AN INVESTIGATION OF STUDENT ENGAGEMENT, MOTIVATION AND ATTITUDES TOWARDS COURSE CONTENT IN A MOBILE-LEARNING ENHANCED COURSE

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ABSTRACT

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This study aims to investigate the students' engagement, motivation and attitudes toward course content in a mobile-learning enhanced computer networking course where authentic collaborative activities were designed, developed and implemented. The computer networking course was a must course in Computer Education and Instructional Technology department curriculum. The participants of the study were 3rd grade students enrolled in the course. The effect of the activities on students' engagement, motivation and attitudes toward course content was investigated using a mixed-method research method. The activities were implemented for two subsequent semesters where the content and the instructional method were modified based on the findings from the first implementation before implementing it for the second time. In order to collect quantitative data on student engagement and attitudes toward course content two surveys were used. In addition, for measuring students' motivation a questionnaire was used. In order to further analyze the effect of the activities on students' engagement and motivation, follow up interviews were carried out in both semesters. The findings of the study indicated that the "personal development" was the component with the highest mean score in both semesters, followed by "satisfaction from the course" in the first implementation, and "collaborative-learning" in the second implementation, as the components of students' engagement.

“Satisfaction from the course” was the component with the third highest mean score in the second implementation as well. Paired sample t-test revealed a difference in “intrinsic value”, “cognitive strategy-use” and “self-regulation” as the motivational components in the first implementation. In the second implementation the differences were in the “self-efficacy”, “test-anxiety” and “self-regulation” components of the students’ motivation according to the t-test analysis results.

The content analysis on the interview transcriptions showed that the students’ perceived the activities as a proper enhancement for the computer networking course in terms of “communication” and “collaboration” with peers. Moreover, students highlighted the role of the activities regarding learning the computer networks concept. They stated that the activities requiring them to find analogical examples between the course content and real-world examples helped them in better understanding the course content, and their applicability in the daily-life.

Keywords: Authentic Learning, Collaborative Learning, M-learning, Real-world Examples, Students’ Engagement, Students’ Motivation, Students’ Attitudes

ÖZ

MOBİL ÖĞRENME DESTEKLİ BİR DERSTE ÖĞRENCİ KATILIMI, MOTİVASYONU VE DERS İÇERİĞİNE YÖNELİK TUTUMUN İNCELENMESİ

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Doktora, Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü

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Bu çalışma, otantik işbirlikli etkinliklerin tasarlandığı, geliştiriliği ve uygulandığı mobil-öğrenme destekli bir bilgisayar ağları dersinde öğrenci katılımı, motivasyonu ve ders içeriğine karşı tutumunu incelemeyi amaçlamaktadır. Bilgisayar ağları dersi Bilgisayar ve Öğretim Teknolojileri Eğitimi bölümü müfredatında zorunlu bir derstir. Çalışmanın katılımcıları derse kayıtlı 3. sınıf öğrencilerden oluşmuştur. Etkinliklerin öğrencilerin katılımı, motivasyonu ve ders içeriğine karşı tutumlarına olan etkisi karma araştırma yöntemi kullanılarak incelenmiştir. Etkinlikler, ardışık iki dönem süresince bilgisayar ağları dersi için geliştirilmiş ve uygulanmıştır. İkinci uygulamadan önce etkinliklerin içeriği ve öğretim yöntemi ilk uygulamada elde edilen bulgular kullanılarak değiştirilmiştir. Öğrenci katılımı ve ders içeriğine yönelik tutumla ilgili nicel verileri toplamak için iki anket kullanılmıştır. Ek olarak, öğrencilerin motivasyonunu ölçmek için ise bir soru formu kullanılmıştır. Etkinliklerin öğrencilerin katılımına ve motivasyonuna olan etkisini daha derinden incelemek için her iki dönem takip görüşmeleri yapılmıştır. Çalışmanın sonuçları, öğrenci katılımında "kişisel gelişim" bileşeninin her iki dönemde de en yüksek ortalamaya sahip olduğu, hemen ardından birinci uygulamada "dersten memnuniyet" in ve ikinci uygulamada "işbirlikçi öğrenme" nin geldiğini ortaya koymuştur.

“Dersten memnuniyet” ikinci uygulamanın da en yüksek üçüncü ögesidir. Bağımlı örneklem t-testi sonuçları, ilk uygulamanın motivasyon bileşenlerinden “içsel değer”, “bilişsel strateji-kullanımı” ve “öz-düzenleme” de fark olduğunu ortaya koymuştur. İkinci uygulamada ise, bağımlı örneklem t-test analizi “öz-yeterlilik”, “sınav-kaygısı” ve “öz-düzenleme” bileşenlerinde farklılık olduğu göstermiştir.

Görüşme transkriptlerinin içerik analiz sonuçları, öğrencilerin etkinlikleri arkadaşlarıyla “iletişim” ve “işbirliği” yönleriyle bilgisayar ağları dersi için uygun iyileştirme aracı olarak algıladıklarını göstermiştir. Öğrenciler ders içeriğiyle gerçek dünya örneklerini benzeştirmeleri gerektiren etkinliklerin ders içeriğini daha iyi anlamakta ve günlük hayattaki uygulanabilirliğini daha iyi kavramada yardımcı olduğunu belirttiler.

Anahtar sözcükler: Otantik öğrenme, işbirlikli öğrenme, m-öğrenme, gerçek-dünya örnekleri, öğrenci katılımı, öğrenci motivasyonu, öğrenci tutumu

To my Parents

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TABLE OF CONTENT

LIST OF TABLES

TABLES

LIST OF FIGURES

FIGURES

CHAPTER 1

INTRODUCTION

As the structure of the societies has changed during the years, the educational system requires and looks for modifications that could meet the needs of the new era which is called "information-age". The rapid growth of technological devices and information technologies encourages educators to enhance their instructional design with these learning technologies (Korucu & Alkan, 2011). Consequently, the first notion of e-learning and subsequently mobile-learning (m-learning) has emerged. Collaboration, emotional development, holism, and integration are considered as the main and required features of "information-age educational system" as defined by Reigeluth (2009). Various research studies such as Keller and Suzuki (1988); Kramarski and Feldman (2000); and Fox (2005) pointed out the relation between technology and students learning outcomes. Overall, the studies revealed an increase in students' interaction in technology-enhanced instruction. Technology was considered as an important tool in terms of what and how student should learned (Norman, 1993).

The role of group work has been mentioned by Nelson (1999) and Reigeluth (2009) respectively. The broadest definition of "collaborative-learning" is it is a situation in which two or more people learn or attempt to learn something together" (Dillenbourg, 1999, p.1). Concisely, collaborative-learning was explained as a situation that is expected to provide particular type of interaction among individuals (Dillenbourg, 1999). Collaborative-learning was considered as a student-centered learning enabling students to discuss and find solution in groups (Laurillard, 2009;

Stahl, Koschmann & Suthers, 2006). In addition, the importance of learners' and instructors' efforts was highlighted in the study by Devilliers (2011). The study by Cagiltay, Ozgit and Askar (1995) showed that learners' social skills and engagement increased via collaboration. Recently, collaborative-learning is not limited to classrooms settings due to the advancement of new technologies. Thus, Computer-Supported Collaborative Learning (CSCL) was emerged (Koschmann, 1996).

Authentic learning's roots reach back to the 1970s and 1980s when the researchers attempted to focus on the success of the traditional model of master and apprentice and its characteristics aiming to investigate the "cognitive apprenticeships". Authentic learning was defined by Herrington, Reeves and Oliver (2014) as a "pedagogical approach that situates learning tasks in the context of future use" (p.401).

A more detailed explanation of authentic learning Spector et al. (2014) explains it as:

> Authentic learning is a pedagogical approach that situates learning tasks in the context of real-world situations, and in so doing, provides opportunities for learning by allowing students to experience the same problem-solving challenges in the curriculum as they do in their daily endeavors. (p.401)

The framework by Herrington and Oliver (2000) for multimedia learning environment was generalized for higher education and analyzed for authentic learning and tasks. Consequently, the framework was designed for authentic learning which addressed e-learning and technology-based learning. In the recent years, the authentic learning received high consideration among researchers leading to emergence of the model by Herrington and Oliver (2000) as the model of instruction. The suggested model is a model different from the system models such as Gagne's Nine Events of instructional model enabling instructors and learners to enjoy from more realistic leaning settings and help to implement complex tasks.

Individuals' lives have been affected with technologies from different facets. Thus, educational domains attempt to use and integrate them. Mobile technologies have been used in different aspects of life, such as performing everyday tasks and socializing with friends, encouraging using mobile devices and technologies in learning the recent years. Mobile learning (m-learning) facilitates anyone to access

learning materials from anywhere and anytime (Ally, 2009). The advantages of learning outside of the classroom is supported by Eliasson, Knutsson, Nouri, Karlsson,Ramberg and Pargman (2012) as "one of the most promising arguments for introducing mobile devices to learning is to provide students with opportunities to learn outside the classroom, with direct access to contents and contexts relevant to the learning goals" (p.92).

The focus on students' engagement and the structure as well as methods to enhance their engagement has received attention of the researchers since 1980s (Zepke & Leach, 2010). Students' engagement has been observed by various educators since 1990s and different definitions have been given in various studies such as Newmann, Wehlage and Lamborn (1992), Kuh (2001), Mestre (2005) and Kahu (2013). Student engagement was defined by Kuh (2001) as the "Students' involvement with academically meaningful activities" (p.310). Student engagement was defined as the construct that includes both institutional practices and student behavior considering students' satisfaction and achievement (Kahu, 2013). Students' engagement are categorized as students' involvement in and out of the classroom, time and effort students expand increases learning, and effort institutions devote to using effective educational practices (Laird & Kuh, 2005). Kuh (2009) believed that students benefit if they have higher level of engagement stating:

> ...engagement increases the odds that any student – educational and social background notwithstanding – will attain his or her educational and personal objectives, acquire the skills and competencies demanded by the challenges of the twenty-first century, and enjoy the intellectual and monetary advantages associated with the completion of the baccalaureate degree. (p. 698)

Motivation was defined based on different theories starting with drive theory (Woodworth, 1918). Definition of motivation was explained using various theories such as conditioning theory, cognitive consistency theory and humanistic theory. Bandura (1991) defined motivation as the combination of both directive and actively process leading an action by individual. Students' motivation was explained by Pew (2007) as "the level of effort an individual is willing to expand toward the achievement of a goal" p.14). Motivation is defined in terms of intrinsic motivation

(i.e. learners engaged in an activity because it is interesting or enjoyable) and extrinsic motivation (i.e. learners engaged in an activity because he or she desires the outcome and wants to achieve some instrumental end such as earning a reward" (Ciampa, 2013). Students' motivation includes both philosophical and practical disciplines. Behavioral, cognitive, humanistic and biological perspectives are the ones which theories of motivation address (Pew, 2007). Behavioral theories define extrinsic motivation as increasing the desired behavior using positive or diminishing negative results (Pew, 2007). Humanistic view explains using learners' five different levels of hierarchical needs. Pew (2007) explains intrinsic motivation of students by stating "if students have their basic physical and safety needs met their needs for belongings, self-stem and self-actualization will intrinsically motivate them to achieve" (p.15).

Eccles and Wigfield (2002) considered students' motivation in terms of self-regulation for conducting their learning activities. They stated that learners need to be active "metacognitively", "motivationally", and "behaviorally" in their learning. Wigfield, Eccles, Schiefele, Roeser and Davis-Kean (2006) defined achievement motivation as the type of motivation which addresses the motivation for achieving higher performance while conducting tasks. Moreover, they highlighted the role of socialization, school and parents in learners' motivational level.

One of the comprehensive models in terms of students' motivation is Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and De Groot (1990). The framework of students' motivation was adapted from the expectancy-value including 1) expectancy component 2) value component and 3) students emotional reaction.The MSLQ was developed using a social cognitive view of motivation and self-regulated learning (Pintrich, 2003). The student' capabilities to self-regulate their learning were related to their motivation in this model.

1.1 Statement of the Problem

The current research focuses on two main problems, first decreasing student engagement and motivation in courses with technical content and, second the attitude towards content in these courses. The literature on student engagement covers

several studies such as Greenwood, Horton and Utley (2002) and Perie, Moran and Lutkas (2005) indicating the importance of students' dissatisfaction from a course and their dropping rate of engagement. Nowadays, there is a decrease in students' engagement and motivation. Decrease in students' satisfactions in educational setting points out a need to consider the learners' level of engagement (Delialioglu, 2012). Chickering and Ehrmann (1996) believed that ICT by itself cannot ensure students' success, whereas it can be assumed as a catalyst which needs to be taken into account for increasing the level of students' engagement and consequently their success in collage. The current study agrees with this idea and tries to increase student engagement, motivation and attitudes using authentic collaborative activities with mobile devices as the ICT catalyst.

A significant component of student engagement is collaboration among students. Collaboration could be enhanced by using different enabling technologies, such as social media and/or mobile applications to support students to work in groups. The use of computers for this aim created the Computer Supported Collaborative Learning (CSCL), which could facilitate more collaboration among students since they could be supported through visualization and argumentation tools (Lu, Lajoie & Wiseman, 2010). The problem with CSCL is that students need a computer to access the enabling tools, which creates a boundary in terms of space and time for the student. The notion of anywhere anytime is significant for extending the instruction from formal learning settings to informal, out of the school and class setting. Mobile technologies have the potential to support the required features of collaborative-learning such as easier information sharing, easier communication, and supporting representational and visualization tools. Lee (2011) explained the features of mobile collaborative learning as follows "…Context awareness, portability, connectivity and social interaction are among the features which are provided by Mobile Collaborative Learning (MCL)" (p. 44). Easier information sharing is the most important capability of mobile devices, which is in the center of collaborative-learning leading to accomplish educational activities (Lee, 2011). Another important feature of mobile devices in terms of collaborative-learning is their capability for providing easier connection and communication (Gil & Pettersson, 2010).

Mobile devices can be perceived as a promising tool for utilizing collaborative-learning inside the classroom rather than their use only outside the class (Frohberg, Goth & Schwabe, 2005). Hsu and Ching (2013) also pointed out the effectiveness of mobile applications for collaborative-learning in terms of increasing participation, sharing materials and facilitating communication. In addition, the results of the study by Alvarez, Brown and Nussbaum (2011) indicated that tablets provide more interaction among peers and increase the participation of group members. Similarly, students explained that their self-confidence increased in expressing their ideas using tablets in group studies.

Although the role of mobile technologies in educational domains was considered in the m-learning literature, there are not enough research studies on the use of instructional methods based on authentic learning principles to enhance student engagement, motivation and attitudes. The use and effect of mobile devices within the practices of authentic learning environment for enhancing students' engagement and motivation for learning has not been fully addressed. This gap in the literature was also highlighted in previous studies, specifically in terms of analyzing students' engagement and motivation in authentic m-learning environment (Laurillard, 2009; Orr, 2010). The main problem that was outline in a recent study as the importance of the context cannot be observed in the daily life, and the relevance of the pedagogy and real-world was ignored in formal learning settings (Spector et al., 2014).

1.2 Purpose of the Study and Research Questions

The features of authentic and collaborative learning were used in order to develop authentic collaborative m-learning activities for a computer networking course in this study. The activities were designed based on the guidelines suggested by Reeves, Herrington and Oliver (2002) and Jonessen (1999) for authentic and collaborative learning supported with m-learning anywhere and anytime access to learning materials capability. The study attempts to analyze the effect of the activities on learners' engagement, motivation and their attitudes toward course content.

A m-learning framework by Koole (2007) including the aspects (i.e. device usability, social technology, interaction learning) which are the intersections of learner, social and device aspects was considered in this study. This study aims to increase students' engagement in their learning using the interaction learning and social technology aspects of the m-learning framework. Since interaction learning provides more "action-oriented" learners rather than passive learners the use of mobile devices was considered as a useful approach. In addition, the role of mobile technologies for facilitating better collaborative-learning was mentioned in different studies which were discussed in previous section.

In the authentic collaborative m-learning activities, students were asked to work in groups to find real-world (analogical) examples of abstract course content in networking, such as bandwidth, throughput, LAN, WAN, from their daily lives enabling them to engage with the content after and class hour. Thinking and searching for a good fit analogical example about an abstract technical course concept from daily life could result in creating easier semantic links between the theory and practice knowledge of students, and could enhance student engagement, motivation and attitudes towards course content. Therefore, the activities could support student in better understanding of the abstract networking concepts. In addition, collaborating with group-mates and discussing the examples could lead to explore more detailed information about the concepts. The study tries to explore whether students' collaboration and interaction will increase while doing the authentic activities. Collaboration with peers provides potential to students to find more refined answers and be more active in their learning process. The activities in this study were presented by means of a mobile application of social learning platform.

The questions which the study attempts to answer are:

1. How do authentic collaborative m-learning activities affect the engagement level of undergraduate students in a computer networking course?
2. How do authentic collaborative m-learning activities affect the level of undergraduate students' motivation in a computer networking course?

3. To what extent authentic collaborative m-learning activities have an effect on students' attitudes toward course content?

1.3 Significance of the Study

Students' dissatisfaction from the course and their dropping out has been linked to the lower level of engagement (Greenwood, Horton & Utley, 2002; Perie, Moran & Lutkas, 2005). Considering the advantages of authentic learning for facilitating learners' engagement, which was also highlighted in the studies such as Wang, Shen and Novak (2009) and Jones, Scanlon and Clough (2013) for new educational paradigm led us to analyze the effectiveness of the features of authentic and collaborative learning in this study. The current study aims to add to the literature on technology enhanced learning and m-learning specifically in regard to design, development and implementation of authentic collaborative m-learning environments. Besides, accomplishing the goals of the study will help educators to enhance students' engagement using the features of authentic and collaborative learning.

Collaborative and active learning are among primary constructs for improving learners' engagement. Moreover, authentic-learning was noted as the useful approach for increasing learners' interaction with peers and instructor which is also as the requirement for engagement of students. Therefore, this study attempted to develop learning activities named as "authentic collaborative m-leaning activities" in order to enhance students' engagement. It was hypothesized that students would be exposed to more authentic type of learning while their collaboration and interaction could increase with each other and instructor using these activities. The mobile application of social learning platform as the social technology aspect of m-learning framework could also facilitate learners' collaboration without time and location constrains.

More collaboration could be achieved among peers while their interaction would also increase thanks to the capabilities of mobile devices. Integrating the authentic collaborative m-learning activities could help students to discover their skills.

Searching and finding an analogy between abstract course content and examples in daily-life could help students to understand the content easily. The activities could enable students to understand the applicability of the theory in daily-life finding the analogical relation between course content and their real-world examples.

Receiving feedback from instructor is another important factor to increase students' interaction with instructor that engages them more in learning settings. On-time and detail feedback would guide students to do the activities in a structured way and result in better understanding the concept. The second important point was the role of grade which increases students' willingness for conducting such activities besides informing them about their progress.

CHAPTER 2

LITERATURE REVIEW

The second chapter presents the review of the literature for the theoretical foundation of the study. The chapter includes studies and researches related to the educational technology, the role of technology in terms of collaborative-learning, and mobile learning. The definition of students' engagement, motivation, and student attitudes towards course content and the related literature which considers the relationship among them are presented.

2. 1 Educational Technology

The term "Educational Technology" is sometimes referred as technology in Education and Instructional Technology. However, Association for Educational Communication and Technology (AECT) (2004) perceived them as separate terms. According to AECT (2001) Educational Technology is "The study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources." AECT (2001) considers Instructional Technology as "the theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning." Saetter (1990) used as the term educational technology while James Finn considered as the person who used the term instructional technology as a first time. The study by Gurbuz (2004) the definition of educational technology was addressed as:

> Education in Technology simply means the application of technology to any of the educational process" and "Instructional Technology as the body of work devoted to the uses of technology in instruction is a subset of educational technology, so it does encompass all of the processes involved in educational technology. (p.33)

Various technology-enhanced learning models have been tested during the years. Duffy and Jonassen (1991) considered instruction technology from the instructivist perspective. Instructional system design might help to identify the materials which are needed to be taught, the way they should be taught and their evaluation (Gurbuz, 2004). Technology plays important role in what is required to be learned as well as how it should be learned. Moreover, this type of learning leads to the development of technology (Norman, 1993). Technology is considered as an effective tool which provides more students' engagement enhancing inquiry-based learning. Therefore, learning becomes more student-centered rather than teacher-centered. Carroll (2000) explained that "education is rapidly moving towards new learning environments that will have no teachers or students- just learners with different level and areas of expertise collaboratively constructing new knowledge" (Carroll, 2000 p.126).

The integration of new technologies into individuals' lives encouraged educational researchers and practitioners to include them in different learning settings. Due to the growing rate of technologies, especially wireless and mobile technologies, educational domains cannot be excluded from this change in society. Therefore, new types of learning method such as electronic-learning (e-learning) and mobile-learning (m-learning) have emerged. Various research studies revealed the connection between technology and students' learning outcomes in different fields (Keller & Suzuki, 1988; Kramarski & Feldman, 2000; Fox, 2005). In addition, their study showed an increase in cooperation and interaction between students in technology-enhanced learning settings. Looking on different interpretation, Roblyer (2006) categorized educational technology into four groups. The first perspective considered the role of technology as media, such as videos, films and etc. as a replacement of books and lectures. The second view emphasizes on the construction of technology enhanced instructional systems. The third view pointed out the educational technology as the technology education. The fourth perspective refers to it as the computing system which could support administrative work of educators and staffs in the educational

domain. The current study is coherent with the second view that is the use of technology to support learning.

The adoption and use of the technologies by students in their learning process needs to be analyzed from different perspectives (i.e. social technologies, researching at university and pedagogical use of technology in school) (Herrington & Parker, 2013). In the study conducted by Herrington et al. (2013) each of aforementioned issues were addressed. In order to analyze students' adoption of the technologies in their life (social technologies) they were asked to develop a family tree using web technologies. Researching a curriculum topic such as solar energy using different tools was considered as an example of an application of technology for researching. Regarding the third issue (i.e. using technology for teaching and learning) students were asked to develop and publish some materials in online environments. The results of the study indicated that some students perceived web 2.0 tools as not so efficient for learning whereas some others expressed very slight problems in terms of using technologies for their learning. In addition, some of the participants explained that they could not follow the fast pace of the technologies and they felt "left in the shadows".

2.2 Collaborative- Learning

In the study by Devilliers (2011) collaborative- learning was defined by emphasizing the effort among learners and instructors. Collaborative-learning was considered by Rosschelle and Teasley (1995) as "the mutual engagement of participants in a coordinated effort to solve a problem together" (p.70). Collaborative- learning is a student-centered learning where students discuss, find solution in groups (Laurillard, 2009; Stahl, Koschmann & Suthers, 2006). The importance of group work and community-based learning has been mentioned by Nelson (1999) and Reigeluth (2009) respectively. Nelson (1999) indicated that there is a need for more comprehensive collaborative- learning environment by stating"…cooperative learning is not usually conceived in the context of problem-based learning and problem-based learning does not always require collaboration" (p. 245).

Cooperative learning and problem-based learning were considered as the most important approaches of collaborative-learning. Moreover, importance of the inquiry-learning in collaborative-learning has been emphasized in different studies through various aspects. Dillenbourg (1999) also stated that engagement by refereeing to Bell, Urhahne, Schanze and Ploetzner (2010) "inquiry learning often incorporates an element of collaboration meaning the engagement of participants in a common endeavor" (2010, p.351).

Collaboration increases students' social skills, achievement, and engagement (Cagiltay, Ozgit & Askar, 1995). Collaboration and collaborative-learning are not limited to classroom settings and could be enhanced using Computer Mediated Communication (CMC). Computer-Supported Collaborative Learning (CSCL) emerged due to advancement in Internet and ICT (Koschmann, 1996). CSCL was the term in the literature highlighting the role of the computers for supporting collaborative learning. In the case study by Lu, Lajoie and Wiseman (2010), the effect of role playing was considered in a CSCL environment. They found that CSCL can lead to more collaborative-learning as long as it supports visualization and argumentation tools (Lu et al., 2010). Moreover, they claimed that CSCL could provide more interactive contextualized learning. Using a shared and interactive whiteboard for facilitating visualization and argumentation, each student had the chance to participate in the learning process. Using a "Mindtool" to guide students for organizing their knowledge in collaborating with each other, students' achievement was significantly better (Sung &Hwang, 2013).

2.3 Mobile-Learning

The notion of m-learning has emerged and received high consideration in educational research. The use of m-learning in the formal and informal learning education settings with wide range of applications was investigated (Sharples, 2013). Portability, immediacy, individuality, connectivity and accessibility which are in the center of m-learning are among the important features of mobile devices (Ally, 2009).

In the literature on m-learning there is no single agreed definition due to the variety of research and interpretation of it (Sharples, Arendillo-Sanches, Milrad & Vavoula, 2009). However, the understanding of m-learning in the current study is close to the definition of Ally (2009), which states that m-learning enables individuals to access information and learning materials from anywhere at anytime by using wireless mobile technologies. Various researches focus on different aspects of mobile learning such as study by Sharples et al. (2009) which addressed the mobility. In their study, the mobility was considered in terms of physical, conceptual and social features. The study by Parsons and Ryu (2006) referred to the characteristics of access while the immediacy was analyzed by Kynaslahti (2003). The ubiquity, convenience and contextuality were addressed in the studies by Kukulska-Hulme et al. (2009), Kynaslahti (2003) and Kearney, Schuck, Burden and Aubusson (2012). As an emerging new term, m-learning is different than e-learning where learners were limited to access information at home or work using their PCs. Thus, they could not access their courseware and materials while they are transiting (Motiwalla, 2007). Besides, wireless technologies allow learners to access information not only from anyplace, but from anywhere (Peters, 2002). Therefore, m-learning refers to learning without time and location constrains.

The need to access to information and knowledge without time and location constrain, the role of formal education and specifically relationship between education, society and technology become more dynamic. According Traxler (2007), m-learning has changed the nature of learning and its delivery. Learning used to be delivered "just-in-case" changed into "just-in-time, just enough, and just-for-me". Moreover, finding the information rather than knowing it, has become the defining characteristics for m-learning. The role of mobile technologies becomes apparent especially in using real-world problems and projects in learning, which is also referred as authentic learning. In authentic learning, learners are engaged in exploration and inquiry where students need to access resources and make social discourse on related content. M-learning provides easier access to resources and provides opportunity for social discourse while at the same time providing location-awareness and collaboration tools for students, including face to face and distance learners (Traxler, 2007).

The most important benefit of m-learning is that it provides interaction beyond the classroom by means of computer networks (Baran, 2014). The importance of accessing information ubiquitously, immediately and conveniently are important for teachers while helping student to learn better (Kynaslahti, 2003). Since individualized, learner-centered, situated, collaborative, ubiquitous and continuing learning is more required, ICT attempted to answer these changes (Motiwalla, 2007). Several newly developed mobile technologies such as location awareness, cameras, social networks and web browsers could be listed as examples of the mentioned ICT tools and could facilitate individualized, learner-centered, situated, collaborative learning (Chen et al., 2012).

Various studies address different issues m-learning during 20 years such as the studies by Jairank, Praneetpolgrang and Mekhabunchakij (2009) and Liaw, Hatla & Huang (2010) regarded the acceptance of m-learning; the importance of personalization in learning was addressed in the study by Yarandi, Jahankhani and Tawil (2012). In the study Weinbrenner et al. (2012) and Forbus, et al. (2008) emphasis has been laid on semantic interpretation of digital sketching and sketch understanding in terms of cognitive science. The study by Baran (2014) which addresses the role of m-learning in teacher education revealed that:

> Several pedagogical affordances support mobile learning integration into teacher education settings. As educators begin to understand the potential of mobile learning in education, the role of teacher and teacher educators in integrating mobile devices becomes essential in addressing students' learning needs across several disciplines. (p.29)

M-learning applications such as ubiquitous and augmented game (Fotouhi-Ghazvini, Earnshaw, Robinson & Excell, 2009) using audio /video streaming and podcasting (Walls, Kucsera, Walker, Acee, McVaugh & Robinson, 2010; Mandula, Meda & Jain, 2012) were developed for different learning settings.

M-learning is a broad term covering different components related to infrastructure, device, people and learning. To understand each component by itself and their intersections that effect learning an arching framework was needed. A framework which could address the technical characteristics of mobile devices, social and personal aspects of learning is required to locate and understand m-learning. Such a

frame work was developed by Koole (2007) which was referred as the Frame Model as presented in figure 2.1.

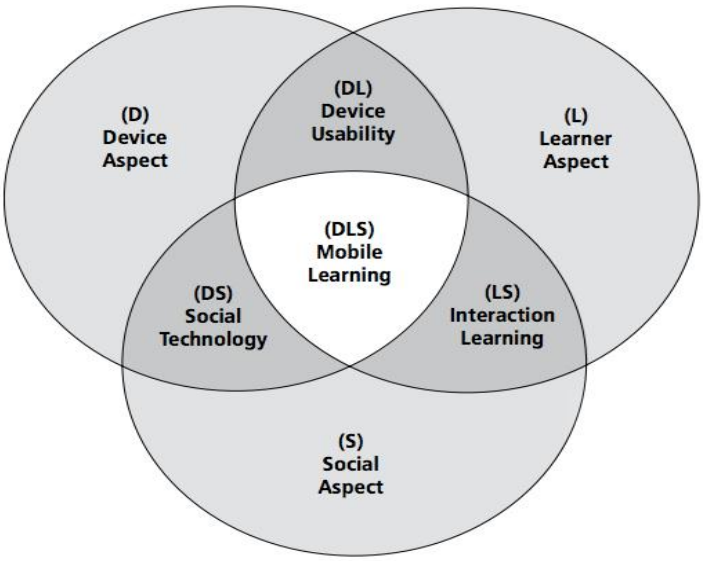


Figure 2.1: Frame Model for M-Learning

The frame model includes three aspects of m-learning as follows:

Device aspect (D): Refers to device characteristics. The characteristics result from the hardware and software design of the device which affects comfort level of the users.

Learner aspect (L): Addresses how learners use their prior knowledge encode and transfer information. This aspect can help learners to utilize learners' memory related to actual and authentic experiences. Driscoll (1994) mentioned that this type of ability help learners to remember the concepts and transfer them to different context. Koole (2007) stated that "Actively selecting or designing learning activities rooted in authentic" (p.31).

Social aspect (S): According to Koole (2007) the social aspect considers the social interaction and cooperation enabling them "to exchange information, acquire knowledge and sustain cultural practices" (p.31).

The intersections of three aspects result in the ideal m-learning. The Frame Model includes the intersections of the three aspects and intersections which belong to different aspects as follows:

Device usability intersection (DL): Refers to both device (D) and learner (L) aspects. It affects the users' comfort by influencing cognitive load; access to information as well as enable them to move different location either physically or virtually (Koole, 2007). Portability, information availability, psychological comfort and satisfaction are the criteria of device usability intersections (Nielse, 1993). Portability and information access are the important concepts in mobile usability. They are influenced by the physical features of the device such as size. Psychological comfort refers to how quickly a learner understands the use of device. However, the ease of use is an important facet which can help learner to focus on cognitive task.

Social technology intersection (DS): Demonstrates how mobile devices facilitate communication and collaboration. Shneiderman and Plaisant (2005) categorized this aspect into three categories (i.e. device networking, system connectivity and collaboration tools). Devices need to support connection to other devices using wired or wireless networks. Wireless technologies are the most significant feature of mobile tools in social technology intersection (DS).

Interaction learning intersection (LS): Regarding (LS) Smith and Ragan (1999) defined learning as "collaborative with meaning negotiated from multiple aspects." (p.36). Smith and Ragan (1999) considered the authentic contexts as the main aspect of situated cognition for learning. Authenticity does not require learners to interact with each other directly, but the results of these kind of activities address the real and lager community (Koole, 2007). Therefore, learners are more "action-oriented" rather than passive learners (Framer, Buckmaster & LeGrand, 1992). Different electronic technologies such as "shared calendars" engage in various type of collaboration. Interaction learning intersection (LS) relay mostly on philosophy of social constructivism.

Mobile learning process (DLS): The intersections of device (D), learner (L) and social (S) aspects result in effective mobile learning. M-learning utilizes enhanced collaboration among learners, information access and deeper conceptualization of

learning. M-learning facilitates distance learners interaction with their peers and instructor to provide enhanced cognitive environment (Koole, 2007).

In this study, m-learning framework was used emphasizing the interaction learning (LS) and social technology (DS). The authenticity and collaboration in learning mentioned as the primary features of this aspect. In addition, collaboration was considered as the important facet of the interaction learning. The authentic contexts increases students' interaction and results in more active type of learners (Koole, 2007). Active-learning, collaborative-learning and interaction with instructor were used as the concepts to assess students' engagement in the NSSE survey that is used in this study as well. Thus, it was hypothesized that the use of the features of collaborative-learning and authentic-learning can be useful in order to design an effective authentic learning environment in which students enjoy the better collaboration with each other. The role of mobile devices in terms of effective collaboration has been emphasized in different studies such as Hsu and Ching (2013); Lee (2011); Gil and Pettersson (2010); Echeverria, Nussbaum, Calderon, Bravo, Infante and Vasquez (2011) Frohberg, Goth and Schwabe (2005) Alvarez, Brown and Nussbaum (2011).

In the literature the interaction learning (LS) and social technology (DS) has been investigated by Lee (2011) referring to is as the Mobile Collaborative Learning (MCL). He claims that MCL provides various advantages such as "… context awareness, portability, connectivity and social interaction" (p.44). He also points out that mobile devices are successful in terms of supporting collaboration since they provide information-sharing tools for accomplishing pedagogical activities (Lee, 2011). Regarding the LS-DS aspects of the Frame model, the study by Hsu and Chang (2013) investigated the role of mobile devices in terms of how they support collaborative- learning as well. They analyzed 15 experimental or quasi-experimental mCSCL (mobile Computer-Supported Collaborative Learning) and selected the papers were published from 2000-2011 which addressed the use of mobile technologies in collaborative- learning in their literature review. Used keywords for searching through databases were (i.e. mobile learning, CSCL, mCSCL and handheld). The studies revealed that mCSCL improved students' understanding

of concepts and applications which refers to the interaction learning aspect of mobile framework.

The device usability (DL) aspect in the Frame Model was addressed in the study by Gil and Pettersson (2010) and perceived mobile devices as an effective tool in terms of collaboration while they could provide flexible activities as long as the activities can be adapted to various contexts. The study by Gil et al. (2010) exemplified the role of mobile technologies as a flexible learning system by explaining Collpad *"*a project which supported collaboration using PDA and netbooks*"* (p.167). It was mentioned that Collpad not only enabled learners to answer the questions, but also to share, discuss and provide feedback on the answers given by peers. Therefore, mobile devices played two different roles in the project since they acted as clients in students' PDA as well as servers in teachers' devices (Gil et al., 2010). Different characteristics of mobile technologies such as their flexibilities in learning activities, demonstrated their effectiveness in collaborative-learning as well. In addition, it was highlighted that mobile devices might play an important role as a connectivity provider in future studies referring to the device usability aspect.

In this study, mobile application of social learning platform was used in order to facilitate and enhance students' collaboration and interaction with their peers and the instructor. Various m-learning research and projects have been conducted recently using different instructional methods and mobile technologies. They were implemented in various learning contexts and educational levels. Systematic literature review of m-learning researches revealed that inquiry-based learning was the most frequently used method in m-learning projects and research. Students' engagement and just-in-time learning were the concepts that were considered for choosing m-learning method. The literature review also showed that m-learning researches were applied mostly for K12 settings rather than higher education (Alioon & Delialioglu, 2014). In the higher education research on m-learning by Cheon, Lee, Crooks and Song (2012) analyzed the factors which could provide better m-learning in higher education using theory of planned behavior. The study by Cheon et al. (2012) demonstrated that higher education needs to consider "…design guidelines,

development phases and articulating norms and considering the current level of students' readiness" (p.1062).

2.4 Authentic Learning

Authentic learning as an instructional approach roots back to the 1970s and 1980s when the educational researchers attempted to focus on the success of the traditional model of master and apprentice and its characteristics to investigate the "cognitive apprenticeships theory" (Herrington, Reeves & Oliver, 2014). Herrington et al. (2014) defined authentic learning as "a pedagogical approach that situates learning tasks in the context of future use" (p.401). Authentic learning was based on the theory of situated cognition. In the courses which use the authentic tasks, the tasks are the essential for engaging students in the course rather than only practicing skills that they have learned in the content-focused approach Woo, Herrington, Agostinho, & Reeves, 2007).

A model for authentic learning environment, which considered the design and implementation of the authentic learning environments, was developed by Herrington and Oliver (2000). It was a system model similar to Gagné's nine events of instruction (Gagné, Briggs, & Wager, 1992). The model for authentic learning environment was uused to develop the framework for multimedia learning environment by Herrington and Oliver (2000). The framework was generalized for higher education for analyzing authentic learning environments and tasks. The original model for authentic learning environment was redesigned and applied to the e-learning environments in 2010 (Herrington, Reeves & Oliver, 2010). According to the new model, an authentic learning environment may provide learning settings which could demonstrate the complex conditions of real life and its limitations (Herrington & Oliver, 2000). The courses which were enhanced with the authentic tasks are being implemented in various countries in recent years (Herrington et al., 2010).

Gulikers, Bastiaens &Martens (2005) found that students faced problems related to the applicability of the course topics learned in the class to their real life (Gulikers,

Bastiaens &Martens, 2005). Since real-world could be simulated by means of technologies, simulators could be used in developing authentic learning environments (Gulikers et al., 2005). Authentic learning environments might provide cognitive and motivational advantages for students. Gulikers et al. (2005) stated that "The motivational effect of authentic environments is that these contexts make it easier for students to identify themselves with the learning materials and making learning more interesting and meaningful" (p.511).

Designers of authentic learning environments can use multimedia in order to provide some experimental tasks which could enable students to conduct the task similar to real life. Moreover, use of multimedia can facilitate learning of the new ideas by using discovery learning and active exploration, which are in center of authentic learning. More interactive learning environment can be designed using technologies which enhance students' understanding of the new ideas (Gulikers et al., 2005). Spector et al. (2014) also defined the authentic learning as:

> Authentic learning is a pedagogical approach that situates learning tasks in the context of real-world situations, and in so doing, provides opportunities for learning by allowing students to experience the same problem-solving challenges in the curriculum as they do in their daily endeavors (p.401).

Studies focused on the role of technologies for implementing authentic learning in terms of higher education (Oldfield & Herrington, 2012). The importance of authentic learning for language learning was addressed in the study by Nikitina (2011). It is important that a language learning program provides learning settings which enable students to use a real-world language (Nikitina, 2011). The study considered the role of a video project which was implemented for Russian language learning students in Malaysia where students were asked to create their own scenarios and write the video scripts. The videos had to be in Russian and had to include vocabulary items learned in the class. The videos must contain role-play activities and all group members should participate and speak in them (Nikitina, 2011). The results of the study indicated that creating videos provide opportunity for students to develop their own learning situations. It also enabled students to share their videos with their peers and communicate with them about the relevant issues

(Nikitina, 2011). The study demonstrated that preparing videos by students showed more real type of learning than performing role play in the classroom, because students could enhance their videos using different materials such as photos from familiar places (i.e. campus, canteen and shopping mall or use music etc). The study showed that students were more active and effective in terms of linguistic performance compared to previous semesters. Students also expressed that they were more confident in speaking Russian. The non-linguistic results of the study explained by students were about social skills. The students in the study by Nikitina (2011) expressed that they learned to be more "…useful, reliable an efficient team member while others mentioned that they had learned about tolerance, responsibility, perseverance "how to never give up", and the importance of time management" (p.43).

2.5 Students' Engagement

The focus on students' engagement, the structure as well as methods to enhance engagement has received attention of educators in the 1980s (Zepke & Leach, 2010). Students' engagement has been observed by various educators since 1990s and different definitions have been given. Newmann, Wehlage and Lamborn (1992) defined student engagement as "the students' psychological investment in and effort directed toward learning, understanding or mastering the knowledge, skills or crafts that academic work is intended to promote" (p. 12,13). Various pedagogies related to student engagement emerged, such as "cooperative or collaborative learning, active learning, case-based learning and hands-on learning" (Mestre, 2005, p.24). The main idea in all of these was to provide a learning environment where students were active, applying the new information to create their knowledge rather than being passive learners (Mestre, 2005). The main focus of pedagogies related to student engagement is the student, not the instructor. Active learning requires students' active engagement with the learning environment and collaboration with their peers while constructing the knowledge. Students spend time on refining the knowledge and applying them in different situations. Students also rely less on direct instruction of the teacher and take more responsibility.

Kuh (2001) defined the engagement as students' active participation in academic activities; time and effort spend on academic work either inside or outside the classroom. Laird and Kuh (2005) considered the relationship between engagement and information technology as stating:

> The relative strength of the positive relationships between academic uses of information technology and engagement, particularly academic challenge, student–faculty interaction, and active and collaborative learning, suggest that, at the very least, engagement in one area often goes hand-in-hand with engagement in other areas." (p.230)

Different studies (e.g. Greenwood, Horton, & Utley, 2002; Perie, Moran, & Lutkus, 2005) linked the students' dissatisfaction from the course as well as their dropping out of schools to learners' low engagement. Students' engagement in higher education has received ever-increasing attention. The most controversial aspects of it are related to the differences between the state of engagement and its antecedents and consequent (Kahu, 2013). Zepke and Leach (2010) believed that "…Active learning in groups, peer relationships and social skills are important in engaging learners" (p.171). Furthermore, peer interaction was found as the most useful concept for predicting capacity of engagement and outcomes (Zepke and Leach, 2010). Student engagement was defined as the construct includes both institutional practices and student behaviors considering students' satisfaction and achievement (Kahu, 2013). The studies by Pascarella and Terenzini (1991) and Ginns and Ellis (2007) students' engagement was considered as the primary component in terms of learners personal development and learning either in traditional or technology-enhanced learning. One of the most important frameworks for students' engagement in higher education is "seven principles of good practices in undergraduate education" proposed by Chickering and Gamson (1987). The framework considers following concepts in terms of students' engagement:

1. Increases the contact between student and faculty
2. Provides opportunities for students to work in cooperation
3. Encourages students to use active learning strategies
4. Provides timely feedback on students' academic progression
5. Require students to spend quality time on academic tasks

6. Establishes high standards for acceptable academic work
7. Addresses different learner needs in the teaching process

Some of the definitions of engagement provide more covering, multifaceted explanations. Fredricks, Blumenfeld and Paris (2004) provide three engagement types, i.e. behavioral engagement, emotional engagement and cognitive engagement:

Behavioral engagement: refers to involvement in academic and social activities which result in positive academic outcomes while preventing drop out.

Emotional engagement: includes positive and negative reactions of students to instructors, peers and school which affect their tendency to work.

Cognitive engagement: refers to investment and effort which is required for understanding ideas and learns skills.

In the current study, students' engagement refers to the aforementioned definition by Kuh (2001). Students engagement level was analyze using National Survey of Student Engagement (NSSE). The NSSE included 70 items which evaluate the time and energy that students spend on the academically purposeful activities. The NSSE has been accepted and used by more than 1000 colleges and universities (Korkmaz, 2007). In NSSE engagement includes both behavioral and psychological elements (Kuh, 2001). The used NSSE survey in this study includes 7 categories, (i) Active learning, (ii) Collaborative-learning, (iii) Interaction with instructor, (iv) Student effort, (v) Feedback, (vi) Satisfaction from the course, and (vii) Personal development.

Active learning refers to student-driven behavior for understanding the course content and procedure (Korkmaz, 2007). Active learning requires students' active engagement with the learning environment and collaboration with their peers while constructing the knowledge. Students spend time on refining the knowledge and applying them in different situations. Students also rely less on direct instruction of the teacher and take more responsibility. Chickering and Gamson's (1987) mentioned that students are required to cooperate with each other both inside and outside of the classroom.

Collaborative-learning is a student-centered learning where students discuss, find solution in groups (Laurillard, 2009; Stahl, Koschmann & Suthers, 2006). Wang (2007) addressed the role of critical thinking by using the shared meaning concept. The broadest definition of "collaborative-learning" by is Dillenbourg (1999) is "it is a situation in which two or more people learn or attempt to learn something together" (p.1).

Interaction with instructor was considered by Chickering and Gamson's (1987) among seven principles of good practice. They mentioned that frequent student-faculty contact as the most important factors in student motivation and involvement (Korkmaz, 2007, p.25). Academic skills, social self-confidence, self-concept, academic and social integration, leadership abilities and satisfaction and persistence are among the outcomes of meaningful interaction among learners and instructors considered by various studies such as (Astin, 1993; Kuh & Hu, 2001; Pascarella & Terenzini, 2005; Woodside, Wong & Wiest, 1999).

Student effort was categorized by Carbonaro (2005) based on rule oriented, procedural, and intellectual effort. He defined effort as "the amount of time and energy that students expend in meeting the formal academic requirements established by their teacher and/or school" (p.28). The definition for effort needs to be distinguished from definitions of three other concepts. First of them is resistance, which was considered in the study by Willis (1977). Second concept is related to motivation and self-efficacy as long as they cover the reason of the different amount of effort among students. Third element is the engagement. Although, engagement described by the actions such as attending the class, spent time on the homework, engagement refers students' interest and attachment to their school (Newmann, 1992). In the study by Zhao and Kuh (2004) academic effort referred to study time and was assessed considering the concepts related to the extent they spent to understand the course and comparison of their effort in the course with other courses. Zhao & Kuh, 2004 stated that "All students should have the chance to benefit from structured efforts that create conditions for connected learning and promote integration of their academic and social experiences" (p.20).

There are different understanding and definitions about **feedback**. It was commonly defined as the information explained to students by teachers (Bound & Molloy, 2013). Based on the work by Ramaprasad (1983) and Sadler (1989) the purpose of feedback considered as the process which attempted to modify the gap between actual level of performance and the desired learning goal. However, other studies explained that the learning environment, the needs of the learner, the purpose of the task, and the particular feedback paradigm adopted could affect the functionality of feedback (Knight & Yorke, 2003; Poulos & Mahony, 2008). Socio-constructivist view of feedback, with highly received attention recently defined feedback as the facilities that provide comments and suggestions to students in order to help them to understand materials rather than oblige them to specific understanding (Archer, 2010). Regarding the students' engagement in higher education the emphasis laid on the students' active participation which was not perceived the sufficient element to enjoy the advantages of feedback (Bound & Molloy, 2013).

Students' satisfaction was defined as the learners' perceptions on education and educational settings value (Astin, 1993). The importance of satisfaction was pointed out in terms of motivation (Chute, Thompson & Hancock, 1999; Donohue & Wong, 1997) academic success (American Psychological Association, 1997) and retention (Astin, 1993; Edward &Waters, 1982). The most important factors influencing the students' satisfaction was addressed by Bradley (1986) as (cited in Bolliger & Martindale, 2007) "(a) academic integration, (b) institutional fit, (c) quality and usefulness of education, (d) social life, and (e) difficulty of the program" (p.62). Satisfaction from the course considered the questions refer to the quality of instruction and overall learning environment (Delialioglu, 2012). The study by Bichelmeyer et al., (2006) revealed that the used materials in networking courses as the technical course were difficult. Nevertheless, in the study by Delialioglu (2012) students were more satisfied with the course which was held as the blended learning environment. One explanation for this outcome could be that the course materials include various resources such as multimedia, simulation, hands-on activities and games delivered over the internet with live classroom sessions" (p.320). Therefore,

the role of easy-access to various types of information as well as use of different tools was apparent in order to increase learners' satisfaction from the course.

Personal development is the result of the prior experience (Leigh, 1999). Identity was considered as the primary element in terms of self. Self is a social component which could evolve through Interaction with other in societies result in the increment of the self (Baumeister, 1997). This evolution is a result of various processes such as psychological motivation and acting different roles (Fitzgerald, 1993). However, Grotevant (1992) emphasized the importance of others' responses of and previous experiences in terms of ones' identity and noted it as the essential factors in terms of well-being and positive personal development. It was considered that the school and interpersonal relationship in the school affect the construction and evolution of identity as the aspect of personal development (Grotevant, 1992).

The study by Chen et al. (2010) revealed that integrating web and the internet in learning settings not only increases students' level of engagement, but also provides active and collaborative type of learning environment which facilitating higher thinking level. Chickering and Ehrmann believed that ICT by itself cannot ensure students' success, whereas it can be assumed as a catalyst which needs to be taken into account for increasing the level of students' engagement and consequently their success in collage (Chen et al., 2010). Although the study by Chen et al (2010) did not explore and mention about the nature of existing relationship between the use of technology and student engagement, it emphasized the role of technology for intensifying the relationship between technology usage and learners' engagement stating that "correlation is persisting even as new technologies are being introduced and students are entering collage with increasingly sophisticated uses for and expectation of technology in their lives and on campus" (p.1230).

2.5.1 M-learning and Students' Engagement

Due to the penetration of technologies and specifically mobile devices in individuals' lives, their usage in educational domains has received an ever-increasing attention. Lee (2011) believed that use of Mobile Collaborative Learning (MCL) provides

various advantages such as "…context awareness, portability, connectivity and social interaction" (p. 44). It was mentioned that mobile devices are successful devices for collaboration as long as they provide information-sharing for accomplishing pedagogical activities (Lee, 2011). Study by Hsu and Chang (2013) considered the role of mobile devices in terms of collaborative learning. They analyzed 15 experimental or quasi-experimental mobile Computer-Supported Collaborative Learning (mCSCL). The studies revealed that mCSCL improved students' understanding of concepts and applications.

The study by Gil and Pettersson (2010) exemplified the role of mobile technologies as a flexible learning system by explaining Collpad "a project which supported collaboration using PDA and netbooks" (p.167). It was mentioned that Collpad not only enabled learners to answer the questions, but also to share, discuss and provide feedback on the answers given by peers. Therefore, mobile devices played two different roles in the project since they acted as clients in students' PDA as well as servers in teachers' devices (Gil et al., 2010). Different characteristics of mobile technologies such as their flexibilities in learning activities, demonstrated their effectiveness in collaborative- learning as well (Gil et al., 2010).

The study by Gil-De-La-Iglesia Andersson and Mirlad (2010) focused on Emerging Learning Objects (ELOs) and defined it as "Information created as a result of learning activities" (p.137). They explained the role of m-learning in terms of ELOs stating that "ELOs are one of the most important additions that m-learning brings to the education arena."(p.137). Furthermore, they stated that there is a need for more collaborative- learning and knowledge-sharing in educational domains (Gil-De-La-Iglesia et al., 2010).

The usefulness of mobile devices in collaborative-learning was pointed out in the study by Echeverria, Nussbaum, Calderon, Bravo, Infante and Vasquez (2011). The study by Meurant revealed that it is required to take consider the role of mobile phones in classroom activities rather than using them only for activities outside the class. Although mobile phones are considered mainly for communication; and cellphones are appropriate tool to support collaborative-learning inside of the

classroom, learners' collaboration and communication have not been fully addressed in m-learning projects. (Frohberg, Goth & Schwabe, 2005). The study by Echeverria et al. (2011) compared the use of mobile phones and PDAs in terms of collaborative activities in the classroom. Their study indicated that learners were comfortable with the use of cellphones. Additionally, students' performances were not significantly different between the ones who used PDAs with those using mobile phones to answer the questions. Thus, they believed that students' performances were not influenced in a negative way by using mobile phones (Echeverria et al., 2011).

Mobile technologies as well as mobile applications are considered the promising tools for collaborative-learning since they increase participation, sharing materials and providing communication (Hsu & Ching, 2013). The studies by Lai and Wu (2006), Liu et al. (2009) explained that learners became more engaged in learning and highly motivated by means of mobile devices. Zurita and Nussbaun (2004), Wu (2006), Liu et al. (2008) pointed out higher level of mutual feedback among peers, shared reflection and interaction among peers and instructors, more activities and discussion are important features of the use of mobile devices in learning (Hsu & Chang, 2013).

Furthermore, the study by Alvarez, Brown and Nussbaum (2011) highlighted the role of wireless technologies, especially tablets, for fostering better collaboration among peers and peers-instructors. In addition, they compared the use of laptops and tables in educational settings regarding collaboration. The results of their study revealed that tablets provided more interaction among peers while increasing the participation of group members in discussions (Alvarez et al., 2011). Alvarez et al. (2011) stated that "in measuring significant quantitative difference both in oral and gesture-based communication, therefore indicating that tablet-style devices can facilitate a richer face-to-face communication in small group collaboration scenarios." (p.842). The result of the study by Alvarez et al. (2011) indicated that students believed that use of tablets provided more self-confidence for them to explain their ideas.

In addition, it was considered that inquiries can be advocated by using mobile devices since they enhance access to the resources by using applications as well as sharing materials (Jones, Scanlon & Clough, 2013). The study by Jones et al. (2013)

analyzed mobile inquiry learning in informal and semiformal settings by two case studies regarding the use of mobile technologies and engaging students. The first case study considered the inquiry which was the part of the larger project namely Personal Inquiry (PI). The purpose of the PI was to provide personal science inquiries which enabled secondary students to be more engaged in learning. Thus, the software (nQuire) was developed and used in various contexts (i.e. classroom, nature reserve, field trips and learners' homes) for enhancing the inquiry process. In the after-school club which was part of the course and held by the geography teacher, food sustainability was considered. Students investigated the aspects of the concept in a group, and discussed and presented inquires to other groups as well as their videos and photos using the software. In this case, mobile devices could support the whole inquiry process, and the results demonstrated that the learners became more engaged in their activities. The second case study was implemented in the Geocaching Community. Jones et al. (2013) perceived that:

> Geocaching and Earthcaching provide a community framework for learning through inquiry in which members both create and participate in a learning process in which they need to solve whatever challenge is presented in order to find and log the cache. (p.27)

The second case study highlighted that the participants' engagements in authentic inquiry-based learning using community-based activity of Geocaching and sharing location-based knowledge in which participants used their own devices. The study revealed that the community had an important role in terms of process and encouraged learners to spend time and resources using their information as well as placing caches (Jones et al., 2013).

Dillenbourg and Jermann (2006) believed that use of different/ various learning scenarios might lead to better learning outcome. Spikol et al. (2009) stated that "designing and implementing new kinds of learning activities supported by mobile technologies is an interdisciplinary activity that poses challenges for educational technology researchers and practioners" (p. 1961). Mobile learning activities were designed for the learning settings which are different from the classroom setting (Alvarez et al., 2011). The activities which can be done in collaboration in doing are

the most important feature of m-learning (Parsons et al., 2007) (as cited in Alvarez et al., 2011).

2.6 Students' Motivation

The theoretical framework for students' motivation was adapted from the general expectancy-value model of motivation (Eccles, 1983; Pintrich, 1988, 1989). The model considers three motivational components as explained below:

1. Expectancy component addresses students' beliefs about their ability to perform a task.
2. Value component addresses students' goals and beliefs about the importance and interest of the task.
3. Students emotional reactions addresses the feelings about performing a task.

The Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich and De Groot (1990) is relying on the expectancy-value model as a theoretical basis. The MSLQ was developed using a social cognitive view of motivation and self-regulated learning (Pintrich, 2003). The student' capabilities to self-regulate their learning were related to their motivation in this model. Duncan and McKeachie, (2005) considered that motivation and learning strategies are not static traits of the learner and it is explained as "motivation is dynamic and contextually bound and that learning strategies can be learned and brought under the control of the student" (p. 117). It means that the course content affects students' motivational level in which the learning methods could be different as well. The model includes the components (i.e. value component, expectancy, affective, cognitive and metacognitive) with their sub-components (Pintrich, Smith, Garcia & Mckeachie, 1991).

1. **Value component**

Intrinsic goal orientation value: The students' reason for engaging in the task is considered as goal orientation. In MSLQ, goal orientation addresses students' goals

to the course; intrinsic goal orientation perceives in what extent students have tendency to involve in the tasks regarding their reasons.

Extrinsic goal orientation value: Similar to intrinsic goal orientation, extrinsic goal orientation addresses the goal for orientation in the course. However, in extrinsic goal orientation, students' orientation in the task linked to the issues such as grades, competence, rewards and etc.

Task value: In general, task value concerns the learners' evaluation of the task whether they are interesting or not. In MSLQ, task value addresses the students' opinion on what extent the task are interesting, important and useful.

2. **Expectancy component**

Self-efficacy for learning and performance: Two aspects of expectancy (expectancy for self-efficacy and success) are considered in this component. Performance expectation entirely is linked to performance on the task. However, Pintrich, Smith, Garcia & Mckeachie (1991) stated that "Self-efficacy is a self-appraisal of one's ability to master a task. Self-efficacy includes judgments about one's ability to accomplish a task as well as one's confidence in one's skills to perform that task (p.13).

3. **Emotional reactions**

Test anxiety: Test anxiety includes two emotionality and cognitive components. The cognitive component is the worry and students' negative thoughts which reduce their performances. Nevertheless, emotionality component addresses the affective and physiological arousal aspect of anxiety. It is assumed that students' anxiety could reduce using the affective learning approaches.

Cognitive and metacognitive strategies:

Rehearsal: The rehearsal approaches refers to practicing the information rather than learning new ones or connecting the information with the prior knowledge.

Elaboration: In contrast to rehearsal, elaboration addresses the connecting the new information with prior knowledge through different strategies.

Organization: This sub-component considers the link between new and previous knowledge besides finding the proper information.

Critical thinking: This approach refers to what extent students use their knowledge for solving problems or making decision.

Metacognitive self-regulation: "*Metacognition refers to the awareness, knowledge, and control of cognition*" (Pintrich, Smith, Garcia & Mckeachie, 1991, p.23). MSLQ does not look from knowledge perspective and it covers control and self-regulation facets of metacognition. Planning, monitoring and regularity are the three parts of metacognitive self-regulatory activities. Planning helps to make connection with previously learned materials while organizing them. In the monitoring part ones has chance to keep track of their progress. Individuals' cognitive adaption is considered as regulating. Regularity might result in better action by learners through enabling them to examine their behaviors.

Regarding the comprehensive characteristics of MSLQ which addresses various aspects in terms of students' motivation, the questionnaire which was adapted from original MSLQ was used in this study for collecting data. The questionnaire includes component of intrinsic value, self-efficacy, cognitive strategy use, test anxiety and self-regulation.

Motivation has been defined considering different perspectives. Brenn (2006) defined motivation as "the effort individuals willing spend to achieve their goals. Motivation is defined in terms of intrinsic motivation (i.e. learners engaged in an activity because it is interesting or enjoyable) and extrinsic motivation (i.e. learners engaged in an activity because he or she desires the outcome and wants to achieve some instrumental end such as earning a reward" (Ciampa, 2013). Intrinsic motivation is considered by self-determination theory (Pew, 2007). Self-determination describes the different motivations which are related to differences in terms of reason or purpose of an action (Pew, 2007). "Bandura's work (1993) on self-efficacy in cognitive development has made significant contribution to the understanding of intrinsic motivation" (Pew, 2007, p.16).

Students' motivation includes both philosophical and practical disciplines. Behavioral, cognitive, humanistic and biological perspectives are the ones which theories of motivation address (Pew, 2007). Behavioral theories define extrinsic motivation as the increasing the desired behavior using positive or diminishing negative results (Pew, 2007). Intrinsic motivation was addressed in cognitive theory in which students were stimulated to see answers. The humanistic view explains using learners' five different levels of hierarchal needs. Pew (2007) explained intrinsic motivation of students by stating "if students have their basic physical and safety needs met their needs for belongings, self-stem and self-actualization will intrinsically motivate them to achieve" (p.15).

If students are given a clear definition of the goals and challenge waiting in learning process, they become more motivated. In addition, feedback is useful in terms of goals since informs learners about their performance.

In higher education the learners' motivation plays an important role. Nowadays, in higher education the non-traditional students expand their learning. Reconsideration of expectations and relationship among learners and instructors are required to engage them in learning (Pew, 2007). The experience of students whose motivation is related to the point-in-time external level is different from the experiences of those who are motivated by internal of self-efficacy (Pew, 2007). Moreover, technology-enhanced environments increase students' chance for searching and accessing required information and satisfy both sensory and cognitive curiosity. Cooperation is also mentioned as an important factor in terms of students' extrinsic motivation (Ciampa, 2013). Furthermore, flexibility in time fosters incomplete information and encourages learners to find the required information. Mobile devices are considered as an opportunity for enhancing the communication since they utilize the settings and conditions to enhance learners' interaction not only in the class but also outside of the class (Ciampa, 2013). Therefore, mobile technologies are assumed as promising tools for facilitating collaboration. Learners can learn their information and comment on each other's work using mobile technologies.

The combination of technology-enhanced method with classroom delivery enhances integration of motivational strategies with new approaches. Keller (2008) stated that "a full motivational learning cycle should be with the motivational processing." (p. 794). The study by Keller (2008) highlighted the principles which affect students' motivation for e-learning, hybrid-learning and m-learning referred as e-learning by Spector and Merill (2008). Keller (2008) redefined "motivation to learning is promoted when a learner's curiosity is aroused due to a perceived gap in current knowledge" (p.176). His principle is explained by the first ARCS (i.e. is summarized as attention, relevance, confidence and satisfaction) category. The result of the study by Wen-Hao Huang et al. (2010) revealed and validated the relationship between motivational processing and outcome processing in terms of Digital Game- Based Learning (DGBL) as well.

The study by Liu and Chu (2010) investigated the effect of context-aware ubiquitous learning in their system called (HELLO, Handheld English Language Learning Organization) which was designed to improve learning English. Their model was designed based on ARCS motivational theory, which not only engaged students in different learning activities, but also included ubiquitous game-based learning, collaboration and context–aware learning. The result of the study highlighted that using context-aware ubiquitous game in learning settings resulted in better learning outcomes and higher motivations. The analysis of learners' interview indicated that students were satisfied and enjoyed using the system. Nevertheless, they explained about importance of non-gaming learning and emphasized that game-based learning could not be useful as the only instructional method and it needed to be integrated with traditional teaching.

The relationship between the used tools and students' motivation, participation as well as their performances in a facultative summer course in Economics was analyzed in the study by Giesbers, Reinties, Tempelaar and Gijselaers (2013). The subjects of the study were the undergraduate students of an international business course. The course was held as an online course in which students could discuss with each other using forums and web-videoconferences. The method was problem-based

and the students were expected to solve six authentic problems in collaboration with one another. The analyses revealed that richer communication tools, the higher the autonomous motivation. The importance of the collaboration and authentic learning are explained in the studies that some of them mentioned above. Therefore, the features of authentic and collaborative- learning were considered for increasing students' motivation in this study. Moreover, it was acquired that mobile technologies can be promising tools for enhancing students' motivation as long as they provide easier collaboration which is important for students' level of motivation. M-learning was implemented using mobile games. However, the results of the study by Chu (2010) showed that the learners were looking for non-gaming instruction using mobile technologies. Thus, interaction learning aspect and social technology aspects of m-learning frame were considered in this study for utilizing the learning environment which motivates students in their learning. The authentic collaborative m-learning activities were developed for computer networking course developed which considers the interaction learning and were implemented by means of mobile application of social learning platforms using social technology aspects of m-learning frame in the study. It was assumed that the activities might increase students' motivation by utilizing more authentic learning environment while mobile application foster easier information-sharing and enabled students to communicate and collaborate easily with each other.

2.7 Students' Attitudes toward Course Content

Attitude was defined by Kotler (2000) as the ones' personal development, feeling about object and willingness for specific action. Attitude was considered as the thought evolution which might be affected with it (Bohner & Dickel, 2011). Some studies (e.g. Solomon, 2010; Petty, Briñol, & DeMarree, 2007) perceived attitude as the structure of long-term memory, while attitude was considered as the construct of stable representation by Cunningham, Zelazo, Packer and Bavel (2007). In the psychology attitude was addressed in terms of affect and cognition. A cognitive aspect addresses the knowledge of an individual about different things (Hsu, 2010; Radocy & Boyle, 2003). The comprehensive definition was given by Eagly and Chaiken (2007) which covers the tendency, attitude object, and evaluation.

Student' attitudes were analyzed toward used instructional settings emphasizing hybrid-learning in different studies such as Leon de la Barra, & Urbina; 1999; Yıldırım, 1999; Truell, 2011; Sanders & Morrison; 2001; Delalioglu, 2004. The study by Sanders and Morrison (2001) analyzed students' attitudes in a biology course enhanced with web. The effectiveness of a hybrid course in terms of students' attitude in computer networking course was investigated in the study by Delialioglu (2004); the attitude scale was adapted Yıldırım's (1999) for computer networking course and used in the study. Since this study attempts to find out students' attitudes toward computer networking course content in which the course was enhanced with m-learning, the same attitude scale in the study by Delialioglu (2004) was used. Because the survey entirely was related to computer networking course content and developed for students' attitudes in the course. The survey and its characteristics are explained in detail in chapter three.

2.8 Summary

2.8.1 Educational Technology

The growth rate of technology and its usage in different aspects of individuals' lives encouraged educational domains to consider their integration in learning settings. Thus, the adoption and acceptance of technology by learners and instructors become an important issue, Herrington and Parker (2013) suggested that the adoption of technology by learners needed to be analyzed in terms of social technologies, researching at university and pedagogical use of technology in school. Different studies such as (Keller & Suzuki, 1988; Kramarski & Feldman, 2000; Fox, 2005) revealed the connection between technology and students' outcomes in various fields of study. The integration of media specifically social media was an effective approach to enhance learning process (Tess, 2013).

Furthermore, new instructional methods (i.e. collaborative-learning, inquiry-based learning, and authentic learning were developed and implemented considered in order to answer the requirements of the new era, which is called "information-age",

"Collaboration and emotional development" was considered as one of the main and required features of "information-age educational system" as well (Reigeluth, 2009). The importance of group work and community-based learning was underlined by Nelson (1999), Jonassen (1999) and Reigeluth (2009).

2.8.2 Students' Engagement

Students' engagement and its structure which could enhance learners' engagement was considered in research studies and different definitions were given (Newmann et al., 1992; Kuh, 2001; Mestre, 2005) (Zepke & Leach, 2010) since the 1980s. Kuh (2001) defined the engagement as students' active participation in academic activities; time and effort spend on academic work either inside or outside the classroom. In addition, students' dissatisfaction from the course was considered as a result of their low level of engagement Greenwood et al., 2002; Perie et al., 2005; Delialioglu, 2012). According to Mestre (2005) various pedagogies related to student engagement emerged, such as "cooperative or collaborative learning, active learning, case-based learning and hands-on learning" (p.24). The emphasis was laid on active participation and collaboration to increase students' engagement (Mestre, 2005).

2.8.3 Students' Motivation

In higher education the learners' motivation plays an important role. Pew (2007) expressed that non-traditional students expanded their learning. Thus, their expectation and learner-instructor interaction needs to be reconstructed. There are differences in students' experiences between the ones who are extrinsically motivated and that of those internally motivated (Pew, 2007). Cooperation was mentioned as an important factor in terms of students' extrinsic motivation (Ciampa, 2013).

2.8.4 M-Learning

Recently, the use of mobile technologies was assumed as important tools for enhancing individuals' life. Thus, educational domains attempted to use and integrate them in learning settings leading to emergence of the notion of the m-learning. Availability of mobile devices outside the formal learning settings provided

the opportunity for learning outside the classroom which was addressed in the study by Eliasson, 2012 and Sharples, 2013. Mobile technologies also facilitate and connect formal and non-formal learning as well as learning outside the classroom (Sharples, 2013).

Portability, immediacy, individuality, connectivity and accessibility which are in the center of m-learning, are among the important features of mobile devices (Ally, 2009). The usefulness of mobile technologies and applications in communication and collaborations led to use of them for facilitating collaborative learning. Therefore, Mobile Collaborative Learning (MCL) was considered by researches. Different characteristics of mobile technologies such as their flexibilities in learning activities, demonstrated their effectiveness in collaborative-learning as well (Gil et al., 2010).

Mobile technologies as well as mobile applications were considered as the promising tool for collaborative-learning since they increase participation, sharing materials and facilitating communication (Hsu & Ching, 2013). Although mobile phones are considered mainly for communication; learners' collaboration and communication have not been fully addressed in m-learning projects (Frohberg, Goth & Schwabe, 2005).

Mobile devices are successful devices in terms of collaboration as long as they provided information-sharing for accomplishing pedagogical activities (Lee, 2011). The studies by Lai and Wu (2006), Liu et al. (2009) showed that learners' engagement and motivation increased by means of mobile devices while the study by Jones (2013) focuses on the role of mobile technologies for easy access to various resources. The role of mobile technologies for enhancing students' motivation was analyzed by different studies.

2.8.4 Authentic and Collaborative-Learning

Computers are the devices that could be used in terms of collaborative-learning because they support different tools and applications, which enable students and instructors to collaborate easily. Since CSCL environments support more visualization and argumentation, they can support more collaboration. Cooperative and inquiry-based learning were considered as two important methods of instruction in terms of collaborative-learning (Nelson, 1999).

An authentic learning environment may provide learning settings, which could demonstrate the complex conditions of real life and its limitations (Herrington & Oliver, 2000). Herrington, Reeves and Oliver (2014) defined the authentic learning, "Authentic learning was considered by as a pedagogical approach that situates learning tasks in the context of future use" (p.401). Authentic learning was perceived to be implemented easier by using technologies since it can better simulate the real life condition (Herrington & Oliver, 2000). The importance of authentic learning was addressed in the study by Nikitina (2011) for language learning

In the study by Giesbers, Reinties, Tempelaar and Gijselaers (2013) the relationship between the used tools and students' motivation, participation as well as their performances in a facultative summer course in Economics was investigated, which revealed that higher autonomous motivation could relate to the use of richer communication tools. The studies revealed that mobile collaborative-learning can be a promising approach in terms of collaborative-learning as long as mobile technologies facilitate and enhance collaboration, and communication between students and instructors.

2.8.5 M-Learning, Engagement and Motivation

The effectiveness of the authentic scenarios and collaborative-learning and their effect on students' engagement and motivation was mentioned in various studies as stated above. Moreover, mobile technologies are promising tools in relation to collaborative and authentic learning. Mobile technologies facilitate the information-

sharing and communication which are the integral parts of collaboration. The growth rate of technology and its usage in different aspects of individuals' lives encouraged educational domains to consider their integration in learning settings. Thus, the adoption and acceptance of technology by learners and instructors become an important issue, Herrington and Parker (2013) suggested that the adoption of technology by learners needed to be analyzed in terms of social technologies, researching at university and pedagogical use of technology in school. Different studies such as (Keller & Suzuki, 1988; Kramarski & Feldman, 2000; Fox, 2005) revealed the connection between technology and students' outcomes in various fields of study. The integration of media specifically social media was an effective approach to enhance learning process (Tess, 2013).

Furthermore, new instructional methods (i.e. collaborative-learning, inquiry-based learning, and authentic learning were developed and implemented considered in order to answer the requirements of the new era, which is called "information-age", "Collaboration and emotional development" was considered as one of the main and required features of "information-age educational system" as well (Reigeluth, 2009). The importance of group work and community-based learning was underlined by Nelson (1999), Jonassen (1999) and Reigeluth (2009) as well.

In the current study, authentic collaborative m-learning activities were developed for a computer networking course and implemented during two consecutive semesters. The effect of authentic collaborative m-learning activities on learners' engagement and motivation was investigated in the study. Comparison of the learners' motivation before and after being exposed to the activities was considered in the study as well. The used methodology including research design model, data collection and analysis are explained in detail in the following chapter.

CHAPTER 3

METHODOLOGY

The third chapter addresses the research methodology including research design model, research questions participants of the study, procedures used in order to answer the research questions. Bothe quantitative and qualitative data collections method and used instruments are represented in this chapter. Finally, the used data analysis method is presented in this chapter.

Mixed-method research design with triangulation approach was utilized in the study in this study in order to answer three research questions.

1. How do authentic collaborative m-learning activities affect the engagement level of undergraduate students in a computer networking course?
2. How do authentic collaborative m-learning activities affect the level of undergraduate students' motivation in a computer networking course?
3. To what extent authentic collaborative m-learning activities have an effect on students' attitudes toward course content?

The purpose of mixed-method is to consider the advantages of both quantitative and qualitative data. The mixed-method research design has been started to be used since 1950s and the use of mixed-method design in educational research studies is highly considered. The use of both quantitative and qualitative approaches contributes to understand the research problems completely (Fraenkel, Wallen & Hyun, 2012). The data has to get collected after implementation in order to explain the quantitative results (Creswell, 2012). Quantitative data explain the outcome of the experiment

while qualitative data demonstrate the process explaining by participants (Creswell, 2012). A mixed-method design with triangulation approach is presented in figure 3.1 (Fraenkel et al., 2012):

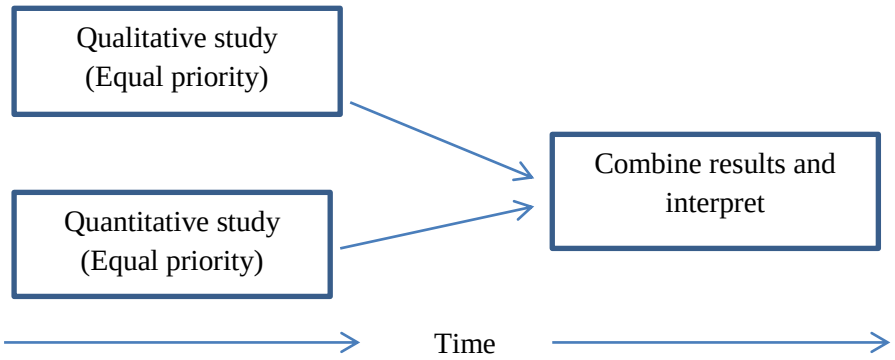


Figure 3.1: Mixed Method Research Designs with Triangulation Approach

Mixed-method research design has several advantages. The first advantage is that the use of mixed-method provides a clear explanation in terms of variables and their relationship. The deep exploration of the relationship among variables is the second advantage of the mixed-method research design. The third advantage is to be able to verify or cross-validate the relationships found between variables (Fraenkel et al., 2012). The main benefit of using mixed-method research design is that the advantages of one method (i.e. quantitative or qualitative) could compensate the drawbacks of the other (Fraenkel et al., 2012).

Triangulation design is used where both quantitative and qualitative methods are used for studying the same phenomenon. Two methods are used in order to analyze whether two methods provide the same results or not. Moreover, if the two methods do not show the same results, the reasons for the differences are explored (Fraenkel et al., 2012). In this study, quantitative data was collected from the developed activities named "authentic collaborative m-learning activities", on students' engagement, motivation, and attitudes toward course content. In order to further explore the effect of the activities on students' engagement, motivation and attitudes toward course content, qualitative data were also collected using interview protocol.

The qualitative data was gathered and analyzed to find out more in-depth explanations for the results acquired by quantitative data analyses. Both quantitative and qualitative data were collected in line with the triangulation design using two surveys, one questionnaire and an interview protocol respectively. Two survey instruments, NSSE and Attitude Scale were used to collect data for analyzing students' engagement, learners' attitudes toward course content. In addition, one questionnaire, the MSLQ, was used for collecting data on students' motivation in terms of quantitative data. An interview protocol was used to collect qualitative data.

The independent variable of the study was the use of authentic collaborative m-learning activities and the dependent variables were students' level of engagement, motivation and attitudes toward course contents. Paired sample t-test was used in order to find out the differences between students' level of motivation and attitudes between the groups in pre and posttests, which have been conducted in the beginning and the end of the semesters. Authentic collaborative m-learning activities were developed based on the suggested guidelines by Reeves, Herrington and Oliver (2002) and Jonassen (1999) for authentic and collaborative learning environments in the study. The aforementioned activities were implemented for the computer networking course in two subsequent semesters, spring and summer semester of 2015. In between the two implementations in spring and summer, modifications related to the content and the instructional procedure were applied on the activities based on the results of data collected during the first implementation of the study and analyzed before the second implementation

Convenient sampling technique was used in the study. The course was implemented as m-learning enhanced course during the semesters in Computer Education and Instructional Technology department (CEIT) of a public university, Middle East Technical University (METU). Authentic collaborative m-learning activities were included in the computer networking course in the form of homework as the independent variable. The participants of the study, the instructional procedures of the study, data collection and analyses are explained in detail in this chapter, while figure 3.2 summarizes the design of the study.

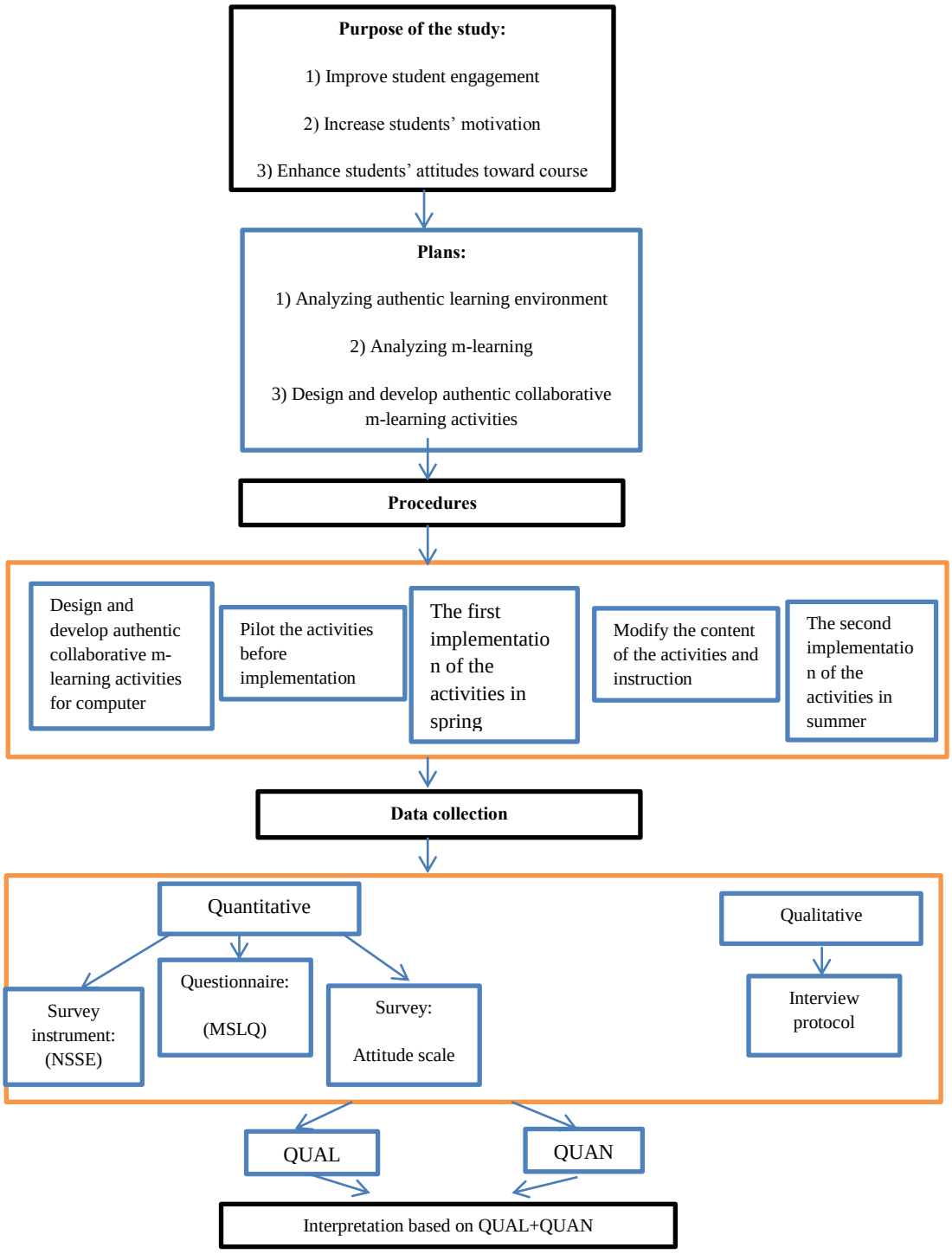


Figure 3.2: Design of the Study

3.1 Participants of the Study

Convenient sampling technique was used in the study. The sample of the research was 3rd grade undergraduate students of Computer Education and Instructional Technology (CEIT) department in METU taking the "CEIT314 Computer Networks and Communication" course in the spring semester and summer semester of 2015. The graduates of CEIT department could work as primary and secondary teachers in both private and public schools. The reason for selecting the course was because the course had highly technical content with a lot of abstract concepts about which students informally complained. The topics and concepts covered in the course were suitable for creating authentic tasks since communications and networking had social and technical examples in the real life of the students. The participants were selected from CEIT department senior students because they had taken information technology courses and had computer skills. Before the implementation, students were asked about their computer and mobile device ownership. All students owned a computer and a smartphone and/or a tablet PC. The number of students who participated in the study was 30 in the spring semester and 33 in the summer semester. Both male and female students with the age range of 18-22 were included in the study which is shown in table 3.1.

Table 3.1 The Participants of the Study

	Female	Male	Total (N)
Spring Semester 2015	16	14	30
Summer Semester 2015	15	18	33

As it is shown in the table 3.1, the number of male and female student at each semester and overall number of students in each implementation were very close.

3.2 Procedure

3.2.1 The Authentic Collaborative Activities

The activities were developed for a computer networking course and implemented in the course for two subsequent semesters. The numbers of the activities were five for different subjects which were covered in the course. The activities addressed some or overall materials which were mentioned and discussed in the course. The activities were implemented in the course as the part of students' homework after the content was covered in the course. The activities were implemented in different weeks of the course after covering the related course content in the class which are depicted in table 3.2. Five activities were implemented in the first implementation of the study (spring semester 2015) while the number of implemented activities were four in the second implementation of the study (summer semester 2015). Table 3.2 shows the relation between the course objectives and the activities. The activities can be found in Appendix A.

Table 3.2: Relation between the Course Objectives and the Used Activities in the Course

The content and related objective(s)	The content of the developed activities
Week 1: Network Platforms LANs, WANs, and the Internet **Objective 1:** Understanding the fundamentals and, basic concepts of communication technologies and computer networks. **Objective 2:** Explaining the devices, connectors and mediums used in LANs and WANs.	Finding an (analogical) example of LAN and WAN in your daily life. Taking photos or videos of the analogical or real examples found in daily-life. Discussing about the appropriateness of the example which you found with peers.

Table 3.2 (Continued)

Week 2: Communication Rules, Protocols and Standards OSI Reference Model, TCP/IP Protocol Model, Encapsulation Objective: Categorizing and explaining the functions and properties of networking into OSI layers and TCP/IP protocol suite.	Developing or designing your own rules for communication. Relating your example (analogically) with the rules of communication in computer networks.
Week 4: Data Link Layer Protocols Media Access Control, Topologies, Frame Objective: Explaining the devices, connectors and mediums used in LANs and WANs.	Finding an analogical example for both bandwidth and throughput from your daily life. Explaining the example according to the meaning of bandwidth and throughput in computer networking.
Week 6: Address Resolution Protocol and Switching, ARP Mapping, Switching and Switch Types Objective: Defining encapsulation and the protocol data units traveling between internetworks.	Finding an example of Address Resolution Protocol from your daily life. Showing analogies between your example and computer networking concepts.
Week 12: Application Layer Protocols, Functionality Issues Objective: Simulating the TCP three-way handshake protocol	Finding an example of Three-way handshake in your daily life. Prepare a short video that can show an example of Three-way handshake from daily-life.

The authentic collaborative m-learning activities were developed based on the guidelines suggested by Reeves, Herrington and Oliver (2002) and Jonassen (1999)

for authentic and collaborative-learning respectively. The characteristics of authentic activities (Reeves et al., 2002) are as follows.

1. Have real-world relevance;
2. Are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity;
3. Comprise complex tasks to be investigated by students over a sustained period of time;
4. Provide the opportunity for students to examine the task from different perspectives, using a variety of resources;
5. Provide the opportunity to collaborate;
6. Provide the opportunity to reflect;
7. Integrated and applied across different subject areas and led beyond domain-specific outcomes;
8. Are seamlessly integrated with assessment;
9. Create polished products valuable in their own right rather than as preparation for something else;
10. Allow competing solutions and diversity of outcome.

Jonassen (1999) defined the following steps for collaborative-learning as well.

1. Select an appropriate problem (or question, case, project) for the learning to focus on;
    a. Interesting, relevant and engaging problem
    b. Ill-defined or ill-structured problem
    c. Authentic problem
    d. Enabling the representation and manipulation of the chosen problems
2. Providing case-based reasoning and enhance cognitive flexibility;
3. Providing just-in-time learning;
4. Conversational and collaborative tools;
5. Social/contextual support for the learning environment;

6. Cognitive problem-representation, knowledge–modeling, performance – support and information-gathering tools.

In the authentic collaborative m-learning activities, students were asked to find the real-world examples of the course content from their daily lives enabling them to be exposed to more authentic type of learning. It was considered that searching for the examples about the course concepts in their daily lives would result in making easier analogies between the theory and practice. Therefore, the activities would help to better understanding of the networking concepts. In addition, collaborating with their group-mates and discussing about the examples is expected to help students to explore more detail information about the concepts. It might enable students to improve their examples or change them as well. Collaboration with peers also helps students to find more refined answers in terms of activities and be more active in their learning process. Students were expected to complete in groups of three by using the mobile application of a social learning platform.

The activities included the features as follows:

1. The students were asked to find the real-world examples of the networking concepts from their daily lives in a group of three students. The mentioned steps of the activities refer to the first step suggested by Reeves et al., 2002 that shows the real-world relevance.

2. They were supposed to take photos or videos of the examples.

3. They were needed to share the photos and videos as well as their comments about the examples with their group-members during 6 days depends on the required time for the completion of the activities using the mobile application of a chosen social learning network

4. Students were needed to discuss and improve their answers through sharing them with each other on the mobile application.

5. Learners were asked to send the screen shots of their activities for their collaboration and answers in order to show how they used the mobile

application while they were doing the activities, which refer to the second and third steps suggested by Jonassen (1999) for collaborative-learning on the mobile application of.

6. The steps (2-5) also are related to the third characteristics of authentic activities suggested by Reeves et al., (2002), which considers "authentic activities comprise complex tasks to be investigated by students over a sustained period of time".

7. In terms of collaboration which was addressed as the requirement for authentic activities, students were needed to do the activities in groups of three and complete the tasks in communication and collaboration with each other. They were also expected to share the real-world examples of computer networking concepts that they found individually with each other. Since the assessment is required in the authentic activities, learners were graded based on their activities in the second implementation of the study. In order to use conversational and collaborative tools among students, the mobile application of the social learning network was used as the medium for communication and collaboration. The developed activities were piloted in a public university (i.e. Gazi University) three weeks before implementing them in the main study in the same course (Computer Networking) at METU in the 2015 spring semester.

In the pilot study, the number of students who enrolled in the computer networking course was 15 which were divided into five groups (three students per group). The course was lectured-based course which was held once in a week. The students attended to the course on campus. The laboratory session related to the course was held once in a week as well. The students received the activities after completing the concepts in the class and they were given 6 days for doing the activities. Two changes were applied to the activities in after pilot study. (i) the step related to "to use different resources while doing the activities for getting information and learning the concept." Was removed it was misleading and it led students to upload the pictures or videos from the internet rather than taking by themselves. (ii) Students

were asked to send the screenshots of their collaboration on mobile tool in order to show how they use the application.

Therefore, required modifications were applied on the activities before implementing them in the main study. The activities are represented in appendix A.

3.2.2 The First Implementation of the Study (Spring Semester 2015)

The first implementation of the study was on spring semester of 2015 in the computer networking course in METU. The number of students in the course was 30. Students were divided into 10 groups (3 students per group) by their preference. The course lasted for 14 weeks. The course was held once in a week besides its laboratory session, which was also once a week. The computer networking course was a lectured-based course in which students attend the class on the campus. The laboratory session included the practical aspects of the course content. The activities were integrated into the course as a part of homework. As mentioned in the previous section, the activities included questions related to the course content.

Students were asked to complete the activities in a group of three on account of the fact that the common group sizes for the collaborative learning are explained as three or four by Slavin (1988), Harasim (1991) and Sharan (1994) (Brandon & Hollingshead, 1999). Also, the most common size for mobile Computer Supported Collaborative Learning (mCSCL) was considered as three as well (Hsu & Ching, 2013). Students were expected to complete the activities within 6 days. The group of students was asked to find the real-world examples of the networking concepts from daily life. They were required to share the examples and information related to them. In addition, the pictures or videos of the examples were needed to be taken and shared by students on their group using the application. The screen shots of their discussions were needed to be added to the activities as the part of the activities. Learners needed to submit one document as the final answers for the activities per group. After completing the activities, students received feedback about their answers.

Moreover, in order to receive students' opinions about the activities and used medium, students were interviewed two times using an interview protocol. At the end of the first semester, students were interviewed about the effect of the activities on their engagement, motivation and attitudes toward course content. They were also asked about the required modifications in activities considering both activities' content and instructional procedure. Therefore, based on the analysis, which was carried on the students' interview transcriptions, it was acquired that students preferred the activities to be graded. They believed that grading the activities would help them to keep track of their progress and to follow more structured and clear procedure while doing the activities. It also would increase their motivation. However, the later step was not addressed in the first implementation of the study. Figure 3.3 demonstrated the steps taken in the first implementation of the study.

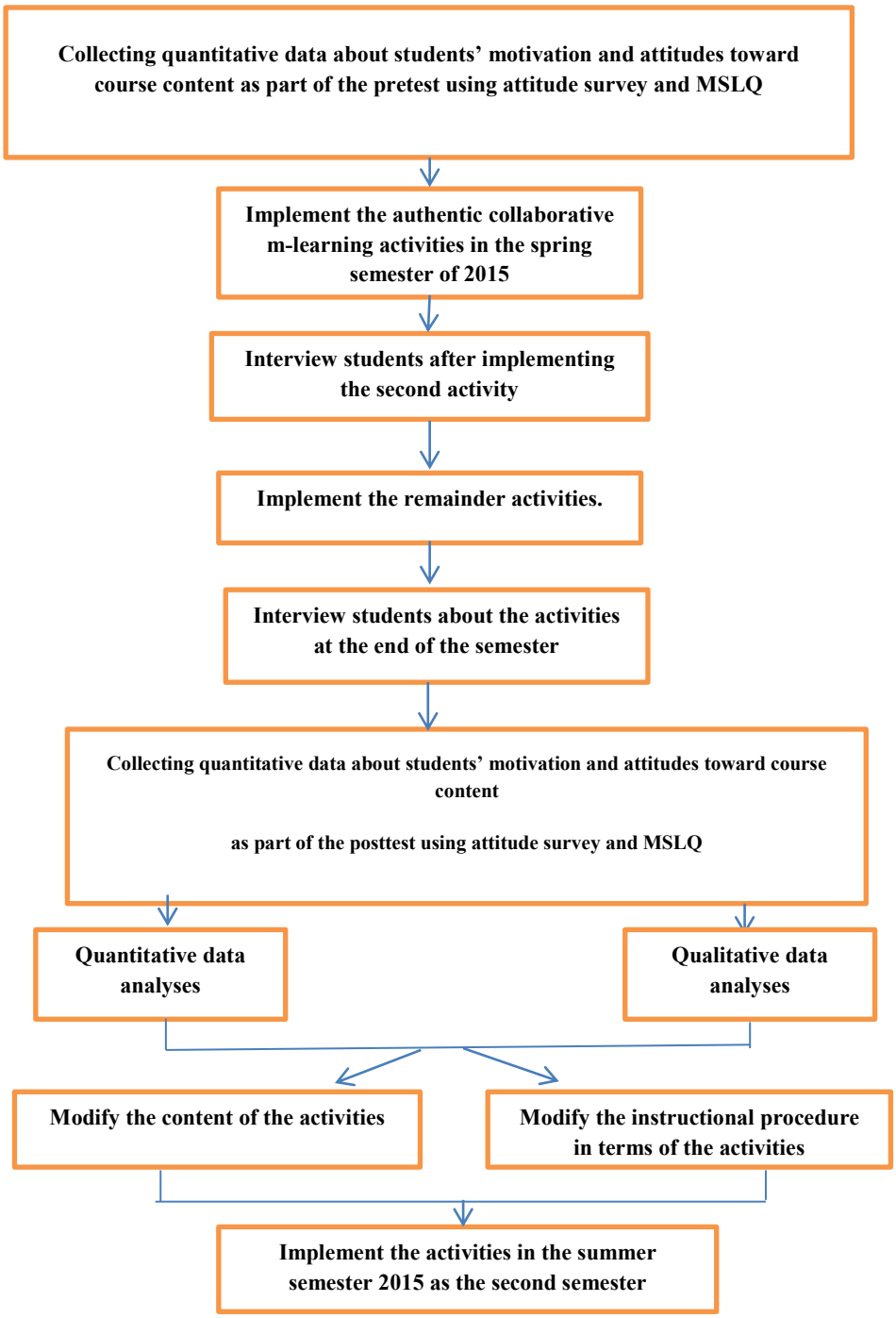


Figure 3.3: Procedures in the First Implementation of the Study

3.2.3 The Second Implementation of the Study (Summer Semester 2015)

The second implementation of the study was in summer semester of 2015 in the computer networking course in METU. The number of students in the course was 33 students who were divided into 11 groups (3 students per group) as in the first semester. The course lasted for 6 weeks with intense schedule since it was a summer semester. The course was held once in a week for 4 hours besides its laboratory session 3 hour. However, the course hours were longer in the summer semester. The computer networking course was a lectured-based course where students attend the face to face class meetings. The laboratory session included the practical aspects of the course content. The authentic activities developed for this research were integrated in the course in the form of homework. In the second semester, modifications were conducted in both activities and instructional procedure as follows:

The second activity was not implemented in the second implementation of the study due to the content ambiguity of the activity from students' perspective. They explained that "*There are two types of answers for this activity and it was not understood which one was addressed in the activity.", "Second activity was not clear", "The second activity was unclear".*

One step of the used activity was removed, which was sending a brief explanation that shows in what extent and how the mobile application was used while the tasks were being conducted. As the students needed to share their discussions with each other and send their screen shots; they expressed that it was as the extra steps because it was understood from their screen shots that how they used the application.

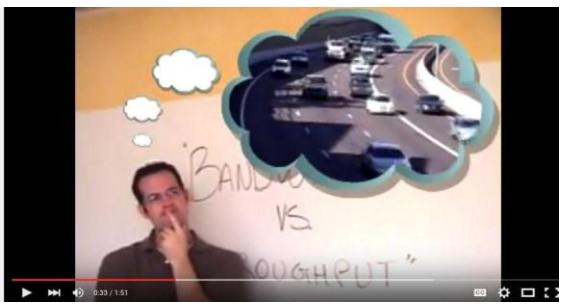
The sample answers were added to the activities especially in terms of finding real-world examples of the computer networking concepts. The examples were added in order to clarify the activities for the students. They were added to the activities because students' interviews analysis depicted that finding real-world examples from daily-life was a new experience for them. They explained the difficulties that they faced in this regard only in the beginning of the semester. They emphasized that the activities became clear and understandable when they discussed and talked about the

real-world example with their peers and the instructor. Thus, the sample answer regarding the finding real-world examples were added to the activities in the second implementation of the study. The sample of real-world examples from daily life were added to the activities in the second implementation, which could demonstrate the path the students were expected to take in terms of finding the real-world examples of the networking concepts from daily life.

One of the sample answers about the concept of bandwidth and throughput is as following:

For example:

The following video shows analogical examples about bandwidth and throughput from daily life. Please watch it and try to find similar examples in your life.
The video shows the highway and the number of the cars as the real-world analogical examples for bandwidth and throughput. The picture labeled (a) (i.e. the highway as the analogy for the bandwidth, the number of cars that can drive the highway for throughput). The second picture labeled as (b) shows the cup as the analogy for bandwidth and the amount of water can pass through it as the analogy for throughput from daily-life. The screenshots of the aforementioned video are demonstrated in figure 3.4.



a) the highway as the analogy for the bandwidth, the number of cars that can drive the highway for throughput

b) the cup as the analogy for bandwidth and the amount of water can pass through it as the analogy for throughput

Figure 3.4: Analogies of bandwidth and throughput of computer networking concepts from real life

Moreover, changes were conducted regarding the implementation of the activities in the second implementation. The students highlighted that they looked for more and detailed feedback in terms of the activities in the interviews of the first implementation of the study. Therefore, it was planned to give detailed feedback about the activities after completing them based on weekly schedule. Moreover, they were asked about the activities (i.e. students' opinion about the content of the activity, difficulties which they faced regarding the tool and procedure). Then, extra time was given to students in order to improve their answers based on the feedback.

Learners' answers to the activities were graded in the second implementation of the study in contrast to the first implementation. Each step of the activities had specific points and students' were informed about it in advance. Figure 3.5 illustrates the procedure and steps taken in the second implementation of the study.

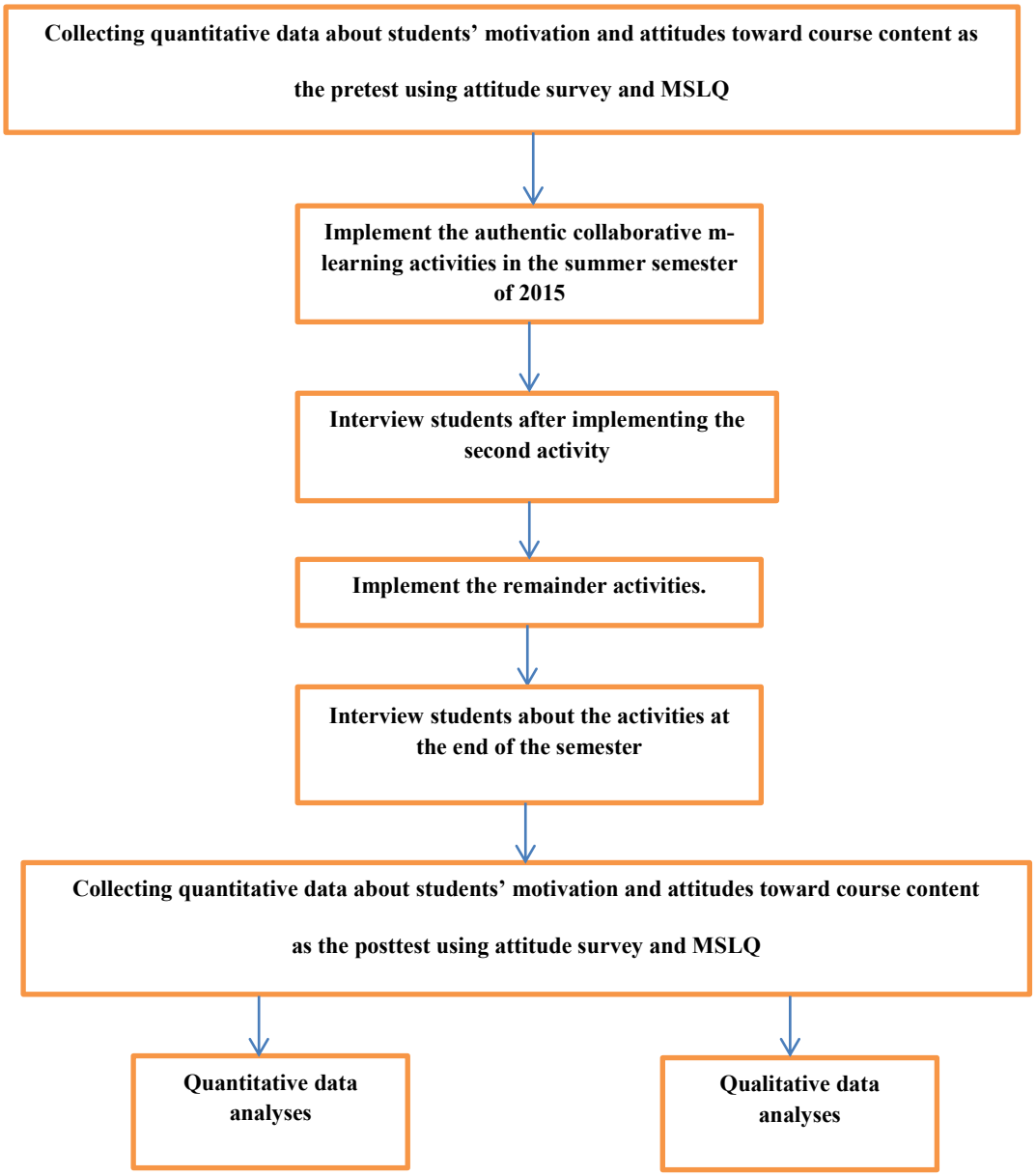


Figure 3.5 Procedures Taken in the Second Implementation of the Study

Students' perceptions were asked using two surveys in relation to students' level of engagement, attitudes toward course content and one questionnaire for collecting data in terms of students' motivation. Students were also interviewed using interview protocol about the activities and used medium in the second implementation of the study two times. The first interview was after conducting the second activity and the

other was at the end of the semester. After the comparative analysis of the collected data as well as content analysis on the students' interview, it was acquired that students looked for more detailed feedback on their activities. Furthermore, they highlighted the role of grading in terms of increasing their motivation.

Therefore, in the second implementation of the study, students' opinions on the effect of the activities on students' level of engagement and motivation as well as on their attitudes towards course content were acquired using two surveys and one questionnaire as the first implementation of the study. While students were interviewed about the activities and the used medium two times as the first implementation they were asked about the activities and the used medium every week after conducting the activities. They received detailed feedback for their answers every week and extra time was given in order to improve or change the activities based on the feedback as well. Since the activities were graded in the second implementation of the study, students were informed about the points related to each step in the activities in advance and received their grades after final submission. Grading the activities gave chance to students to keep track of their progress while receiving feedback and discussing about their problems helped them to conduct the activities in a structured way in the consequent weeks. Receiving feedback also clarified the activities and enabled them to answer the activities correctly.

3.3 Data Collection Methods and Tools

Two survey instruments namely National Survey of Student Engagement (NSSE) and Attitude scale (Delialioglu, 2004) as well as one questionnaire namely Motivated Strategy for Learning Questionnaires (MSLQ) were used to collect data on students' engagement, their attitudes toward course content and students' motivation respectively. In addition, interview protocol was used to collect students' opinions in terms of the activities and used medium.

3.3.1 NSSE (National Survey of Student Engagement)

National Survey of Student Engagement (NSSE) was adapted and used to collect data regarding students' engagement. It was first released in 2000 and updated in 2013. The original questionnaire collects information in five categories (i.e. participation in educationally purposeful activities, institutional requirements and the challenging nature of course work, perceptions of the college environment). NSSE is using student survey (The College Student Report) annually for collecting information from undergraduates about how they spend their time and to what extent attending the college was useful for them. Although NSSE doesn't analyze learning in a direct way, it shows the facets which can be enhanced in terms of undergraduate experience (NSSE, 2016). The used questionnaire which was adopted from NSSE includes 52 questions in 7 categories (i.e. active learning, collaborative-learning, interaction with instructor, student effort, feedback, satisfaction from the course, personal development). The complete survey is provided in Appendix B.

The active learning category included 9 questions as listed below:

"Ask questions about the course content in class", "Use different information resources (Internet, books, and library) to complete an assignment", "Lookup other sources of information or search the Internet to gather more information about the topics and learned in the class", "Make class presentation".

The second used category entitled (collaborative-learning) and included 9 questions which addressed the questions as follows:

a) work with my classmates outside of class hours to prepare the activities;

b) Explain the topics in the course content that my classmates have difficulty to understand during or outside the class hour;

c) Share the projects, activities, or assignment that I did for the activities with my friends in the classroom or on mobile application;

d) Ask a classmate to check before submitting an assignment.

The category related to “interaction with instructor” included 8 questions and covered the concepts as:

a) Ask my teacher questions about the parts of the homework that I have difficulty with.

b) Talk with my teacher about activities that I made while doing the laboratory work.

The forth category was “student effort” and it had 5 questions about such as:

a) I had to work harder for this course than I expected.

b) I had to work harder in doing the project, homework and tasks.

c) The activities in the course laboratories were harder to complete than I expected).

The category entitled feedback included 7 questions which addressed the issues such as:

a) The teacher gave comments on time for the activities I did.

b) The mistakes done in doing the activities were explained by the teacher.

c) I was informed in detail about what I was expected to do about the activities.

The category in terms of students’ satisfaction from the course included 7 questions as follows:

a) I enjoyed this course. I learned a great deal from this course.

b) I would recommend this course to others.

The seventh category was “personal development”. It included 6 questions which addressed the concepts such as:

a) Contribution to using information and communication technologies towards a purpose.

b) Contribution of communicate clearly and effectively. Contribution of discover individual skills/abilities. The reliability test was Cronbach’s α =.95 for the questionnaire and the items were scored based on 5-points Likert scale.

3.3.2 Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich and De Groot (1990)

Motivated Strategies for Learning Questionnaire (MSLQ) by Pintrich and De Groot (1990) was used for measuring students' level of motivation. The original questionnaire included 56 questions. The questionnaire was adapted from the studies by Eccles, 1983; Harter, 1981; Weinstein, Schulte and Palmer, 1987. Factor analysis determined three categories (i.e. self-efficacy; intrinsic value and test anxiety) as the factors for measuring motivation while some items were excluded from the questionnaire since they were less correlated. The analysis revealed two cognitive scales (i.e., cognitive strategy and self-regulation) in the original MSLQ. MSLQ is demonstrated in appendix C. The questionnaire, which is categorized into three motivational categories, self-efficacy (α=.89) which included nine questions considering confidence in performing class work (For example, a) I think that what I am learning in this class is useful for me to know. b) I am sure I can do an excellent job on the problems and tasks assigned for this class). The category entitled intrinsic value (α=.87) included nine questions. The nine items were constructed using the strategies that were taken into account by the studies Eccles (1983) in terms of perceived importance of course work. Performance for challenge and mystery goals (e.g. I prefer class work that is challenging so I can learn new things) (Herter, 1981). There were four questions regarding the test anxiety (e.g. I am so nervous during a test that I cannot remember facts I have learned) with (α=.75).

Two cognitive scales were cognitive strategy use (α=.83) including 13 questions considering rehearsal strategies (e.g. When I read materials for this class, I say the words over and over to myself to help me remember)

Elaboration strategies such as summarizing and paraphrasing (e.g. When I study I put important ideas into my own words) and organizational strategies (e.g. I outline the chapters in my book to help me study (Weinstein et al., 1987).

The self-regulation (α=.74) was the second category related to cognitive scale based on the conducted factor analysis and adapted from the studies by Weinstein et al. (1987) and Zimmerman and Pons (1986) respectively. The categories included nine

questions. The questions addressed the metacognitive such as planning, skimming and comprehension monitoring (e.g. I ask myself questions to make sure I know the material I have been studying) and management scales. Management scales considered students persistence for doing the difficult tasks (e.g. when work is hard I either give up or study only the easy parts). The items are scored using 7-point Likert scale (1=not at all true of me to7=very true of me).

3.3.3 Attitude Scale

The questionnaire by Delialioglu (2004) was used in order to measure students' attitudes toward course content. The questionnaire has 37 questions (α= .93). The items are scored based on 5-point Likert scale. Positive items (i.e. 18 questions) were coded (1=strongly disagree to 5=strongly agree) whereas the negative items (i.e. 19 questions) were coded from (1=strongly agree to 5=strongly disagree) for each statement.

Some of the items in the attitude scale were adapted from the study by Yıldırım (1999) subject attitude scale about circulatory and excretory systems in Biology to computer networks and communication topics. The original attitude scale included 43 items. The questionnaire was piloted on 32 students who enrolled the "computer networks and communication course" in spring semester 2001. After analyzing the results and receiving field experts' opinions six questions were excluded from the survey. Appendix D includes the attitude scale.

3.3.4 Interview Protocol

In order to further investigate the effect of the activities on students' level of engagement and motivation, students were interviewed using interview protocol. The interview questions were developed based on research questions. The interview protocol includes six questions related to the first research question which address the effect of the activities on students' level of engagement and two questions related to the second research questions which is related to the effect of the activities on students' level of motivation. The validity of questions was checked by three subject-field experts. Among 8 questions two questions were removed from interview protocols which were not addressed the research questions and one question (i.e.

which other courses would you like to use the collaborative m-learning activities in?) Moreover, the interview questions were piloted with four students of the same course in spring semester 2015 whose answers were excluded in the main interviews. In the second implementation, one question (i.e. how did the feedback which you received from the instructor help you for doing the activities?) was added to the interview protocol. Some modifications were done on instructional processes in the second implementation and one of them was giving detailed feedback to students related the activities every week. Therefore, the effect of this modification was investigated by asking a new question from students in this regard. Thus, the number of questions in the first implementation was 7 whereas the number was increased to 8 questions in the second implementation.

Students were asked questions in terms of the effect of the activities on learners' engagement which is addressed in the first research question. The questions in this regard addressed students' opinions in terms of the effect of the activities on learning the course content, discovering the personal skill, improving their collaboration and interaction with their peers and instructor. Moreover, students' opinion on the effect of the activities on motivational level was asked. The questions included students' opinion on the role of the activities for facilitating learning process as well as on changing learners' attitudes towards course content, similarities and difference of this course with other course without enhancement of the activities. Interview questions are represented in appendix E.

3.4 Data Analysis

Descriptive and inferential statistics were utilized in order to analyze the collected data. In this study, authentic collaborative m-learning activities were developed and implemented during two consecutive semesters in a computer networking course. Thus, Independent variable of the study was the method of instruction (use of authentic collaborative m-learning activities) while students' level of engagement,

motivation as well as their attitudes toward course content are the dependent variables.

In order to analyze the effect of the activities on students' engagement, the data collected using NSSE was analyzed by means of descriptive analysis. Moreover, students were interviewed using interview protocol in order to further explore the effect of the activities on their engagement.

Students' motivational level was investigated before and after being exposed to the activities using MSLQ. Paired sample t-test was conducted for comparative analyses between pre- posttests in terms of students' motivational level and their attitudes toward course content besides using descriptive statistics.

Content analysis was carried out on the collected data using interview protocol about the effect of authentic collaborative m-learning activities on students' level of engagement and motivation. The results of the data analysis are depicted in chapter 4.

CHAPTER 4

RESULTS

In this chapter the results of the data analyses are represented. In order to analyze the effect of the activities on students' engagement the survey "National Survey of Student Engagement" (NSSE) was used. Moreover, students were interviewed using interview protocol to further explore the effect of the activities on their engagement. Students' motivations were also investigated before and after being exposed to the authentic collaborative m-learning activities using Motivated Strategies for Learning Questionnaire (MSLQ) besides conducting interviews. Students' attitudes towards course content were analyzed using attitude scale in the beginning and at the end of each semester.

4.1 The Effect of the Authentic Collaborative M-learning Activities on Students' Level of Engagement

In order to answer the first research question regarding the effect of authentic collaborative m-learning activities on students' level of engagement, the data collected in two consequent semesters using NSSE was analyzed. The number of returned survey was 25 in spring semester 2015. In the second implementation of the study which was conducted in the summer semester of 2015, the data collected using NSSE was analyzed in terms of students' level of engagement in order to answer the first research question. The number of returned survey was 27.

Table 4.1: Authentic Collaborative M-learning Activities and Students Level of Engagement in Spring and Summer Semesters 2015

	Spring semester 2015			*Summer Semester 2015*		
Components	*N (Number)*	*M (Mean)*	*SD (Standard Deviation)*	*N (Number)*	*M (Mean)*	*SD (Standard Deviation)*
Active learning	24	3.23	.62	27	3.61	.84
Collaborative- learning	25	3.24	.77	27	3.95	.33
Interaction with instructor	23	2.79	.89	27	3.79	.97
Student effort	25	3.36	.86	27	3.10	.59
Feedback	25	3.50	.68	27	3.74	.96
Satisfaction from the course	25	3.51	.88	27	3.81	.88
Personal development	25	3.78	.65	27	3.99	.89

However, some questions which are related to the categories of "active learning" and "Interaction with instructors" have not been answered by some of the participants. Thus, the number of the analyzed survey in these categories has been decreased to 24 and 23 respectively. The results of descriptive statistics indicated that the highest mean score belonged to personal development (M=3.78, SD=.65) which was followed by "satisfaction from the course" (M=3.51, SD=.88) while the least mean score was in "interaction with instructor" (M=2.79, SD=.89).

In the second implementation of the authentic collaborative m-learning activities in summer semester of 2015, some modifications were conducted in terms of both the activities and instructional procedure. In the second implementation of the study, one activity was not implemented due to the confusion regarding the possible answers for the activity explained by the students in the first implementation. The second change

was to add the sample of the real-world examples of the networking concepts for the activities in order to clarify the steps which students were required to follow. The modifications regarding the instructional procedure are as follows:

1. Detailed feedback was given to the students based on weekly schedule after conducting each activity.
2. Grading the activities

The results of the analyses on the collected data are demonstrated in detail in the following sections.

The results of descriptive statistics indicated that the highest mean score belonged to "personal development" (*M*=3.99, *SD*=.89) which was followed by "collaborative- learning" (*M*=3.95, *SD*=.33) and "satisfaction from the course" (*M*=3.81, *SD*= .88) while the least mean score was on "active learning" (*M*=3.61, *SD*=.84). The descriptive statistics for other categories used in NSSE are also demonstrated in table 4.1.

In order to further investigate the effect of the activities on students' level of engagement, participants were interviewed using interview protocol. Content analysis was carried out on the students' interviews transcripts with the inter-rater reliability of 75% and 85 % for spring and summer semesters respectively which are demonstrated as follows.

Students were interviewed whether the use of activities in the course helped them to discover their skills or not**.** In spring semester 2015, finding real-world examples of the networking concepts from daily life was the most important feature of the activities mentioned by students. They emphasized on the role of "real-world examples" stating "*finding real-world examples of the networking concepts helped us to learn more about them"* in terms of learning the computer networking course. They continued and explained that "*taking photos and video of the real-world examples of networking concepts helped us to understand the concepts better and easier*".

The analysis on the students' interview in summer semester 2015 showed that the students believed in the role of the activities on their learning the concepts since the activities helped them to remember the concept for a long time in comparison with other course stating "*The activities helped us not to forget what we have learned in the class*", "*They helped us to remember the previous networking topics in the class easily"* and *"We understood the concepts deeply because of the activities and we could use them later on".*

They stated that "*The examples for the activities helped us to find relationship between course content and real-life easily."* Moreover, they mentioned the role of the activities for connecting the networking concepts to real-world examples explaining *"Finding the analogies between the course content and the real-world examples provided extra information about the course content.", "Connection between the course content and real-world examples showed us the usefulness of the networking concepts."* Some students' quotations related to the "understanding the course" were "*Finding the example of the networking course was as the supplement for understanding the course content*", "*We understood the course by discussing them with our peers*" and "*Finding the real-world examples of networking course made the course content more understandable*". Daily-life connection was the second category which emerged after content analysis on students' interview transcripts. Students stated that *"Finding the real-world example of the course content showed the similarities between the course content and their examples form the life"*, "*Explaining about real-world examples of networking concepts showed their usefulness in life*". Thus, "understanding the concepts", "daily-life connection" were the categories which were emerged after content analysis.

The answers given by students were categorized into two themes (i.e. understanding the concepts and daily-life connection) and the explanations were demonstrated in table 4.2.

Table 4.2: Students' Perceptions on the Role of the Activities on Discovering Their Skills in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F (Frequency)	Categories	Codes	F (Frequency)
Understanding the Concepts	Real-world Examples	6	Understanding the Concepts	Long-term remembering	3
	Discussing	3		Remember for long time	3
	Talking	2		Deep understanding	3
				Learn deeply	2
Daily-life Connection	Similar	4	Daily-life Connection	Real-world Examples	4
	Related	2		Similar	4
	Useful	3			
	Can be used	2			

The second interview question was whether the use of the activities in the course helped them to connect the course content with daily-life. The analysis of learners' interviews transcripts in spring semester indicated that searching about and finding the real-world examples of the networking concepts helped students to relate the course content to daily-life. Furthermore, finding the real-world examples of the computer networking helped us to perceive the content from their applicability points of view; real-world examples showed us the use of the concepts in different context as well. Therefore, we understood the relevance of the course content to daily life. Students elaborated their answers as "*Sharing the real-world examples of the networking concepts helped us to learn the concept betters"*, "*Finding the real-world examples of the course content showed the connection between the courses with daily life*" in terms of role of real-world examples of networking concepts. They emphasized the role of the activities and how they showed the possible uses of the concepts in different settings where they have not been applied by explain "*We understood the use of the course content in different context"* and "*One example of*

the concepts encourage us to think about their possible application in various settings"

The content analysis on the student' interviews on summer semester showed that the students perceived the activities as the enhancement for networking course since they show the real-examples of the concepts besides the usage of the concepts in the settings different from the computer networking course. Therefore, students' answers were categorized into two categories "real-world example" and "Applicability of the Concept". In the summer semester, students believed that the activities helped them to relate the course content to daily life as long as they looked for real-world examples of the course content and finding the analogies between them stating "*finding the real-world examples of the networking concepts help us to connect the course with life*" and "*finding the similarities between the course content and their examples in daily life was new for us and shows their relationships*". They also mentioned about the applications of the computer networking content to other settings which are not related to computer networking course. They elaborated their answers "*We understood that, it is not a completely theoretical course*", "*Some settings use the computer networking concepts in which the computers even are not used*". Students' answers were classified into different categories (i.e. real-world examples and applicability) which are represented in table 4.3.

Table 4.3: Students' Perceptions on the Role of the Activities on Relating the Course Content to Daily-life in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Real-world examples	Searching the Example	7	Real-world examples	Searching the Example	8
	Sharing photos and/or videos	5	Analogies	Discussion	3
Analogies	Taking photo	3		similarities	3
Applicability of the concept	Various contexts	6	Applicability of the concept	Various contexts	3
	Usage/ Use	4		Different places	
	Useful	2			3
				Not only theoretical concepts	5

Furthermore, students were interviewed whether the activities encourage them to search more about the course content or not. The answers given by students in the spring semester showed that they used different resources in order to do the activities as well as the activities increased their search and study about the networking concepts. They believed that the activities encouraged them to search about the concepts stating "*to understand the networking concepts better we looked up different resources*" and "*Yes, we could access other examples about the networking concept through searching."* In the spring semester; students believed that searching different resources helped them to learn the course content easily. It also enabled them to find more real-world examples of the concept. Some of their explanations are as follows. "*We learned about different examples of networking topics using various resources*", "*Yes, since we needed to find real-world examples of the networking concepts, we needed to understand the course content well, so we should search different resources*", "*for better understanding of the concepts we needed to search for them*" and "*We could get detailed information about the course content by searching*"

They continued that searching through different resources helped them to understand and find more real-world examples stating "*for finding different examples about the course content we needed to search more*" and " *We needed to find the relationship between course content and their daily-life connection; so we needed to search different resources*".

In the summer semester, students believed that the activities encouraged them to use and search different resources because they needed to understand the concepts deeply and in detail. They also expressed that they needed to use various materials in order to find different types of real-world examples of the computer networking concepts emphasizing the analogies between the course content and their examples. Therefore, two categories "Variety of context" and "Daily-life Connection" which are represented in table 4.4. Students explained that they used different resources rather than course materials to learn about the computer networking course stating *"we used other resources for learning about the concept definition"* and *"We searched other resources for getting information about course content".* In terms of

the second category (i.e. daily-life connection), the students expressed that "*Different resources gave ideas about real-world examples of the networking concepts", "We needed to search using various resources because we were expected to find real-world examples of the course content" and "Learning about the connection between course content and their daily-life examples made us to search about them more."*. Students' explanations are illustrated in table 4.4 according to various categories.

Table 4.4 : Students' Perceptions on the Role of the Activities on encouraging them for Searching More Resources in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Learn the Concept	Searching the Concept	6	Variet of Context	Different examples	6
	Finding detail information	3		Finding detail information	8
	Detail information	5			
Daily-life Connection	Real-World Examples	5	Daily-life Connection	Real-world examples	3
	Similar	4		Practical example	2
	Related	2		Similar	7
	Connected	1			

Students' answers regarding the activity 3 which addressed the concept of bandwidth and throughput in spring semester which considers the topic of bandwidth and throughput in networking and their collaboration with each other are shown in figure 4.1.

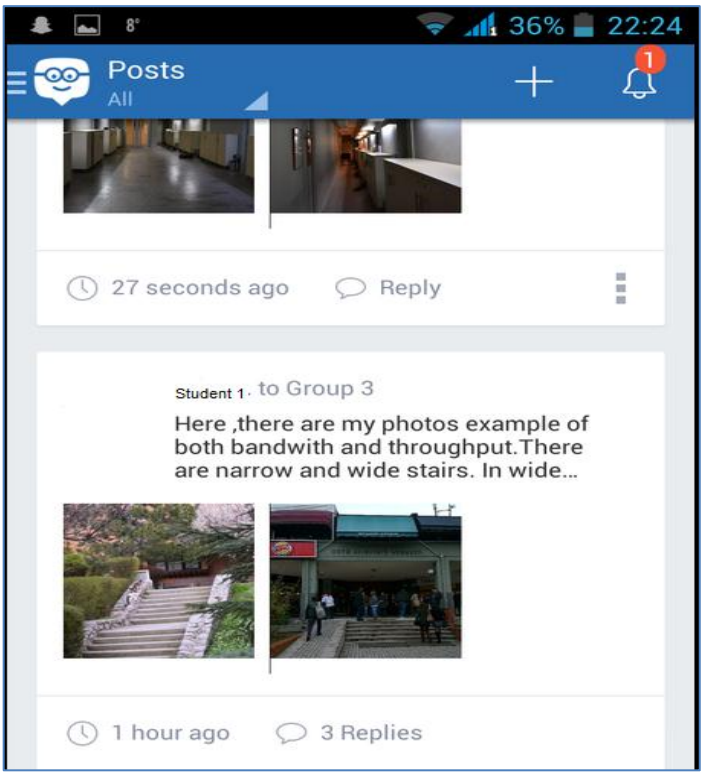


Figure 4.1*: Students' Answers Regarding the Activity 3, the Concept of Bandwidth and Throughput of Networking Concept

* Students' photos and names were removed from original screenshots considering privacy issues.

In order to find out the effect of the activities on increasing the collaboration among students, students' ideas were analyzed as well. Students' answers in spring semester revealed that the activities increased their communication and interaction with their group-mates, but they did not explain an increase related to their communication with their instructor.

The students stated that they could discuss about the activities by their friends and learned more about the networking concepts for doing the activities. They explained that *"we talked with our peers more than before because we needed to find real-world examples of the networking concepts from daily-life."*, "*we shared our examples with the peers before submitting them" and "for better understanding the concepts we needed to talk about them with our group-mates".*

They also mentioned that they communicated with their peers before submitting the activities in order to be sure about them and check the answers by stating "*for*

checking the correctness of the answers, we checked them with our friends before submission", "we needed to check our answers before sending them". Some students told that they talked to each other about the use of the tool. They explained that "*We asked to each other how we can use different features of tool" and "for example we talked about the file attachment for the tool as it was new tool for us*". Thus, the emerged categories based on the content analysis are "Learn the concepts" and "Completing the activities". Table4.5 shows the students' ideas in terms of the effect of the activities on collaborative-learning. Students' answers revealed that the activities increased their communication and interaction with their group-mates and the instructor. They stated that they could discuss about the activities by their friends and learned more about the networking concepts for doing the activities. They explained that *"we talked with our peers more than before because we needed to find real-world examples of the networking concepts from daily-life."*, "*we shared our examples with the peers before submitting them"* and *"for better understanding the concepts we needed to talk about them with our group-mates".* They also mentioned that they communicated with their peers before submitting the activities in order to be sure about them and check the answers by stating "*for checking the correctness of the answers, we checked them with our friends before submission", "We needed to check our answers before sending them"*. They explained that their interaction with the instructor was mainly related to receive acknowledgment in terms of the correctness of the activities stating "*We asked about the correctness of the real-examples which we found from daily life*" and "*In order to be sure that we did the activities correctly, we talked to the instructor*".

Thus, the emerged categories based on the content analysis are "Learn the concepts" and "Feedback". Table 4.5 shows the students' ideas in terms of the effect of the activities on collaborative-learning. Moreover, figure 4.2 and 4.3 illustrates students' collaboration through mobile tool.

Table 4.5: Students' Perceptions on the Role of the Activities on Collaboration with Their Peers in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Learn the Concept	Discussing concept	5	Learn the Concept	Different examples	5
	Sharing materials	7		Sharing the materials	7
	Finding real-world examples	6			
Daily-life Connection	Checking the answers	5	Feedback	Finding real-world examples	5
	Use of tool	7		Acknowledgment	1
				Being sure	2
				Ensure	3

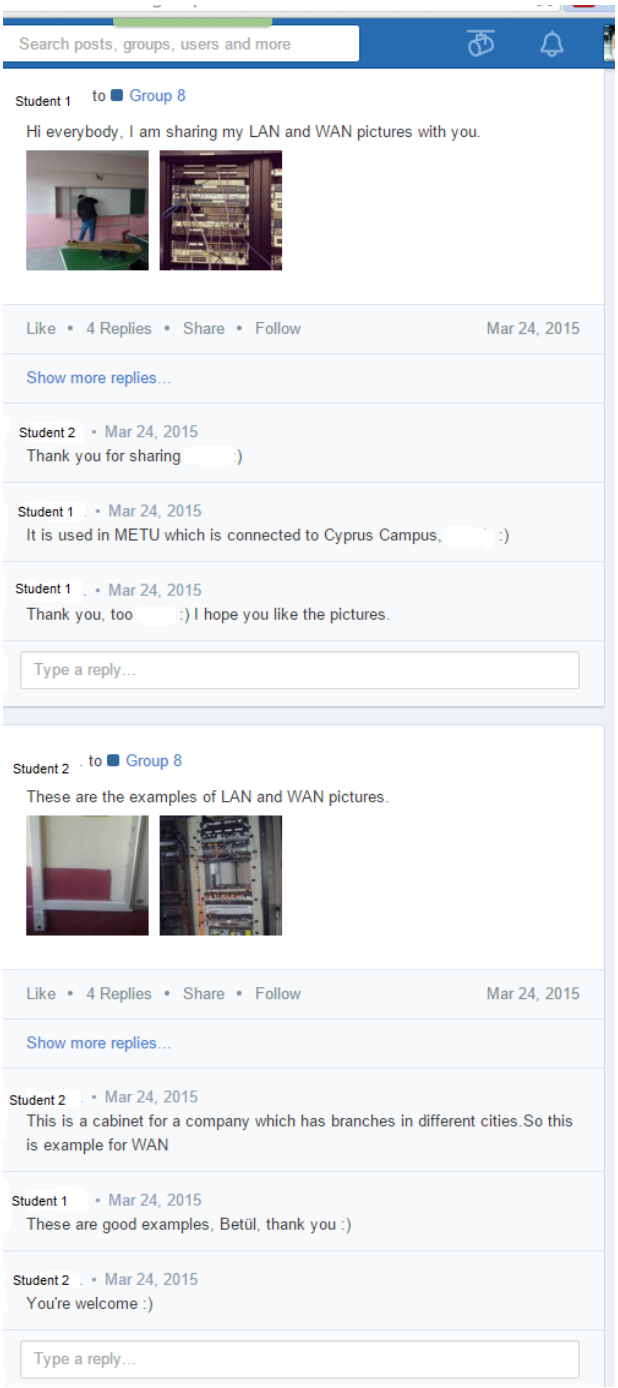


Figure 4.2*: Students' Collaboration Using Mobile Application in Spring Semester

*Students' photos and names were removed from original screenshots considering privacy issues.

Search posts, groups, users and more

The water is data throuhput , and the hose is bandwidth . the hose(hortum) of widht effect the size of the water flow. I mean the water is much more in the hose , the bandwidth is wider the throuhput is increase the data increase

Student 1 . • Jul 24, 2015
Yes true

Student 2 . • Jul 24, 2015
Thanks for your example ☺ it was better to understand the relationship between width and flow ☺

Type a reply...

Student 2 to Group 5 Summer

Assignment_2
Hello everyone☺ I took some photos to make a relation between topic and daily life. I am not sure they are suitable or not. I need help by your comments to learn the topic ☺ thanks

Like • 7 Replies • Share • Follow Jul 19, 2015

Show more replies...

Student 2 • Jul 21, 2015
Thanks for your comment ☺ I will think about it more ☺

Student 2 • Jul 21, 2015
I am sorry I forgot to reply your comment☹ everything is okey☺ What about you☺ Then let me talk about my post☺ If we consider the roadways like as the channels that are located in a cable , we can form a link between bandwidth and throughput and the roadways. Here is the thing, each roadway has its own maximum capacity of car number like bandwidth since bandwidth can be defined as the number of data passing through a channel.Moreover the measurement of actual number of cars that travel throu More...

Student 1 . • Jul 22, 2015
Hello Everyone . I havent found myphone until now. Nagihan you are very careful . I am coming to ankara last 9 hours and I saw 10 bridge like this but This is not make sense to me . roadway has its own maximum capacity of car number like bandwidth since bandwidth can be defined as the number of data passing through a channel.measurement of actual number of cars that travel through the roadways is throughput. Very good point thank you for your attention

Type a reply...

Figure 4.3 *: Students' Collaboration Using Mobile Application in Summer Semester

* Students' photos and names were removed from original screenshots considering privacy issues.

Students were interviewed about the difficulties which they faced while conducting the activities. The analysis of the learners' interviews demonstrated that the used medium mobile application was among the difficulties which expressed by students. Participants were not familiar with the used medium (mobile application). They explained their ideas by stating "*We did not use it before", "We are not familiar with it"*, "*it is not user-friendly" and "Its features are not easily used"*. They also perceived networking course as a difficult one by itself.

Students believed that the course content were complicated bay itself and finding real-world examples of them were difficult stating " *The course content was difficult*" , "*We could not understand the content"* and *" The course contents were difficult, so we could not understand them and find their examples from daily-life*". Students in the summer semester 2015 emphasized on the novelty of the used medium stating *"It was new tool for us, so we could not use it", "We did not use it before this course" , "It does not support different features"* and *"It is not the tool can be used easily".* Another difficulty which the students mentioned was about the activities. They explained that the activities was new type of homework for them stating "*The activities was new type of homework*" , *"In the first activity we did not know how to do the activities", "Finding real-world examples was difficult"* and " *we did not know how to find real-world examples of the networking concepts*". Students' opinion and explanations related to the difficulties which they faced for doing the activities are classified into two themes as "tool" and "activities". Students' ideas were categorized into two themes and represented in table 4.6.

Table 4.6: Students' Perceptions on the Difficulties which They Encountered while Doing the Activities in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Tool	Unfamiliarity	8	Tool	Unfamiliarity	6
	Non-user friendly	6		Non-user friendly	8
Course content	Complicated	5	Activities	Novelty	5
	Real-world relevance	7		Real-world relevance	7

In the second implementation of the study, students were interviewed about the feedback that they received from the instructor. This implementation was added to the interview protocol after students' explanation in the first implementation of the study. Because they expressed that they looked for more detailed feedback in terms of the activities after implementation of the activities in the first implementation of the study. Therefore, learners were received feedback for their activities after each activity every week and the extra time was given to them in order to do the required changes. Moreover, they were able to discuss the required changes every week. They were asked about the effect of the feedback which they have received in the interview protocol using the following question**.** Students expressed that receiving feedback facilitated the way which they followed in order to do the activities. Thus, the most considered advantage of receiving feedback was the facility that the feedback brought to the students for doing the activities. Learners explained their opinions using the following sentences *"Receiving information about our activities helped us to do the other activities without problems.", "When we talked about the activities with the instructor, we did them easily.", "The feedback about the activities helped us to do the rest of the activities easily and better."*, "*After receiving feedback on our assignments we faced fewer difficulties for doing them"* and *"Talking about the activities helped us to do them easily".* Thus, the first category was emerged as

"Simplifying". Students' answers indicated that receiving feedback about the activities not only facilitated the way which they followed for doing the activities, but also helped them to understand the activities especially in terms of finding real-world examples. Students support their ideas stating "*Explanation about the activities helped us to find more real-life examples without difficulties"*, "*We understood the activities better while we talked about them"* and "*Talking about the activities helped us to find more examples from daily life easily".* Consequently, the second emerged category is informative. Participants' answers which were categorized based on content analysis are depicted in table 4.7 as follows.

Table 4.7: Students' Perceptions on Receiving Feedback from Instructor in terms of the Activities in Summer semester 2015

Categories	Codes	F
Simplifying	Easier	5
	Less-problems simply	5
Informative	Finding real-world examples easier	3
	Receive information	2
	Understandable	4
	Understand easily	2

Students' posts while performing the activities was also were classified into different categories in spring semesters 2015 which are shown in Appendix F.

The analysis of the collected data by using NSSE in terms of students' engagement for two semesters represented that the highest mean score was on "personal development" (*M*=3.78, *SD*=.65) and (*M*=3.99, *SD*=.89) in both consequent semesters respectively. "Satisfaction from the course" (*M*=3.51, *SD*=.88) was the category which the second highest mean score belonged to it in the spring semester 2015 (The first phase of the study) as well as it was the category with the third highest mean score (*M*=3.81, *SD*= .88) in summer semester 2015. The least mean

score was on “interaction with instructor” (*M*=2.79, *SD*=.89) in the first implementation of the study and in “students effort” (*M*=3.10, *SD*=.59) in the second implementation of the study.

Since the descriptive analysis indicated that the least mean score was on the “interaction with instructor” (*M*=2.79, *SD*=.89) in the first implementation of the study as well as students’ expression showed that they looked for receiving more feedback on their activities, the procedure for implementing the activities in the second implementation was changed and more feedback was provided for each activity as it was mentioned in the third chapter (methodology). Thus, the analysis showed the improvement in terms of the “interaction with instructor” (*M*=3.79, *SD*=.97) in the second implementation of the study. The data analysis showed that the modifications which were done in the activities and their procedures of implementation increased collaborative-learning (*M*=3.95, *SD*=.33) in the second implementation compared to collaborative-learning in the first implementation (*M*=3.24, *SD*=.77). Since the students were informed that each step of the activities would be graded, it affected their collaboration with each other; because various steps of the activities were related to sharing the materials in terms of the activities by each member in the group.

Moreover, students’ interaction with instructor was increased in the second implementation (*M*=3.79, *SD*=.97) in comparison with the first implementation (*M*=2.79, *SD*=.79*)* due to the changes that were applied in the procedure of implementing the activities. Students were received weekly feedback on their activities in the class and on the used mobile application after conducting each activity as well as the learners were given time to improve their activities based on the feedback while they were informed on their progress by their grades.

4.2 The Effect of Authentic Collaborative M-learning Activities on Students' Motivation

In order to answer the second research question in terms of the effect of the authentic collaborative m-learning activities on students' motivation besides descriptive analysis paired sample t-test was used in order to compare students' level of motivation in the beginnings and at the end of the semesters. The normality check for distributions also were conducted which indicated that the distributions were normal $p>.05$ in semesters and demonstrated in table 4.8.

Table4.8: Test of Normality for the Distribution of Leaners in Spring Semester 2015

	Kolmogorov-Smirnov[a]		Shapiro-Wilk	
Categories	*df*	*p*	*df*	*p*
Self-efficacy	22	.20*	22	.68*
Intrinsic Value	22	.20*	22	.13*
Cognitive Strategy Use	22	.20*	22	.33*
Self- regulation	22	.20*	22	.44*

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance

The descriptive statistics of the pretest indicated that "intrinsic value" (M=5.05, SD=.52) was the one with the highest mean score while "self-efficacy" (M=4.83, SD=.64) was the lowest among other indicators of students' motivation in the pretest. Descriptive statistics related to students' motivation in pretest is shown in table 4.9.

Table 4.9: Descriptive Statistics for Students' Level of Motivation in Pretest for the First Implementation of the Study in Spring Semester 2015

	Pre test			*Post test*		
Categories	*N*	*M*	*SD*	*N*	*M*	*SD*
Self- efficacy	24	4.83	.64	26	4.60	.77
Intrinsic value	26	5.05	.52	24	4.73	.84
Test Anxiety	28	4.63	.77	26	4.82	.76
Cognitive strategy use	28	5.00	.60	23	5.50	.71
Self-regulation	28	4.92	.86	26	5.49	.83

The results of the posttest analysis in the first implementation of the study showed that the "cognitive strategy use" (*M*=5.50, *SD*=.71) was the category which had the highest mean score while "self-efficacy" (*M*=4.60, *SD*=.77) was the one with the least mean score.

In order to analyze the effect of the activities on students' level of motivation and compare students' motivational level in the beginnings and at the end of the semester, paired sample t-test was used. The paired sample statistics and paired sample t-test are represented in table 4.10 and 4.11 respectively.

Table 4.10: Paired Sample Statistics for Students Level of Motivation in Spring Semester 2015

Pairs	N	M	SD
Self-efficacy 1	21	4.75	.63
Self-efficacy 2		4.51	.62
Intrinsic value1	21	5.04	.55
Intrinsic value2		4.62	.72
Test anxiety1	25	4.59	.80
Test anxiety 2		4.55	.69
Cognitive strategy use 1	22	5.00	.57

Table 4.10(Continued)

Cognitive strategy use 1		5.44	.67
Self -regulation1	25	4.90	.86
Self-regulation 2		5.44	.80

Table 4.11: Paired Sample t-test for Students' Motivation in Spring Semester 2015

Pairs	*M*	*t*	*df*	*P*
Self-efficacy 1- Self-efficacy 2	.24	1.28	20	.22
Intrinsic value1 -1Intrinsic value2	.43	2.34	20	.03*
Test anxiety 1- Test anxiety 2	.16	.70	24	.49
Cognitive Strategy use 1-Cognitive Strategy use 2	.44	2.48	21	.02*
Self–regulation1-Self-regulation2	.54	3.08	24	.00*

*P<.05

The paired sample t-test indicated that there is a significant difference $p<.05$, t (24) = 3.08 between students' "self-regulation" before using the activities (M =4.92, SD =.86) and after using them (M = 5.49, SD=.83).

In addition, there is a significant difference t (21) = 2.48, $p<.05$ on "students' cognitive strategy use" before doing the activities (M=5.00, SD= .60) and after being exposed to the activities (M=5.50, SD= .71).It was acquired that the used activities in networking course had effect on "students' intrinsic value" as well. The paired t-test showed the significant differences t (20) = 2.34, $p<.05$ before conducting the activities (M=5.05, SD=.52) and after their implementation in the course (M=4.73, SD=.84).

The paired sample t-test was used in order to compare students' level of motivation in the beginnings and at the end of the semester in summer semester 2015. The normality check for distribution has also been conducted which indicated that the distribution was normal $p>.05$.The descriptive statistics of the pretest indicated that "cognitive strategy use" (M=5.05, SD=.77) was the category with the highest mean score while "self-efficacy" (M=4.79, SD=.81) was the category with the lowest mean

among indicators in terms of students' motivation in pretest. Descriptive statistics related to students' motivation in pretest is shown in table 4.12.

Table 4.12: Descriptive Statistics for Students' Level of Motivation in Pretest for the First Implementation of the Study in Summer Semester 2015

	Pre test			*Post test*		
Categories	*N*	*M*	*SD*	*N*	*M*	*SD*
Self- efficacy	24	4.79	.81	27	4.88	.88
Intrinsic value	27	4.86	.94	27	4.29	.88
Test Anxiety	27	4.86	.92	27	4.44	.79
Cognitive strategy use	27	5.05	.77	27	4.78	.80
Self-regulation	28	4.95	.96	27	5.80	.40

The results of the posttest analyses indicated that the highest mean score belonged to the "Self-regulation" (*M*=5.80, *SD*=.40) while the least one was on "Intrinsic value" (*M*=4.29, *SD*=.88)

In order to check the effect of the activities on students' level of motivation and compare students' motivational level in the beginnings of the semester and at the end of the semester paired sample t-test was used. The paired sample statistics and paired sample t-test are represented in tables 4.13 and 4.14 respectively.

Table 4.13: Paired Sample Statistics for Students Level of Motivation in Summer Semester 2015

Pairs	N	M	SD
Self-efficacy 1	27	4.84	.15
Self-efficacy 2		5.80	.08
Intrinsic value1	27	4.85	.94
Intrinsic value2		4.88	.88
Test anxiety1	27	4.85	.93
Test anxiety 2		4.29	.87

Table4.13:(Continued)

Cognitive strategy use 1	27	5.11	.78
Cognitive strategy use 1		4.78	.80
Self -regulation1	27	5.00	.96
Self-regulation 2		4.44	.80

Table 4.14: Paired Sample t-test for Students' Motivation in Summer Semester 2015

Pairs	*M*	*t*	*df*	*P*
Self-efficacy 1- Self-efficacy 2	-.95	5.81	26	.00*
Intrinsic value 1- Intrinsic value 2	-.02	11	26	.91
Test anxiety 1- Test anxiety 2	.56	2.37	26	.023*
Cognitive Strategy use 1- Cognitive Strategy use 2	33	1.60	26	.12
Self –regulation1- Self-regulation2	.55	2.23	26	.034*

*P<.05

The paired sample t-test indicated that there is a significant difference $p<.05$, t (26) = 5.81 between students' "self-efficacy" before using the activities (*M =4.84, SD=.15*) and after using them (*M* =5.80, *SD*=.08).

In addition, there is a significant difference t (26) =2.23, $p<.05$ on students' self-regulation before doing the activities (*M*=5.00, *SD*=.96) and after being exposed to the activities (*M*=4.44, *SD*=.80).

In order to further investigate the effect of the authentic collaborative m-learning activities on students' motivation, learners were also interviewed using interview protocol in the spring and summer semester of 2015. The content analysis was carried out on the students' transcripts with the inter-rater reliability 83.4 % and 83 % respectively.

Students' ideas were collected in terms of the effect of the activities on their motivational levels using interview protocols as well. Learners were to what extent the authentic collaborative m-learning activities used in this course support their learning the computer network concepts**.** Students emphasized the importance of finding real-world examples of the networking concepts from daily life by stating "*The activities helped*

us to make analogies between networking concepts and their examples in daily life." They believed that "thinking about" and "searching for" real-world examples of the networking concepts made the course more interesting for them. They also mentioned the usefulness of taking photos and videos of the examples as well as sharing and discussing about the course content.

Students explained that the activities especially finding the analogies between real-world examples of the networking concepts helped them to understand the course content stating "*I understood the course content easily by doing the activities*" and "*We understand the networking course because the activities provided more and detailed information*". They also mentioned about the important role of discussions with their peers for understanding the course content. They elaborated the answers stating "*Discussing about real-world example of networking course made us to study deeply*" and "*The networking concepts became more understandable while we were discussing them".* Another category which was emerged based on the content analysis was "daily-life connection". Students perceived that the activities helped them to find the relationship between course content and their usage in daily-life stating "*Finding the real-world examples of networking course showed us the relationship between course content and their usage in daily life*", "*I learned about the applicability of networking course by finding their examples from daily life"* and "*The examples given in the activities made us to be more alert about our environment*".

In summer semester 2015, students' answers were classified into two main categories "real-world examples" and "learning the concepts". They focused on the learning the course content and highlighted the role of group-work in terms of learning the networking concepts. They elaborated their ideas *"Sharing the materials and photos helped us to learn the course content well"* and *"Sharing the photos and video from real-world examples with our peers was very helpful to understand the content of the course".* They perceived the usefulness of the activities from collaboration point of view. They stated that "*Since we shared our answers, we were able to get feedback from our peers*", "*we could discuss the answers with our friends*

before main submission" and *"we became sure about our answers by talking about them with our friends*".

They also believed in the role of "finding real-world examples" of the networking concepts from daily life for better understanding as well as learning the computer networking concepts. They supported their ideas saying *"Explaining about the relationship between the networking concepts and their real-world examples was helpful."* and *"Finding the relationship between content and real-world examples helped us to learn the course better."*

Table 4.15 shows the students' opinions regarding the effect of the activities on learning computer networking concepts. In addition, some of students' answers to the activities in summer semester are depicted in figure 4.4.

Table 4.15: Students' Perceptions on the Effect of the Activities on Learning the Networking Concepts in Spring and Summer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Understanding course content	Detail information	5	Understand course content	Group-work	3
				Working together	2
	Discussing	5		Checking answers	5
Applicability of the Concept	Finding real-world examples	8	Daily-life Connection	Finding real-world examples	8
				Similar	4
	Applicable	3		connected	2
	Can be used in life	3			

Figure 4 4*: Some Samples of the Students' Answers for Activities in Summer Semester 2015

* Students' photos and names were removed from original screenshots considering privacy issues.

Students were also asked to compare the computer networking course which enhanced with authentic collaborative m-learning activities with the courses without using the activities. Finding the analogies between computer networking concepts and their examples in daily life and being active learners was highlighted as the main differences between this course and the course without enhancement of the activities. The content analysis showed that the students perceived themselves as more "active" in the course which is enhanced by the activities. They elaborated their answers stating "*We were more active in the course because we needed to find real-world examples of the computer networking course*", "*Sharing the materials from daily-life*

made us to participate in the course more than before", "*Taking the photos from daily-life and sharing them using mobile application encourage us to be more active*" and "*We completed various steps in each activity and were more involved in the course*". Students expressed that they learned the course in detailed thanks to the activities saying "*We focused more on the detail of the course because we needed to find their real-life examples"*, "*These activities made us to think about course content outside the class for finding the real-world examples"* and "*The activities made the course more informative*" and "*Since we found the analogies between the real-world examples and networking concepts, we got more information about the concept in the courses*". In summer semester 2015, students refer to being active type of learner in the course and finding the analogical examples of the networking concepts in daily life as the main difference between the courses with enhancement of the activities and the ones without using the activities. They believed that they became more active learners in the course thanks to the activities as in the first implementation of the study. They explained their ideas stating "we were active in the course, because we needed to share material", "*we needed to discuss about the activities with our peers and the instructor in this course*", "*sharing the real-world examples made us to became more active in the course, because we needed to find real-world examples*" and "*I feel the activities made us to be alert about the course content in different context rather than class*"

They believed that making analogies between the course content and daily life was the most important differences between the course with enhancement of the activities and the ones without using the activities. They explained the role of making analogies between course content and daily life stating "*the activities showed us how the content of the course were related to our life*", "*finding the real-world examples of the computer networking course was new type of the activity in the course*", "*The similarities between course content and their examples was new type of homework for us*" and "*Finding the analogical examples of the course content made the course interesting"*. Students' answers were categorized as "Active learner" and "Daily- life connection".

Students' answers to the aforementioned question in spring semester 2015 were categorized into two categories and demonstrated in table 4.16.

Table 4.16 Students' Perceptions on the Similarities and Differences between the Courses with Activities and the Ones without Activities in Spring and Sumer Semesters 2015

Spring semester 2015			Summer semester2015		
Categories	Codes	F	Categories	Codes	F
Active learners	Finding real-world examples	6	Active learners	Sharing the materials	7
	Sharing the materials	7		Doing the assignment	4
	Taking photos	4		Discussing	3
				Talking	1
Informative	Detail information	3	Daily-life Connection	Finding real-world examples	8
	Learning more	2		Analogies	2
	Finding More information	3		Similarities	3
	Analogies	4		Connection	1
	Relations	2			

Students' interview was continued by talking about the other suitable courses rather than the computer networking course for using the activities as well. Students perceived that "*data management course"*, "*language learning"* and "*educational course"* as the suitable courses for implementing the activities. Students elaborated their opinions for highlighting the aforementioned courses stating "*data management course, because database has many examples in daily life and activities made us to search about the real-world examples of the course content in daily-life.", "Language course, because this course needs more group work, activities can be suitable for language course."* and "*language learning needs more collaborative type of learning"*. Students' interview transcripts are *represented* in appendix G.

4.3 The Effect of Authentic Collaborative M-learning Activities on Students' Attitudes toward Course Content

In order to answer the third research question regarding the students' attitude toward course content both descriptive and inferential statistics have been used. The descriptive statistics has been conducted on the collected data using the attitude scale as pretest and posttest in the beginnings and at the end of the semester respectively. In addition, inferential statistics (paired sample t-test) was used for analyzing the effect of the authentic collaborative m-learning activities on students' attitudes toward course content. The normality test indicated that the distribution of the sample is p>.05 normal.

The descriptive statistics in terms of students' attitudes toward course content in the beginnings of the semester and at the end of the spring semester 2015 are represented in table 4.17.

Table 4.17: Descriptive Statistics for Students' Attitude toward Course Content in in Spring Semester 2015

	Pretest			*Posttest*		
	N	*M*	*SD*	*N*	*M*	*SD*
Attitude	23	3.44	.50	22	3.26	.68

In order to check the effect of the authentic collaborative m-learning activities on students' attitude toward course content, paired sample t-test was conducted. The results of the paired sample t-test indicated that there is not a significant difference *p*>.05 between students' attitudes toward course content in the beginnings of the semester and the end of the semester after conducting authentic collaborative m-learning activities. The paired sample statistics and paired sample t-test are demonstrated in table 4.18 and 4.19 respectively.

Table 4.18: Paired Sample Statistics for Students' Attitudes' toward Course Content in Spring Semester 2015

Pairs	*N*	*M*	*SD*
Attitude 1	20	3.44	.45
Attitude 2	20	3.23	.70

Table 4.19: Paired Sample t-test for Students' Attitude toward Course Content in Spring Semester 2015

Pairs	*M*	*t*	*df*	*p*
Attitude 1-Attitude 2	.19	1.00	19	.33

The descriptive statistics was conducted on the collected data using the attitude scale as pre and posttest in the beginnings and at the end of the summer semesters 2015 respectively. In addition, inferential statistics (paired sample t-test) was used for analyzing the effect of the activities on students' attitudes towards course content. The normality test indicated that the distribution of the sample was normal in terms of attitude scale $p>.05$.The descriptive statistics in terms of students' attitudes toward course content in the beginnings of the semester as pretest and at the end of the semester as posttest are represented in table 4.20.

Table 4.20: Descriptive Statistics for Students' Attitude toward Course Content in Summer Semester 2015

	Pretest			*Posttest*		
	N	*M*	*SD*	*N*	*M*	*SD*
Attitude	19	3.12	.79	27	3.55	.94

In order to check the effect of the activities on students' attitude towards course content, paired sample t-test was carried out. The results of the paired sample t-test indicated that there is not a significant difference $p>.05$ between students' attitudes

toward course content in the beginnings of the semester and at the end of the semester after conducting the activities similar to the first implementation of the study. The paired sample statistics and paired sample t-test are demonstrated in table 4.21 and 4.22 respectively.

Table 4.21: Paired Sample Statistics for Students' Attitudes' toward Course Content in Summer Semester 2015

Pairs	*N*	*M*	*SD*
Attitude 1	23	3.15	.75
Attitude 2	23	3.40	.93

Table 4.22: Paired Sample t-test for Students' Attitude toward Course Content in Summer Semester 2015

Pairs	*M*	*t*	*df*	*p*
Attitude 1-Attitude 2	.25	.93	22	.36

*P< .05

CHAPTER 5

CONCLUSION

This study was a mixed-method research design with triangulation approach and its purpose was to investigate the effect of authentic collaborative m-learning activities on students' engagement, motivation and attitudes toward course content. The activities were designed and implemented for a computer networking course in two consequent semesters. Data was collected using four instruments including two surveys, one questionnaire and interview protocol from the undergraduate students who enrolled in the course. Since the role of authentic scenarios was shown in different studies for facilitating collaborative-learning, authentic collaborative m-learning activities were developed for a computer networking course. The activities include the questions related to the course content and students were asked to find real-world examples of computer networking course. They were also required to take photos and /or videos of the examples in collaboration with each other. To further investigate the effect of the activities on students' engagement, students' interviews transcriptions were analyzed as well.

5.1 Students' Level of Engagement

In order to answer the first research question regarding the effect of the authentic collaborative m-learning activities on students' engagement, collected data using NSSE were analyzed. The analyses indicated that the highest mean score belonged to "personal development" in both semesters as the component of students' engagement. Students' answers to the interview questions demonstrated that the

students perceived the activities as the proper enhancement for computer networking course. Students addressed the role of real-world examples of computer networking concepts in their learning skill. They believed that the activities were helpful since enabled them to connect the concepts with their daily life, in their own words *"the activities helped us to make connection between what we have learned in the class and their examples outside the class".* Nevertheless, in the first implementation of the study, students emphasized on "deep understanding of the concept" while in the second implementation of the study "remembering for a long time" and "not forget the concepts" were mentioned in terms of understanding the concepts. The main idea in terms of students' engagement is to provide learning settings with more active learners where they could apply new information to create their knowledge (Mestre, 2005). Coates (2007) explained the importance of collaboration stating:

> Students reporting a collaborative style of engagement tend to favor the social aspects of university life and work, as opposed to the more purely cognitive or individualistic forms of interaction … High levels of general collaborative engagement reflect students feeling validated within their university communities, particularly by participating in broad beyond-class talent development activities and interacting with staff and other students. (p. 134)

Students' engagement cycle was illustrated by Coates (2007) including collaborative, intense, passive and independent components which are depicted in figure 5.1.

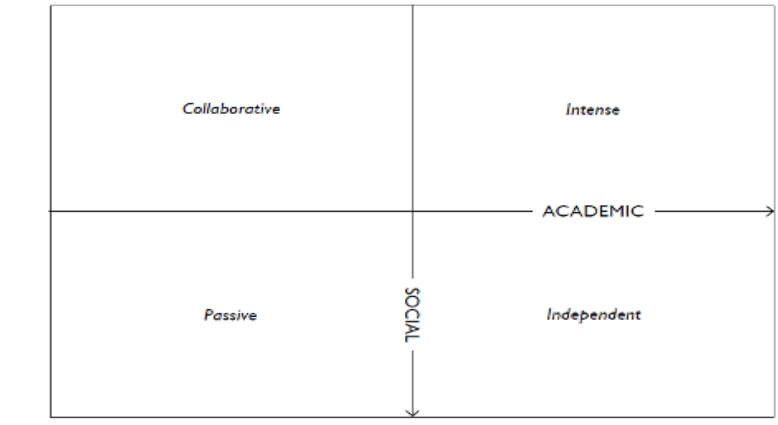


Figure 5.1: Student engagement styles (Coates, 2007)

From the above perspective, finding analogies between the abstract course content and examples from daily life increases students' interest in the course content while they become more engaged learners.

"Collaborative- learning" was the component with the second highest mean score in the second implementation of the study. Students perceived that the activities increased their collaboration with their peers in the first implementation and with peers and instructor in the second implementation. The modifications were applied to the instruction in the second implementation and students received discussed the about activities with instructor while they received feedback about their answers, their interaction and collaboration was increased in the second semester. As it is shown in the above figure, collaborative-learning is as the important component for students' engagement. Use of mobile application in the study facilitated students' collaboration with each other enabling them to communicate each other without time and location constrain. It also enhances their material-sharing while mobile devices support sharing various type of information. It shows the effect and usefulness of the m-learning regarding students' engagement and highlight the importance of "Social technology", "Device usability" and "Interaction learning" in the m-learning frame model by Koole (2007). The model considers the role of mobile devices for providing easier communication and collaboration. Thus, the study proves the effect of the "social technology" and "devise usability" features of m-learning frame regarding student' collaboration. In addition, the role of authentic context for enhancing students' collaboration becomes evident in the current study and shows that the interaction learning plays important role in students' collaboration. Thus, the result of the study shows that the features of authentic and collaborative-learning which are used for developing authentic collaborative activities increase students' engagement. Moreover, it is revealed that m-learning is the suitable framework facilitating students' collaboration and increased students' engagement.

The study shares some similar results with study by Hsu and Ching (2013), which indicated the role of mobile computer-supported collaborative learning (mCSCL) in terms of enhancing the students' understanding of the concepts and applications as

well. The results of the study were similar to the results those by Hashim et al. (2015), which indicated the role of m-learning in personal fulfillment

5.2 Students' Level of Motivation

In order to answer the second research question, which considered the effect of the authentic collaborative m-learning activities on students' motivational level, data collected using MSLQ and interview protocol were analyzed.

The paired sample t-test on the data collected using MSLQ indicated that there was a significant difference in "self-regulation", "students' cognitive strategy use" and "students' intrinsic value" at the beginning and end of the semester in the first implementation of the study. . In the expectancy-value model of motivation (Eccles, 1983; Pintrich, 1988, 1989), value considers as the one of the three components as the motivational components. Intrinsic value was address in terms of expectancy. The current study shows that the activities enhance students' willingness and interest to do the activities while their intrinsic value has increased after performing the activities. students were satisfied using the activities in the course and they expressed that "*using the activities in the course helped them to understand the course content deeply.*" They also stated that "*making the analogies between course content and their real-world examples showed the usefulness of the course content in daily-life."*

Moreover, expectancy is considered as another component in the expectancy-value model of motivation (Eccles, 1983; Pintrich, 1988, 1989). Cognitive strategy use as students' emotional reaction is the important features helps for increasing students' motivation. Students perceived that the activities encourage them to think about the course content more because they needed to find analogical relation between the course content and real-world examples. In addition, making connection between theory and practice increase their thinking skill while they become more self-regulated learners. Collaboration with peers and instructor helped students to find more appropriate examples from daily-life reflecting the course content. Therefore, the results of the study reveal the effectiveness of the authentic collaborative activities for increasing students' motivation.

In the second implementation, the comparison of the effect of the activities on students' motivation using paired sample t-tests showed that there were significant differences in "self-efficacy", "test-anxiety" and "self-regulation" between the pre and post-tests in the study.

In the second implementation of the study, students' self-efficacy was increased. Self-efficacy is considered as the important factor in the expectancy-value model of motivation (Eccles, 1983; Pintrich, 1988, 1989). It reveals that the activities helped students to consider their abilities in performing the task. The use of authentic tasks which students were expected to do in collaboration with each other encourage them to use and discover their abilities. However, in the second implementation students were graded on the conducted activities which encourage them to use their abilities more than previous implementation where they were not graded based on their activities. In addition being graded helped them to keep track of their progress while they become more motivated.

Students' self-regulation was decreased in the second implementation; it might be as a result of the modifications which were applied in the instructional procedure of the activities; because students were more regulated in the second implementation of the study by instructor. Students received feedback from instructor every week and they were graded on the activities.

The results indicated that the activities helped to decrease students' anxiety level. The anxiety level affects their success. Thus, it can be assumed as another advantage of using the authentic collaborative activities. Since they perform the activities, they understand the course in detail which is mentioned by students in their interview and leading to a decrease in their anxiety level related to the test. . The outcomes of the study were in parallel with the results of the study by Hsu and Ching (2013) in terms of enhancing the students' understanding of the concepts and applications. The study shares similar outcomes with the study by Jones et al. (2013) in terms of authentic problem–solving approach and instructional method. The study by Jones et al. (2013) also considered the role of real-world scenarios on students' level of motivation

5.3 Students' Attitude toward Course Content

To answer the third research question addressing the effect of the authentic collaborative m-learning activities on students' attitudes toward course content, collected data using attitude scale was analyzed. Paired sample t-test indicated that there was not a significant difference between students' attitude toward course content before and after being exposed to the activities in two implementations of the study. However, students related their perceptions to the content of the course rather than the activities. They considered the concepts of the computer networking course as a difficult one rather than relating their perceptions to the activities used in the course. The computer networking course is one of the technical course of this field, its content seems more difficult for the students who prefer more educational-oriented course. Thus, the students' attitudes toward course content needed to be analyzed in various courses with different content than computer networking course using similar activities in the courses.

5.4 Suggestion for the Further Research

The results of the study can shed light on the path to design authentic and collaborative learning settings by means of mobile technologies. The results obtained from the study illustrate the required features of the authentic learning environments and facilitate its design using mobile technologies in the future studies.

Results of the study shows that the integration of authentic collaborative m-learning activities in the computer networking course helped students to discover their skills and enabling them to make analogies between the course content and real-world. Students mentioned they become more active in the course thanks to the activities in their interviews. Hence, future research could focus on implementing this approach in other courses in order to enhance students' collaboration and interaction with each other. Authentic collaborative m-learning activities could be developed for other courses rather than the computer networking course in future studies. This study provides suggestions for enhancing student engagement through authentic m-

learning activities in courses with technical content. It could be interesting to also study the effects of such activities on other domains.

Moreover, the study highlighted the role of real-world scenarios in terms of students' motivation. Students believed that finding the analogical relationship between course content and their examples in daily life encouraged them to learn course content deeply. Therefore, one suggestion for further research could be the use of real-world scenarios as a proper approach for increasing students' motivation besides being active learners.

Another suggestion is to use of the appropriate tool in instructional procedure especially in m-learning research. Mobile applications are developing rapidly. The selection of proper and user-friendly tools is important. In this study, students stated that they prefer to use more informal tool as well as a tool which they were familiar with its features. A more preferred tool by students could facilitate its use.

5.5 Limitation of the Study

The first limitation is related to the number of students who enrolled in the course which was 63 students (i.e. 30 students in the first implementation and 33 students in the second implementation of the study).

The second limitation of the study is related to the number of the courses in which the activities were implemented. The activities were developed and implemented only for one course (computer networking). Thus, the generalization of the results should to be made cautiously.

The third limitation is related to the span of the semesters. Since there was a difference in the span of the semesters which the activities were implemented, comparisons of the results are needed to be done carefully. In the first implementation of the study the activities were implemented for a regular semester which lasted 14 weeks. However, the second implementation of the study was conducted for a summer semester and lasted 6 weeks which was an intense course.

However, the total number of hours for both courses was exactly the same in two semesters.

5.6 Implications for Practice

The result of the study indicated that the authentic collaborative m-learning activities could increase students' engagement in the categories related to discovering their skill thanks to the analogical relationship between course content and daily-life which they were expected to find. However, students needed to follow more structured steps in conducting the activities. Thus, it is important to provide detailed feedback to students in terms of the steps to be taken. The importance of receiving feedback from instructor was acquired from the study. Students become more confident about their answers when they receive feedback and acknowledgment from their instructor. Receiving feedback also gave chance to them to learn about their mistakes and improve them. Another benefit of receiving feedback from instructor was increase in students' interaction with instructor and engagement in learning, as observed in the second implementation of the study. Thus, detailed and on-time feedback is an important required feature for implementing authentic and collaborative activities.

The second important point was the role of grading. Since students' activities were graded in the second implementation of the study, their willingness for performing the activities was increased. However, one the indicators of motivation, "self-regulation", was decreased in the second implementation of the study in relation to feedback and grades. Thus, a moderate approach, which would guide students in a precise and structured way while encouraging self-regulation, is essential in the learning settings enhanced with authentic and collaborative-learning features.

REFERENCES

Abas, Z.W., Peng, C.L., & Mansor, N. (2009). A study on learner readiness for mobile learning at Open University Malaysia. *IADIS International Conference Mobile Learning,* Barcelona, Spain. 151-157.

Alioon, Y., & Delialioglu, O. (2014). A Frame for the Literature on M-learning. *Procedia - Social and Behavioral Sciences*, 182 (2015), 127 – 135.

Allport, G.W. (1935). Attitudes. In C. Murchison (Ed.), Handbook of social psychology. Worcester, Mass: Clark University Press.

Alvarez, C., Brown, C., & Nussbaum, M. (2011). Comparative study of netbooks and tablet PCs for fostering face-to-face collaborative learning. *Computer in Human Behavior*, 27, 834-844.

Alvarez, C., Alarcon, R., & Nussbaum, M. (2011). Implementing collaborative learning activities in the classroom supported by one-to-one mobile computing: A design-based process. *The journal of system and software*, 84 (2011), 1961-1976.

Ally, M. (2009). *Mobile Learning: Transforming the delivery of Education and Training*. Athabasca: Athabasca University Press.

Archer, J. C. (2010). State of the science in health professional education: Effective feedback. *Medical Education*, 44, 101–108.

Association for Educational Communications and Technology. (2001). What is the Knowledge Base? Retrieved August 20, 2016 from http://www.aect.org/standards/knowledgebase.html.

Association for Educational Communications and Technology. (2001). The Definition of Educational Technology. Retrieved August 20, 2016 from http://ocw.metu.edu.tr/file.php/118/molenda_definition.pdf.

Astin, A. W. (1993). *What Matters in College? Four Critical Years Revisited*. San Francsco. CA: Jossey-Bass.

Bandura, A. (1991). *Self-regulation of motivation thought and action: A social cognitive theory*. Englewood Cliffs, NJ : Prentice- Hall.

Baran, E. (2014). A Review of research on Mobile-learning in teacher education, *Educational Technology & Society*, 17 (4), 17-32.

Baumeister, R. (1997). *The self and society: changes, problems and opportunities*. In R.D.Ashmore & L. Jussim (Eds.), Self and indetity (pp.191-217). New York: Oxford university press.

Bell, T., Urhahne, D., Schanze, S., Ploetzner, R (2010). Collaborative Inquiry Learning: Models, tools, and challenges. *International Journal of Science Education*, 32, 349-377.

Bichelmeyer, B., Cakir, H., Dennis, A., Duffy, T., Bunnage, J., Kou, X.,… Oncu, S. (2006).Instructors' Experiences in the Cisco Networking Academy: Impact of the Curriculum on Teaching (No. WP 06-01). Bloomington, IN: Indiana University.

Brandon, D.P., & Hollingshead, A.B. (1999). Collaborative learning and Computer-Supported groups. *Communication Education*, 48, 109-126.

Bryson, C., & Hand., L (2007). The role of engagement in inspiring teaching and learning. *Innovations in education and teaching international*, 44, 383-402.

Bohner, G.; Dickel, N. (2011). Attitudes and attitude change. *Ann. Rev. Psychol*. 62, 391–417.

Bolliger, D.U., &Martindale, T. (2004). Key factors for determining student satisfaction in online course. *International Journal on E-learning*, January-March (2004), 61-67.

Bound, D., & Molloy, E. (2013). Rethinking models of learning for feedback: The challenge of design, *Assessment & evaluation in higher education in higher education,*38(6), 698-712.

Carbonaro, W. (2005). Tracking, students' effort and academic achievement. *Sociology of Education.*2005 (78), 27-49.

Cagiltay, K., Ozgit, A., & Askar, p. (1995). Setting up a Computer Mediated Communication Network for Secondary School. Proceeding INET'95, 315-320.

Carroll, T.G. (2000). If we didin't have the schools we have today, could we create the schools we have today? *Contemporary Issues in Technology and Teacher Education*, 1(1), 117-140.

Chen, P., Lambert, A., & Guidry, K.R. (2010). Engaging online learners: The impact of Web-based learning technology on college student engagement. *Computer& Education*, 54, 1222-1232.

Cheon, J., Lee, S., Crooks, S.M., & Song, J. (2012). An investigation of mobile learning readiness in higher education based on the theory of planned behavior. *Computer & Education*, 59(2012), 1054-1064.

Chickering, A. W., & Gamson, Z.F. (1987). Seven principles for good practice in undergraduate education. *AAHE Bulletin*, 39 (7), 3-7.

Chute, A.G., Thompson, M.M., & Hancock, B.W. (1999). *The McGraw-Hill handbook of distance learning.* New York: McGraw-Hill.

Ciampa, K. (2013). Learning in a mobile age: an investigation of student motivation. *Journal of Computer Assisted Learning*, 30, 82-96.

Cunningham,W.A.; Zelazo, P.D.; Packer, D.J.; van Bavel, J.J. (2007). The iterative reprocessing model: A multilevel framework for attitudes and evaluation. Soc. Cogn. 2007, 25, 736–760.

Coates, H. (2007) A Model of Online and General Campus-Based Student Engagement. Assessment and Evaluation in Higher Education. 32 (2), pp. 121–141.

Delialioglu, O. (2012). Student Engagement in Blended Learning Environments with Lecture-Based and Problem-Based Instructional Approaches. *Educational Technology & Society*, 13, 310-322.

Devilliers, J.G. (2011). Asynchronous web-based technologies to support learning. Unpublished thesis. University of Pretoria, South Africa.

Dillenbourg P. (1999). *What do you mean by collaborative learning*? In P. Dillenbourg (Ed) Collaborative-learning: Cognitive and Computational Approaches. (pp.1-19). Oxford: Elsevier

Donahue, T.L., & Wong, E.H. (1997). Achievement motivation and college satisfaction in traditional and nontraditional students. *Education*, 118, 237-243.

Driscoll, M. (1994). Psychology of Learning for instruction. 1st ed. Toronto: Allyn and Bacon.

Duffy, T.M & Jonassen, D.H. (1999). Constructivism: New applications for instructional technology? *Educational Technology*, 31 (5), 7-12.

Eagly, A.H.; Chaiken, S. (2007) The advantages of an inclusive definition of attitude. *Soc. Cogn*. 25, 582–602.

Eccles, J.A. (1983). Expectancies, values and academic behaviors. In J. T.Spence (Ed.), Achievement and achievement motives (pp. 75-146). San Francisco: Freeman.

Eccles, J. S., Wigfield, A. (2002). Motivational beliefs, values, and goals. Annual Review of Psychology, 53, 109-132.

Eccles, J. A. (2007). Motivational perspective on school achievement: Taking responsibility for learning and teaching. In. R. J. Sternberg and R. F. Subotnik (Eds.), Optimizing student success in schools with the new three Rs (pp. 199–202). Charlotte, NC: Information Age.

Eccles, J. S., Wigfield, A., & Schiefele, U. (1998). Motivation. In N. Eisenberg (Ed.), Handbook of child psychology (Vol. 3, 5th ed.). New York: Wiley. Experimental Research National Research Council. (2003). Engaging schools. Washington, DC: National Academy Press.

Echeverria, A., Nussbaum,M., Calderon, J., Bravo, C., Infante, C., & Vasquez,A.(2011). Face-to-face collaborative learning supported by mobile phones. *Interactive Learning Environment*.19, 351-363.

Edwards, J.E., & Waters, L.K. (1982). Involvement, ability, performance, and satisfaction as predictors of college attrition. *Educational and Psychological Measurement, 42*, 1149-1152.

Eliasson, J., Knutsson, O., Nouri, J., Karlsson, R.,Ramberg, R., & Pargman, T. C. (2012). Evaluating Interaction with Mobile Devices in Mobile Inquiry-

Based Learning," .*IEEE Seventh International Conference on Wireless,Mobile and Ubiuqutious Technology in Education*, 92-96.

Englemann, T., & W.Hesse, F. (2010). How digital concept maps about the collaborators' knowledge and information influence computer-supported collaborative problem solving. *Computer-Supported Collaborative Learning*, 5, 299-319.

Farmer, J., Buckmaster, A., & Legrand, B. (1992). Cognitive apprenticeship: Implications for continuing professional education. *New Directions for Adult and Continuing Education*, 55, 41-49.

Fitzgerald, T. (1993). *Metaphors of identity*. Albany, NY :State university of New York press.

Fredricks, J.A., Blumenfeld, P. C., & Paris, A.H. (2004). School Engagement: Potential of the concept, state of the evidence. *Review of Educational Research*, 74(1), 59-109.

Frohberg, D., Göth, C., & G. Schwabe (2009). Mobile Learning projects – a critical analysis of the state of the art. *Journal of computer assisted learning*, 25, 307-331.

Fotouhi-Ghazvini, F., Earnshaw, R.A., Robinson, D., & Excell, P.S. (2009). Designing augmented reality games for mobile learning using an instructional-motivational paradigm, *International Conference on CyberWorld. Bradford*. UK .312-319.

Fox, E. (2005). Tracking U.S. trends: There is now almost no difference in the availability of Internet access between poor schools and wealthy ones. *Education Week*, 24(35), 40–42.

Gagné, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design* (4th ed.). Orlando, FL: Harcourt Brace Jovanovich.

Giesbers, B., Reinties, B., Tempelaar, D., & Gijselaers, W. (2013). Investigating the relation between motivation, tool use, participation, and performance in an e-learning course using web-video conferencing. Computers in human behavior, 20, 285-292.

Gil, D., & Pettersson, O. (2010). Providing flexibility in learning activities system by exploiting the multiple roles of mobile devices. *The 6th IEEE international conference on wireless and ubiquitous technologies in education.*

Gil-De-La-Iglesia, D., Andersson, J., & Mirland, M. (2010). Enhancing mobile learning activities by the use of mobile virtual devices-some design and implementation issues. *2010 International conference on intelligent networking and collaborative system.*

Gil-Rodríguez, E.P. & Rebaque-Rivas, P. (2010). Mobile Learning and Commuting: Contextual Interview and Design of Mobile Scenarios, *Springe*r, 6389, 266–277.

Ginns, P., & Ellis, R. (2007). Quality in blended learning: Exploring the relationships between on-line and face-to-face teaching and learning. *Internet and Higher Education*, 10(1), 53-64.

Greenwood, C.R., Horton, B.T., & Utley, C.A. (2002). Academic engagement: Current perspective on research and practice. *School Psychology Review*, 31 (3), 328-349.

Gulikers, J.T.M., Bastiaens, T.J., & Martens, R.L. (2005). The surplus value of an authentic learning environment. *Computer in human behavior*, 21(2005), 509-521.

Gurbuz., T. (2004). An assessment of an online course environment based on the perceptions of students and instructor: A Case Study. Department of Computer Education and Instructional Technology, Middle East Technical University. Turkey.

Herrington, J., & Oliver, R.(2000). An instructional design framework for authentic learning environments. *Educational Technology, Research and Development*, 48(3), 23-48.

Herrington, J., Oliver, R. & Reeves, T.C., (2003).Patterns of engagement in authentic online learning environments. *Australian Journal of Educational Technology*, 19 (1), 59-71.

Herrington, J., Parker, J., (2013). Emerging technologies as cognitive tools for authentic learning. *British Journal of Educational Technology*, 44 (4), 607-615.

Hsu, S.C. (2010). *Correlation study between internalization of extrinsic motivation and self-determination in learning for Taiwan music students*. J. Res. Elem. Second. Educ., 17, 25–53.

Hsu,Y.C &Ching, Y.H. (2013). Mobile computer-supported collaborative learning. *British Journal of Educational Technology*.44, E111-E114.

Huizenga, J., Admiraal, W., Akkerman, S., & Ten Dam, G. (2009). Mobile game-based learning in secondary education: engagement, motivation and learning in a mobile city game. *Journal of Computer Assisted Learning*, 25, 332-344.

Huang, Wen-Hao., Huang, Wen-Yeh., Tschopp. J. (2010). Sustaining iterative game playing processes in DGBL: The relationship between motivational processing and outcome processing. *Computer& Education*, 55, 789-797.

Jairak, K., Praneetpolgrang, P., &Mekhabunchakij, K. (2009). An acceptance of mobile learning for higher education students in Thailand. *The Sixth International Conference on e-learning for Knowledge-Based Society*. Bangkok, Thailand. 36. 1-36.8.

Kahu, E.R. (2013). Framing student engagement in higher education, *Studies in higher education*, 38 (5), 758-773.

Kearney, M., Schuck, S., Burden, K., & Aubusson, P. (2012). Viewing mobile learning gical perspective. *Research in Learning Technology*, *20*(1), 1–17.

Keller. J., Suzuki, K. (1988). *Use of the ARCS motivation model in courseware design.* Hillsdale, NJ: Earlbaum.

Kennedy,G.E., Judd,T.S., Churchward,A., Gray, k., & Lee- Krause, K. (2008). First year students' experiences with technology: Are they really digital natives? *Australian Journal of Educational Technology*, 23, 108-122.

Keller, J.M. (2008). First principles of motivation to learn and e[3]learning. *Distance education*, 29, 175-185.

Knight, P., & Yorke, M. (2003). *Assessment, learning and employability*. Maidenhead, UK: SRHE/Open University Press.

Kolloffel, B., H.S. Eysink, T.,& Jong, T. (2011). Comparing the effect of representational tools in collaborative and individual inquiry learning. *Computer-Supported Collaborative Learning*, 6, 223-251.

Kramarski, B., & Feldman, Y. (2000). Internet in the classroom: Effects on reading comprehension, motivation and metacognitive awareness. *Education Media International*, 37, 149-155.

Korkmaz, A. (2007). *Does Student Engagement Matter to Student Success?* (Doctoral dissertation). Department of Instructional Systems Technology, Indiana University, USA.

Korucu, T., & Alkan, A. (2011). Differences between m-learning (mobile learning) and e-learning, basic terminology and usage of m-learning in education. *Social and Behavioral Science*, 15, 1925-1930.

Koschmann,T.(1996). *Paradigm shifts and instructional technology: An introduction.* In. D.Koschmann (Ed.), CSCL: Theory and practice of an emerging paradigm (pp.1-23). Mahwah, N.J.: Erlbaum Associates.

Kotler, P. (2000). *Marketing Management*. Prentice Hall: Englewood Cliffs, NJ, USA, 2000.

Koole, M.L. (2007). A Model for Framing Mobile Learning, *International Review on Research in Open and Distance Learning (IRRODL),* 8(2). 25-47.

Kuh, G.D (2001). *Assessing what really matters to student learning*: Inside the National Survey of Student Engagement. Change, 33(3), 10-17,66.

Kuh, G.D. (2009) What Student Affairs Professionals Need to Know about Student Engagement. Journal of College Student Development. 50 (6), pp. 683–706.

Kukulska-Hulme, A., Sharples, M., Milrad, M., Arnedillo-Sánchez, I., & Vavoula, G. (2009). Innovation in mobile learning: A European perspective. *International Journal of Mobile and Blended Learning, 1*(1), 13–35.

Kynäslahti, H. (2003). *In search of elements of mobility in the context of education*. In H. Kynäslahti & P. Seppälä (Eds.), *Mobile learning* (pp. 41–48). Helsinki, Finland: IT Press

Laird, T., & Kuh, G. (2005). Student experiences with information technology and their relationship to other aspects of student engagement, *Research in higher education*, 46 (2), 211-233.

Laurillard, D. (2009). The pedagogical challenges to collaborative technologies. *International Journal of Computer-Supported Collaborative Learning*, *4*, 1, 5–20.

Lee, K.B. (2011). Developing Mobile Collaborative Learning Applications for Mobile Users. *International Journal of Interactive Mobile Technologies*,5, 42-48.

Liaw, S.S., Hatala, M., & Huang, H.M. (2010).Investigating acceptance toward mobile learning to assist individual knowledge management: based on activity theory approach. *Computer & Education*, 54, 446-454.

León de la Barra, G.E., León de la Barra, M.B. & Urbina, A.M. (1999). On Special "Hybrid" Courses in Mathematics. *Proceedings of Frontier in Education Conference, San Juan, Puerto Rico.*

Lee, K.B. (2011). Developing Mobile Collaborative Learning Applications for Mobile Users. *International Journal of Interactive Mobile Technologies*,5, 42-48.

Liu, T., & Chu, Y. (2010). Using ubiquitous games in an English listening and speaking course: Impact on learning outcomes and motivation. *Computer & Education*, 55, 630-643.

Lu,J., P.Lajoie, S., Wiseman, J. (2010). Scaffolding problem-based learning with CSCL tool. *Computer-Supported Collaborative Learning*, 5, 282-298.

Mandula, K., Meda, S. R., & Jain, D.K. (2012). Research and implementation of a mobile video streaming application for ubiquitous learning, *IEEE*

International Conference on Technology Enhanced Education, Kerala. India. 1-6.

Mcniff, J. and Whitehead, J. (2005) *Action Research for Teachers: A Practical Guide*, David Fulton Publishers, London.

Mestre, J.P. (2005). Facts and Myth about pedagogies of engagement in science learning. *(AAC &U),* 24-27.

Motiwalla, L.F. (2007). Mobile-learning: A Framework and evaluation, *Computer & Educati*on, 49 (2007), 581-596.

Nelson, L.M. (1999).Collaborative Problem Solving. In Reigeluth, C. M & Carr-Chellman, A. A (Eds.), *Instructional-Design Theories and Models, Building a common knowledge base*, (241-267). Mahwah, NJ: Lawrence Erlbaum Associates.

Newmann, Fred, ed. 1992. *Student Engagement and Achievement in American Secondary Schools.* New York: Teachers College Press.

Newmann, F. M., Wehlage, G. G., & Lamborn, S.D. (1992). *The significance and source of student engagement*. In F.M.Newmann (Ed.), Engagement and achievement in American secondary school (pp. 11-39). New York: Teachers College Press.

Nielsen, J. (1993). *Usability engineering*. San Francisco: Morgan Kaufmann.

Nikitina, L. (2011). Creating an authentic learning environment in the foreign language classroom. *International journal of instruction*, 4 (1), 33-46.

Norman, D.A. (1993). Things that make us smart: Defining human attributes in the age of the machine. Addison-Welsey, New York, US.

Jonassen,D. (1999). Designing Constructivist Learning Environment. In In Reigeluth, C. M & Carr-Chellman, A. A (Eds.), *Instructional-Design Theories and Models, Building a common knowledge base*, (215-239). Mahwah, NJ: Lawrence Erlbaum Associates.

Oldfield, J., & Herrington, J. (2012). Mobilizing authentic learning: understanding the educational affordances of the iPad. In M.Brown, M.Hartnett & T.Stewart (Eds), *Future challenges, sustainable future. Proceeding ascilite Wellington*, 2012. (pp.723-727).

Orr, G. (2009). A Review of Literature in Mobile Learning: Affordances and Constraints. *The 6th IEEE International Conference on Wireless, Mobile, and Ubiquitous Technologies in Education*.

Ozdamli, F., & Cavus, N. (2011). Basic elements and characteristics of mobile learning. *Procedia-Social and Behavirol Science* , 28, 937-942.

Parkin, H.J., Hepplestone, S., Holden, G., Irwin, B., & Thorpe, L. (2012). *Assessment & Evaluation in Higher Education,* 37 (8), 963-973.

Parsons, D., & Ryu, H. (2006*). A framework for assessing the quality of mobile learning.* In R. Dawson, E. Georgiadou, P. Lincar, M. Ross & G.

Staples (Eds.), Learning and Teaching Issues in Software Quality, *Proceedings of the 11th International Conference for Process Improvement, Research and Education* (17–27), Southampton, UK

.

Pascarella, E. T., & Terenzini, P.T. (1991). *How college affects students: Findings and insight from twenty years of research (1st ed*). San Fransisco: Jossey-Bass.

Pascarella, E. T., & Terenzini, P.T. (2005). *How college affects students: Athird Decade of Research (2nd ed)*. San Fransisco: Jossey-Bass.

Perie, M., Moran, R & Lutkus, A. D. (2005). *The nation's report card. NAEP 2004 Trend in academic progress: Three decades of student performance in reading and mathematics.* (NCES No. 2005-464). Washington DC:U.S. Department of Education Institute of Education Sciences.

Petty, R.E.; Briñol, P.; DeMarree, K.G. (2007). The meta-cognitive model (MCM) of attitudes: Implications for attitude measurement, change, and strength. *Soc. Cog*, 25, 657–686.

Pew, S. (2007). Andragogy and pedagogy as foundational theory for student motivation in higher education. *Student Motivation*, 2, 14-25.

Pintrich, P.R. (1988). *A process-oriented view of student motivation and cognition.* In J. Stark & L. Mets (Eds.), Improving teaching and learning

through research : New directions for institutional research (Vol. 57,pp. 65-79). San Francisco: Jossey-Bass.

Pintrich, P.R. (1989). *The dynamic interplay of student motivation and cognition in the college classroom*. In C. Ames & M.Maehr (Eds.), Advances in motivation and achievement: Motivation-enhancing environments (Vol. 6, pp. 117-160). Greenwich, CT: JAIPress.

Pintrich,P.R.&De Groot, E.V. (1990). Motivational and Self-Regulated Learning Components of Classroom Academic Performance. *Journal of Educational Psychology*, 82, 33-40.

Pintrich, P. R. (2003) A motivational science perspective on the role of student motivation in learning and teaching contexts. *Journal of Educational Psychology*, 95, 667-686.

Poulos, A., & Mahony, M. J. (2008). Effectiveness of feedback: The students' perspective. *Assessment and Evaluation in Higher Education*, 33, 143–154.

Radocy, R.E.; Boyle, J.D. (2003). Psychological Foundations of Musical Behavior, 4th ed.; Charles C. Thomas: Spring field,IL, USA.

Ramaprasad, A. (1983). On the definition of feedback. *Behavioral Science,* 28: 4–13.

Reeves, T.C, Herrington, J., & Oliver, R. (2002). Authentic activities and online learning. *Proceeding of HERDSA 2002*.

Reigeluth, C. M. (2009). Instructional Theory for Education in the Information Age. In Reigeluth, C. M & Carr-Chellman, A. A (Eds.), *Instructional-Design Theories and Models, Building a common knowledge base*, (387-399). New York : Taylor &Francis.

Roblyer, M.D. (2006). *Integrating educational technology into teaching*. Upper Saddle River, NJ: Pearson Education, Inc

Roschelle, J & Teasly, S.D. (1995). The Construction of school knowledge in collaborative problem solving. In C.OMalley (Ed.),Computer- Supported Collaborative Learning. New York: Springer- Verlag.

Sadler, D.R. (1989). Formative assessment and the design of instructional systems. *Instructional Scie*nce, 18(2), 119–44.

Sanders, D. W. & Morrison-Shetlar, A. I. (2001). Student attitudes toward Web enhanced instruction in an introductory biology course. *Journal of Researchon Computing in Education*, 33 (3I), 251-263.

Schmuck, R. A. (2006). *Practical action research for change*. Arlington Heights, IL : IRI/Skylight Training and Publishing.

Shadiev, R., Hwang, W., & Huang, Y. (2015). A pilot study: facilitating cross-cultural understanding with project-based collaborative learning in an online environment. *Australian Journal of Educational Technology*, 31(2), 123-139.

Sharples, M., Arnedillo-Sánchez, I., Milrad, M., & Vavoula, G. (2009). *Mobile learning: Small devices, big issues*. In S. Ludvigsen, N. Balacheff, T. D. Jong, A. Lazonder, and S. Barnes (Eds.), Technology-enhanced learning: Principles and products (pp. 233–249). Berlin, Germany: Springer-Verlag

Sharples, M. (2013). Mobile learning: research, practice and challenges. *Distance Education in China*, 3(5), 5-11.

Smith, P., & Ragan, T. (1999). *Instructional design.* 2nd ed. Toronto: John Wiley & Sons.

Solomon, M.R. (2010). *Consumer Behaviour: A European Perspective*. Pearson Education: New York, NY, USA.

Stahl, G., Koschmann, T. & Suthers, D. (2006). *Computer-supported collaborative learning: an historical perspective*. In R. K. Sawyer (Ed.), Cambridge handbook of the learning sciences (pp. 409–426). Cambridge: Cambridge University Press.

Sung, H., & Hwang, G. (2013). A collaborative game-based learning approach to improving students' learning performance in science courses. *Computer &Education*, 63(2015), 43-51.

Tess, P.A. (2013). The role of social media in higher education classes (real and virtual) – A literature review. *Computers in Human Behavior*, 29 (2013), A60-A68.

Traxler, J., (2007). Current State of Mobile Learning, *International Review on Research in Open and Distance Learning.* (IRRODL), 8(2). 10-24.

Truel, A. T. (2001). *Student Attitudes toward and evaluation of Internet-assisted Instruction*. DeltaPhi Epsilon Journal, 43(1), 40-49.

Turner, S.E, & Bowen, W.G. (1999). Choice of major: The changing (unchanging) gender gap. *Industrial and labor Relations Review*, 52(2), 289-313.

Wang, M. J. (2007). Designing online courses that effectively engage learners from diverse cultural backgrounds. *British Journal of Educational Technology*, 38(2), 294–311.

Walls, S.M., Kucsera, J.V., Walker, J.D, Acee, T.W., McVaugh, N.K, & Robinson, D.H. (2010). Podcasting in education: Are students as ready and eager we think they are? *Computer & Education*, 54, 371

Wang,M., Shen,R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviors and performance: Report from a large blended classroom. *British journal of Educational Technology*, 40, 673–695.

Wang, H.C, P.Rose.C, & Chang, C.Y (2011). Agent-based dynamic support for learning from collaborative brainstorming in scientific inquiry. *Computer-Supported Collaborative Learning*, 6, 371-395.

Weinbrenner, S., Engler, J., Tehrani, P. F., & Hoppe, H. U. (2012). Semantic Interpretation and Feedback for Digital Sketching Environment , *IEEE Seventh International Conference on Wireless,Mobile and Ubiquitous Technology in Education*, Takamatsu. Kagawa. Japan. 223-225.

Weinstein, C.E., Schulte, A., &Palmer, D.R. (1987). The learning and study strategies Inventory. Clearwater, FL: H& H publishing.

Willis, Paul. 1977. *Learning to Labor*. New York: Columbia University Press.

Wigfield, A., Eccles, J. S., Schiefele, U., Roeser, R. W., Davis-Kean, P. (2006). The development of achievement motivation. In N. Eisenberg (Ed.), Handbook of child psychology (Vol. 3, 6th ed.). New York: Wiley.

Woodside, B.M., Wong, E.H., & Wiest, D.J. (1999). The effect of student-faculty interaction on college students' academic achievement and self-concept. *Education*, 119 (4), 730-733.

Woodworth, R.S. (1918). *Dynamic Psychology*. New York: Columbia University Press.

Woo, Y., Herrington, J., Agostinho, S., & Reeves, T. C. (2007). Implementing authentic tasks in web-based learning environments. *Educause Quarterly, 2007* (3), 36–43.

Yorke, M., & Knight, P.(2004). Self-theories: Some implications for teaching and learning in higher education, *Studies in higher education,* 29 (1), 25-37.

Zepke,N., &Leach, L. (2010). Improving student engagement: ten proposals for action. *Active learning in higher education*, 11(3), 167-177.

Zhao, C.M., &Kuh, G.D. (2004). Adding value, learning communities and student engagement. *Research in higher education*, 45 (2), 115-138.

APPENDIX A:

DEVELOPED ACTIVITIES

"Activity 1"

Topic: LAN (Local Area Network), WAN (Wide Area Network)

Chapter: 1

Question: Find an example of LAN and WAN in your daily life. Explain your examples in terms of following categories and fill out the table.

- **Show** and **explain** your example by taking photos or preparing short videos which give information about **your example.**
- **Share** your example with your group members using mobile application .
- **Each** member in the group needs to **post** materials on tool about your example.
- **All** group members need to **discuss** and **share** materials on tool **before** submitting the assignment.
- **Share all pictures or videos which you have taken**
- **Share** your comments and notes about those pictures and videos which you have taken.
- **Send a brief explanation** which shows in **what extend** and **how you used the tool and mobile devices** while you were conducting your tasks.
- Send **the screen shots of your posts, shared pictures** and **videos on mobile application.**

- **Submit** your answers **after** sharing and discussing all the materials with your peers on mobile application.

"Activity 2"

Topic: Rules of Communication

(Network protocols and communications)

Question: Develop or design your own rules for communication, while developing your rules of communication consider the following issues:

- **Show** and **explain** your example by taking photos or preparing short videos which give information about **your example.**
- **Share** your example with your group members using mobile application.
- **Each** member in the group needs to **post** materials on mobile application about your example.
- **All** group members need to **discuss** and **share** materials on mobile application **before** submitting the assignment.
- **Share all pictures or videos which you have taken**
- **Share** your comments and notes about those pictures and videos which you have taken.
- **Send a brief explanation** which shows in **what extend** and **how you used tool and mobile devices** while you were conducting your tasks.
- Send **the screen shots of your posts, shared pictures** and **videos on mobile application.**
- **Submit** your answers **after** sharing and discussing all the materials with your peers on mobile application.

- The following video shows examples about bandwith and throughput from daily life.Please watch it and try to find similar examples in your life.

For example: Imagine two persons tried to send an email to each other. Therefore,

a) They need to use the language which both of them knows it.
b) They need to know which type of files can be sent through the email system which they use (e.g. in some communication systems executable files cannot be sent).
c) They need to know about the possible size which can be transfer in their email system. (e.g. in some communication systems files with large size cannot be sent).
d) They need to be aware of the email address of each other.
e) They need to know how to use the system for sending an email. (i.e. the format of the email system, the place for writing the address, subject, personal information "if they use")
f) They need to be aware whether they are in the same network or not (e.g. if they are in the same network, they might use another email which is used only within a local domain)
g) They need to know about the system delivery (e.g. Is there any notification of email delivery , in the case it is not sent)

"Activity 3"

Topic: The concepts of Bandwidth and Throughput in the Networks

Question: Find an example of both bandwidth and throughput in your daily life

- **<u>Show</u> and <u>explain</u> your example by taking photos or preparing short videos which give information about <u>your example.</u>**
- **<u>Share</u> your example with your group members using mobile application.**
- **<u>Each</u> member in the group needs to <u>post</u> materials on mobile application about your example.**

- **All group members need to discuss and share materials on mobile applicationbefore submitting the assignment.**
- **Share all pictures or videos which you have taken**
- **Share your comments and notes about those pictures and videos which you have taken.**
- **Send a brief explanation which shows in what extend and how you used tool and mobile devices while you were conducting your tasks.**
- **Send the screen shots of your posts, shared pictures and videos on mobile application.**
- **Submit your answers after sharing and discussing all the materials with your peers on mobile application.**

  For example:

  The following video shows examples about bandwith and throughput from daily life.Please watch it and try to find similar examples in your life.

  http:// www.youtube.com/watch?v=EQqFw7FGVEs

"Activity4"

Topic: Address Resolution Protocol (ARP)

Question: Find an example of Address Resolution Protocol (ARP) in your daily life

- **Show and explain your example by taking photos or preparing short videos which give information about your example.**
- **Share your example with your group members using mobile application .**

- **Each member in the group needs to post materials on tool about your example.**
- **All group members need to discuss and share materials on mobile application before submitting the assignment.**
- **Share all pictures or videos which you have taken**
- **Share your comments and notes about those pictures and videos which you have taken.**
- **Send a brief explanation which shows in what extend and how you used tool and mobile devices while you were conducting your tasks.**
- **Send the screen shots of your posts, shared pictures and videos on mobile application.**
- **Submit your answers after sharing and discussing all the materials with your peers on mobile application.**

  For example:

- **The following video shows examples about bandwith and throughput from daily life.Please watch it and try to find similar examples in your life..**

  http://www.youtube.com/watch?v=1ujt0lSs-QY

"Activity 5"

Topic: TCP three-way handshake

Question: Find an example of TCP three-way handshake in your daily life

http://www.youtube.com/watch?v=dWnuqCsahNw

- **Show** and **explain** your example by taking photos or preparing short videos which give information about **your example.**

- **Share** your example with your group members using mobile application .
- **Each** member in the group needs to **post** materials on mobile application about your example.
- **All** group members need to **discuss** and **share** materials on tool **before** submitting the assignment.
- **Share all pictures or videos which you have taken**
- **Share** your comments and notes about those pictures and videos which you have taken.
- **Send a brief explanation** which shows in **what extend** and **how you used tool and mobile devices** while you were conducting your tasks.
- Send **the screen shots of your posts, shared pictures** and **videos on mobile application.**
- **Submit** your answers **after** sharing and discussing all the materials with your peers on mobile application.

APPENDIX B:

NATIONAL SURVEY OF STUDENT ENGAGEMENT

Consider the Computer Networking course you took this semester and then check the box that best describes how often you have done each of the following.

1. **Active Learning**

	Never (1)	Rarely (2)	Some times (3)	Frequently (4)	Always (5)
1. Carefully listen to the class lectures.					
2. Ask questions about the course content in class.					
3. Make comments about the collaborative m-learning activities in face to face or online environments.					
4. Prepare for homework and readings before class.					
5. Use different information resources (Internet, books, library) to complete an assignment.(Authentic collaborative m-learning activities)					
6. Review and make changes on authentic collaborative m-learning activities before					
7. Lookup other sources of information or search the Internet to gather more					
8. Take notes in the class.					
9. Make class presentation.					

2. **Collaborative Learning**

	Never (1)	Rarely (2)	Some times (3)	Frequently (4)	Always (5)
10. Share the authentic collaborative m-learning activities that I did with my friends in the classroom or in online environments.					
11. Work with my classmates outside of class hours to prepare authentic collaborative m-learning activities.					
12. Discuss the topics covered in the class with my classmates outside of class hours.					
13. Explain the topics in the course content that my classmates have difficulty to understand during or outside the class hour.					
14. Work with my classmates for authentic collaborative m-learning activities.					

15. Asking a classmate to check before submitting an assignment.					
16. Ask my classmates for help in authentic collaborative m-learning activities that I do not understand.					
17. Share printed or online resources about authentic collaborative m-learning activities with my classmates.					
18. Work with my classmates in authentic collaborative m-learning activities.					

3. Interaction with the Instructor

	Never (1)	Rarely (2)	Some times (3)	Frequently (4)	Always (5)
19. Communicate with my teacher about the authentic collaborative m-learning activities through e-mail or mobile application.					
20. Communicate with my teacher about the authentic collaborative m-learning activities through mobile application.					
21. Work with my teacher on topics outside of the course content.					
22. Ask my teacher questions about the parts of the homework that I have difficulty with.					
23. Talk with my teacher about career opportunities related to the course content.					
24. Talk with my teacher about issues related to the of the authentic collaborative m-learning activities outside the class hours.					
25. Talk with my teacher about activities that I made while doing the authentic collaborative m-learning activities.					
26. Talk with my teacher about the grade I got from the course exam.					

4. Student Effort

	Never (1)	Rarely (2)	Some times (3)	Frequently (4)	Always (5)
27. I had to work harder for this course than I expected					
28. I had to work harder in doing the authentic collaborative m-learning activities.					
29. I had to learn the topics that I found difficult to understand from my friends.					
30. The authentic collaborative m-learning activities were complex and difficult to understand.					
31. The activities in the course were harder to complete than I expected.					

5. Feedback

	Never (1)	Rarely (2)	Some times (3)	Frequently (4)	Always (5)
32. The teacher gave comments on time for the authentic collaborative m-learning activities I did.					
33. The authentic collaborative m-learning activities we did were examined by our teacher and the parts that were not understood were explained.					
34. Questions asked in the exam were explained afterwards in the class hour.					
35. The mistakes done in doing the authentic collaborative m-learning activities were explained by the teacher.					
36. I could talk with my teacher about the authentic collaborative m-learning activities.					
37. I was informed in detail about what I was expected to do inside and outside the class hours.					
38. I could check my exam results online.					

6. Satisfaction from the Course

Please think about the Computer Networking course for which you are answering the survey in this semester and answer the following questions. Please click the response that best matches your level of agreement with each statement.

	Strongly Disagree 1	Disagree 2	Neutral 3	Agree 4	Strongly Agree 5
39. What I learned in this course has been valuable to me.					
40. I enjoyed this course.					
41. I would recommend this course to others.					
42. The course met my goals and expectations.					
43. The value I received from this course was worth the effort I put in.					
44. I learned a great deal from this course.					
45. I believe other courses, such as math and science, should be taught the same way this class was taught (authentic collaborative m-learning activities, mobile application).					

7. Personal Development

Please think about the Computer Networking course for which you are answering the survey in this semester and then check the box that best describes to what extent your experiences in this course contributed to the following.

	Not at all important 1	**A little Important 2**	**Somewhat Important 3**	**Quite a bit Important 4**	**Very Important 5**
46. Contribution to critical thinking					
47. Contribution to using information and communication technologies towards a purpose.					
48. Contribution to individual learning					
49. Contribution to the ability of working with others in harmony					
50. Contribution to communicate clear and effectively					
51. Contribution to discover individual skills/abilities.					

APPENDIX C:

(MOTIVATED STRATEGY FOR LEARNING QUESTIONNAIRE)

Dear participants:

Direction: There are statements on the scale of 1(not at all true of me) to 7 (very true of me) in this questionnaire. Please respond to each statement which represents your idea. We would like to thank you for participating in this study.

	Not at all true of me	Untrue of me	Somewhat untrue of me	Neutural	Some what true of me	True of me	Very true of me
1. I prefer class work that is challenging so I can learn new things.							
2. Compared with other students in this class I expect to do well.							
3. I am so nervous during a test that I cannot remember facts I have learned.							
4. It is important for me to learn what is being taught in this class.							
5. I like what I am learning in this class.							
6. I'm certain I can understand the ideas taught in this course.							
7. I think I will be able to use what I learn in this class in other classes.							
8. I expect to do very well in the class.							
9. Compared with others in this class, I think I'm good student							
10. I often choose paper topics I will learn something from even if they require more work.							
11. I am sure I can do an excellent job on the problems and tasks assigned for this class.							
12. I have an uneasy, upset feeling when I take							

a test.							
13. I think I will receive a good grade in this class.							
14. Even when I do poorly on a test I try to learn from my mistakes.							
15. I think that what I am learning in this class is useful for me to know.							
16. My study skills are excellent compared with others in this class.							
17. I think that what we are learning in this class is interesting.							
18. Compared with other students in this class I think I know a great deal about the subject.							
19. I know that I will be able to learn the materials for this class.							
20. I worry a great deal about tests.							
21. Understanding this subject is important to me.							
22. When I take a test I think about how poorly I am doing.							
23. When I study for a test, I try to put together the information from class and from the book.							
24. When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly							
25. I ask myself questions to make sure I know the material I have been studying.							
26. It is hard for me to decide what the main ideas are in what I read.							
27. When work is hard I either give up or study only the easy parts.							
28. When I study I put important ideas into my own words.							

29. I always try to understand what the teacher is saying even if it doesn't make sense.							
30. When I study for a test I try to remember as many facts as I can							
31. When studying, I copy my notes over to help me remember material.							
32. I work on practice experiences and answer end of chapter questions even when I don't have to.							
33. Even when study materials are dull and understanding, I keep working until I finish.							
34. When I study for a test I practice saying the important facts over and over to myself.							
35. Before I am being studying I think about the things I will need to do to learn.							
36. I use what I have learned from old homework assignments and the textbook to do new assignments.							
37. I often find that I have been reading for class but don't know what it is al about.							
38. I find that what the teacher is talking I think of other things and don't really listen to what is being said.							
39. When I am studying a topic, I try to make everything fit together.							
40. When I'm reading I stop once in a while and go over what I have read.							
41. When I read materials for this class, I say the words over and over to myself to help me remember.							
42. I outline the chapters in my book to help me study.							
43. I work hard to get a good grade even when							

I don’t like a class.							
44. When reading I try to connect the things I am reading about with what I already know.							

APPENDIX D:

ATTITUDES FORM FOR COMPUTER NETWORKS AND COMMUNICATION TOPIC

Direction: Below, you will find statements about the attitudes towards "Computer Networks and Communication Topics". For each statement put an (X) sign on the choice reflecting your opinion.

	Strongly disagree	**Disagree**	**No opinion**	**Agree**	**Srongly Agree**
1. I like computer network topics.					
2. I fear exams about computer networks.					
3. I like to discuss about computer networks issues.					
4. Information about computer networks are boring.					
5. Computer networks topics are helpful for cognitive development.					
6. Computer networks topics make me feel uncomfortable.					
7. There should be more classes related to computer networks.					
8. Computer networks topics are easy to learn.					
9. Computer networks topics are not likable.					
10. Computer networks topics do not bring about cognitive development.					
11. Computer networking topics have no impact on critical thinking ability.					
12. Computer networks topics are exciting.					
13. I fear computer networks topics.					
14. If it would be possible, I wouldn't learn about computer networks.					

15. I like to study for computer networks topics.					
16. Everyone should be familiar with computer network topics like Internet resources.					
17. I get bored while studying computer networks topics.					
18. I would like to learn advanced topics about computer networks.					
19. I don't even want to hear anything about computer networks.					
20. Computer networks topics are confusing.					
21. Computer networks topics should be learned by everyone.					
22. I don't enjoy computer networks topics.					
23. I'm not interested in listening to computer networks topics.					
24. It would be better if computer networks classes are not offered.					
25. Computer networks topics are amazing.					
26. Communicating with others over a computer network can help me to be more effective in doing my job in the future.					
27. I am confident about my ability to do well in courses related to computer networks.					
28. All university students should be required to take courses on computer networks.					
29. I don't think that knowledge about computer networks will be useful in my career.					
30. Computer networks topics are not exciting.					
31. Knowledge on computer networks is not required for everyday life.					
32. Computer network topics increase the critical thinking ability.					
33. The thought of using computer networks					

frightens me.					
34. I cannot recognize how computer networks topics can be helpful in my future life.					
35. I feel comfortable about my skills to work with computer networks.					
36. I look forward to using computer networks to perform tasks related to my field of study.					
37. Computer networks can take over tedious and time consuming tasks effectively.					

APPENDIX E:

INTERVIEW PROTOCOL

1. To what extent the authentic collaborative m-learning activities used in this course help you to discover your skill?
2. How the authentic collaborative m-learning activities help you to relate the course contents with your daily life?
3. How did the activities affect the method you look up different resources rather than course materials while you were conducting the activities in this course?
4. To what extent the activities increase your interaction with your peers and instructor?
5. How did the feedback which you received from the instructor help you for doing the activities?
6. What types of difficulties did you encounter while doing the activities?
7. Which other courses would you like to use the collaborative m-learning activities in?
8. Which other courses would you like to use the collaborative m-learning activities in?

APPENDIX F:

STUDENTS' POSTS

Table F.1: Students' Posts Regarding the Activities Using Mobile Application in Spring Semester 2015

Activity	Concept of the Activity	Number of posts per group					Total posts
		Group 1	Group 2	Group 3	Group 4	Group 5	
Activity 1	Local Area Network (LAN) and Wide Area Network (WAN)	18	3	37	9	14	81
Activity 2	The rule of communication	14	4	9	7	8	53
Activity 3	Bandwidth and Throughput	13	-	15	4	10	42
Activity 4	Address Resolution Protocol (ARP)	9		6	4	7	26
Activity 5	TCP three-way handshake	4	1	5	-	5	15

Table F.2: Students' Posts Regarding the Activities Using Mobile Application in Summer Semester 2015

Activity	Concept of the Activity	Number of posts per group									Total posts
		G1	G2	G3	G4	G5	G 6	G7	G8	G9	
Activity 1	Local Area Network (LAN) and Wide Area Network (WAN)	18	42	17	4	13	12	5	18	-	129
Activity 2	Bandwidth and Throughput	23	48	38	15	34	25	15	31	-	229
Activity 3	Address Resolution Protocol (ARP)	14	43	14	9	33	9	9	15	10	156
Activity	TCP three-way	25	30	48	11	45	-	2	17	15	193

Table F.3: Students' Posts Regarding Collaborative-Learning Features in Spring Semester 2015

Activity	Concept of the Activity	Categories			
		Participation Presence[a]	Concept Presence[b]	Strategic Presence[c]	Teacher Presence[d]
Activity 1	Local Area Network (LAN) and Wide Area Network (WAN)	✓	✓		✓
Activity 2	The rule of communication	✓	✓		✓
Activity 3	Bandwidth and Throughput	✓		✓	
Activity 4	Address Resolution Protocol (ARP)	✓	✓	✓	
Activity 5	TCP three-way handshake	✓		✓	✓

a. Interaction with peers
b. Interaction with facilitator
c. Interaction with pedagogy and technology
d. Interaction with content

Table F.4: Students' Posts Regarding Collaborative-Learning Features in Summer Semester 2015

Activity	Concept of the Activity	Categories			
		Participation Presence [a]	Concept Presence [b]	Strategic Presence [c]	Teacher Presence [d]
Activity 1	Local Area Network (LAN) and Wide Area Network (WAN)	✓			✓
Activity 2	Bandwidth and Throughput	✓		✓	
Activity 3	Address Resolution Protocol (ARP)	✓	✓	✓	✓
Activity 4	TCP three-way handshake	✓	✓	✓	✓

a. Interaction with peers
b. Interaction with facilitator
c. V Interaction with pedagogy and technology
d. Interaction with content

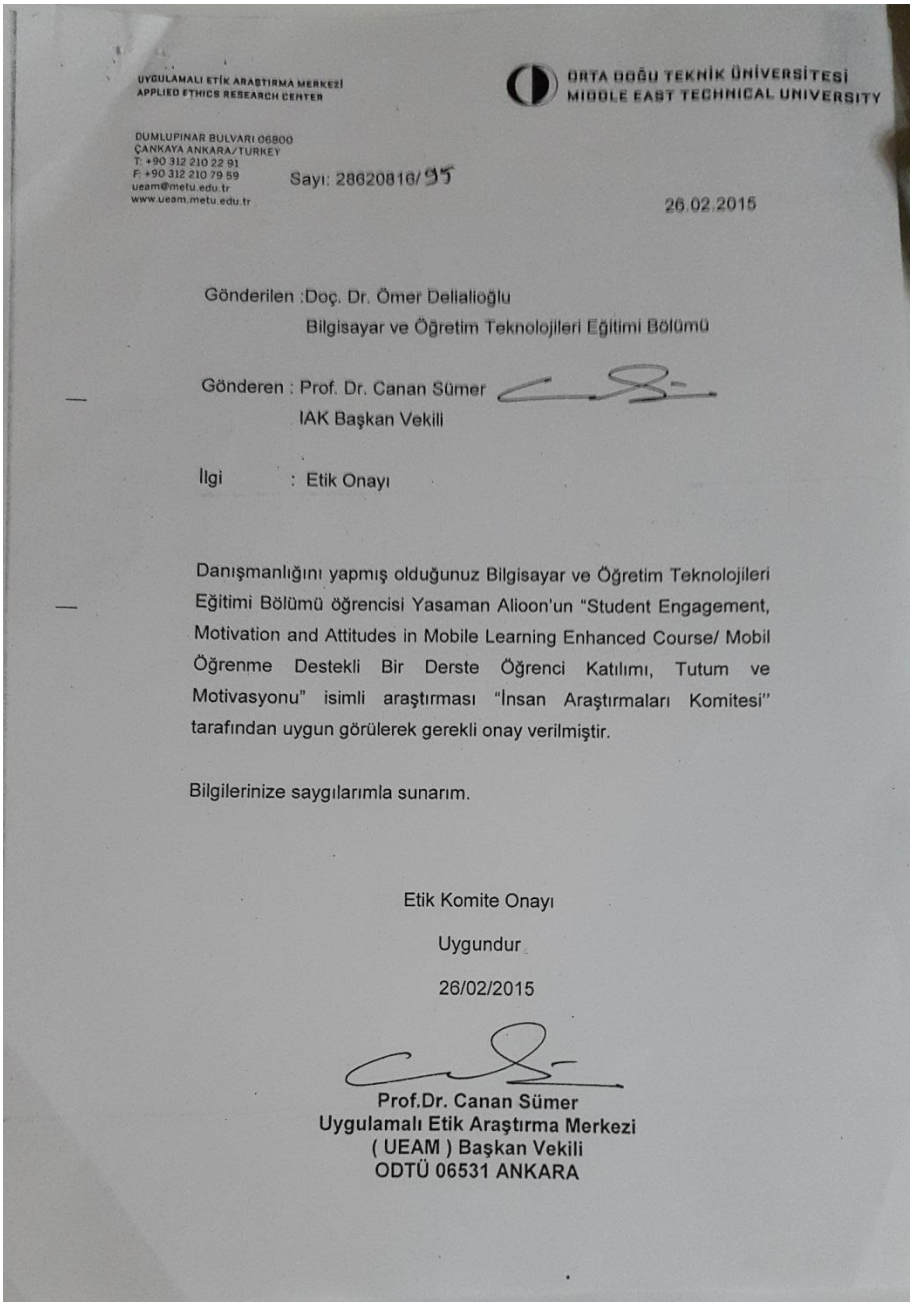
APPENDIX G:

Table G.1 Codes and Categories in the Content Analysis of Interviews

Categories	**Codes**							
Understand the Concepts	Real-world example	Discussing	Talking	Long-term remembering	Remember for a long-time	Learn deeply	Understand	Learn deeply
Daily- life Connection	Similar	Related	Useful	Can be used	Real-world example	Connected	Related	Practical
Applicability of the Concept	Various Context	Useful	Usage	Different places	Not only practical concepts	Applicable	Can be used	
Real-world Examples	Searching the example	Sharing the photos/ videos						
Analogies	Taking the photos/ videos	Discussion						
Feedback	Finding the example	Being sure	ensure					
Tool	Unfamiliar	Non-user friendly						
Activities	Novel	Real-world relevance						
Simplifying	Easier	Less problems	Simply					
Informative	Understandable	Understand easily	Detail info	Learning more	Find more info	Analogies	Relation	
Course content	Complicated	Real-world relevance						

APPENDIX H

APPROVAL OF ETHICAL COUNCIL-PAGE I



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26.02.2015

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Gönderen : Prof. Dr. Canan Sümer
IAK Başkan Vekili

İlgi : Etik Onayı

Danışmanlığını yapmış olduğunuz Bilgisayar ve Öğretim Teknolojileri Eğitimi Bölümü öğrencisi Yasaman Alioon'un "Student Engagement, Motivation and Attitudes in Mobile Learning Enhanced Course/ Mobil Öğrenme Destekli Bir Derste Öğrenci Katılımı, Tutum ve Motivasyonu" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

Bilgilerinize saygılarımla sunarım.

Etik Komite Onayı

Uygundur

26/02/2015

Prof.Dr. Canan Sümer
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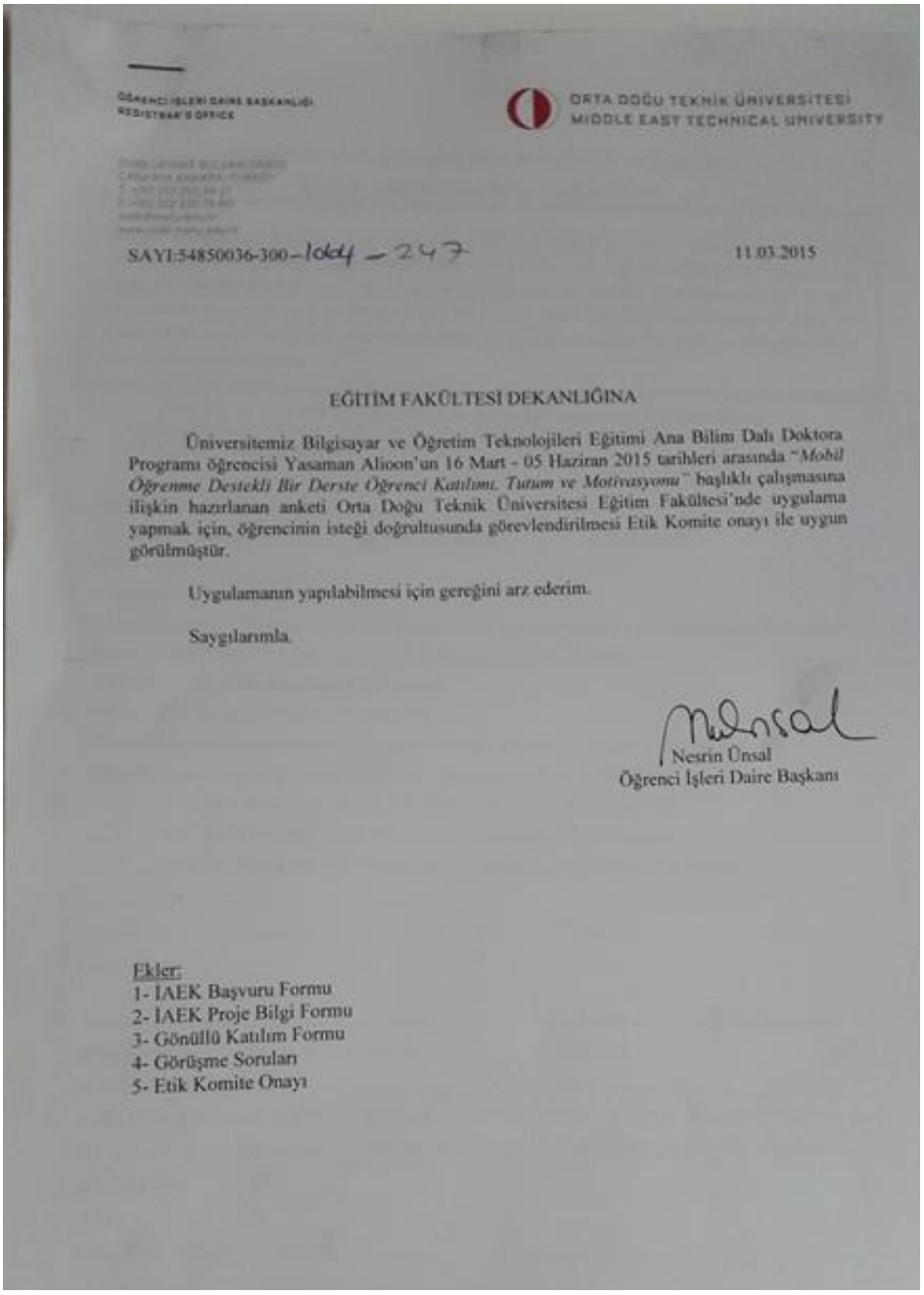
(UEAM) Başkan Vekili
ODTÜ 06531 ANKARA

APPROVAL OF ETHICAL COUNCIL-PAGE II



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EĞİTİM FAKÜLTESİ DEKANLIĞINA

Üniversitemiz Bilgisayar ve Öğretim Teknolojileri Eğitimi Ana Bilim Dalı Doktora Programı öğrencisi Yasaman Alioon'un 16 Mart - 05 Haziran 2015 tarihleri arasında "*Mobil Öğrenme Destekli Bir Derste Öğrenci Katılımı, Tutum ve Motivasyonu*" başlıklı çalışmasına ilişkin hazırlanan anketi Orta Doğu Teknik Üniversitesi Eğitim Fakültesi'nde uygulama yapmak için, öğrencinin isteği doğrultusunda görevlendirilmesi Etik Komite onayı ile uygun görülmüştür.

Uygulamanın yapılabilmesi için gereğini arz ederim.

Saygılarımla.

Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

Ekler:
1- İAEK Başvuru Formu
2- İAEK Proje Bilgi Formu
3- Gönüllü Katılım Formu
4- Görüşme Soruları
5- Etik Komite Onayı

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Delialioglu, O., Alioon, Y. (2015). The effect of students' subject discipline on their m-learning application preferences. *Interactive Learning Environments,* DOI: 10.1080/10494820.2015.10702731-10.

Alioon Y., Delialioglu, O. (2014). Frame for the Literature on M-learning. Procedia - Social and Behavioral Sciences 182 (2015) 127 – 135.

Delialioglu, O., Alioon, Y. (2014). Student Preferences for M-learning Application Characteristics. *10th International Conference Mobile Learning 2014*, February, Madrid, Spain.

Alioon, Y., Delialioglu, O. (2012). An Overview to Mobile Learning: Foundations and Current State. *Exploring Turkey's Education Policy: What Do the Global Trends*

Suggest, What Do the Recent Amendments Really Amend? December, METU, Ankara, Turkey.

Alioon, Y., Sadighi Moshkenani, M. (2011). How Semantic Attributes Contribute to More Transitive Social Network. *The International Conference on Informatics Engineering & Information Science,* University Technology Malaysia, November, Malaysia. (Accepted)

Alioon, Y., Sadighi Moshkenani, M. (2010). Relation Maintenance in Social Networks Using Semantic Attributes. 1st *International Symposium on Commuting in Science & Engineering*, June, Kusadasi, Turkey.