TECHNOLOGY AND CULTURAL HERITAGE

We have seen that memory is not just remembering the past but it is strongly connected with physical artefacts, places and social interaction. Memory, for example, can be contained in objects, buildings, images, sounds, tastes, smells, narrations, texts. Since the challenge about memorising an absent past is the reproductions of it, to

the certain extend that is meaningful, a solution would be the reconstruction through the valid combination of various artefact types that would create a collective nostalgia through a grounding process. Visiting an archaeological site is more that a multimodal experience of the monuments and certainly more that learning about a specific culture and its heritage. Such a place is a centre of interaction and communication for exchanging ideas in a certain socio-cultural setting. Therefore cultural memory can be supported through a collective interaction among people with various artefacts and electronic resources in a certain social and cultural setting. To be able to maintain distractlessly such a collective experience, people need to achieve a situation for interaction with others and with artefacts in the versatile environment of a cultural setting. Freedom, mobility, understanding, communication, lack of distraction and guidance are factors that need to be satisfied respectively.

Mobile technology nowadays offers a wide range of learning and communication opportunities. In the area of cultural heritage mobile technologies provide complete solutions for the dissemination of multimedia enriched content related to the cultural elements and new methods for perceiving and understanding information. Since experience with cultural artefacts can be a social event, mobile technology creates virtual and conceptual environments for people to talk, discuss and exchange their experiences either synchronously or asynchronously. The following are characteristics of the mobile technology necessary to facilitate the dissemination of cultural memory:

User Centred and Accessibility Design: In order to provide a technological solution appropriate for the dissemination of cultural memory we need to understand the user needs but also the possibilities that the available technology can provide (Beyer & Holtzblatt 1998). A user is a visitor in an archaeological site who wants to be culturally informed regarding the monuments and the artefacts of the site. The design includes device and application solutions the provide ease and most comprehensive access to the cultural content even for people with disabilities.

Multimedia: The content that a visitor of an archaeological site is accessing, needs to be provided with various ways to meet the different sensory modalities of the user. Therefore, text, sounds, images, graphics, videos are various media types to present the necessary content. The media types should be used either in combination or in alternation of each other depending on the contextual setting of the visitor.

Adaptive Learning: A user is a visitor in an archaeological site who is of a specific age, speaks a specific language, is a student, or an older person, who visits or not the place for first time and have or not a close connection to the specific culture, and is alone or with other people. A mobile device has to provide profile-based content that is appropriate to the specific situation which is predefined by the user.

Connectivity Infrastructure: Mobility means freedom and access from anywhere. A mobile device within an archaeological site has to be able to follow a user within the site and provide information to the user either this information exists on the device, or on a central system at the site, or even on the internet. Therefore, wireless, infrared and Bluetooth technologies should be used for the connection to content.

Social Networking: Since cultural memory is a result of social interaction, we should not neglect the role of various people within the archaeological site. Either someone has visited the site alone or with others, the mobile technology should provide the individual with opportunities for discussion and exchange of information either synchronously or asynchronously through common and shared virtual spaces.

Context Awareness: Earlier we identified the importance of context to create and recall an individual's memory. Individuals have the ability to perceive and conceptualise their context in order to respond with specific actions. Even in the case of communication with others, Common Ground Theory determines that there is a repetitive process towards understanding the context. In the case of electronic device this is not so obvious. When someone is using an application which provides information on the individual's context, the application should be able to recognise this context and provide only the necessary information. Context awareness combined with metadata content enrichment will be able to provide easy access to more appropriate content whenever this is necessary.

9. MOBILE TECHNOLOGY FRAMEWORK

The current research proposes a mobile technology framework for the implementation of customised solutions to support with the dissemination of cultural memory. The framework will move along three axes: the perception, the memory and the expectation. The perception is about the current situation of the physical, social and e-context. The memory is about the conceptual context, the experience of the past that has been preserved until the present. The expectation is about the externalisation process, which is the intention to be achieved concerning the past experience for the present physical, social and e-context. The following figure represents this process.

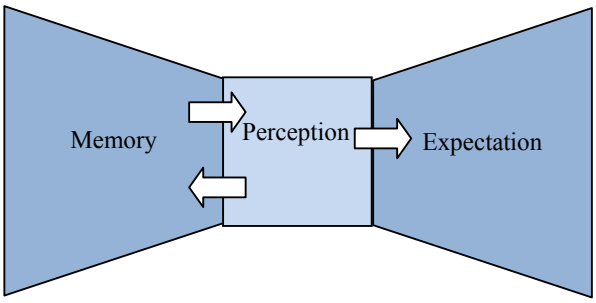

Fig. 5 A generic mobile technology framework.

The framework will be able to provide with a mobile technology solution with the six different sensory modalities: auditory, visual, kinaesthetic, tactile, olfactory and gustatory in respect to the certain perception, memory and expectation axes. Since individuals are learning either alone or within a social context, the available technology should be able to provide with alternative views and experience recreations that would create a more pluralistic collective memory. Therefore changing places, changing time, changing people and interpretations, correspond to a changing and dynamic cultural memory.

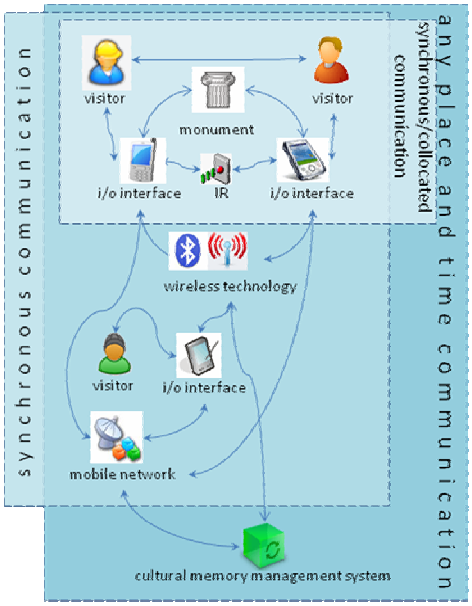

Fig. 6 Mobile communication for any place and time (adapted from Kammas et al. 2003)

A mobile device would respectively provide with human memory capabilities for perceiving, storing and retrieving information. Connectivity among the various devices is also important for the social interaction. Finally, semantic organisation of stored memory for easier information retrieval is vital. The following figure provides the extended mobile technology framework for the dissemination of cultural memory.

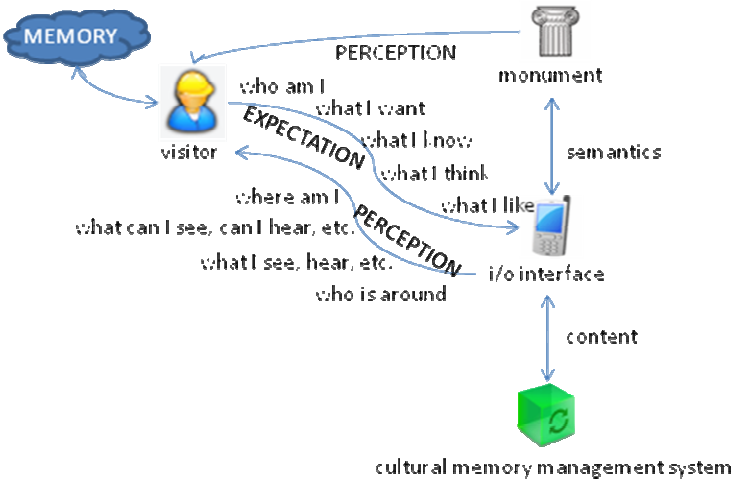

Fig. 7 Extended mobile technology framework for the dissemination of cultural memory

A visitor in the archaeological site is using a mobile device to define identification and preferences on the use of the device and the site visit. The device interacts with the monuments of the site through bluetooth or wireless technologies and with the use of semantic annotation (metadata) is bringing relevant content to the visitor from the cultural memory management system. The cultural content is related to information on the available monuments on the site, the current location of the visitor, information on the current monument where the visitor is nearby, and information on the social setting of the visitor (who else is around). The visitor can still enter a learning process by expressing personal knowledge on the subject, so that the device may better adapt the content to the visitor's needs. Finally the visitor may provide thoughts and preferences on specific monuments or information provided which will become annotated content to the specific content in the cultural memory management system. The final information may be available to other visitors through the system as the result of building collective memory on the specific archaeological setting.

10. CONCLUSIONS

Cultural memory is more than information and experience and sometimes it regards things so tacit that cannot be expressed. The current research claims that the use of mobile technology infrastructure is able to solve the problem of organising and especially disseminating cultural memory. The theoretical approach of the issue might sound too simplistic for the operational success in a realistic situation. Designing a mobile technology framework for the dissemination of cultural memory, demands the consideration of multiple parameters for representing the present situation of the monument, the multicultural visitors and their previous knowledge on the situation, the available resources, the past experience that exist on the current cultural setting and the desired outcome. Towards implementing this theoretical framework, technological limitations as well as human cognition limitation will be able to provide us with valuable information on the limitations of the framework itself.

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DETERMINING DIFFICULTY OF QUESTIONS IN INTELLIGENT TUTORING SYSTEMS

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ABSTRACT
The object of this study is to model the level of a question difficulty by a differential equation at a pre-specified domain knowledge, to be used in an educational support system. For this purpose, we have developed an intelligent tutoring system for mathematics education. Intelligent Tutoring Systems are computer systems designed for improvement of learning and teaching processes in the domain knowledge. The developed system, which is called as MathITS, is based on conceptual map modeling.The Mathematica Kernel is used as an expert system and knowledge representation is based on *LaTeX* notation in MathITS.

1. INTRODUCTION

Nowadays, it is too hard to imagine the education without computers. When properly applied, computer assisted educational technologies can provide effective means for learning. In this manner, we have developed an intelligent tutoring system to teach mathematics at undergraduate and graduate levels.

An intelligent tutoring system (ITS) is used to enable the students work independently, to improve their understanding of concepts within the related domain, and to observe progress of problem solving ability. Of course, an ITS can assist not only to the students but also to the teachers for developing and managing the courses.

Mathematics is a nightmare for lots of students. Inevitably, many students doubt their intelligence, creativity, talent, and motivation when studying mathematics. In class based education, the real teachers which have some mental capabilities such as the reasoning ability, planning, problem solving, abstract thinking, comprehending ideas, and learning, can motivate and encourage the students with intitutively selected methods. They, also take the creativity, personality, or character of students into account. In this sense, the tutoring systems must have the capability of real teachers as much as possible. It should permanetly encourage the students to study and keep them in high motivation. To unbreak their enthusiasm, the system must ask different questions according to the level and capability of each student. Hence, determining the difficulty of a question to test the understanding of the related concepts is crucial.

Intelligent Tutoring Systems can statistically model understanding the concepts in the learning domain. Several methods have been proposed to determine the hardness of questions (Khan et al., 2003, Kunichika et al., 2002, Li & Sambasivam, 2003). Hwang (2003) introduced the “Concept Effect Graphs” where the subject materials can be viewed as a tree diagram comprising chapters, sections, sub-sections and key concepts to be learned. Originally, concept maps should be thought as directed graphs. According to this method, each question consists of some concepts, and Hwang specifies the hardness of questions related to the number of concepts to be learned. In these studies, the hardness of questions depends on only the number of related concepts, and these approaches take into account neither the learning perfomance of students nor the possibility of inefficient training.

In this paper, a population dynamics based model has been proposed which models hardness of questions using differential equations. The developed model has been applied to mathematics education. An ITS has been developed which uses the conceptual map modeling technique and in which the hardness of the question to be asked to students is determined by a dynamical equation. This enables the tutors to track the learning performance of students individually.

Developing an intelligent tutoring system clearly needs to consider various factors, such as domain, knowledge representation, measuring student performance, preparing lecture notes and feasible tests (Kinshuk, 2001). They have high development costs. With this manner, this study focuses on only a small part of the system. In the sequel, firstly the student modeling which uses the conceptual map modeling approach, has been explained. Then, the population dynamic based determination of questions’ hardness procedure has been accomplished. Finally, MathITS system has been introduced as the implementation of these concepts.

2. STUDENT MODELLING

The most critical component of ITS is the student module whose necessity has been addressed by Self (1999). Simply, this module is about the theory of student behaviours, and it generates all information about individual learner. The student model evaluates each learner's performance to determine his or her knowledge, perceptual abilities and reasoning skills. It provides the information such as what the student knows or does not know, any misconceptions, student's degree of forgetfulness (Jeremic & Devedzic, 2004).

In tutoring systems, students can learn new concepts and the relationships between the previously learned and the new concepts. This knowledge is represented as a conceptual map in MathITS. Figure 1 simply illustrates the concept map for the "number" concept.

The conceptual map approach offers a cognition of the subject contents. With this approach, diagnosis process can be made easily. If a student fails to learn the concept "common divisor", it is possible that the student did not learn the concept "factors". Therefore, the system suggests that the student must study the factor concept again. For this reason, the ITS must contain the relationships between concepts. To do this, a conceptual map-based notation is proposed. Suppose that C_i and C_j are two different concepts and if the concept C_i is prerequisite for the concept C_j, then a concept effect relationship $C_i \rightarrow C_j$ exists. Of course, a single concept may have multiple prerequisite concepts, and it can be a prerequisite concept for multiple concepts.

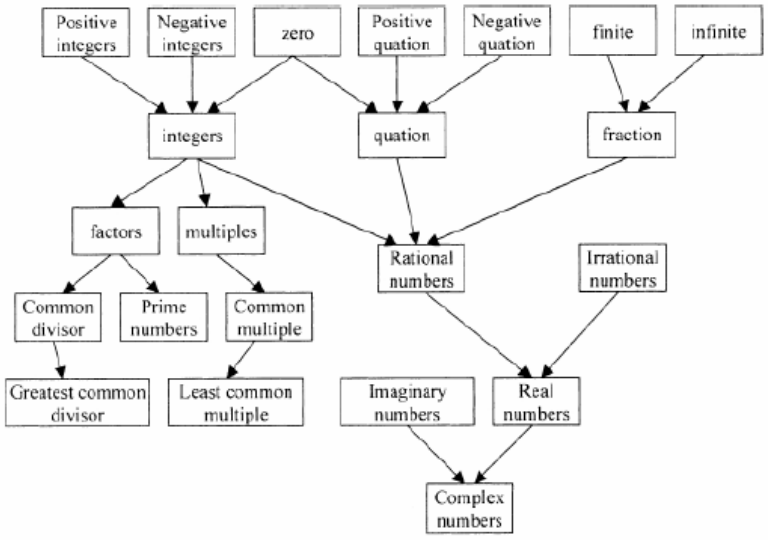

Figure 1. Concept map for numbers (Hwang, 2003).

To construct the concept effect graph in MathITS, the Concept Effect Table(CET) is used, which represents the relationships between the concepts to be learned. Table 1 demonstrates how the CET is constructed. As seen in Table 1, if $CET(C_i, C_j) = 1$ then C_i is the one of prerequisite concept for concept C_j and NP_j represents the total number of the prerequisite concepts for C_j.

Table 2 demonstrates the difficulty rates for each question. Initially, the question difficulty rates (QDRT) are calculated as the ratio of the total number of related concepts with a question (Nc) to total number of concepts (n). The mark of the question Q_i is calculated as $10 \times Nc_i / n$. According to Table 2, the test contains 10 questions and n different concepts. Thus, the QDRT value of the question Q_5 is QDRT(5) = $3/n$ and the mark of this question is $10 \times 3/n$ points at the first step. With this calculation, the difficulty of a question has a value in the range of interval (0, 10]. Suppose that a test contains m different questions and n different concepts. Then total mark for this test is calculated in Equation 1.

$$Total\ Mark = 10 \times \frac{\sum_{i=1}^{m} Nc_i}{n} \quad (1)$$

Table 1. An Example of the Concept Effect Table

	C_1	C_2	C_3	…	C_j	…	C_n
C_1	0	0	1	…	0	…	0
C_2	0	1	1	…	0	…	1
C_3	0	0	0	…	1	…	1
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C_j	0	0	0	…	1	…	1
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
C_n	0	0	0	…	0	…	0
NP_j	0	1	2	…	2	…	3

Table 2. The Question Difficulty Rate Table (QDRT)

	C_1	C_2	C_3	…	C_j	…	C_n	Nc
Q_1	1	1	0	…	0	…	0	6
Q_2	0	1	1	…	0	…	0	5
Q_3	1	0	1	…	1	…	0	4
Q_4	0	0	0	…	1	…	1	4
Q_5	1	0	0	…	0	…	0	3
Q_6	1	1	0	…	1	…	0	3
Q_7	0	1	1	…	0	…	0	2
Q_8	0	1	0	…	1	…	0	7
Q_9	1	1	0	…	1	…	0	4
Q_{10}	1	1	0	…	0	…	1	4

Table 3. The Test Item Relationship Table (TIRT)

	C_1	C_2	C_3	…	C_j	…	C_n
Q_1	5	1	0	…	0	…	0
Q_2	0	4	2	…	0	…	0
Q_3	2	0	3	…	1	…	0
Q_4	0	0	0	…	3	…	5
Q_5	1	0	0	…	0	…	0
Q_6	4	1	0	…	2	…	0
Q_7	0	5	2	…	0	…	0
Q_8	0	0	5	…	2	…	0
Q_9	3	2	0	…	4	…	4
Q_{10}	1	1	0	…	0	…	1
$\sum C_j$	17	14	12	…	12	…	10

Hwang (2003) also proposed the Test Item Relationship Table(TIRT) to calculate the total strength of a concept as shown in Table 3. If a test sheet contains 10 questions on a learning unit, TIRT(Q_i, C_j) represents the intensity of the relationship between the question Q_i and the concept C_j. The intensity value is specified between 0 and 5 in MathITS. While 0 value indicates no relationship and 5 intensity value represents the most strong relationship between the question and the concept. In Table 3, $\sum C_j$ presents the total strength of concept C_j. Briefly, the TIRT table is used to calculate the probability of failure for a student. If a student fails to answer only the question Q_4, the student will fail to answer 25% of questions related to the concept C_j and 50% of questions related to the concept C_n. This probability is calculated as the ratio of TIRT(Q_4, C_j) to $\sum C_j$ and the ratio of TIRT(Q_4, C_n) to $\sum C_n$. If the student fails to answer more than one question, then the Equation 2 can be used to calculate failing rates for each concept. Assume that $\mathbf{A}$ represents the student's answers for each of the questions and the test set has m questions. If i^{th} index of $\mathbf{A}$ is 1 then the student answers the question Q_i correctly, otherwise $\mathbf{A}_i = 0$.

$$P(C_j) = \frac{\sum_{i=1}^{m} (1 - \mathbf{A}_i) \times TIRT(Q_i, C_j)}{\sum_{i=1}^{m} TIRT(Q_i, C_j)}, \; j = 1, 2, \text{K}, n \tag{2}$$

In Equation 2, $P(C_j)$ represents the probability of failing to answer for the concept C_j. Let $\mathbf{A}$ be $\mathbf{A}$ = (1, 1, 1, 0, 1, 0, 1, 1, 0, 0) for m = 10 and $TIRT$ is as given Table 3. Then the student will fail to answer 50% of questions related to the concept C_1, 28.5% of questions related to the concept C_2, 58.33% of questions related to the concept C_j. According to the demonstration, it can be seen that the student does not understand the concept C_n, because the $P(C_n)$ = 1. For that reason, the system advices to the student for studying the concepts related to the concept C_n. As seen in Table 1, the system can easily determine the related concepts using Concept Effect Table (CET). It suggests that the student should study the concepts C_2, C_3 and C_i.

According the ratio of incorrect answer provided by a student related to concept C_j, the student's learning status of this concept is specified as in Table 4. These values are used in MathITS, however they are not certain standard. The range is only determined intuitively in this study. Our example shows that while the student has learned the concept C_1 and C_2, the concept C_j is less poorly learned and the concept C_n is very poorly learned by the student.

Table 4. The Student Learning Status related to a concept.

$P(C_j)$	Learning Status
> 0.75 and <= 1	Very poorly learned
> 0.50 and <= 0.75	Less poorly learned
> 0.25 and <= 0.50	Learned
>= 0 and <= 0.25	Vey well learned

3. DETERMINING THE DIFFICULTY OF QUESTIONS

Although some studies are available in literature, we suggest a new paradigm to determine the level of hardness for a question (Khan et al., 2003, Kunichika et al., 2002, Li & Sambasivam, 2003). As seen in Question Difficulty Rate Table, any question has a value in interval (0, 1] initially. Each time a question has been asked, it has been solved successfully or not by a student. When it occurs, the question difficulty rate must be changed. Motivated by the population dynamics, we propose the following differential equation to recalculate the new difficulty rate of question Q_i, where $\alpha, \beta \in N$ and y represents the new difficulty rate. Originally, this type of differential equation has been used to modeling population dynamics.

$$\begin{cases} y'(t) = \left(\frac{\beta - \alpha}{\alpha + \beta}\right) y(t) \left[1 - \frac{y(t)}{p}\right], & t > t_0 \\ y(t_0) = QDRT(i) \end{cases} \tag{3}$$

In Equation 3, α and β specifies how many times the question Q_i answered correctly and with failure respectively. So, the question Q_i has been asked to students $\alpha + \beta$ times, totally. In the differential equation, $1 - \frac{y(t)}{p}$ has been used to stabilize to the system. In this way, when $t \to \infty$, either the solution converges p or it oscillates around p. In particular, we select p = 1 to guarantee the solution has the range between [0, 1]. The initial value of the differential equation verifies the condition $0 \le y_0 \le 1$ and this condition also guarenties $0 \le y(t) \le 1$ for all t.

Let $k = \left(\frac{\beta - \alpha}{\alpha + \beta}\right)$ and $p = 1$, then the solution of the Equation 3 is,

$$y(t) = \frac{y_0}{y_0 + (1 - y_0).e^{-kt}} \tag{4}$$

Figure 2 shows the simulation of the changes on the difficulty rate for the question Q_i , which has been answered 49 times correctly and 51 times wrongly. The initial value of $QDRT(i)$ has been set as 0.5. Each time the question asked, the difficulty rate has been recalculated, according to the value of $\frac{\beta-\alpha}{\alpha+\beta}$.

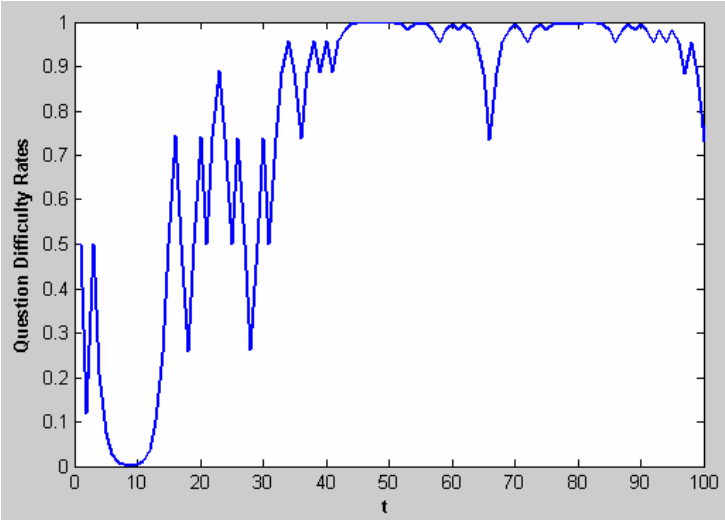

Figure 2. The question difficulty rate with $\alpha = 49$ and $\beta = 51$ and y_0 = 0.5.

4. MATHITS : AN INTELLIGENT TUTOR FOR MATHEMATICS EDUCATION

In this study, we suggest an Intelligent Tutoring System for mathematics education, whose architecture can be seen in Figure 3 (Günel, 2006).

MathITS has two types of users. The users login to the system through the administration module. Administration module checks and gets the user information from the database. If the user exists, then the user has been directed to a user interface according to user types.

In addition, MathITS consists of a knowledge representation system, which has strengths unavailable to normal database systems. The knowledge representation systems allow a complex structural representation of the data. This allows inferencing and complex query evaluation to be performed. In the field of artificial intelligence, problem solving can be simplified by an appropriate choice of knowledge representation. The knowledge representation in MathITS is based on LaTeX. The original TeX (Tau epsilon Chi) system was built by Donald Knuth. TeX is a computer language designed for using typesetting; in particular, for math and other technical material (TUG, 2006). Although TeX is a relatively low-level language, it is expandable and the common TeX can be combined into macros. The most successful of such macros is called LaTeX, which designed by Leslie Lamport. Hence, MathITS uses LaTeX. In MathITS, all the knowledge such as small lecture units, questions, answers and hints are stored in LaTeX format, and they are converted to PDF documents when it is necessary.

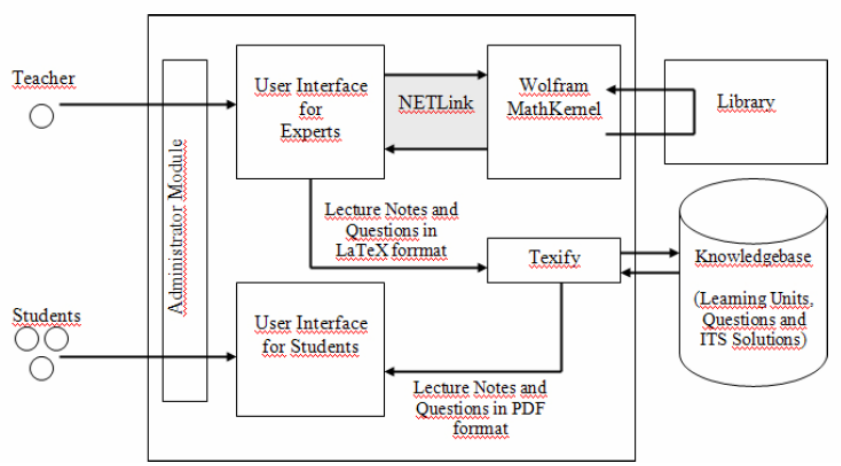

Figure 3. The system architecture

Originally LaTeX is not a word processor! MathITS has an user interface to connect LaTeX shell. This part of system acts as a graphical front end for LaTeX. This is basically a text editor that communicates with the LaTeX program. It may also highlight TeX keywords and provide other useful functions. Also the user interface consists of an ActiveX component, which is used for document viewer. All of the knowledge is presented to students with a Portable Document Format (PDF) viewer.

To illustration of this system, the domain has been selected as small as possible in the study. The only lecture unit which has been added into the knowledgebase was "Exact differential equations". The knowledge base stores 24 different concepts and a sample test involving totally 30 questions.

The other module of the system supports a connection to Mathematica Kernel. The Mathematica kernel is basically an interpreter for the Mathematica programming language. This language combines the features of procedural, functional, and rule-based programming together (Wolfram, 2002). The interface provides that an expert can enter Mathematica commands and receives the results in text-based, graphics or LaTeX notation of the command. Figure 4 shows this paradigm.

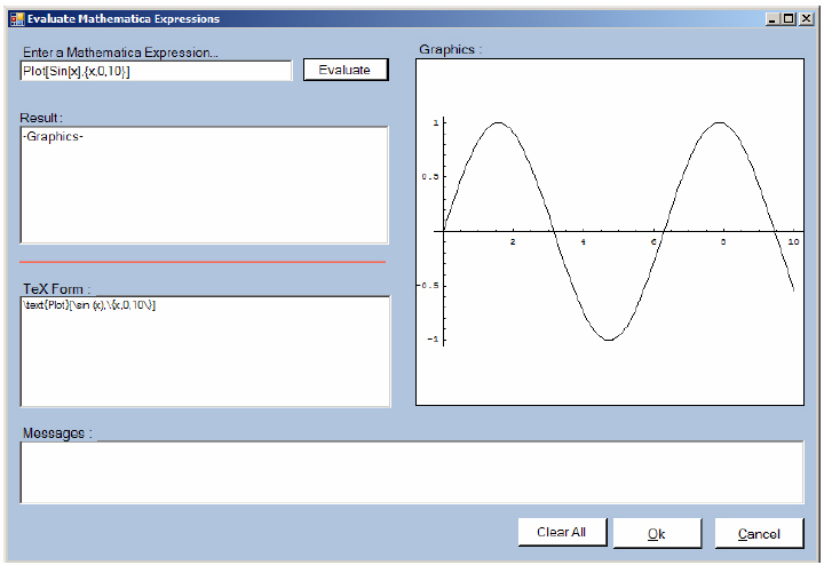

Figure 4. An Interface for Expert Module of system

The Mathematica library incorporates the system's "expert knowledge"; it consists of a large number of mathematical algorithms written in the Mathematica language and interpreted by the Mathematica kernel. The communication between the MathITS's user interface and Mathematica Kernel is supported by Microsoft .NET/Link component. Microsoft .NET/Link integrates Mathematica and Microsoft's .NET platform. Microsoft .NET/Link lets you call .NET from Mathematica in a completely transparent way, and allows you to use and

control the Mathematica kernel from a .NET program. Microsoft .NET/Link uses MathLink, the protocol, defined by Wolfram Research, for sending data and commands between programs. Many of the concepts and techniques in .NET/Link programming are the same as those for programming with the MathLink C-language API (Wolfram, 2002).

The experts access the user interface shown in Figure 5. Expert users can write small lecture units, examples and questions. If an expert wants to write a question, he/she can use the Mathematica expression. Then the system executes the Mathematica Kernel by using .NET/Link component and evaluates the mathematical expression. The output of the MathKernel can be seen in two different forms:

- Solution of the expression
- LaTeX notation of expression

The teachers have an essential role in MathITS and have lots of tasks to do. Probably, the most complex scenario within MathITS belongs to the teachers. With this scenario, a teacher is able to

- create a new book,
- add a chapter into a book,
- create concepts, which will be learnt to a student in a chapter,
- associate a concept with others. Thus, he/she can generate a concept map for a chapter.
- add a section into a chapter of a book,
- create a lesson in a section,
- create a test question associated with a lesson
- use a Mathematica expression to solve and generate the choices of the question,
- associate a question with a lesson,
- connect a question with all the concepts in a chapter with specifying the weights of relation between the question and the concepts. Thus, he/she specifies the difficulty level of a question, initially.

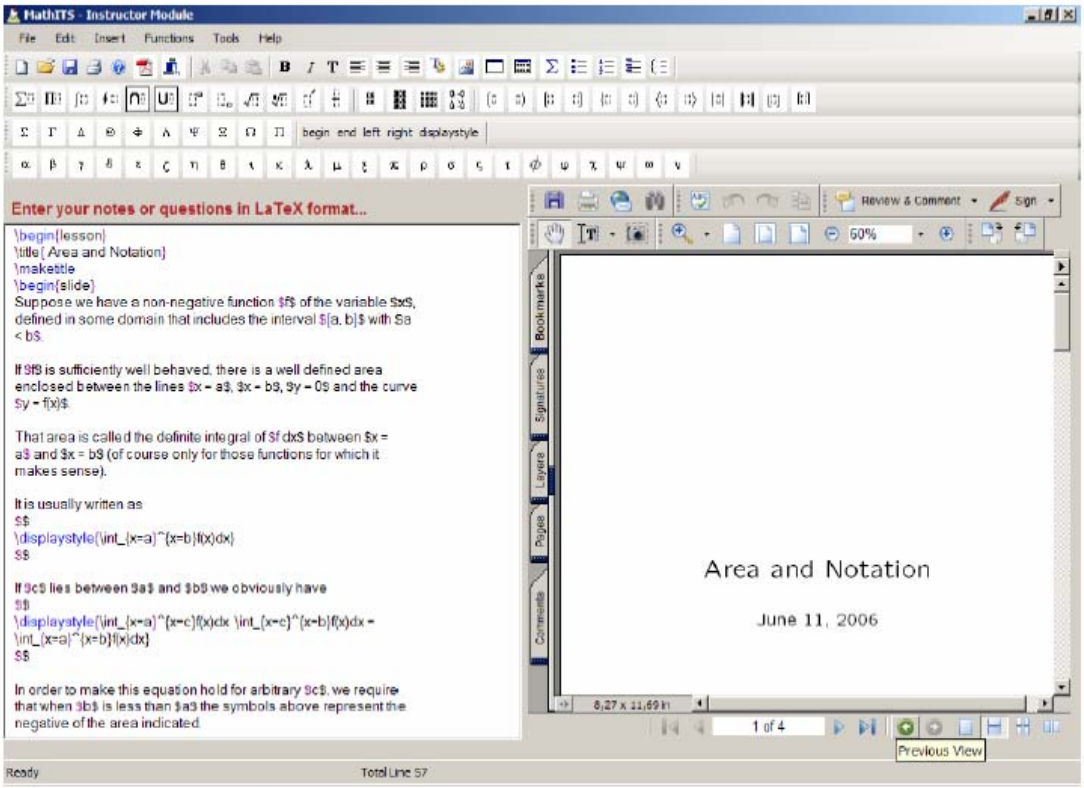

Figure 5. Instructor Module of the system.

Although the students are in the centre of the system, the scenario is so simple for students. The student selects a lesson to study and takes a test. When student completes the test, his/her performance is calculated by the MathITS. Then, the feedback given to the student is the learning rate of the related concepts in the test.

Therefore, MathITS determines the student's weaknesses on concepts using conceptual map modelling. Also, the system advices to the student to study the misunderstood concepts using the Concept Effect Table.

5. CONCLUSION

Taking the necessities of the high cost for developing an ITS into account, this study focuses on only the student modeling. We proposed an intelligent tutoring system for mathematics education, which uses conceptual map modelling as a student modeling paradigm. The knowledge representation used in the system is based on LaTeX notation to write the mathematical expressions easily. From the viewpoint of an expert user, Mathematica Kernel is used as an expert system. With Mathematica Kernel, an expert can easily write questions, solve them and he/she simply adds to the system in LaTeX representation.

Based on the proposed model, MathITS can identify poorly-learned and well-learned concepts for individual students. Overall, the main contribution of us is determining the difficulty of questions in ITSs with a new approach. We believe the importance of keeping the students in high motivation in learning and selecting the suitable questions within randomly generated tests or quizzes. The next step of our study will be testing the system with actual students and teachers and observing how it affects their learning performance.

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DEVELOPING A SOFTWARE FOR FUZZY GROUP DECISION SUPPORT SYSTEM: A CASE STUDY

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ABSTRACT
The complex nature and uncertain information in social problems required the emergence of fuzzy decision support systems in social areas. In this paper, we developed user-friendly Fuzzy Group Decision Support Systems (FGDSS) software. The software can be used for multi-purpose decision making processes. It helps the users determine the main and sub evaluation criteria, their weights, and evaluate the performance according to the number of decision makers and evaluation weights of criteria. It also allows the user to use two different fuzzy inference methods. In the fuzzyfication unit, universe of discourse is made up of three different membership functions. The software, which has four main screens, is developed by using Delphi programming language and is used for the purpose of performance assessment of research assistants at Marmara University, Technical Education Faculty.

Keywords: Fuzzy logic, Multi-criteria decision making, Performance evaluation

INTRODUCTION

In real world systems, the decision–making problems are often uncertain or vague in a number of ways. However in many areas of daily life, such as engineering, manufacturing education, human judgment or performance assessment often employ natural language to express thinking so it is likely to come up with a subjective perception. In these natural languages the meaning of a word might be well defined, but when using the word as a label for a set, the boundaries within the objects which belong to the set become fuzzy or vague. Furthermore, based on individuals' subjective perceptions or personality, human judgment of events may be different (Chiou & Tzeng 2002). Therefore, we combined fuzzy sets theory and natural language in our software for performance evaluation.

Fuzzy multi-criteria decision making technique has been one of the fastest growing areas in decision making and operations research during the last three decades. A major reason for the development of fuzzy multi-criteria decision making is that the decision makers can incorporate a large number of criteria in their actions and FGDSS overcomes the difficulty of expressing decision makers' opinions by crisp value in practice. Group decision making pays attention to the way people work together in reaching a decision (Ruan, et al.,2007). Fuzzy logic allows computers to make decisions as human being do, so it can be used in any area where human decision is necessary. Fuzzy set theory (Zadeh 1965) can play a significant role in this kind of decision situation. Fuzzy logic combines the decision ability of human beings and speed of the computers, and through this combination, an excellent decision making progress is obtained under imprecise, vague and uncertain conditions. The complexity of today's socio-economic problems requires more complex decision making processes. That's why decision makers have to consider many aspects of a problem. The necessity of considering all relevant aspects of a problem forces them to use fuzzy multi-criteria decision making systems.

The most important thing in Fuzzy Group Decision Support Systems is to determine the evaluation criteria and their weights in decision process. The knowledge and experience of a human expert is the best source for such kind of information. This can be considered as the design of an expert system. In other words, it is the simulation of the expert's knowledge and experience in a digital environment. Human beings make decisions in fuzzy environments by using fuzzy variables. In order to simulate human decision making in computer environment, fuzzy variables should be represented to computer. This requires the use of fuzzy set theory. Therefore, fuzzy set theory plays a significant role in expert systems which can think and give decisions just like a human being as a result of their inferences (Parsaye, 1988).

There are many studies on multi-criteria decision making process in many social areas. Kwok, Ma, Vogel (2001) developed and applied a fuzzy set approach to collaborative assessment in university classroom contexts. Rasmani and Shen (2005) classified student academic performance using fuzzy techniques. Feng, Rozenblit and Hamilton (2008) developed a novel objective performance assessment module for the minimally invasive surgical trainers. Biswas (1995) presented a fuzzy set approach to evaluating students' answerscripts.

In this study, a user-friendly Fuzzy Group Decision Support Systems software was developed by using Delphi programming. It gives the users the opportunity to determine the main and sub evaluation criteria and their weights, and to evaluate the performance according to evaluation weights. More than one assesse can take place in this assessment procedure. That's why it can be used for multi-purpose decision making processes, such as assessing projects or performance of students, teachers, employees, journals, etc. The software has four modules such as a Fuzzfication, Fuzzy Grading1, Fuzzy Grading2 and Assessment and Report. In order to test the effectiveness of the software the performance of research assistants in the Technical Education Faculty was evaluated. For the fuzzy evaluation process, five main criteria and twenty three sub-criteria was set by lecturers in the department.

FUZZY SET THEORY

In decision making process, it is difficult to make an exact evaluation because of the vagueness of human feeling and recognition. Therefore, fuzzy set theory, which provides reliable and objective results, can play a significant role in our evaluation process. Zadeh (1988) proposed a computational procedure for fuzzy logic inference, which consists of an implication function and inference rule. Given that A and B are both fuzzy sets defined over U and V respectively, a fuzzy rule $A \rightarrow B$ is first transformed into a fuzzy relation $R_{A \rightarrow B}$ that represents the correlation between A and B. The developed software has two relation methods, max-min and max-product relation methods, as the compositional rule of inference. Max-min relation is defined as follows (Chiueh 1992):

$$\mu_R(x,y) = \min_{x \in U,\, y \in V}(\mu_A(x), \mu_B(y))$$

where min is an implication function. Given a fact is A' and a rule is $A \rightarrow B$, Zadeh's composition rule says

$$B' = A' \circ R_{A \rightarrow B}$$

$$\mu_{B'}(y) = \max_x \min (\mu_{A'}(x)\ \mu_{RA \rightarrow B}(x,y))$$

This computation can be viewed as a vector-matrix product with multiplication and addition replaced by min and max. Consequently, when a rule is $A \rightarrow B$ and an input is A', the membership function of the inferred output B' is calculated as follows:

$$\mu_{B'}(y) = \max_{x \in U} \min (\mu_{A'}(x)\ \mu\ \mu_{RA \rightarrow B}(x,y))$$

$$\mu_{B'}(y) = \max_{x \in U} \min (\mu_{A'}(x), \min(\mu_A(x), \mu_B(y)))$$

$$\mu_{B'}(y) = \min \max_{x \in U} [\ \min(\mu_{A'}(x),\mu_A(x)), \mu_B(y)\ ]$$

$$\mu_{B'}(y) = \min (\alpha, \mu_B(y))$$

where

$$\alpha = \max \min (\mu_{A'}(x),\mu_A(x))$$

The max-product as the compositional rule of inference multiplication operation $(\cdot)$ is used instead of the min operation. The max-product inference, $\mu_{B'}(y)$, is performed as follows:

$$\mu_{B'}(y) = (\alpha \cdot \mu_B(y))$$

where

$$\alpha = \max (\mu_{A'}(x) \cdot \mu_A(x))$$

Since value of α and the final centroid change more smoothly depending on inputs (observation), the inference based on the max-product method is more sensitive than the max-min. method (Zadeh, & Kacpyrzyk, 1992).

When more than one fuzzy output is enabled, the consequents of all fuzzy outputs are combined. Supposing that $B'_1, B'_2, \ldots B'_n$ are derived results, the combined result is the individual fuzzy result (Baba, 2004).
Final step is defuzzification which converts fuzzy results into a single value that best represents the whole sets. One useful method computes the centroid or center of area is shown in below:

$$G = \frac{\sum_{i=1}^{N} \mu_{Bi} w_i}{\sum_{i=1}^{N} \mu_{Bi}}$$

Where, w_i is the support value, the membership function reaches the maximum value $\mu_{Bi.}$

FUZZY DECISION SUPPORT SYSTEM SOFTWARE

The whole decision process mainly includes four stages; determination of fuzzy variables, selection of main and sub decision criteria, determination of decision criteria weights, and fuzzy grading (Ma, &Duanning, 2000). The developed user friendly software can also be used for different and multiple assessment purposes such as assessing the performance of students, lecturers, employees etc. In the system, user accessibility was enhanced for users to input or change the shape and values of membership functions in fuzzyfication unit. The main and sub criteria and their weights in decision systems can also be changed by the user. At the fuzzy inference system the user can also choose either max-product inference method or min-max inference method. The software works in a windows environment. It has four windows; Fuzzfication, Fuzzy Grading1, Fuzzy Grading2 and Assessment and Report. Contents of the menu window vary according to the chosen window in the menu. When one of the windows is selected, it replaces the menu window.

The fuzzyfication window, shown in Figure 1, is used to define main and sub criteria and their weights in decision support systems. The program provides users maximum five main criteria, each of which can consist at most five sub criteria. In this window, the universe of discourse is made up of maximum five fuzzy sets representing the defined linguistic variables. Three shapes of membership function; triangle, trapezoid and bell can be selected. The user can enter the value of the membership functions and build the universe of discourse. Moreover, membership functions can be seen graphically on this window. In the figure trapezoid type of membership functions are selected.

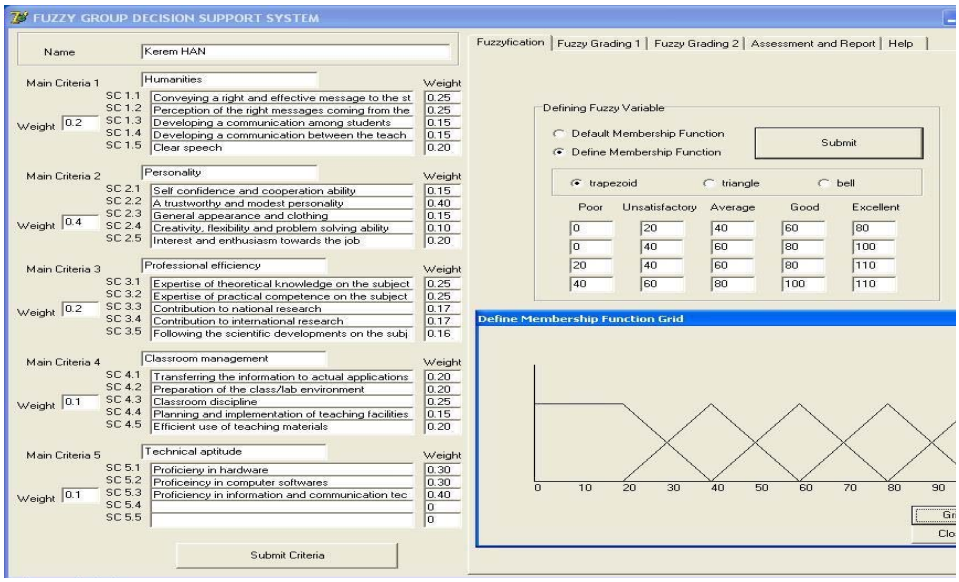

Figure 1. The Fuzzyfication window

In the Fuzzy Grading 1 window shown in Figure 2, the fuzzy linguistic evaluation results of each decision maker between 1 and 5 (Poor:1, Unsatisfactory:2, Avarage:3, Good:4, Excelent:5) gives the opportunity to determine the quantity and evaluation weights. The window in Figure 2 displays evaluation results of five decision makers

attaining 0.2 weights. The software enables the user define maximum fifteen decision-makers. For the decision process, fuzzy inference method can choose either Max-Min inference or Max-Product inference.

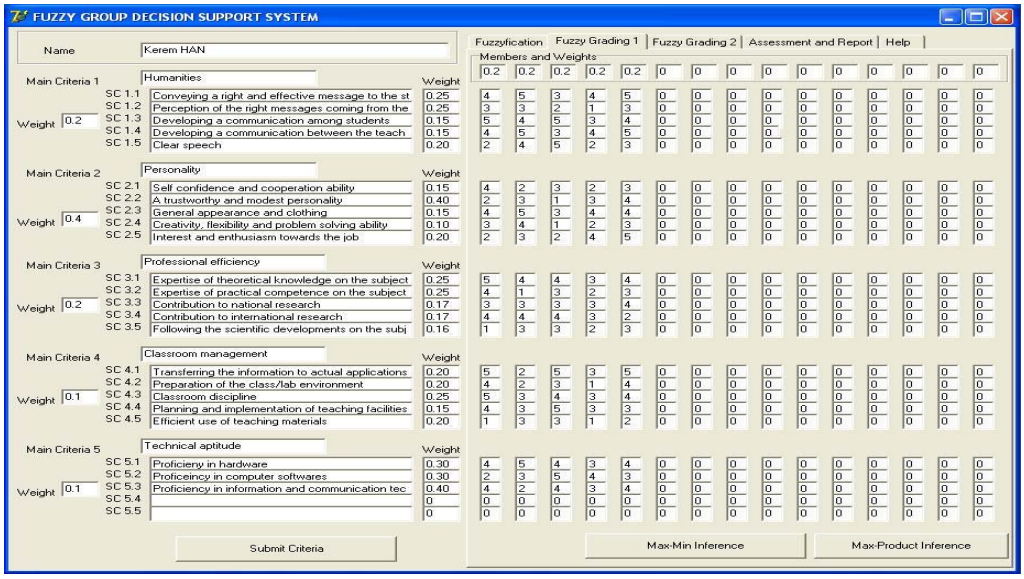

Figure 2. The Fuzzy Grading 1 window

Fuzzy Grading 2 window shown in Figure 3 makes it easy to computerize the evaluation scores of the decision makers when all decision makers have the same evaluation weights.

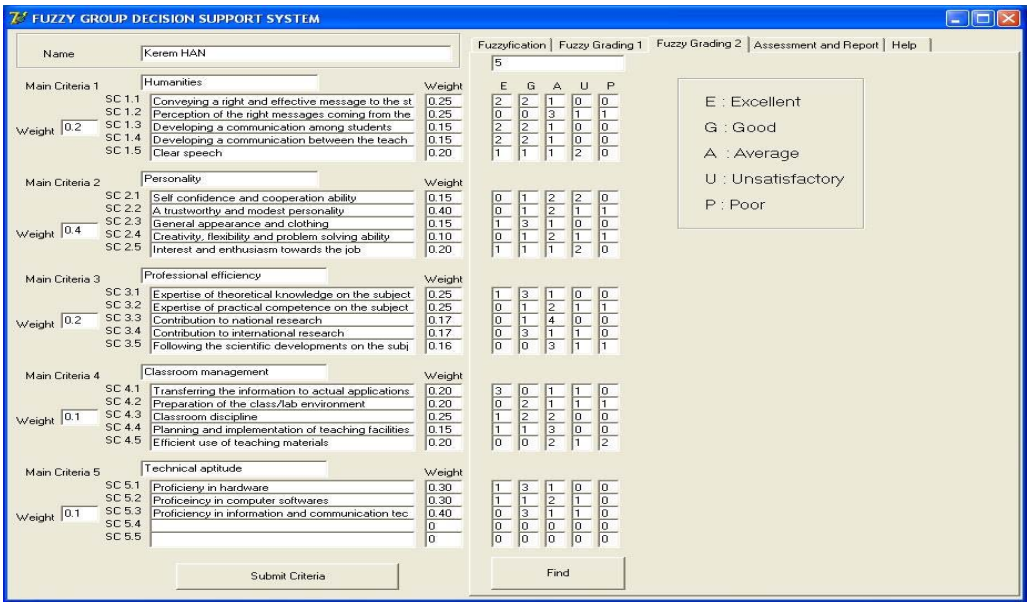

Figure 3. Fuzzy Grading 2 window

The assessment and report window is shown in Figure 4. Fuzzy and crisp evaluation scores of both inference methods can be seen. The grade of the candidate for each main criterium and final score is displayed. The evaluated grades are listed either according to the total score or one of the chosen main criteria score. The evaluation final report can be printed by using the print button. In Figure 5, the candidates are listed according to their final scores.

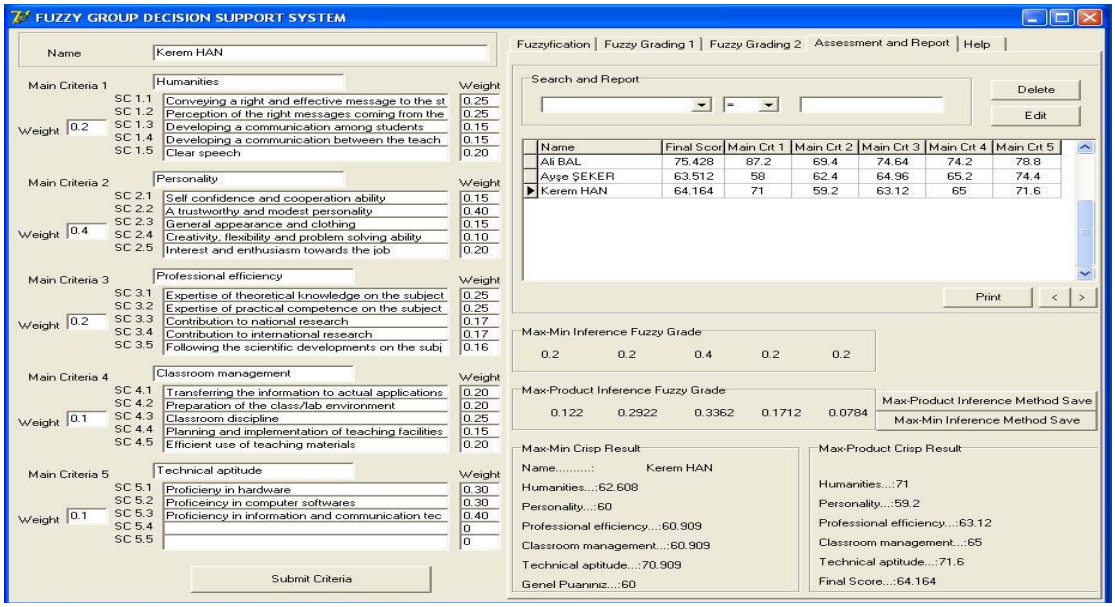

Figure 4. Assessment and Report window

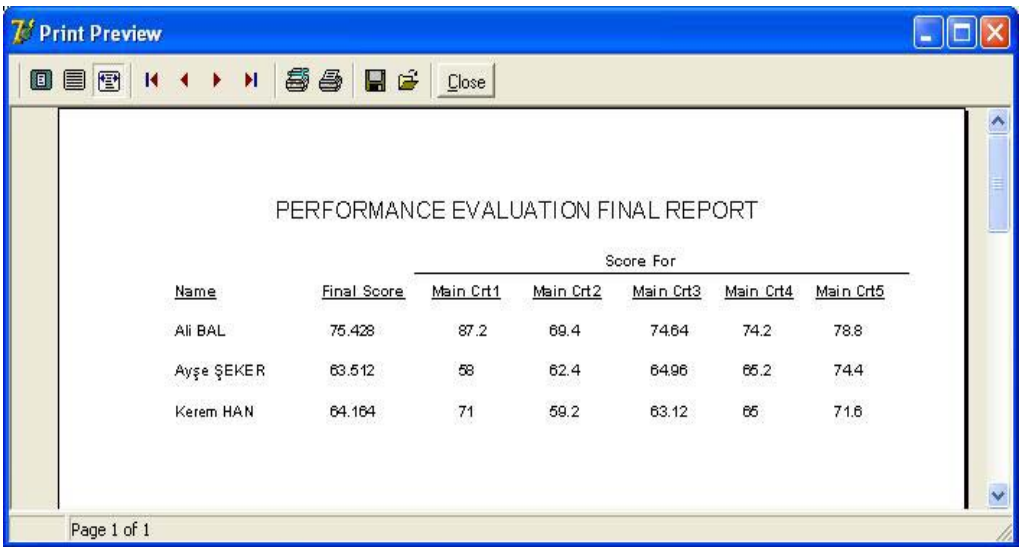

Figure 5. Final Report Window

CASE STUDY

Fuzzy decision support systems were applied to university teachers (Kuo, & Chen, 2002), administrators (Li et al., 2004) and students (Rasmani and Shen, 2005) for performance assessment. We used the developed software to evaluate the performance of research assistants at Technical Education Faculty. The selection criteria are represented by a hierarchical structure shown in Figure 6. This hierarchical structure consists of five main criteria and twenty three sub-criteria.

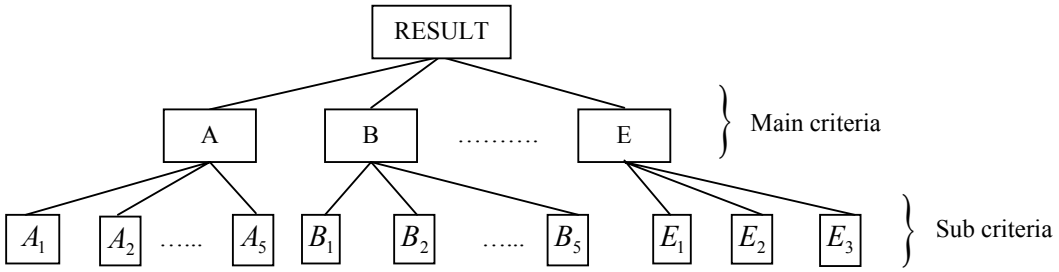

Figure 6. Hierarchical structure of performance evaluation

The main and sub criteria and their weighs are shown in Table 1. These evaluation criteria and their weights are composed of interviews carried out by the head of departments, professors and research assistants.

Table 1. Evaluation criteria and weights (Kuscu,2007)

Main Criteria	Wgt	Sub-Criteria	Weight
Humanities	0.2	Conveying a right and effective message to the students	0.25
		Perception of the right messages coming from the students.	0.25
		Developing a communication among students	0.15
		Developing a communication between the teacher and the students	0.15
		Clear speech	0.20
Personality	0.4	Self confidence and cooperation ability	0.15
		A trustworthy and modest personality	0.40
		General appearance and clothing	0.15
		Creativity, flexibility and problem solving ability	0.10
		Interest and enthusiasm towards the job	0.20
Professional efficiency	0.2	Expertise of theoretical knowledge on the subject	0.25
		Expertise of practical competence on the subject	0.25
		Contribution to national research	0.17
		Contribution to international research	0.17
		Following the scientific developments on the subject	0.16
Laboratory management	0.1	Transferring the information to actual applications	0.20
		Preparation of the class/lab environment	0.20
		Laboratory discipline	0.25
		Planning and implementation of teaching facilities	0.15
		Efficient use of teaching materials	0.20
Technical aptitude	0.1	Proficiency in hardware	0.30
		Proficiency in computer soft wares	0.30
		Proficiency in information and communication technology	0.40

To explain the process with an example; Let's assume that the candidate, Kerem Han is evaluated as shown Figure 2. by five professors who have same evaluation weights.

If the max-min compositional rule of inference is used for inference, Max-Min fuzzy grade is calculated as (0.2, 0.2, 0.4, 0.2, 0.2) as shown in Figure 4. It means that the candidate has the grades of 0.2 Poor, 0.2 Unsatisfactory, 0.4 Average, 0.2 Good and 0.2 Excellent. All these fuzzy grades have to be deffuzzyfied in order to get crisp grade. Figure 7 shows defuzzfication process of the max-min inference. Crisp grade can be calculated as below;

$$G = \frac{(0.2)*20 + (0.2)*40 + (0.4)*60 + (0.2)*80 + (0.2)*100}{0.2 + 0.2 + 0.4 + 0.2 + 0.2} = 60 \quad \text{(Average)}$$

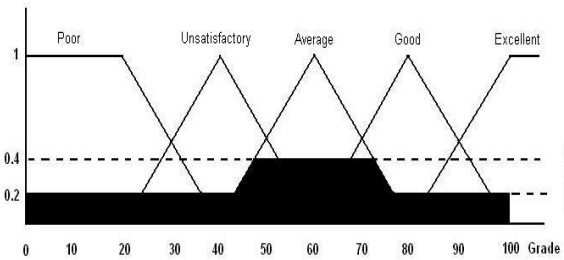

Figure 7. Max-min inference method

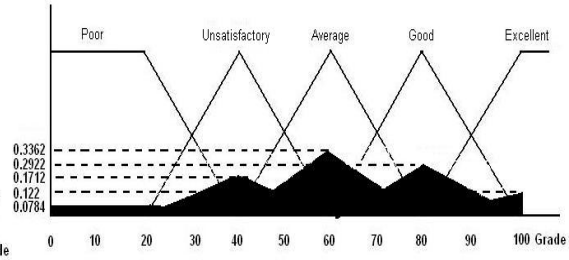

Figure 8. Max-product inference method

When the max-product compositional rule of inference is used for inference, Max-Product fuzzy grade can be calculated as (0.0784, 0.122, 0.1712, 0.2922, 0.3362) as shown in Figure 2. It means that the candidate has the grades of 0.0784 Poor, 0.122 Unsatisfactory, 0.1712 Average, 0.2922 Good and 0.3362 Excellent. All these fuzzy grades has to be deffuzzyfied in order to get crisp grade. Figure 8 shows defuzzfication process of the max-product inference. Crisp grade can be calculated as below;

$$G = \frac{(0.0784)*20 + (0.1712)*40 + (0.3362)*60 + (0.2922)*80 + (0.122)*100}{0.0784 + 0.1712 + 0.3362 + 0.22922 + 0.122} = 64.164$$

(Average)

As seen in the example, the performance of the candidate is found by using fuzzy group decision support systems. Crisp grade of candidate is 60 according to the Max-min inference method while it is 64.164 to the Max-product inference method. Although both of the results are averages, the max product compositional rule of inference method is more sensitive and reliable to small changes than the max-min compositional rule of inference method (Zadeh, & Kacpyrzyk, 1992). These two results have been calculated from 115 total fuzzy scores of five decision makers who marked twenty three criteria. It enables us a fair and objective evaluation. It reduces the probable bias of evaluators, minimizes the miscalculations and the assessment procedure gives more reliable results as the number of assesses increases.

CONCLUSION

In real life, because of the uncertain information as well as the vague human feeling and recognition, it is difficult to make an exact evaluation in social problems. That's why using fuzzy logic set theory helps decision makers deal with complex issues under the fuzzy environment. In this paper we developed user-friendly fuzzy group decision support systems software. This software provides users with the opportunity of determining the main and sub evaluation criteria and their weights, and evaluating the performance according to referees' evaluation weights and numbers. It also allows the user to use two different fuzzy inference methods The developed software can be used for multi-purpose decision making processes such as assessing projects or performance of students, teachers, employees, journals, etc.

In order to test the effectiveness of the software we evaluated the performance of research assistants in the Technical Education Faculty in the light of the criteria above. It enabled us a fair and objective evaluation. We were also able to attain the values and weight of each main criteria according to our priorities. We could prioritize the criteria of performance evaluation according to our needs.

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EVALUATING ENGLISH LANGUAGE TEACHING SOFTWARE FOR KIDS: EDUCATION OR ENTERTAINMENT OR BOTH?

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ABSTRACT
The purpose of this study is to offer a critical consideration of instructional software designed particularly for children. Since the early 1990s computer applications integrating education with entertainment have been adopted on a large scale by both educators and parents. It is expected that through edutainment software the process of learning is going to be colorful and fun and that learners can acquire information without work and serious study. The aim of this article is to draw attention to possible harmful effects of this wholesale adoption of edutainment software, particularly to introducing learning "as a bitter medicine that needs the sugar-coating of entertainment to become palatable" (Resnick, 2004). It argues that it may be time to examine critically the educational potential of such software together with the advantages and disadvantages it might bring to the instructional process. The discussion focuses, after a brief definition of edutainment, on five English language teaching software packages for kids which are randomly selected from the market. They are examined through McKenzie's (2000) Assessment Chart to see to what extent the implementation of edutainment software has been able to match their promises. The study calls for critical awareness of how instructional software is impacting education and at the same time for the engagement of teachers in exploring the computer applications that shape classroom learning and teaching.

Keywords: Educational Technology, Instructional Software**,** Edutainment

INTRODUCTION

There is no question that information and communications technologies play very important roles in today's educational settings. However, the question of how to adapt it into different learning environments still remains and concerns both educators and parents. There is a widespread expectation that these technologies will change the nature of instruction and provide the learners with cognitively challenging, attractive materials. Through the use of Internet, multimedia etc., learners can engage in individualized instruction where they can investigate and learn concepts and content to meet their specific needs. It is widely believed that because students are highly motivated through rich, interesting and engaging learning experiences, their understanding of the subject is enhanced. Thus students cannot help but pay attention to information that is presented in dynamic and memorable ways.

A number of empirical studies done in the field of Computer-assisted Language Learning (CALL) has also contributed to our understanding of how computers are used within particular classroom settings (Laufer & Hill, 2000; Chun & Plass, 1996; Sullivan & Pratt, 1996; Warschauer & Healy, 1998; Kern, 1995). Studies reveal several benefits for students related to the general use of technology for foreign language learning. These include improved motivation, self-concept and mastery of basic skills, increased student centered learning and engagement in the learning process (Stepp-Greany, 2002). As technology adoption for language teaching and learning continues to grow, studies confirm that learners often display improved thinking skills, recall and active language processing (Dywer, 1996; Weiss, 1994). Historical accounts of how technology has been used in second language learning and teaching also offer further insights into the role that computers have played in the language learning classroom (Salaberry, 2001, Chaudron, 2001).

However, it seems that a great deal of work has usually centered upon how ICTs are used in the classroom, not taking the "why" into account. As Okan (2003) stated, a critical perspective on computers is lacking among modern educators. There are numerous reasons for that, according to Bloom and Hanych (2002), for example:

- It is believed that computers enhance learning.
- Educational software can motivate students to study topics deeply.
- It is beneficial for teachers too.
- Education has entered the digital age. It is inevitable.

- Digital learning has dynamic, interactive and visual features that cannot be provided by printed materials.
- Hypertext and interactive feature of the digital materials allow learners to develop a nonlinear thinking skill.
- Distance education also suggests solutions to many problems of educational systems.

All these reasons can be considered valid and sufficient to welcome technology to education, but that should not prevent us from having a critical look at it. We believe it is time to draw attention to possible harmful effects of adopting this seemingly harmless technological fad. The purpose of this study is, of course, not to disparage the use of technology in education but to stimulate a debate on including fun elements in educational software and to examine critically the educational potential of edutainment software together with the advantages and disadvantages it might bring to the instructional process. At this point, CEIT (Computer Education and Instructional Technologies) departments can be regarded as the right platforms for such a debate as they are responsible for training people well-equipped in both instructional software design and teaching and learning theories as well as computer programming.

EDUTAINMENT

Recently, the definition of educational technology has evolved and included the term "edutainment" which is coined to mean the integration of "education" and "entertainment." Buckingham and Scanlon (2000) define it as a hybrid genre that relies heavily on visual material, on narrative or game-like formats, and on more informal, less didactic styles of address. The term "edutainment" promises fun and learning together. The educational software packages and websites for kids frequently use slogans suggesting effortless and entertaining learning that makes kid learn without any pain:

"The place where you can have fun and learn" http://www.englishforkids.com.ve/
"Would you like your child to learn English in a fun-filled and friendly atmosphere?"
http://www.englishforkids.net/efkeng/index.htm
"Yes. You can have real fun with the English language" http://www.fun-with-english.co.uk/

One of the inevitable implications of such promises is, as Olson and Clough (2001) draw attention to, learners' demand for effortless learning: "…one of the most pervasive outcomes of technology use is that students acquire the belief that learning should not be a struggle and that good teaching will make learning enjoyable and easy." The tendency of learners for learning without any struggle forces the teachers and the educational software designers to present the instruction with full of fun elements like games, animations and visuals etc.

In fact, developing effective materials in any medium that facilitates learning for young children requires an understanding of the principles of how children learn. Malone and Lepper (1987), for example, provide valuable guidance with their list of key characteristics of a learning game: **fantasy**, **curiosity**, **challenge** and **control.** Haugland (1992) suggests that educational software must be open and exploratory to increase children's creativity and allow them to choose and control the activity until completion. The design of educational software will also adapt itself to the progress of the child. As the child interacts with the programme the system will respond and provide feedback (Hohmann 1998). Agudo et al. (2005) also claim that by using an adaptive hypermedia system that is in line with the developmental abilities of children, they can be actively engaged in activities that improve their second language skills. Perhaps the most widely articulated argument for the use of edutainment materials is that such engaging software motivates students to explore topics in greater depth. Because students are highly involved in interactions their attention is attracted for longer periods of time.

However, creating an environment that is able to catch a child's attention is only the first step in the instructional process. What is equally important is to maintain this attention through the design of computer software which is grounded in constructivist learning theory considering the findings of research on educational technology and educational psychology. Here the argument is in favour of the software that acts as cognitive tools that can engage students in learning, rather than in playing with it. Olson and Clough's (2001) also warn that

- The technology used in the classroom should not be further than students' conceptual understanding.
- Technology should not determine the content or the activity but teachers should shape the technology in order to meet his/her or the students' needs.
- The technology used in the classroom should be goal-oriented, not just for the sake of the technology.
- The reasons for the technology should be strong, if the only reason is to have fun, other options should be considered.
- Advantages and disadvantages of the technology should be considered before the decision to use it.

THE STUDY

The aim of this study is to examine five randomly chosen educational software programmes in order to determine the value and effectiveness of the activities offered in the packages. The main criteria when selecting the software has been that they should be teaching English and they should be addressing to kids. The analysis has been carried out to see whether these software packages offer elements well balanced in terms of both entertainment and education of children. The names and some basic features of the software packages are given below.

1. Garfield G1

It is a spelling and vocabulary software for kids. The program uses the famous cat -Garfield as the main character of exercises and activities. The storyline is that Jon left the house and told Garfield not to mess up the house or he would be in big trouble. But Odie decides to mess it up and Garfield must clean the house before Jon gets home. Although there is no presentation of the subjects, there are a number of activities in the program. Therefore it can be considered as activity software. There are also relatively short animations of Garfield following each activity.

2. English Plus Basic 1

This is the second CD-ROM of a large software package which consists of 12 CD-ROMs. This is one of the most popular sets of English teaching software in the market and also widely used in Turkey. It includes many skills of language teaching and also grammar. Although it is colored with well-designed graphics, grammar sections usually seem to be a mere transformation of grammar books onto to the digital screen.

3. English with the Little Mole

This software is basically a story-telling program with colorful pictures and voice effects. The users can read, see and hear the stories. Although there are not activity or exercise sections, it includes a useful picture dictionary for kids.

4. Spot and His Friends

It is a simple software package for younger kids, probably around pre-school ages. There are very simple tasks to accomplish and a dog named "Spot" helps the user with the tasks. The user should understand the audio commands in order to perform the activities.

5. Little Elephant Interactive

This is an activity software package with mostly listening comprehension exercises. Almost all of the instructions of exercises are of the same format: "Listen and choose". A little elephant and his family are the main characters of the program. Users click or drag-and-drop on objects according to what they hear.

EVALUATION PROCESS

It should be noted that selecting an evaluation method depends on the purpose of the study. Being aware of advantages and disadvantages of both empirical method (testing with real users in a controlled experiment) and expert reviews, we have used the latter mainly because comments and criticisms are made from a position of knowledge (Booth 1991). We believe that as Squires and Preece (1999) suggest, in educational software evaluation the application of a carefully selected set of heuristics by a group of experts can lead to a principled but cost effective evaluation methodology (see also Nielsen 1992). In addition, any technique used by teachers need to be relatively quick and easy to use. Heuristic evaluation is designed to address key usability issues in a cost effective way. As Squires and Preece (1999) put it "guidelines or heuristics focus reviewers' attention as they work their way through the system, using their expertise to role-play the behaviour of a typical user" (p.472)

The evaluation team in this study included three female teachers, two working at the Department of Computer Education and Instructional Technologies and one working at English Language Teaching Department, Çukurova University. They had access to the stated aims of the software programmes and also knowledge about the context in which the programmes are in use. They investigated the balance between education and entertainment and made comments on possible problems or design improvements.

The study was carried out over three days. Each evaluator did two or more passes through the interface with the aim of inspecting the flow of the interface from screen to screen, and the specific features of each individual screen, such as dialogue boxes, feedback messages, etc. The experts relied basically on McKenzie's (2000) Assessment Chart (see Appendix 1) and their personal experience and opinions in their evaluations. According to that chart, eight main criteria were suggested for the software evaluation. These are:

- Pointless
- Nonstandard
- Robotic
- Glib
- Static
- Disneyfied
- Flashy
- Empty

Here these points will be presented and discussed on the basis of the information received from each evaluator. Relevant software evaluations reported elsewhere will be referred to as well. Two screenshots from the selected software which reflect the related feature best are also provided.

1. Pointless

Pointless means that the activity involves the use of a tool such as a spreadsheet or presentation program without an authentic connection to the regular (social studies, science, etc.) curriculum for the grade level of the student. PowerPointing and spreadsheeting become goals rather than just means to ends (McKenzie, 2000).

This is one of the most common misconceptions in educational software and websites. It is believed that when someone, somehow transforms any information into a digital platform, the activity takes the form of a computer-based activity. This feature is mostly observed in "English Plus Basic 1" software series (Figure 1). The software merely presents the grammar topics just like it is presented on a piece of paper. English Plus is far from capturing the advantages of multimedia environments. It separates four main skills in language learning such as listening, writing, and reading etc. rather than adopting an integrated approach, and then presents different learning activities. To evaluators, such a practice impedes the flow of learning. Writing exercise, for example, becomes pointless after a while since it only allows dragging and dropping rather than being a real writing activity. A similar situation is observed in "English the Little Mole" software too, with its simple story telling feature (Figure 2).

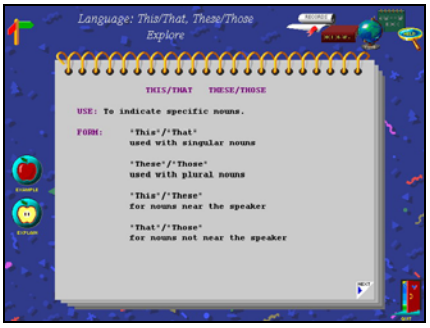

Fig. 1 Grammar is just like on paper.

Fig. 2 Story is just like on paper.

2. Nonstandard

The activity is disconnected from state standards and the new tests. No relationship or contribution made to the students' grasp of either content or skills (McKenzie, 2000).

Edutainment software is commonly used as a means of measuring the progression and attainment of children in the national curriculum and these are seen by parents to be important indicators of achievement. Teachers, in particular, are under heavy pressure if the requirements of the curriculum are not met. The software packages examined in this study are not found to be designed to assist children in the preparation for the tests at all levels of the curriculum.

3. Robotic

The activity requires little original thought or higher level thinking. The student blindly follows directions and wins success by taking orders (McKenzie, 2000).

This feature is frequently used in the activities of "Little Elephant Interactive" software. The Little Elephant just gives orders and children are expected to obey them without any reasoning. For instance, in the activity seen in Figure 3, children are to color the flowers according to the orders of the elephant and in Figure 4, they are to

click on the objects again instructed by the elephant. They do not have any other choices. They just obey the orders of the elephant and the order is always the same: "Listen and choose!" Especially grammar exercises of English Plus has a robotic character since they are not connected and supported adequately to the other parts of the software. In fact, such a design is not compatible with, as Lin et al. (2001) suggests good education software which should be active, not passive, in that the learner should be doing something actively and not watching something passively.

Fig. 3 Color the flowers.

Fig.4 Listen and choose.

4. Glib

The activity requires nothing more than skimming along the surface of the content without probing, exploring, asking essential questions or creating new insight (McKenzie, 2000).

The common problem of the activities in all the software examined is that they lack creativity. For example, in "Garfield G1" software as seen in Figures 5 and 6 below, learners just need to click on the word which is the correct answer of the question. The only difference between such activities and paper-based activities is just the instruction: "Click the right answer" instead of "Mark the right answer."

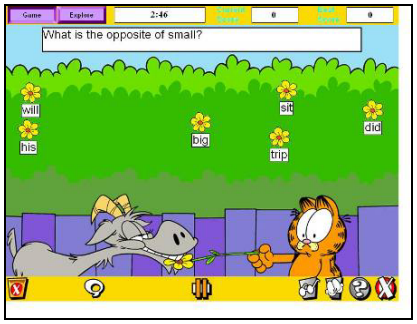

Fig. 5 Click on the opposite word.

Fig.6 Click on the correct spelling.

5. Static

The activity does nothing to advance the skill level or the skill repertoire of the student (McKenzie, 2000).
Most of computer-based activities focus on limited skills. It is usually the case that software designers are not deeply concerned to produce more creative or effective activities which help the learner acquire new skills. However, to Lennon and Maurer (2004) any software for children to play and learn should be an extension of the real world, media-rich, challenging, controllable, and leave room for creativity. The software examined in this study usually contains drag-and-drop or click-on activities. Here in Figure 5 which is a screen shot from "Spot and His Friends" software, kids are just supposed to drag the animals and drop them on the field. Likewise, as seen in Figure 6, "The Little Elephant" ask the kids to click on what they hear.

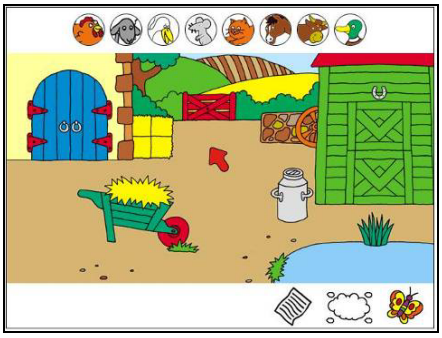

Fig. 7 Drag-and-drop

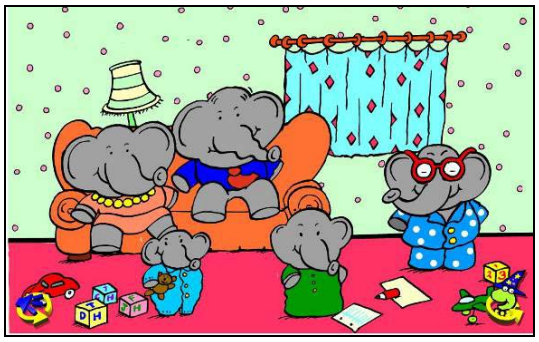

Fig. 8 Listen and choose

6. Disneyfied

The activity is sugar coated and packaged with arcade quality graphics as if learning must be turned into a game or cartoon before young people will find it rewarding (McKenzie, 2000).

In fact, as the name suggests, Disney and similar characters are usually used as heroes of the activities. All activities are designed in game formats. This feature can be seen in most of the software packages. Below, there are two screenshots (Figures 9 and 10) from "The Little Elephant" and "Garfield G1". For instance, Garfield animations between activity transitions might appeal especially young learners but this feature might also encourage them to quit the learning activity to watch these animations when they are bored.

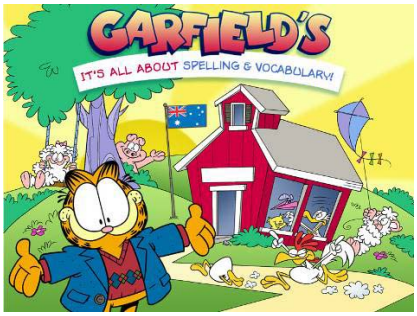

Fig. 9 Garfield and his friends

Fig. 10 Little elephant and his friends

7. Flashy

Special effects, transitions, bells and whistles are prevalent. Students are encouraged to devote more than 25% of their time and effort to packaging and special effects rather than the thought, the content and the production of new ideas (McKenzie, 2000).

The learners face this problem mostly in introduction, conclusion and transition section of the software. There usually exists an animation or something flashy to attract the attention of the learner. But in fact they are usually time consumers and distract the attention of the learner. In "The Little Elephant" software there is a 42-second introduction animation that you cannot skip and you have to watch it each time you run the software. And in "Garfield G1" there is approximately 10 seconds' animation between each activity (Figures 11 and 12).

Here the members of the evaluating team have reported that most software designers attempt to place fun in the software by incorporating multimedia stimuli in a game genre. However, they state that measuring of fun, especially where the users are children is difficult. As Carroll (2004) suggests that things are fun when they attract, capture, and hold our attention by provoking new or unusual emotions in contexts that typically arouse none, or arouse emotions not typically aroused in given context. The problem is that something can be engaging or captivating without necessarily being fun.

Fig. 11 42-second introduction animation


Fig. 12 10-second transition animation

8. Empty

The activity does little to advance student understanding of any issue, question or idea worth study (McKenzie, 2000).

Some activities give nothing to learners but waste their time by doing very simple tasks. Such problems may be due to a mismatching of the level of the software with the level of the learners i.e. kindergarten software for elementary school students. As seen below, in the "Spot and his Friends" software, learners just need to drag-and-drop the objects on the screen. There is no task or reason to do that (Figures 13 and 14). In fact, as research on edutainment artifact shows, such products should be designed with the following aspects in mind: effective learning, effective teaching, and effective communication of the content and effective use of technology to achieve the previous aspects (Adams et al. 1996).

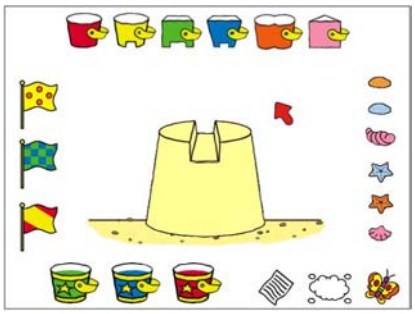
Fig. 13 Drag-and-drop


Fig. 14 Drag-and-drop

CONCLUSION AND SUGGESTIONS

The use of educational software in the school setting is not a simple task. Evaluating the software before applying it is even more difficult especially if the software claims that it blends education and entertainment in order to create a motivating and successful environment for learning, From the analysis of five software packages teaching English for kids, it is very clear that these products are more of a nature of electronic games rather than educational software. They lack most of the parameters required to be considered as effective software addressing both pedagogical and entertainment factors. We have found excessive, pointless, and flashy use of entertainment elements while cognitive tools that can engage students in learning are completely missing.

We believe that to realize the full potential of computer technology and to engage students in learning, one needs to look beyond the packaging and special effects (McKenzie, 2000) that make computers engaging in the most superficial sense. There is more to motivating learners than adding entertainment value to lessons or tests. Otherwise, as Healey (1998) put it, learners will not be motivated to learn but just to play with the computer. Olson et al. (2001) also warn that

> If the primary advantage of using the technology is that it will be fun for students or more "motivating", seriously consider why this is so. We think you will find that technology often diminishes the need to attend seriously to prior knowledge, to use metacognitive strategies, question prior ideas, generate examples, compare alternative solutions, grapple with experiences, make sense of these new experiences, make new connections, and analyse whether prior connections make sense.

Here, the need for critical awareness by educators and parents of the importance of a deeper understanding of the role of edutainment software is essential. Such awareness demands that before voluntarily adopting edutainment software as a symbol of innovation, they need to question the pedagogical and didactic philosophy the software design incorporates. The following list of questions might help teachers, learners, and educational designers when trying to select or design educational software:

- What is the point of having this subject/activity/exercise on computer?
- Is the content of the software complying with what is intended to be taught?
- Do the activities in the software really provide gains to the learner? Or they are just robotic?
- Do the activities support learners to ask questions or create new insight?
- Does the software fit the level of the learner?
- Do the activities include so much fun elements which cover the learning?
- Are the activities drowning in flashy animations and effects with noises?
- Do the learners waste time with the program?

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APPENDIX 1 McKenzie's Assessment Chart

Trait	Traits of Technotainment	Y/N
Pointless	The activity involves the use of a tool such as a spreadsheet or presentation program without an authentic connection to the regular (social studies, science, etc.) curriculum for the grade level of the student. PowerPointing and spreadsheeting become goals rather than just means to ends.	
Nonstandard	The activity is disconnected from state standards and the new tests. No relationship or contribution made to the students' grasp of either content or skills.	
Robotic	The activity requires little original thought or higher level thinking. The student blindly follows directions and wins success by taking orders.	
Glib	The activity requires nothing more than skimming along the surface of the content without probing, exploring, asking essential questions or creating new insight.	
Static	The activity does nothing to advance the skill level or the skill repertoire of the student. Same old, same old!	
Disneyfied	The activity is sugar coated and packaged with arcade quality graphics as if learning must be turned into a game or cartoon before young people will find it rewarding.	
Flashy	Special effects, transitions, bells and whistles are prevalent. Students are encouraged to devote more than 25% of their time and effort to packaging and special effects rather than the thought, the content and the production of new ideas.	
Empty	The activity does little to advance student understanding of any issue, question or idea worth study.	

PHOTOGRAPH USAGE IN HISTORY EDUCATION

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ABSTRACT
In this study; the effect of photograph usage in history education to the students' achievement was tried to be identified. In the study which was done with a pre-test post-test control group design, a frame was tried to be established between the experimental group and the analytical usage of the photograph, the control group's courses were done with traditional teaching methods (lecture, question-answer). After the five weeks of application, it was identified that photograph usage effected the student's achievement in history education.

Key words: History education based on evidence, visual material, photograph

The nature of the historical information is that everyone who inclines towards this information is essential to face the basic sources of the information. Being past, the experiences of people in earlier times can only be recovered through analysis based n the relics they have left behind, through the physical, material and documentary remains available to us, even though such might be misleading or inaccurate. Historical evidence is not simply the basis for information-processing activities; it is also an avenue of enquiry into the historicity of the past, into exploring the language, and the meanings which language had for participants (Husbands, 1996).

The American Congress Library puts the primary sources that can be used in historical research in six groups. These are;

a. Object Sources: foundlings, tools, weapons, inventions, uniforms, fashion, gravestones.
b. Image Sources: Photographs, films, videos, fine arts.
c. Auditory Sources: Auditory historical records, interview records, music records.
d. Statistical Sources: Population data, maps, architecture drawings.
e. Text Sources: Newspapers, letters, historical cookbooks, advertisements, diaries, the original texts of the known historical documents.
f. Public Sources: Family photographs, tools, equipments and clothes remaining from ancestors.

Most teachers of history in schools would now argue that if evidence is the "basis of the discipline" then development of "historical skills" in the use of evidence is an essential prerequisite of accumulating information about and understanding of the past (Husbands, 1996: 16).The originators of the history education schemes take these into consideration in their classes:

1-Make students understand the things the historians have done,
2-Make the students do partly or wholly the things the historians have done,
3-Act to the students as they were the future historians who will continue history studies (Nichol, 1996: 15).

Evidence is a concrete determination of the historical events not the stories of the past historical events. Within this side, evidence takes responsibility as a laboratory in history education. It transports the intransient result of a historical truth to the recent days and the classroom and makes observation possible (Safran and Köksal, 1998). Evidence has a place in history education not because that it make the history course original or shows the historian's activity as a model, because that it supports opinion variations and makes various learning ways possible. For evidence, there is always much more than the questions and the comments it brings.

The evidence is the basis for something in ourselves rather than being something simply "from the past": it does not have a clear identity. In this, the past itself is not what is generating the meaning. The meaning is generated through thought processes which enable meanings to be conferred on the past. The meanings of relics, or the evidence, of the survivals, are social and personal (Husbands, 1996: 26). In the evidence based learning method the students are active, not the teacher. Coping with evidence problems (to overcome the problem) make people get use to contend; makes them do brain gym, guesses and makes the dealt matter understandable. It leads to active learning and understanding. Using source-material and tackling the problems of evidence gives a feeling of reality which second- hand history can rarely give. To handle evidence from the times gives an insight into many aspects of that time, and helps us to feel for the topic we are studying. Material given at second-hand does

not readily attach our emotions, our imagination or our commitment; first-hand, primary sources do, if they are handled with care (Fines, 1996: 125).

Lee and et al state that students who are not taught the importance of historical document or evidence concept and are equipped with only information when examining sources contradiction to each other; they try to understand the truths by submitting to the authorities or accepting the majorities' thoughts (Dilek, 2001). M. Booth, Blake and Drake, Scemilt, Dickinson and Lee, Asby and Lee's studies put forth that students can develop their historical thinking skills within an effective teaching and learning frame including many primary sources and methods (Ata, 2002: 82-83). According to Cooper students who have learned the past with secondary sources would realize the difference of the records in these sources. By asking their questions about the primary sources, they are going to find out that the arguments should be supported with these sources and would realize that generally there isn't a one "right" answer. This kind of a learning model (interrogation based learning) would not only help the students to gain historical understanding but also have an important effect on their mental and social development (Dilek, 2001: 86).

The published standards of National Social Science Council in America states that "students should be able to know and use different sources (as letters, diaries, maps, photographs, etc.) in structuring the past (Ata, 2002: 82). The "New History", the not-so-new movement in history teaching which began about 1970, included an insistence that pupils should be made aware of the nature of historical sources and how to use them (Culpin, 1996: 131). The European Council's 31 October 2001 dated recommendation sentence states that to transfer historical phenomena, to present an appropriate critical and analytic learning, the possible widest sources should be used as a teaching material, in more specific points: archives opened to public, films, documentaries and visual materials, materials transmitted by information technology (which should be examined with the teacher individually and collectively) should be used, make students gain a realist up to date viewpoint to the near past events, get use of every kind of 20th century museums established throughout Europe, places having historical importance, a point of view of the near past events with witnesses making history live to the youth, "not recorded events because of neglect of history" and get use of oral history offering perspectives (Tarih Vakfı, 2002: 59).

Pupils should be actively involved in historical investigations which stem from their own interests, through asking questions, selecting and recording their own sources, organising the information they collect, and presenting their findings in a variety of ways: orally, in writing, or through model-making, pictures, drama or information technology (Cooper, 1996: 76). The students' engaging actively with history and their state of perceiving historical information and their interpretation could be associated with Bruner's three important processes in understanding information. These are defined as; animating/ role play according to physical experience and senses or learning by doing (inactive) (as visiting a place or using a material, etc.); picturing the heart of experience (iconic) (as pictures, maps, schemes, models, photographs, etc.) and organizing the concepts with symbols and language (symbolic) (Cooper, 1996a:112; Nichol, 1995: 8).

In history education, emphasizing pedagogic principles, gaining life skills, evaluating evidence and concentration on decision making, dominating visuality in mass media, programmed studies made to gain visual evidence evaluation skills for the teachers has become a necessity (Ramsden, 1996). Visual images, music, old objects and animation should be in the teacher's repertory in history education. How many ways to the past that is taught to the students will make them relate to the things they know (Levstik and Barton, 1997:38). History is not the questions asked to the students or the given materials forcing them to a certain distance or "gaining historical reality which the teacher wants". The base is to pass these processes in the history courses by interrogating, and by gaining basic skills as judging to include the indefiniteness and the probability factor. In this relation, history is analyzing a picture or a document, creating a discussion to consolidate conceptual understanding, and giving importance to the learning process more than –gaining a result- and this will highly effect the students' development of history opinion (Dilek, 2001).

Analyzing visual sources has several advantages for students. Unlike the events they represent, for instance, visual images are fixed in time. When you analyze a still image (or stop a moving one) you are undisturbed by the changing moment, by movement or the emotional fluctuations that were part of actual event. Yu can go back to an image repeatedly, searching it multiple dimensions, asking new questions, bringing new information and experience to bear (Levstik and Barton, 1997: 149). Pictures, statues, printings and other symbols provides us, that is to the future generations, to share the past cultures unwritten experience and information. Documentary evidence, mostly, for a person to read the document can be reachable by going to the archive and reading it for hours, however gaining a picture or photograph, especially if it is increased in number, is easy and the message it has can be easily reached. Another advantage of the witnessed symbols is that details which will take more time

even not in details in a text, as an example the details of the invention of printing which had a complex process, will transfer information more rapid and clear (Burke, 2003).

There can be an effect of the individuals cultural past when interpreting a visual element and this should not be forgotten. Individuals from a different cultural past can interpret the same visual material differently.

In our more digitalized age, the general aim is to see photographs as a cultural reminiscence and putt them to museums or archives as all good reminiscences. But as photographs take their journey "deep and quiet", they function as an object and subject for the visual world (Grundberg, 2002: 119). According to Barthes (2000: 104) photographs are different from all agents: it doesn't invent, it is a confirmation itself. The written things about a person or event just as hand made visual expressions, as an example as pictures and drawings, are interpretations. The images on the photographs are a part of it or reality miniatures that everyone can do or have instead of expressions about the world. (Sontag, 1999: 20-21).

Photograph from its invention in 1839, has been seen more effective as a real copy of the reality from other visual materials (as an example picture and gravure) and from other record texts (Danacıoğlu, 2001: 91). Photograph, firstly used as a historical document in the Crimea War (1853-1856), has an important place in our historical information records from then.

Stradling (2003) suggests that when choosing and using photographs it should be appropriate in relating to primary and secondary sources, judging the assumptions which are indisputable, clearing contradictions and indefiniteness which should be examined and explained, and when compared with other sources photograph should reflect a certain comprehension it presents, supporting the answers of the questions that other sources can answer; also making the students help to gain an analytic frame on how to examine and interpret the historical photographs systematically; and also let them have the chance to develop their skills on practice, analyse and interpret within this frame.

A photograph evaluated as evidence should be taken into consideration that it has been chosen from a dense selection, has information about the period it was taken, visual interference on it is possible, and it reflects the person who has taken it and the mood and aspects of the people who have been taken.

Visual messages, besides perceiving direct meanings easily, they also gain meaning which can not be understood at first sight. To unravel the sub-meanings of the visual texts which mostly cannot be perceived at once –these can be photographs, film, television images, cartoons, commercials and press photographs- should be taught how to be evaluated (Algan, 1999: 11).

The best way to evaluate a photograph is to ask systematic questions to it. These questions can consist about the person who took it, the people whose photograph is taken, the people and objects out of the limits of the photograph, which culture marks the photograph's atmosphere carries, if there is a set up in the photo or not, the time it was taken, the details of the photograph and its contribution to the whole, the mood, status and occupation of the people in the photograph. A historian who evaluates the photograph should ask questions to identify if it is appropriate to the historical aim (and the reason) of the photo (Kyvig and Marty, 2000).

Felton and Allen (1990) developed a model of eight steps to use photographs. In this model;

1. step, directing the students towards the context of the photograph, the usage of the context of the time period they are studying in the local or state history courses,
2. step, the teacher should determine the key questions. Who are these people and what are they doing? What does this photograph show about the life of that time?
3. step, the teacher asks the students to label and identify every person, group and object in the photo.
4. step period, the students compare and contrast what they see and identify the relationship between the people and the objects.
5. step, the teacher asks the students to draw their prescience and inference about their observations.
6. step, the teacher guides the students to renew, postpone or approve the hypothesis on the board by using their observations and prescience.
7. step, the students gain more detailed information from books or the media centres of the school to support or change their hypothesis. In some cases the student's hypothesis can come to be results because of the evidences they have found. For the writing to be completed in the course, the teacher provides an address to reveal the unanswered questions and to perceive the contemporary meaning of the historical events or titles of the subject.

8. step, the teacher leads to the investigation and repetition of the student's interpretation and what they say about the historical photograph. Which reasons were taken as a based to get the best data? Thinking is the most important process to develop and overview effective skills.

A sample study on analyzing a photograph is given in Appendix 1. The first photograph of the study was chosen to identify the education system and cultural structure of the last periods of the Ottoman Empire. The second photograph was chosen to identify the education system and cultural structure of the Republic of Turkey. By directing questions to both of the photographs the Ottoman Empire's and the Republic of Turkey's general structure of the education systems, changes in the cultures and the general principles and characteristics of Mustafa Kemal Atatürk's revolutions were tried to be identified.

METHOD

In the study, a pre-test post-test control group design was used to identify effect of the usage of photograph based teaching method and traditional method (lecture, question-answer) on the student's academic achievement in history education. The experimental study of the research was done for five weeks in the second term of the 2002-2003 academic years.

THE SAMPLE OF THE STUDY

The experimental study of the research was done on the sample group of 52 form three lycee students of two different classes whose teacher were the same at Sincan Fatih Anadolu Teknik ve Endüstri Meslek Lise (Sincan Fatih Anatolian Technique and Industry Vocational Lycee) in the second term of the 2002-2003 academic years. In the study, two different classes of the same teacher was chosen, and the experimental group which photographs as visual materials were going to be used in history education consisted of 24 students and the control group which traditional teaching method was going to be used consisted of 28 students.

MEANS OF COLLECTING DATA

The test which item analysis was applied to 94 form three students in three different classes in the Keçiören Teknik ve Endüstri Meslek Lise (Keçiören Technique and Industry Vocational Lycee) was consisting of 40 questions having multiple choice items (one correct, 4 distracters) and was prepared according to written aim and behaviour of the information, comprehension, application and analyzing level of the "Revolution Movements Done on Education and Culture, The Abundance of the Turkish History and Language and Organization of Public Life" subjects in the T.C. İnkılâp Tarihi ve Atatürkçülük (Republic of Turkey's Revolution History and Ataturk's Political Doctrine) course. The results were evaluated with the "ITEMAN" programme. The statistic, arithmetic mean, standard deviation and validity of the test were computed and necessary item correction studies were done. According to the analysis, when doing the item selection the discrimination power index being over 0.40, difficulty index being between %40-60 was taken into consideration. In the end of this application a test of 20 questions examining aimed behaviour was developed. This test consisting of 20 questions was applied as a post-test of the study.

Table 2. Item Analysis Results of the Test Questions

N	$\bar{x}$	S	p	Validity	Discrimination
94	18.06	5.24	0.45	0.75	0.42

DATA ANALYSIS

In the statistical analysis SPSS/PC (Statistical Package for Social Sciences for Personal Computers) programme was used

FINDINGS AND INTERPRETATION

In this section, the findings of the study and interpretations on the findings are stated.

Table 3 The t-Test Results of the Experimental and Control Group's Pre-test Achievement Score Differences

Group	N	$\bar{x}$	S	sd	t	p
Control	28	10,00	2,21	50	,818	,417
Experimental	24	9,38	3,27			

In Table 3, the pre-test results done to identify the achievement level of the experimental and control group in history education is given. Results of the test showed that meaningful difference between the groups was not

identified ($t_{(50)}$=,818; p>05). According to this result, the information levels of the students in the experimental group who will take history education with photographs and the control group who will take history education with traditional teaching methods in the beginning of the process are equal. This data shows that the study is suitable to be carried out with equal groups. It can be stated that the groups' achievement level in history education has a homogeneous structure.

Table 4. The t-Test Results of the Experimental and Control Group's Post-test Achievement Score Differences

Group	N	$\bar{x}$	S	sd	t	p
Control	28	12,75	2,577	50	2,598	,012
Experimental	24	14,54	2,359			

In Table 4, the post-test results done to identify the achievement level of the experimental and control group in history education is given. Results of the test showed that there was a meaningful difference between the groups ($t_{(50)}$ = 2,598; p<.05). Whereas the post-test score means of the experimental group students was ($\bar{x}$ =14, 54), this value was realized as ($\bar{x}$ =12,75) in the control group. The difference between them is statistically meaningful. For this, it can be said that the scores of the experimental group which took history education with photographs showed meaningful increase according to the control group which took traditional teaching method. According to the experimental design applied by the researcher, the academic achievement of the experimental group was higher than the control group which took traditional teaching method (lecture, question- answer). This condition can be interpreted as history courses done with photographs have more contribution to the students' academic level than the traditional teaching method.

Table 5. The t-Test Results of the Experimental Group's Pre and Post-test Achievement Score Differences

Measurement	N	$\bar{x}$	S	sd	t	p
Pre-test	24	9,37	3,268	23	-7,316	,000
Post-test	24	14,54	2,359			

In Table 5, the pre and post-test achievement scores of the students in the experimental group is given. According to this data, there is a significant meaningful difference in the pre and post-test achievement scores of the experimental group students ($t_{(23)}$= -7,316, p<.05). To this data, the pre-test scores realized as ($\bar{x}$ =9, 37), and the post-test scores realized as ($\bar{x}$ =14, 54) for the experimental group students who took history education with photographs. According to these results a meaningful difference has been seen in the pre and post-test scores. It is seen in the table that this increase is in the favour of the post-test scores. Photographs were used as visual materials in the "Revolution Movements Done on Education and Culture, New History Concept, The Abundance of the Turkish History and Language and Organization of Public Life" subjects to the experimental group students and as a result a significant rise in the academic achievement has been observed.

Table 6. The t-Test Results of the Control Group's Pre and Post-test Achievement Score Differences

Measurement	*N*	$\bar{x}$	S	sd	t	p
Pre-test	28	10,00	2,211	27	-4,625	,000
Post- test	28	12,75	2,577			

In Table 6, the pre and post-test achievement scores of the students in the control group is given. A meaningful difference has been seen in the pre and post-test scores done to identify the effect of the traditional teaching method in history education to the students' academic achievement ($t_{(27)}$= -4,625; p<.05). This difference is in the favour of the post-test. The control group students' academic achievement has been higher in the end of the process according to the process in the beginning. The increase in the academic achievement scores of the control group can be defined as that there should also be a specific increase in the students' achievement in the courses done with lecture and question-answer method. The "Revolution Movements Done on Education and Culture, New History Concept, The Abundance of the Turkish History and Language and Organization of Public Life" subjects were done with the traditional teaching method to the control group students and as a result a the academic achievement has risen. But, when compared with the achievement level in the experimental group this increase is small.

CONCLUSION AND SUGGESTIONS

It has been observed that the students who took "Revolution Movements Done on Education and Culture, New History Concept, The Abundance of the Turkish History and Language and Organization of Public Life" subjects in the T.C. İnkılâp Tarihi ve Atatürkçülük (Republic of Turkey's Revolution History and Ataturk's Political Doctrine) by using photographs in an analytic method have been more successful according to the students who took the same course with the traditional teaching method. The analysis of the photographs as a visual material and historical document in history education and the inferences presented as a result of this analysis, besides increasing the students' academic achievement, it also contributes to the students' aimed behaviour development in the course (problem solving, information on chronology, creative thinking, critical thinking, empathy) and makes the course be taken more cheerfully. When preparing history course programmes, the photographs presence and contribution to history education should not be ruled out. Photographs should be used in the history course books to gain historical information by enriching the subjects, explaining the subject and for an analytic analysis. Photograph archives where we could reach historical information about the institution should be constituted in our schools by the support of every person. Teachers should use photographs in their courses as conscious as a photographer. The support of photographs in teaching abstract concepts which is in the nature of history teaching should not be ruled out and this source should be used productively. Necessary education on gaining an analytic frame which will help the students to interpret and examine the historical photographs systematically should be given. Choices for practicing the skills of application, analysis and interpretation of the analytic frame which they hold, should be given to the students.

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APPENDIX 1. REVOLUTION MOVEMENTS DONE ON EDUCATION AND CULTURE

Ottoman Empire, 1916

Where could have the photograph been taken?
Can the place in the photograph be an educational institution?
Can the place in the photograph be a classroom?
Can you classify the people and objects in the photograph?
Which objects do you think the photographer has left out that should have been in the class?
Could the students be sitting on the floor because there aren't any chairs or desks here?
What things are included in the photograph that shouldn't be in an educational institution?
Is there an item in the photograph symbolizing any state?
Which state can this be?
Which clues about the culture of this state does the photograph give?
Which date could the photograph have been taken?
Could it be taken in 1929?
Did you like the clothes of the teachers and students in the madrasah (theological school attached to a mosque)?
Aren't they better than the suits you wear?
Would you like to wear the fezzes these children wear?
Who would the fez fit mostly in your class?
Every thing that a youngster wears fits, doesn't it?
Could courses always be done here or did they come together to be taken a photograph?
What are the clues that show which courses are done here?
Could the courses be done practically here?
How could the students be educated?
What are the things students have forgotten to bring to the course?
If the students had notebooks, which alphabets would have they written the things lectured?
Could the students just memorize without taking notes?
Could science education and mathematics courses taken like this?
If we put out the globe in the photograph which clues of which course would we be deprived?
If we put out the map which clues of which course would we be deprived?
If we also put out the objects on the table which clues of which courses would we be deprived?
Which courses can the madrasah teacher give to the students where these things are absent?
Could chemistry, biology, mathematics, geography, history courses be lectured?
Could religion courses lectured here?
Could the students always been taking this course?
What could the name of the child sitting in the first on the left in the front could be?
Could Mehmet be a doctor, lawyer or an engineer after graduating from this school?
What could the name of the teacher standing near the pillar be?
Could Sir Mehmet give courses in the Medicine School which we opened by modelling from the European countries?
Could you be a computer programmer in a vocational school by taking religion courses continuously?
Which nationality could the child standing at the back could be?
Could he be a Turk? Could he be an Arab? What could his name be?
If you were Hüseyin would you like to go on your education here or in the War Academy opened in Istanbul?

Could the student in the War Academy or the student in this Madrasah do more beneficial duty in the states' bad condition?
If Sir Ahmet, the teacher of a madrasah, had become the minister of education would he open schools modeling from the western countries or close these schools and go on religion courses in the madrasahs or would he change the madrasahs to a place where science, mathematics, astronomy, and social science courses are given as it was before?
What would you do if you were Sir Ahmet?
What would you do Ali?
Would you close schools completely?

Balıkesir / Republic of Turkey 1929

Where could the place in the photograph be?
Could it be a classroom?
Could this place be a laboratory?
Could you classify the objects and people in the photograph?
Which objects has the photographer forgotten to take which has to be in the class?
If you were a photographer what objects would you include in the photograph?
Could history courses be done in this laboratory?
Which tools are absent? Could chemistry courses done here?
Could these courses be done here continuously or did they come here together to be taken a photograph?
Is there an object symbolising any state here?
Could this school be opened by Mustafa Kemal Atatürk?
Which nation's children could have Atatürk open this school for?
Was this school be opened by the state or private companies?
Had people from the Turkish Nation have enough money to open private schools in this period?
Whose duty is it to open this school which Ali, Ayşe, and Ahmet go to?
Hasan, the boy on the right to the teacher, controls the class when the teacher is absent?
Could his friends bring him to this duty?
Could the people who brought him to the class presidency bring him to the Presidency of the Republic?
Had the newly formed republic give this right to its nation?
Could Zekeriya, the boy on the left to the teacher, be the Balıkesir governor's son?
Could Ali, who makes his living by collecting olive in Gemlik, be your cousin (uncle's son)?
Then, can all children from every part of the nation go to this school?
Well, what could the name of the girl at the other end of the table right across Ayşe be?
Could it be Büşra? If this school was a religion science madrasah could Fadime go to this school?
Could she get education in a school where a secular education system is carried out?
If we took our course in this laboratory today which tools would we need to interpret our experiments, save our data, and solve our chemistry problems?
Is the chemistry course in the photograph done in an advanced laboratory?
Well, do we have the sufficiency to take the science course today?

Then, can we say that we have to renew ourselves without loosing our national personality, and have a revolutionary and contemporary personality?
What is revolution? You didn't ask me then I think everyone knows its meaning.
Can this place be a primary school?
Before starting here everyone has to finish primary school, don't they?
Could he start from secondary school because he is very intelligent?
If the course in the laboratory was taken in the class, students would have learned chemistry better, wouldn't they?
Well, When Ayşe finishes this school could she enter the Chemistry Vocational Lycee and be a chemist?
Can Fadime go to the Nurse Vocational School and become a nurse?
What could the name of the tall boy at the back be? Could it be Ejder?
Ramazan seems not to like the chemistry course. Could music be his best course?
Well, when he finishes this school can he go to a State Conservatory and become a piano Artist?
Hasan is writing a letter to his father at Gemlik about how good his courses are going on.
But Hasan's father is illiterate and he makes the village mukhtar read it?
Could we teach Hasan's father to read the letter from his son?
Then, to teach Hasan's father, Uncle Ali, are we going to send him to a school where small children go to?
Could we open a school for Uncle Ali and our elder people who are illiterate?
Could we give a name to this school?
Could the photograph be taken before 3 March 1924?
If it was taken before who wouldn't be in the photograph?
What could the name of the girl at the front of the table be?
Could Ayşe go to this school?
A coeducational school where girls and boys go together gave the chance to Ayşe and Hasan to go the same school together, didn't it?
There is something written on the board at the left in the laboratory. I think it's in the Arab alphabet, I can't understand what is written, can you?
If the photograph was taken before 3 November 1928, would it be written the same?
Can you classify the difference in the two photographs?
If you opened an exposition where these two photographs are exposed, what would you name it?

ROLE OF MOBILE TECHNOLOGY IN PROMOTING CAMPUS-WIDE LEARNING ENVIRONMENT

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ABSTRACT
The present study examines the role of mobile technology in promoting campus-wide learning environment. Its main objectives were to a) evaluate the role of mobile technology in higher education in terms of its i). appropriateness ii). flexibility iii). Interactivity, & iv). availability & usefulness and to b). identify the problems of students with mobile technology.

The population of the study consisted of all the Ph.D scholars (N= 83) and faculty (N=10) of the Department of Education, International Islamic University, Islamabad. The samples of the study comprised of 100% of both the populations. The study was descriptive in nature, therefore survey approach was considered appropriate. The researchers used questionnaires as research tools developed on five point rating (likert) scale to collect the data from the respondents (students and faculty respectively). The researchers personally administered the finalized research tools (through pilot testing) to the respondents to collect the data. The data collected was analyzed through applying the mean score and percentage and main findings were (i) 92% of the respondents (students and faculty) were of the opinion that mobile technology is appropriate for effective communication and interaction (ii). 94% of the respondents ((students and faculty) were of the view that mobile technology promotes flexible interactive learning environment (iii). 93% of the respondents (students) supported that they do face problems with technology.

Keeping in view these findings, it was concluded that mobile technology is appropriate for research and education throughout the campus as it promotes effective interaction among faculty and scholars.

Keywords: Mobile Technology, Personal Digital Assistants, Information and Communication Technologies, Mobility, Synchronous Communication, Asynchronous Communication.

INTRODUCTION

21st century is said to be a century of knowledge and sharing of knowledge. Information and communication technology is taking over all aspects of human life and activities (Hussain, 2007). Developments in information and communication technologies (ICTs) lead to the creation of "portable computing/ communication devices such as laptops, PDAs and smart phones connected to wireless networks" (Corbeil & Valdes-Corbeil, 2007, p.51) to promote and enhance opportunities of advanced communication. Mobile technology such as iPods, MP3 Player, Personal Digital Assistants (PDAs), USB Drive, E-Book Reader, Smart Phone, Ultra-Mobile PC (UMPC) and Laptop/Tablet PC seems having capabilities of storage and transmission of data and information either in sound, text, sound-text, pictures or all (Corbeil & Valdes-Corbeil 2007). Such devices may extend the opportunities of synchronous as well as asynchronous communication. In education and training, the use of mobile technology is likely to change the nature of teaching and learning process as well as the training of teachers as more individuals and institutions are applying mobile technology in training programmes and incorporating it for real time (Holmes & Schmidt, 2002) performance support and evaluation in developed as well as developing countries like Pakistan.

Such real time performance supports what Shield & Poftak (2002) predicted can "revolutionize the face of learning" (p.24). Rather it has changed the learning material as different institutions and service departments are extensively now using mobile technology in different ways according to their needs and circumstances. Ally (2007) ha provided some evidences such as its use is increasing in business, healthcare, training of field workers in extension services for exchange of information and communication, entertainment and socialization.

The use of mobile technology, particularly Mobile phone, is popular technology in Pakistan. People from different walks of life are keen to use the technology according to their needs, interests and situations & circumstances. For example, a shepherd would be making a phone call through mobile phone to his wife and talking to his, a researcher would be downloading and manipulating data on laptops through Wi-Fi network,

students would be recording lectures of their teachers in classrooms, an executive coming to the office would be sending a text message to arrange for a meeting and others would be discussing and sharing their learning experiences with teachers and fellows through text messaging or voice/ live calls. Such infusion of mobile technology into different activities, Wagner (2005) rightly claimed 'mobile revolution' proclaiming that the "evidence of mobile penetration is irrefutable……[and] no demographic is immune from this phenomenon" (p.41).

Students use different portable technologies & devices that promote mobility of individuals and flexibility of time and place. Traxler (2007) used the term mobile devices for mobile technology and reported its use in education and training throughout the world. It is at a stage of advancement in terms of technical modalities, functional mechanism and instructional pedagogies of teaching learning process in classroom or at a distance. It has promoted opportunities of flexible teaching-learning process and reshaping it in new situations & circumstances and demands in terms of space & time, community and discourse (Katz & Akhus, 2002) and research ethics & attitude (Hewson, Yule, Laurent & Vogel, 2003).

The appropriate use of mobile technology in education seems to enhance the opportunities of individual as well as group and in cooperative or collaborative work. It is (Perry, 2003) personalized, and interactive use of handheld technologies in classroom situation. Different researchers and scholars viewed its strategic and purposive use & intervention in education and training according to their understanding of the feasibility and practices. For example, it is effective for collaborative learning/work (Pinkwart, Hope, Milrad & Perez, 2002), feasible for information dissemination and supporting for workers in field work (Chen, Kao & Sheu, 2003) and appropriate & effective for guidance & counseling (Vuorinen & Sampson, 2003) for individuals of different professions and trades.

Its use in education and training is likely to flourish as it brings mobility and connectivity between learners and teachers; promotes opportunities for effective communication and enhances efficiency of teachers in teaching learning process. Experts of different trades and professions appear to use it effectively for the training of their workers. It is effective for dissemination of new ideas, information & knowledge and corporate training (Pasanen, 2003). Educationists and human resource managers are convinced that in various services & sectors like doctors & other medical professionals (Smordal & Gregory, 2003; Kneebone, 2005), teachers and academicians (Seppala &Alamaki, 2003) are using essentially mobile technology Mobile technologies, particularly personal digital assistants are playing an effective role in music education (Polishook, 2005); in training of musicians and composition of new tones & tunes.

Teachers and students can benefit more from the technology using it in an appropriate profession to enhance their productivity & efficiency. Holmes & Schmidt (2002) worked on a mobility project between University of Texas at Austin (TU's) and Hewlett Packard (HP); integrating the use of wireless technology into teaching and learning environment. They concluded that wireless infrastructure is useful for both students and instructors to make the time spent in the classroom teaching new concepts more useful and productive.

RATIONALE

As discussed earlier, invention and intervention of mobile technology seems crucial for dissemination of new concepts, ideas, information & knowledge and experience sharing throughout the world. The methods and purpose of its utilization depends on the interests, needs and circumstances of users' community. Its formal use in education and training is limited in developing countries like Pakistan. However, faculties as well as scholars/learners are exploiting it in academic life for their higher studies to transfer data, provide real time support services, guidance and counseling. But the area seems nascent where users have less orientation about different mobile technologies, their appropriateness, academic use and effectiveness in the field.

Universities and higher education institutions are questing for providing latest learning technologies to support the learners. But there is no instructional policy regarding the use of such technologies. The present study examines the practices, possibilities and consequences of its use in education & training particularly at higher education level in Pakistan. It also suggests some measures for effective and efficient use of the technology at higher studies.

OBJECTIVES OF THE STUDY

The present study was undertaken with the main objectives to

a). evaluate the role of mobile technology in higher education in terms of its

i. appropriateness
ii. flexibility

iii. interactivity
iv. availability & usefulness

b). examine the current practices of using mobile technology in higher education
c). identify the problems of students with mobile technology
d). suggest appropriate use of mobile technology in higher education

METHODOLOGY

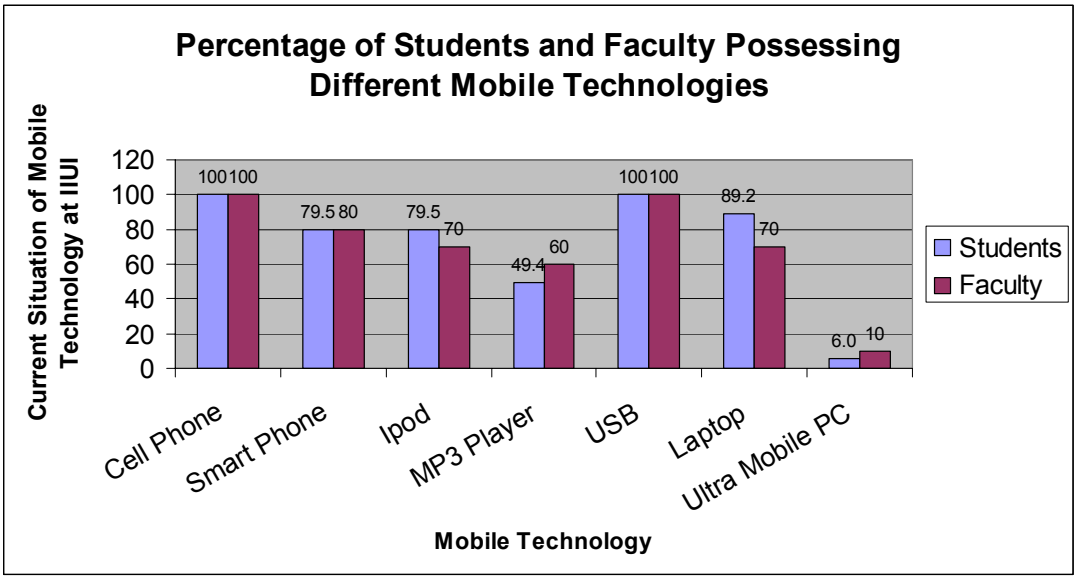
The population of the study was all the Ph. D scholars (N= 83) and faculty (N=10) of the Department of Education International Islamic University Islamabad. The samples of the study comprised of 100% of both the populations.

The study was descriptive in nature, therefore survey approach was considered appropriate. The researchers used questionnaires developed on five point rating (likert) scale and a semi-structured interview schedule as research tools to collect data from the respondents (students and faculty). The researchers personally administered the finalized (through pilot testing) research tools to the respondents to collect the data.

The data collected was analyzed through quantitative (mean score and percentage) as well as qualitative approaches. The data collected through questionnaires are presented below in tabular-cum graphical form and results drawn out are given below:

PRESENTATION OF DATA

Graph-A Use of Mobile Technology at International Islamic University Islamabad



Graph-A indicates the current situation of various mobile technologies that the students and faculty use at the campus. All the students and faculty use simple cell phones for communication and USB for data/ information transfer. However, they also use other mobile technologies as Smart Phone (students 79.5% and faculty 80%), iPod (students 79.5% and faculty 70%), MP3 Player (students 49.4% and faculty 60%), Laptop (students 89.2% and faculty 70%) and Ultra Mobile PC (students 06% and faculty 10%). It is evident from the data that all university students and teachers use cell phones and USB for transferring information in Pakistan. Ultra Mobile PC on the other hand is hardly used for educational purposes.

Table-1 Responses of students and faculty about appropriateness of mobile technology in teaching-learning process

Sr. No	Domain	Themes	Respon-dents	Responses SA	A	UNC	DA	SDA	Mean Score
1.	Appropriate-ness	Comfortable to use	Student	37 (44.6)	41 (49.4)	0	03 (3.6)	02 (2.4)	4.3
			Faculty	07 (70)	2 (20)	0	01 (10)	0	4.5
		Compatible with learning styles	Student	44 (53.0)	36 (43.4)	01 (1.2)	02 (2.4)	0	4.5
			Faculty	05 (50)	03 (30)	01 (10)	01 (10)	0	4.2
		Appropriate for using anywhere in the campus	Student	51 (61.4)	29 (34.9)	01 (1.2)	01 (1.2)	01 (1.2)	4.5
			Faculty	06 (60)	03 (30)	0	01 (10)	00	4.4
		Affordable to purchase the technology	Student	46 (55.4)	27 (32.2)	02 (2.4)	05 (6.0)	03 (3.6)	4.3
			Faculty	04 (40)	05 (50)	01 (10)	00	00	4.3
		Technology know how	Student	21 (25.3)	56 (67.5)	02 (2.4)	02 (2.4)	02 (2.4)	4.1
			Faculty	07 (70)	03 (30)	00	00	00	4.7
		Data transfer, sharing learning experiences, exchange of information	Student	49 (59.0)	28 (33.7)	03 (3.6)	01 (1.2)	02 (2.4)	4.5
			Faculty	08 (80)	01 (10)	0	01 (10)	0	4.6
Average percentage & mean score of all themes in the domain			**Student**	**41 (49.4)**	**36 (43.4)**	**2 (2.4)**	**2 (2.4)**	**2 (2.4)**	**4.3**
			Faculty	**06 (60)**	**03 (30)**	**00**	**01 (10)**	**00**	**4.4**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses. Decimal values adjusted.

Table-1 reflects the appropriateness of mobile technology in terms of its utilization, know how and affordability. According to the table 93% & 90% of the respondents (students & faculty respectively) agreed that mobile technology is appropriate for them to use in teaching learning process. It is affordable to purchase, comfortable and appropriate to use anywhere in the campus. They (students and faculty) use it to transfer data, share learning experiences and exchange information and knowledge with students and faculty. The mean score 4.3 & 4.4 (students and faculty respectively) did support strongly the appropriateness of mobile technology for teaching learning process. However, 4.4% & 10% of the respondents (students and faculty respectively) disagreed with it.

Table-2 Responses of students and faculty about flexibility of mobile technology in teaching-learning process

Sr. No	Domain	Themes	Respon-dents	Responses SA	A	UNC	DA	SDA	Mean Score
2.	Flexibility	Access	Student	21 (25.3)	54 (65.1)	02 (2.4)	03 (3.6)	03 (3.6)	4.0
			Faculty	04 (40)	05 (50)	01 (10)	00	00	4.3
		Learner centered teaching learning environment	Student	33 (39.8)	42 (50.6)	01 (1.2)	03 (3.6)	04 (4.8)	4.2
			Faculty	06 (60)	03 (30)	0	01 (10)	0	4.4
		Individual pedagogical/ learning needs	Student	19 (22.9)	48 (57.8)	03(3.6)	03 (3.6)	10 (12)	3.8
			Faculty	03 (30)	05 (50)	01 (10)	01 (10)	0	4.0
		Group learning opportunities	Student	22 ((26.5)	44 (53.0)	02 (2.4)	06 (7.2)	9 (10.8)	3.8
			Faculty	03 (30)	05 (50)	0	02 (20)	0	3.9
		Students learn on their own pace	Student	37 (44.6)	42 (50.6)	01 (1.2)	01 (1.2)	02 (2.4)	4.3
			Faculty	03 (30)	06 (60)	0	0	01 (10)	4.0
		Heterogeneous learners-learner's age and sex	Student	26 (31.3)	47 (56.6)	01 (1.2)	02 (2.4)	07 (8.4)	4.0
			Faculty	05 (50)	04 (40)	0	01 (10)	0	4.3
Average percentage & mean score of all themes in the domain			**Student**	**26 (31.3)**	**46 (55.4)**	**2 (2.4)**	**3 (3.6)**	**6 (7.2)**	**4.0**
			Faculty	**04 (40)**	**05 (50)**	**00**	**01 (10)**	**00**	**4.1**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses. Decimal values adjusted.

Table-2 indicates the flexibility of mobile technology in terms of learners' access to the knowledge through the technology. It is evident from the table that 86.7% and 90% of the respondents (students and faculty respectively) agreed that it promotes flexible learning environment where students learn on their own pace and place. The mean score 4.0 & 4.1 (of students & faculty respectively) also supported the main domain. Only 10.8% & 10% of the respondents (students and faculty respectively) disagreed with it.

Table-3 Responses of students and faculty about interactivity of mobile technology in teaching-learning process

Sr. No	Domain	Themes	Respon-dents	Responses SA	A	UNC	DA	SDA	Mean Score

3.	Interactivity	Synchronous interaction	Student	18 (21.7)	45 (54.2)	03 (3.6)	08 (9.6)	9 (10.6)	3.7
			Faculty	04 (40)	04 (40)	01 (10)	01 (10)	0	4.1
		Asynchronous interaction	Student	24 (28.9)	47 (56.6)	02 (2.4)	06 (7.2)	04 (4.8)	4.0
			Faculty	04 (40)	05 (50)	01 (10)	0	0	4.3
		Immediate feedback on students performance	Student	27 (32.5)	35 (42.2)	03 (3.6)	06 (7.2)	12 (14.5)	3.7
			Faculty	02 (20)	04 (40)	01 (10)	02 (20)	01 (10)	3.4
		Equal opportunities of learning	Student	39 (47)	36 (43.4)	02 (2.4)	04 (4.8)	02 (2.4)	4.3
			Faculty	04 (40)	05 (50)	01 (10)	0	0	4.3
		Remote connectivity	Student	22 (26.5)	51 (61.4)	02 (2.4)	06 (7.2)	02 (2.4)	4.0
			Faculty	05 (50)	03 (30)	0	01 (10)	01 (10)	4.0
		Collaborative learning environment	Student	23 (27.7)	38 (45.8)	02 (2.4)	11 (13.3)	09(10.6)	3.7
			Faculty	03 (30)	04 (40)	01 (10)	02 (20)	0	3.8
		Learning community	Student	16 (19.3)	51 (61.4)	03 (3.6)	04 (4.8)	09(10.6)	3.7
			Faculty	02 (20)	07 (70)	01 (10)	0	0	4.1
		Group dynamic	Student	31 (37.3)	44 (53)	02 (2.4)	05 (6.0)	01 (1.2)	4.2
			Faculty	04 (40)	03 (30)	0	02 (20)	01 (10)	3.7
Average percentage & mean score of all themes in the domain			**Student**	**26 (31.3)**	**43 (52.0)**	**02 (2.4)**	**06 (7.2)**	**06 (7.2)**	**3.9**
			Faculty	**03 (30)**	**05 (50)**	**01 (10)**	**01 (10)**	**00**	**4.0**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses. Decimal values adjusted.

Table-3 depicts that 69.3% and 80% of the respondents (students and faculty respectively) agreed with the statement that mobile technology enhances and creates opportunities of interactivity through remote connectivity either through real time communication through mobile/ wireless phones or delayed communication by text messaging & e-mail. Mean scores 3.9 & 4.0 (students and faculty respectively) proved it. But 14.4% & 10% of the respondents (students and faculty respectively) did not agree with it.

Table-4 Responses of students and faculty about availability & its usefulness of mobile technology in teaching learning process

Sr. No	Domain	Themes	Respon-dents	Responses					Mean Score
				SA	A	UNC	DA	SDA	
4.	Availability & usefulness	Personalized learning environment	Student	27 (32.5)	44 (53.0)	02 (2.4)	07 (8.4)	03 (3.6)	4.0
			Faculty	02 (20)	07 (70)	00	01 (10)	00	4.0
		Compatible with learners needs	Student	24 (28.9)	41 (49.4)	02 (2.4)	06 (7.2)	10(12.0)	3.8
			Faculty	04 (40)	05 (50)	01 (10)	00	00	4.3
		Interest and motivation	Student	32 (38.6)	47 (56.6)	01 (1.2)	02 (2.4)	01 (1.2)	4.3
			Faculty	04 (40)	05 (50)	01 (10)	00	00	4.3
		Reasonable prices	Student	36 (43.4)	29 (34.9)	02 (2.4)	05 (6.0)	11(13.3)	3.9
			Faculty	02 (20)	06 (60)	00	01 (10)	01 (10)	3.7
		Easily Available	Student	26 (31.3)	48 (57.8)	02 (2.4)	04 (4.8)	03 (3.6)	4.1
			Faculty	04 (40)	05 (50)	01 (10)	00	00	4.3
Average percentage & mean score of all themes in the domain			**Student**	**29 (34.9)**	**42 (50.6)**	**01 (1.2)**	**05 (6.0)**	**06 (7.2)**	**4.0**
			Faculty	**03 (30)**	**06 (60)**	**0.5 (5)**	**0.5 (5)**	**00**	**4.1**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses

Table-4 expresses that 85.5% & 90% of the respondents (students and faculty respectively) agreed with the statement that mobile technology is easily available at reasonable prices in the market. The mean score 4.0 & 4.1 (students and faculty respectively) supported it. However, 13.2% & 5% of the respondents (students and faculty respectively) did not agree with it.

Table-5 Responses of students and faculty about current practices of students in using mobile technology

Sr. No	Domain	Themes	Respon-dents	Responses					Mean Score
				SA	A	UNC	DA	SDA	
5.	Current practices	Data transfer	Student	31 (37.3)	49 (59)	00	03 (3.6)	00	4.3
			Faculty	04 (40)	06 (60)	00	00	00	4.4
		Connectivity with learners and faculty	Student	27 (32.5)	51 (61.4)	01 (1.2)	03 (3.6)	01 (1.2)	4.2
			Faculty	05 (50)	04 (40)	00	01 (10)	00	4.3
		Downloading (text, photos & videos)	Student	20 (24.1)	48 (57.8)	02 (2.4)	06 (7.2)	07 (8.4)	3.8
			Faculty	03 (30)	06 (60)	00	01	00	4.1
		Appropriate utilization & management of time	Student	32 (38.6)	46 (55.4)	01 (1.2)	02 (2.4)	02 (2.4)	4.3
			Faculty	02 (20)	05 (50)	01 (10)	02 (20)	00	3.7

		Recording the lectures	Student	14 (16.9)	42 (50.6)	03 (3.6)	17(20.5)	07 (8.4)	3.5
			Faculty	02 (20)	06 (60)	00	01 (10)	01 (10)	3.7
		Guidance and counseling	Student	42 (50.6)	35 (42.2)	01 (1.2)	05 (6.0)	00	4.4
			Faculty	05 (50)	04 (40)	00	01 (10)	00	4.3
		Sharing learning difficulties	Student	36 (43.4)	42 (50.6)	01 (1.2)	03 (3.6)	01 (1.2)	4.3
			Faculty	02 (20)	06 (60)	00	02 (20)	00	3.8
		Short messages (SMs)	Student	29 (34.9)	46 (55.4)	01 (1.2)	05 (6.0)	02 (2.4)	4.1
			Faculty	04 (40)	05 (50)	00	01 (10)	00	4.2
		Excursion	Student	38 (45.8)	41 (49.4)	02 (2.4)	02 (2.4)	00	4.4
			Faculty	03 (30)	05 (50)	00	01 (10)	01 (10)	3.8
Average percentage & mean score of all themes in the domain			**Student**	**30 (36.14)**	**44 (53)**	**01 (1.2)**	**04 (4.8)**	**04 (4.1)**	**4.1**
			Faculty	**03 (30)**	**06 (60)**	**00**	**01 (10)**	**00**	**4.0**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses. Decimal values adjusted.

Current practices and use of the mobile technology in teaching learning process is obvious from the table-5. According to the table, 89.14% & 90% of the respondents (students and faculty respectively) are currently using the mobile technology in different ways and styles for improving teaching learning process. Mean score 4.1 & 4.0 (students and faculty respectively) supports its current use. But 8.9% & 10% of the respondents (students and faculty respectively) do not agree with its use in teaching learning process. They misuse it in different ways wasting their time. Some listen to music and others chat and bully their fellows.

Table-6 Responses of students and faculty about Problems of students with mobile technology

Sr. No	Domain	Themes	Respon-dents	Responses					Mean Score
				SA	A	UNC	DA	SDA	
6.	Problems	Non affordability/Expensive	Student	19 (22.9)	46 (55.4)	03 (3.6)	04 (4.8)	11(13.3)	3.7
			Faculty	03 (30)	04 (40)	01 (10)	02 (20)	00	3.8
		Non-Availability	Student	16 (19.3)	22 (26.5)	02 (2.4)	33(39.8)	10 (12)	3.0
			Faculty	02 (20)	01 (10)	00	05 (50)	02 (20)	2.6
		Inferiority complex	Student	29 (34.9)	46 (55.4)	02 (2.4)	04 (4.8)	02 (2.4)	4.2
			Faculty	04 (40)	03 (30)	00	02 (20)	01 (10)	3.7
		Lack of Social interaction	Student	17 (20.5)	45 (54.2)	02 (2.4)	12(14.5)	07 (8.4)	3.6
			Faculty	02 (20)	07 (70)	00	01 (10)	00	4.0
		Tech-savvy	Student	33 (39.8)	41 (49.4)	02 (2.4)	03 (3.6)	04 (4.8)	4.2
			Faculty	03 (30)	06 (60)	00	01 (10)	00	4.1
		Misuse of technology	Student	18 (21.7)	47 (56.6)	01 (1.2)	09(10.8)	08 (9.6)	3.7
			Faculty	03 (30)	04 (40)	00	02 (20)	01 (10)	3.6
Average percentage & mean score of all themes in the domain			**Student**	**22 (26.5)**	**42 (50.6)**	**02 (2.4)**	**10 (12)**	**07 (8.4)**	**3.7**
			Faculty	**03 (30)**	**04 (40)**	**00**	**02 (20)**	**01 (10)**	**3.6**

Note: Values given in the parentheses indicate percentage of their respective values without parentheses. Decimal values adjusted.

Table-6 indicates that 77.1% & 80% of the respondents (students and faculty respectively) faced different problems with mobile technology. The mean score 3.7 & 3.6 (students and faculty respectively) also proved it. Only 20.4% & 30% of the respondents (students and faculty respectively) were not of the same view.

RESULTS OF THE STUDY

Following results were drawn out from Interview and the data analysis:

1. All the students and faculty (100%) use simple cell phones for communication and USB for data/ information transfer. However, they also use other mobile technologies as Smart Phone (students 79.5% and faculty 80%), iPod (students 79.5% and faculty 70%), MP3 Player (students 49.4% and faculty 60%), Laptop (students 89.2% and faculty 70%) and Ultra Mobile PC (students 06% and faculty 10%). They (students and faculty) use demand based mobile technology (graph-A).

2. Majority of the respondents (93% & 90% students & faculty respectively) agreed that mobile technology is appropriate for them to use it in teaching learning process. It is comfortable to use (94% & 90% students & faculty respectively), compatible with learning styles of the students (96.4% & 80% students & faculty respectively), appropriate for using anywhere in the campus (96.3% & 90% students & faculty respectively), affordable to purchase (87.6% & 90% students & faculty respectively), they have technical know-how (92.8% & 100% students & faculty respectively) and they (92.7% & 90%

students & faculty respectively use it transfer data, share learning experiences and exchange information and knowledge with students and faculty in an appropriate way (table-1).

3. A prominent majority of the respondents (86.7% & 90% students & faculty respectively) were of the view that mobile technology promotes flexibility. It promotes flexibility in terms of access (90.4% & 90% students & faculty respectively) to the material, information and knowledge, promotes learner centered teaching learning environment (90.4% & 90% students & faculty respectively) in the campus, caters (80.7% & 80% students & faculty respectively) to individual pedagogical and learning needs of faculty and learners respectively, creates (79.5% & 80% students & faculty respectively) group learning opportunities where students learn (95.2% & 90% students & faculty respectively) at their own pace & place. It is feasible (87.9% & 90% students & faculty respectively) for heterogeneous learners and accommodates learners of all age group of either sexes (table-2).

4. Interactivity is the basic component of an effective teaching learning process. Majority of the respondents (83.3% & 80% students & faculty respectively) agreed that the use of mobile technology promotes (75.9% & 80% students & faculty respectively) synchronous as well as asynchronous (85.5% & 90% students & faculty respectively) interaction of students with their fellow students and teachers through live calls through mobile phones or wireless communication and/or by text messaging/ an e-mail over the net. It provides (90.4% & 90% students & faculty respectively) equal opportunities of learning to all the students and also provides (74.7% & 60% students & faculty respectively) immediate feedback on student's performance. It plays an important role in (86.9% & 80% students & faculty respectively) connecting students from far-away/remote places. It creates (80.7% & 90% students & faculty respectively) learning community of the students living in different cities/ place or countries to work and learn in (73.5% & 70% students & faculty respectively) collaborative learning environments benefiting from (90.3% & 70% students & faculty respectively) group dynamics (table-3).

5. Availability of technology and its usefulness in teaching learning process increases its demand in students and faculty. Majority of the respondents (85.5% & 90% students & faculty respectively) agreed that it is available and useful. It is (89.1% & 90% students & faculty respectively) easily available in the market at (78.3% & 90% students & faculty respectively) reasonable prices that the respondents can afford to pay for it. Mobile technology is (78.3% & 90% students & faculty respectively) compatible with needs of the learners, creates and sustains (95.2% & 90% students & faculty respectively) interest & motivation in learners thus promoting (85.5% & 90% students & faculty respectively) personalized learning environment for individual learning at learner's own pace (table-4)..

6. A prominent majority of the respondents (89.1% & 90% students & faculty respectively) agreed that they are using the mobile technology in teaching learning at the campus. Currently they are using the technology for (96.3% & 90% students & faculty respectively) data transfer, (81.9% & 90% students & faculty respectively) for downloading (text, photos & videos) and (67.5% & 90% students & faculty respectively) for recording the lectures in classrooms. They use it for (93.9% & 90% students & faculty respectively) connectivity with students and faculty when they are in traveling or at their homes to know about the classroom/ campus activities. Students often use mobile technology for (94% & 80% students & faculty respectively) sharing learning difficulties and (92.8% & 90% students & faculty respectively) seeking guidance and counseling from their teachers or class fellows. They also send and receive (90.3% & 90% students & faculty respectively) short messages (SMS) and chat with each other for (95.2% & 80% students & faculty respectively) excursion and recreation (table-5.

7. Majority of the respondents (77.1% & 80% students & faculty respectively) reported that they faced problems while using mobile technology. They (88.3% & 70% students & faculty respectively) reported that the technology is expensive and they cannot purchase its advanced forms/latest models. They also described that the latest models of different mobile technologies are not (51.8% &70 % students & faculty respectively) easily available in the market. Mobile technology has become a status symbol in the society and it has resulted (90.3% &70 % students & faculty respectively) inferiority complex among those who cannot afford the advanced technologies. It has minimized (54.7% &70 % students & faculty respectively) social interaction among people and promoted technology phobia breaking the social cohesion and integrity. Respondents (78.3% & 70% students and faculty respectively) were also of the opinion that individuals misuse it (table-6).

FINDINGS OF THE STUDY

The main findings of the study are;

1. Mostly, the students and faculty use simple and economical cell phones for communication and USB for data/ information transfer. However, they also use other mobile technologies as Smart Phone iPod), MP3 Player, Laptop and Ultra Mobile PC. They use demand based mobile technology.

2. Mobile technology is appropriate to be used anywhere to enhance campus-wide learning environment. It is compatible with needs of the learners and they feel comfort working with it. It is easy to use and appropriate for research scholars to transfer data, share learning experiences and exchange of information and knowledge with students and faculty.

3. Mobile technology promotes flexible learning environment. It enhances learners' (particularly research scholars) access to the learning material from anywhere in the campus. It creates learner centered teaching-learning environment where they study at their own pace. Mobile technology helps them work on groups projects.

4. Interactivity is the basic component of an effective teaching learning process. The use of mobile technology promotes synchronous as well as asynchronous interaction among students and faculty through live calls on mobile phones or wireless communication networks and/or by text messaging/ an e-mail over the internet. It provides equal opportunities of learning to all the students and also provides immediate feedback on student's performance. It plays an important role in connecting students from far-away/remote places. It creates learning communities of the students living in different cities/ place or countries to work and learn in collaborative learning environments on cooperative projects, benefiting from group dynamics.

5. Availability of technology and its usefulness in teaching learning process increases its exposure to students and faculty. Simple technologies are easily available in the market at reasonable prices that the respondents can afford to pay. Mobile technology is compatible with needs of the learners, creates and sustains interest & motivation in learners thus promoting personalized learning environment for individual learning at learner's own pace.

6. Currently students and faculty are using mobile technology for data transfer, downloading (text, photos & videos) and recording the lectures in classrooms. They use it to stay connected with students and faculty when they are in traveling or at their homes to know about the classroom/ campus activities. Students often use mobile technology for sharing learning difficulties and seeking guidance and counseling from their teachers or class fellows. They also send and receive short messages (SMS) and chat with each other for excursion and recreation.

7. Students & faculty reported some problems while working with technology. Advanced/ latest models of the technology are expensive and rarely available in the market because of which students cannot afford/ purchase these models. Mobile technology has become a status symbol in the society and it has caused inferiority complex among those who cannot afford the advanced technologies. It has minimized social interaction among individuals and promoted technology phobia, breaking the social cohesion and integrity. It is misused by some students and they use it for bullying & harassment (through e-mails, SMS and live calls). They waste their time of study listening to music.

RECOMMENDATIONS

Keeping in view the results and findings of the study, following suggestion are made:

1. University/ higher education institution's administration and academician may arrange an orientation workshop/seminar for scholars/researchers about its appropriate and effective use in research and teaching learning process.

2. University/higher education institution may develop collaboration with different technology manufacturing companies for providing students different technologies on economical rates. Universities may also suggest invention of new technologies or some changes/alterations in different technologies to enhance their potential in research and teaching learning process.

3. Academicians may encourage the use of mobile technology throughout the campus by interacting with students, responding and accommodating their queries through e-mail, SMS or mobile phone calls.

4. Universities may formulate a clear policy about the use of mobile. Universities may envisage the rules and regulations regarding misuse (bullying & harassment through e-mails, SMS and live calls) of the technology.

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