

## ORIGINAL ARTICLE

### Investigate the effect of mobile learning over the critical thinking in higher education

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#### ABSTRACT

The purpose of this study is to investigate the effect of mobile learning over the critical thinking in higher education. The volunteer sample in this experimental study consisted of 60 students in institute language in thehran- Iran. The students' critical thinking disposition was measured by California Critical Thinking Disposition Inventory Scale (CCTDI). Also, the usefulness of mobile learning systems (UMLS), a questionnaire adapted by Motiwalla (2007), was used to collect data. The data was analyzed using descriptive statistical analysis techniques; T-test, mean and standard deviation. Overall, students' attitudes toward the usefulness of a mobile learning system improved significantly at the end of the experimental study. Also, it wasn't a significant difference in critical thinking between male and female in pre-test and post-test. It was found that after the study the students' creativity improved significantly. Furthermore, researchers found that outdoor experiences influenced students' attitudes positively. Additionally, results indicate that in this study, working collaboratively and sharing information were built into a group activity.

**Key words:** M-learning; environmental awareness; collaborative learning; critical thinking

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#### Introduction

The goal of educational system ,that verifies based on improvement of students, is to activate students in learning process; it also rear people who have different abilities such as critical thinking. (Thompson, Martin *et al.* 2003). Nowadays, technology provides facilities for teaching and learning. Learning has appeared in different styles from classroom learning to distance and virtual learning and one of the functions of technology is helping to deliver the content to learners. (Nordin, Embi *et al.* 2010) .Among the recent technologies, mobile phones are in the category of the most popular and successful ones. (Hashemi and Ghasemi 2011).The number of educators who use mobile phone as an educational tool is increasing. Mobile learning (ML) establishes the potential for collaborative interaction and learning opportunities for geographically sporadic groups and people. It has dramatically attracted the interest of companies , educators and researchers that promote learning systems and publish instructional materials.(Cavus and Uzunboylu 2009) . Mobile devices have the ability to change the behaviour of students, their interact with other students as well as their attitude towards learning. M-learning is actually a quite new tool in the pedagogical cache for advocating both teachers and students as they navigate the choices available in the world of distance learning.(Liaw, Hatala *et al.* 2010). M-Learning is the modern learning accomplished that it can provide critical thinking. Teaching for critical thinking is the goal of modern education, as it equips students with the competency that is necessary for education in a rapidly changing world. (Kelly Y.L 2009)The aim of education is rearing independent students who have critical thinking. The objective of this study is to investigate the effect of mobile learning over the critical thinking skills in higher education.

#### Relevant study in mobile learning:

According to Hargreaves (2003), a knowledge society is a learning society. The responsibility of a learning society is to establish ways for its people to look for knowledge. Technology has helped to remove restrictions of knowledge in the classrooms. So technology can help to promote lifelong learning indirectly. (Nordin, Embi *et al.* 2010) . Today, students can have more activity, improved creativity and better learning performance by attending in an m-learning environment. According to some studies, mobile device can act as a guide that helps

children to raise their geographical or environmental knowledge as well as their motivation for learning activities. (Chang, Chen *et al.* 2011). Mobile learning or m-learning (ML) has increasingly attracted the interest of educators, researchers, and companies that develop learning systems and publish instructional materials. This technology provides the potential for collaborative interaction and learning opportunities for geographically dispersed persons and groups (Biström, 2005; Edwards *et al.*, 2002).

Bates and Poole (2003) have offered a model for the effective use of technology for teaching in higher education that recommend eight criteria to be used in determining choice of technology. An investigation of whether the right and modern technology has been chosen is arguably an important feature of a comprehensive assessment of mobile learning. So it would be recognized by these criteria, namely costs, organizational issues, ease of use and reliability, Only the appropriateness of the technology for students, speed, i.e. how quickly materials can be developed, interactivity, teaching and learning approaches, novelty, as a choice not to use existing technology. (Idrus and Ismail 2010)

For the past one decade, m-learning has been a subject of interest to researchers and many research findings show that m-learning is an influential instrument for strengthening learning methods and its learners can use mobile learning device and wireless network to access immediacy, convenience and expediency of mobile learning in suitable time and reaching proper learning content. (Nordin, Hamzah *et al.* 2010 ). Also, it has proposed a new concept in the field of distance learning which is ubiquitous learning (U learning). This type of learning refers to the way students get knowledge from traditional classroom resources and strategies and on request for learning system anywhere and anytime (Huang, Lin *et al.* 2010).

In this regard, the informal features of m-learning are often emphasized new technologies especially mobile devices like mobile phones, PDA, etc. Which are connected to internet with wireless communication technologies such as WiFi, Bluetooth and so on, can respond this demand and enable learning at anytime and anywhere. Although it could be said that m-learning involves the use of any portable learning materials, so includes audio-cassettes, books, audio-CDs, DVD players and portable radios, for example, m-learning usually focuses on the most recent technologies. Trifanova (2004) define mobile devices as "...any device that is small, autonomous and unobtrusive enough to accompany us in every moment". Typically, m-learning is identified both by being available "anywhere, anytime" (Geddes 2004) and by the tools used: Mobile learning can perhaps be defined as 'any educational provision where the sole or dominant technologies are handheld or palmtop devices'. (Traxler 2005) So, mobile learning can be any formal or informal learning which is mediated through handheld devices and is available anywhere and anytime. (Hashemi and Ghasemi 2011).

But these devices cannot acquire information about the context of his/her learning. Omnivorous mobile learning is kind of learning which is improved by context awareness and intelligent environment. The information about the learner's context is gained through the learning environment that is surrounded by tags, sensors, etc. The system dynamically advocates his/her learning by communicating with embedded devices in the environment while the learner is moving with his/her mobile device. (Vinu, Sherimon *et al.* 2011).. Mobile applications have a lot of advantages and Ben Moussa (2003) identified many of them. These benefits allow users to filter or control the flow of communication and information which are used in personalized and individualized tools. BenMoussa (2003) identified several benefits of using mobile applications, which generally permit users to control or filter the flow of information and communication using individualized or personalized devices. The effect of constructivism has resulted in more exploratory and self-directed in classroom activities (Karagiorgi & Symeou, 2005).

Mobile learning is evolving rapidly. Early generations of mobile learning projects offered formally-designed activities which were carefully crafted by technologists and educators, and using emerging technologies that were not yet well understood or widely accessible. Because of extensive ownership of wireless devices and mobile, learners can attend activities including those which are arisen from greater mobility, according to their personal needs. While the new ideas have fore grounded the mobility of the learner, mobile learning, in the past, was known just as its use of mobile technology. (Sharples,2006).

ML is potentially useful in many educational settings, but currently is used in small-scale projects. Since mobile phones are familiar to students, they don't scare users, don't require technological training and stay modest in classrooms (Nyiri, 2003).

Although in an educational environment students move frequently, their mobile phones are accessible all the day and by using wireless/handheld devices both students and instructors can use discretionary periods while travelling by train, bus, etc to prepare lessons or complete assignments (Virvou & Alepis, 2005). Two other types of wireless data communication, Wireless Application Protocols (WAP) and Short Message Service (SMS), faced global popularity; of course they have had limited use in online education (Motiwalla, 2007). The frequent use of messaging and telephones for facilitating socialization and friendship has resulted in launching a role for mobile telephones as a means of collaborative learning However, few researches have investigated educational results of ML. (Uzunboylu, Cavus & Ercag, 2009). The mobile learning system can help the students to recognize and monitor the situation of target patients in the real world by using mobile, sensing technologies and wireless communication.

Actually, Mobile Author Project is one of the most sophisticated uses of m-learning to date (Virvou & Alepis, 2005), which enables instructors to create an intelligent tutoring system (ITS) for any subject.

Also, the Mobile Learning Tool (MOLT) developed by Cavus and Ibrahim (2009) investigates the use of wireless technologies in education, particularly for learning technical English words using text messaging. They were concluded that away from the regular classroom environment, students completed daily activities and learned new technical words. It is well known that one of the most important issues in education is critical thinking. (Cavus and Uzunboylu 2009).

#### *Relevant study in Critical thinking:*

The improvement of critical thinking skills is often categorized as the most important purpose of formal education, since the ability to think critically is necessary for success in the world where the creation of new knowledge is increasing rapidly. Critical thinking (CT) has had lifelong interest among educators, scholars and those who are concerned with thinking skills (Bernard, Zhang *et al.* 2008) Critical thinking discerns concealed values, examines assumptions, assesses conclusions and evaluates evidence (Petress, 1984). . Norris (1985) describes critical thinking as students' practice of all previous knowledge on an exclusive topic and the assessment of their own thinking skills and the change of manners. According to Ennis (1985) critical thinking is a responsible, reasonable, reflective and skilled thinking process which concentrates on what to do and what to believe (Ivie, 2001). According to Richard (1991) critical thinking is reaching the results based on knowledge and observation. Warnick and Inch (1994) defined critical thinking as the ability to discover a situation, problem or question; to merge all of the accessible information about the subject under review and come to a hypothesis or solution for justifying one's position. They also recognized the related hypothesis of the authors of a decision as well as the capability to review the propositions and debates of decision makers for their applicability to the problem solved, as essential to effective critical thinking and related results. Many scholars have mentioned that critical thinking is not easy; it's hard and challenging , meanwhile, it isn't limited "smart people" (Marin and Halpern 2011). John Dewey concentrated on ways of thinking as an educational issue.(Paul 2011). The experts and critical thinking theorists, such as Watson and Glaser (1980), McPeck (1981), Facione (1990), Boychuck Duchscher (1999) and Simpson and Courtney (2002), all generally define critical thinking as including inference, analysis, evaluation. In addition, Bitner and Tobin (1998) used self-regulation, interpretation, explanation as central to critical thinking. (Sharon L 2007; Serap 2009). If students use critical thinking skills they reach profound, bright clear views, they are more interested in events, they approach in a more reasonable behaviour and they become fairer (Connerly, 2006). On the other hand, Rudd, Baker and Tracy (2000) state critical thinking is an introspective, reasoned, purposive approach to addressing questions with incomplete information and evidence or solving problems and for which an indisputable solution is unlikely. Moore and Parker (2007) underline critical thinking as "the careful and deliberate determination of whether to accept, reject, or suspend judgment about a claim". Another outlook from Facione (2007) that recommended critical thinking is thinking that has a purpose (proving a point, interpreting what something means, solving a problem), but critical thinking can be a cooperative, non competitive attempt.

Since 1970, another important role of education in understanding, protecting, and solving environment problems has been universally recognized. Researchers have considered the use of environmental education in schools, universities and colleges. Afterwards researchers examined students' attitudes and knowledge towards the environments and methods for teaching environmental awareness. During the last years, this discussion has disappeared because most researchers commonly accept the existence of the notion that some general critical-thinking skills, which are widely practicable in several contexts, and that awareness of a knowledge base also plays an important role in thinking. Thus, research concentrates primarily on how to promote influential instructional designs for teaching general critical-thinking skills.(Angeli and Valanides 2009)

#### *2. The Purpose of the Study:*

The purpose of this study is to investigate the effect of mobile learning over the critical thinking skills. The study focuses on context learning with the following questions.

1. Is there a significant difference in pre-experience test and post-experience test results of the critical thinking of the participants?
2. Is there a significant difference in pre-experience test and post-experience test results of the usefulness of mobile learning systems (UMLS) questionnaire?
3. Is there a significant difference in pre-experience test and post-experience test results between males and females in the critical thinking of the participants?

### 3.1. Participants:

The volunteer sample in this study ( $N = 60$ ) consisted of 25 males and 35 females. The volunteer sample in this experimental study consisted of 60 students in institute language in thehran- Iran. The mean age of participants was 21-28 years. In the first stage each participant was same and completed pre-test that included experience and post-experience questionnaires.

### 3.2 Instrument:

The students' critical thinking disposition was measured by California Critical Thinking Disposition Inventory Scale (CCTDI). California Critical Thinking Disposition Inventory Scale was developed by Facione, Facione and Giancarlo (1992) and was adapted into Turkish by Kökdemir (2003). It includes seven subscales which is determined theoretically and tested psychometrically. The CCTDI consists of 75 Likert-type questions that represent seven critical thinking constructs. The developers report an overall reliability Chronbach's of .88. However, in order to determine the critical thinking disposition, a total point of these subscales is used Facione, Facione and Giancarlo (1992).

The usefulness of mobile learning systems (UMLS), a questionnaire adapted by Motiwalla (2007), was used to collect data. This 23-item questionnaire focuses on the usefulness of mobile telephones for increasing students' awareness of environment concerns. Each participant completed the UMLS before the project began and after its completion. The questionnaire addresses three dimensions: Asynchronous communication, synchronous communication, and mobile communication. Respondents rate each item on a 1-5 Likert scale from "strongly agree" (5) to "strongly disagree" (1). The Cronbach's alpha of the questionnaire is .87.

### 3.3. Procedure:

Nowadays, individuals use more new learning environments because of their mobility. Since mobile technologies improve very fast nowadays, learning occurs at anytime and anywhere (Vinu, Sherimon *et al.* 2011). Mobile technologies potentially facilitate, improve and enhance interaction and collaboration, the processes that are known as a means of accessing, discovering, debating and sharing environmental concerns through MSN Messenger, short message services, electronic mail or multimedia messaging services (MMS). Although traditional classroom occasionally supports collaboration, it could also take place outside the classroom, unlimited by time, space or geography. Students can take photograph in subjects as use them as a means for sharing concerns with friends. Therefore students can ask questions which are related to the environment, learn new knowledge, collaborate with classmates and devise plans to solve environmental problems. In this study, the volunteer sample students included 60 males and females in institute language in thehran- Iran.. They are divided into two parts (control group and Experimental group). In the first stage we took a pre-test included California Critical Thinking Disposition Inventory Scale (CCTDI) and mobile learning systems Scale (UMLS). The pre-test was aimed to ensure that both groups of students had the equivalent basic knowledge required for learning the subject unit.

Table 1 shows the result of mobile learning systems Scale (UMLS) for control and experimental group. The mean value and standard deviation for pre-test in mobile learning systems are 42.20 and 20.20 for the controlling group, and 41.90 and 12.80 for the experimental group. According to the t-test result ( $t=0.87$  and  $p>.05$ ), it is evident that both groups of students had equivalent abilities prior to taking this unit. After 180 minutes of mobile and traditional learning for experimental and control groups relatively, according to T-test, the result of mean value and standard deviation for experimental group is significantly higher than that of the control group. Result shows mean and standard value for control group are 48.30 and 12.28 and for experimental group are 62.85 and 8.25 and ( $t=2.57$  and  $p<.05$ ). Table 1 presents the t-test results of the pre-test and post-test in mobile learning systems Scale (UMLS).

Table 2 shows result California Critical Thinking Disposition Inventory Scale (CCTDI) for control and experimental groups. First, the mean value and standard deviation in pre-test for (CCTDI) are 192.20 and 30.80 for the control group, and 194.90 and 34.80 for the experimental group. According to the t-test result ( $t=0.97$  and  $p>.05$ ), it is evident that the two groups of students had equivalent abilities prior to taking this unit. According to the result of t-test, after 180 minutes of mobile learning and traditional learning in experimental group and control group relatively, it was displayed that experimental group is significantly higher than control group. It is noticeable that the mean and standard value for control group are 220.20 and 32.27 and for experimental group are 257.85 and 38.52 and ( $t=3.49$  and  $p<.05$ ).

Also, this research shows that there isn't significant difference in critical thinking between males and females in control group and experimental group before and after t-test. Table 3 shows mean and standard deviation in pre-test and post- test between male and female before and after t-test.

**Table 1:** T-test of the pre and post-test UMLS results.

		N	Mean	S.D.	t	Sig
Pre-test UMLS	control group	30(13 male 17female)	42.20	20.20	0.87	0.90
	Experimental group	30(12male , 18 female)	41.90	12.80		
Post-test UMLS	control group	30(13 male, 17female)	48.30	12.27	2.57	0.05
	Experimental group	30(12 male , 18 female)	62.85	8.52		

**Table 2:** T-test of the pre and post-test CCTDI results.

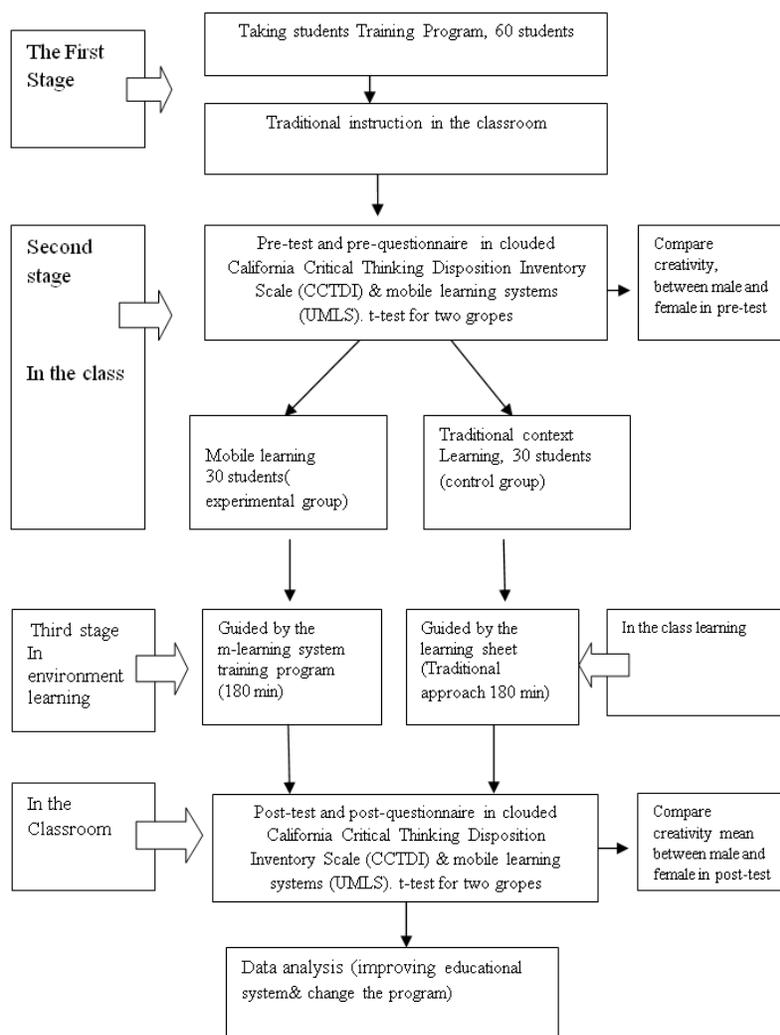
		N	Mean	S.D.	t	Sig
Pre-test CCTDI	control group	30(13 male 17female)	192.20	30.80	0.97	1.02
	Experimental group	30(12male , 18 female)	194.90	34.80		
Post-test CCTDI	control group	30(13 male, 17female)	220.20	32.27	3.49	0.05
	Experimental group	30(12 male , 18 female)	257.85	38.52		

**Table 3:** Mean and S.D between male and female in pre-test and post-test results.

Test	N	Mean	S.D	N	Mean	SD	t	Sig	
Pre-test CCTDI	control group	13 male	190.21	15.00	17female	189.90	13.07	0.65	0.90
	Experimental group	12male	193.20	12.03	18female	194.77	12.5	0.89	1.2
Post-test CCTDI	control group	13male	220.20	12.07	17female	219.81	12.3	0.88	1.24
	Experimental group	12male	256.05	7.72	18female	258.20	8.82	1.1	1.8

\* p> 0.05

Figure 1 shows process in this study. It can help to more comprehension and highlight important stages in this research.



**Fig. 1:** The experiment procedure in this study.

### 3.4. Data analysis:

The data was analyzed using descriptive statistical analysis, T- test in pre-test and post-test.

## Results and Discussion

The aim of present study is evaluating the effect of Mobile learning on the critical thinking in higher education. M-learning provides further flexibility for the learner to learn while moving at anytime and anywhere. ML potentially shifts learning to an outer activity and into students' environments, both virtual and real, thus re-conceptualizing learning as collaborative, personal, creative, situational, and lifelong. All the activities during the study were organized in a way that students could use their critical thinking skills. Kökdemir (2003) states when critical thinking education is the part of the current education, students are not only more successful academically but also they are more positive socially. Interestingly, the study of Ip *et al.*, (2001) stated that in the majority of sub-scales of CCTDI, students showed a negative disposition towards critical thinking.

Also this study answered the research question and as the main answer, result shows that between pre and post test of the experimental group is significantly higher than that of the control group. So, in the post-test the experimental group is more critical than the control group and the mean of experimental group is significantly higher than that of the control group. Also there is a significant difference between the experimental group and control group in the matter of the usefulness of mobile learning systems (UMLS).

However, as the participants in this study are small, more studies with larger participant and learning scope will be needed to make future research. Also more other researches can be done on the other subjects and different fields in higher education.

Overall, this study displays the use of mobile learning system on students' attitude toward critical thinking in higher education.

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