# STUDENTS' PERCEPTIONS ABOUT THE USE OF A QUESTION-ANSWER SYSTEM VIA MOBILE DEVICES IN A LECTURE-BASED LEARNING ENVIRONMENT

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# ABSTRACT

STUDENTS' PERCEPTIONS ABOUT THE USE OF A QUESTION-ANSWER SYSTEM VIA MOBILE DEVICES IN A LECTURE-BASED LEARNING ENVIRONMENT

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The advents in mobile technologies offer a great potential for in-class learning by supporting conventional teaching methods. Question-Answer Systems used through mobile devices are one of the valuable learning tools to be improved further by taking viewpoints of students into account.

The major aim of this study was to explore the opinions, perceptions, evaluations of students on their experiences with a Question-Answer System used on mobile devices in a lecture-based course.

Basic Qualitative Research Methodology was employed in this study to understand how students make sense of their experiences in the teaching-learning transaction. The participants of the study were 42 sophomore METU, Computer Education and Instructional Technology students who enrolled in a Computer Hardware course. The sampling method used for data collection was convenient sampling of 25 of 42 students, who participated in five sessions of focus-groups voluntarily. Data analysis

was done based on six-steps of inductive analysis. Through all the research process; credibility, consistency, transferability and ethical consideration were taken into account.

The results of data analysis showed that students mostly ascribed the meaning of their engagement to the observable behaviors about academic challenge. Concerning inhibiting factors for participating in a lecture, they stressed the constraints of lecture method. As inhibiting factors for asking questions, they mostly stated shyness as a reason.. The results of the research were discussed reflectively with the preexistent results stated in literature so as to investigate the constructed meanings of participants about the context and to make suggestions for further studies.

**Keywords:** Question-Answer Systems (QAS), Lecture-based teaching, mobile learning, m-learning, Student perceptions

# ÖZ

ANLATIM METODU TABANLI ÖĞRENME ORTAMINDA MOBİL CİHAZLAR ARACILIĞIYLA KULLANILAN SORU-CEVAP SİSTEMİNE İLİŞKİN ÖĞRENCİ GÖRÜŞLERİ

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Mobil teknolojilerin hızla gelişmesi, geleneksel öğrenme yöntemlerinin uygulandığı öğrenme ortamları için imkanlar sunmaktadır. Mobil cihazlar aracılığıyla kullanılan Soru-Cevap Sistemleri(SCS) geleneksel öğrenme ortamlarında kullanılan ve öğrenci görüşleri dikkate alınarak geliştirilmesi gereken araçlardan biridir.

Bu çalışmanın temel amacı, anlatım yönteminin uygulandığı bir öğrenme ortamında, mobil cihazlar aracılığıyla, Soru-Cevap Sistemini ders içinde kullanmış olan öğrencilerin tecrübelerine ilişkin görüş, yorum ve değerlendirmelerini araştırmaktır.

Çalışma, temel nitel araştırma yöntemi çerçevesinde, öğrencilerin tecrübelerini anlamaya yönelik olarak tasarlanmıştır. Bu çalışmanın örneklemi; ODTÜ, Bilgisayar ve Öğretim Teknolojileri bölümünde okuyan ve Bilgisayar Donanımı dersine kaydolmuş 42 ikinci sınıf öğrencisinden oluşmaktadır. Veri, derse dahil olan 42 öğrenci arasından odak grup görüşmelerine gönülllü olarak katılmayı kabul eden 25 öğrenciyle gerçekleştirilen görüşmeler sonucunda elde edilmiştir. Görüşmeler

sonucunda elde edilen veri, tümevarımsal analiz yöntemi esas alınarak kodlanmıştır. Çalışma; güvenirlik, tutarlılık, aktarılabilirlik ve etik kaygılar dikkate alınarak sürdürülmüş ve rapor edilmiştir.

Veri analizi neticesinde, öğrencilerin, derse katılımın kendileri için ne anlama geldiğine ilişkin görüşlerini, çoğunlukla gözlemlenebilir davranışlarını vurguladıkları eğitsel aktivitelerle açıkladıkları anlaşılmıştır. Derse katılımlarını engelleyen sebepleri ise anlatım metodunun kısıtlılıklarına bağladıkları anlaşılmaktadır. Ders esnasında soru sormalarını engelleyen faktörleri ilişkin olarak, öğrencilerin birçoğu çekingenliği sebep olarak göstermiştir. Çalışma sonuçları yansıtıcı bir tutumla literatürdeki benzer çalışmalar dikkate alınarak; öğrenci görüşlerini anlama ve gelecek çalışmalar için önerilerde bulunma kaygısıyla sunulmuştur.

**Anahtar Kelimeler:** Soru Cevap Sistemi (SCS),Anlatım metodu, mobil öğrenme,m-öğrenme, öğrenci görüşleri

To my little brother,

Orhan Ataş

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## LIST OF ABBREVATIONS

| | |
|---|---|
| **ARS** | Audience Response System |
| **CRS** | Classroom Response System |
| **EVS** | Electronic Voting System |
| **SRS** | Student Response System |
| **QAS** | Question Answer System |
| **ITU** | International Telecommunication Union |
| **AFL** | Assessment for Learning |
| **TurkStat** | Turkish Statistical Institute |

# CHAPTER 1

# INTRODUCTION

This chapter introduces the background of the study, the purpose of the study, research questions, and significance of the study, assumptions and lastly the definitions of terms.

## 1.1 Background of the Study

The term ubiquitous started to be used in 1980s as computers have become an integrative part of social life. Kukulska-Hulme and Traxler (2005) state a quotation from Weiser (1999) as below:

> *…too complex and hard to use; too demanding of attention; too isolating from other people and activities; and too much dominating as it colonized our desktops and our lives. We wanted to put computing back its place, to reposition it into the environmental background, to concentrate on human-to-human interfaces and less on human-to-computer ones… (p.2).*

It was concerns of 1980s on the purpose of computers; however, the nowadays pervasive computing is accessible from everywhere by helping people to rescue them from getting stack on their desktop computers. One step ahead would be the "ambient" technology. Such a technology would be something like natural part of our lives like our breath as Weal et al. (2003) and Fritz et al. (2004) stated (as cited in Kukulska-Hulme and Traxler, 2005, p.3).

Aside from the foresights of researchers about future's ambient technology, handheld devices have already surrounded our lives. According to the statistics of The International Telecommunication Union (ITU) reported by Sanou (2014), there are about 7 billion mobile subscriptions around the world; indeed, the number of these subscriptions continues to increase. Figure 1.1 shows that while the number of total

mobile-cellular subscriptions was 719 million in 2005, it is about 6.9 billion in 2014 (See Figure 1.1). Moreover, Sanoa (2014) reveals that the number of internet users is 3 billion, nearly 40% of the World's population.

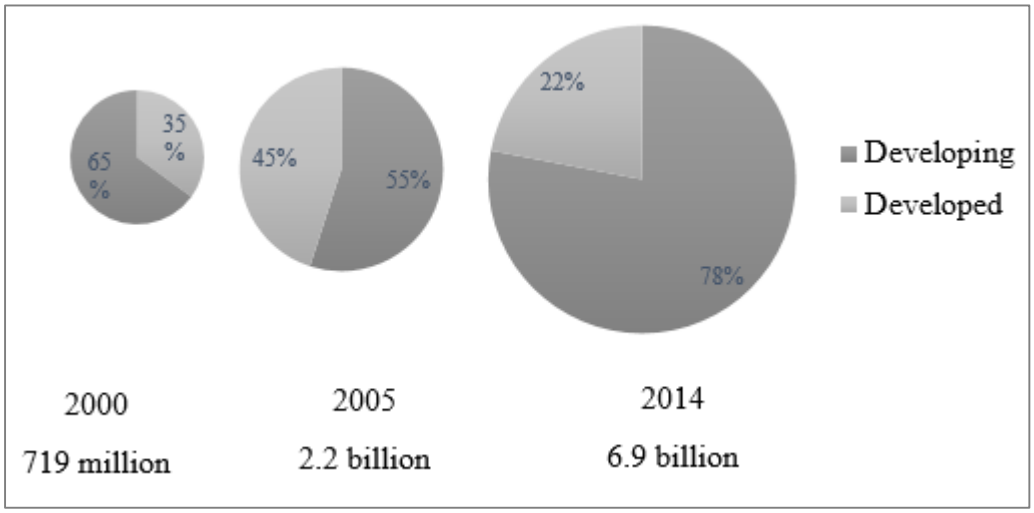



**Figure 1.1** Share of Mobile-Cellular Subscriptions, by level of development (2000, 2005, 2014)

**Note:** Estimate Values for 2014

**Source:** ITU World Telecommunication/ICT Indicators Database, 2014

Mobile technology, especially as the most popular handheld devices, mobile phones has become part of our lives though Weiser (1999) once said "…*we wanted to put computing back its place*…" (as cited in Kukulska-Hulme and Traxler, 2005, p.2). One of the fields that mobile devices are widely used is education. There are many benefits of mobile devices as flexibility and mobility, stated by Seong (2006) (as cited in Lam, Yau and Cheung, 2010, p.307). This dramatic departure from old fashion of learning environments to those supported by mobile devices reveals new term as "Mobile Learning (m-Learning)." Though there are many definitions of mobile learning, Colazzo, Ronchetti, Trifonova, and Molinari (2003) gave the definition, which is "A mobile learning educational process can be considered as any learning and teaching activity that is possible through mobile tools or in settings where mobile equipment is available" (as cited in Caudill, 2007,para.3). Ozdamli and Cavus (2011) elaborate the core characteristics of mobile learning as "ubiquity, portability, small size, blended, private, interactive, collaborative, and instant" (p.940). The characteristics of mobile

tools make them favorable in classrooms. Mehdipour and Zerehkafi (2013) listed the possible capabilities of mobile learning as student-student communication, teacher-student communication, feedback, assessment, presentations and etc. Orr (2010) states in his study named "A Review of Literature in Mobile Learning: Affordances and Constraints" that most of the educational theories are applicable in mobile learning. The affordances of mobile devices such as feedback, accessing to information instantly and portability make it possible to support mobile learning with behaviorism, constructivism, situated learning and collaborative learning theories (p.107-108).

The implementation of mobile tools in classes depends on the needs of the teaching/ learning systems. The deficiencies of teaching methods encourage researchers and instructor to integrate technology into learning environments. Lecture method is one of those teaching methods having some pedagogical constraints. As stated in literature chapter, Exley and Dennick (2009) define *lecture* as a stand of passive learning in which students mainly listen to the instructor and take notes. Parallel with the advents in mobile technology, question-answer systems have begun to be involved in lectures. These newly systems, having various names due to their novelty like Student Response Systems, Classroom Response Systems, Clickers or even Zapper, enable instructors to ask questions or enable students to ask/answer questions through mobile devices. The capabilities of mobile technology make it possible to design such systems by adding features like using nickname use for posting response anonymously, giving feedback through the system, adding different question types like multiple choice, True/False, open-ended and etc.

The various capabilities/components of these systems, with an embracing term **Question-Answer System (QAS)**, need further investigation to understand whether such systems are adding enhancements to instructional settings and student learning. Additionally, since these tools have various attributes and vary from each other, students' viewpoints concerning QASs can provide valuable information on improving them and generating new empirical research on technology enhanced learning environments.

## 1.2 Purpose of the Study and Research Questions

This study was based on the nature of a qualitative research as "understanding how students interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (Merriam, 2009, p.5). In context of this study, students who experienced a specific web-based QAS, in a lecture-based course were asked to express their opinions and perceptions about the learning situation. Students were asked to express how they give meaning to engagement and how they evaluate the system from their own point of view. Instead of quantitatively measuring the possible impacts of the system, it was aimed to explore how students perceive the system, how they gave meaning to the learning situation. Parallel to the purpose of the study, the main research questions are listed below:

1. What does engagement mean to students?
2. In students' opinion, what are the inhibiting factors for participating to a lecture?
3. In students' opinion, what are the inhibiting factors for asking questions?
4. What are the students' opinions about how the QAS affects their learning?
5. What are the students' opinions about how the QAS affects their engagement?
6. What are the students' opinions about the practices in the implementations of the QAS?

The more specific questions were elaborated in the "Method" chapter.

## 1.3 Significance of the Study

This study, which aimed to explore the opinions/perceptions/suggestions of sophomore undergraduate students who experienced the QAS through wireless mobile technologies, provides leading results for researchers and instructional technologists.

The variety of students' opinions concerning both asking and answering questions implementations with its numerous merits like opinions about its possible impacts on student learning and engagement also components like feedback, nickname use provide significant interpretations for researchers searching for the perspectives of students. As Creswell (2005) stated as a requirement of qualitative research, the general questions let participants generate and voice their own responses. In this

manner, the general open-ended questions asked to participants provide leading suggestions for further quantitative/qualitative researches.

The QAS itself serves as a valuable example for instructional technologist who designs educational software/QASs. The results and interpretations can be valuable to improve and adjust pre-existing systems or to create a new question and/or answer system. Thereto, the variety of interpretations and perceptions suggest researchers to conduct further research in this area.

## 1.4 Assumptions

Under this heading, assumptions concerning research methodology and sampling are presented.

### 1.4.1 Assumptions regarding research methodology

Fredricks, Blumenfeld and Paris (2004) mentioned the basic assumptions of qualitative research as below:

- As opposed to the positivism, of which the fundamental premise assert that reality is independent from individuals; in qualitative research, each individual construct the reality by herself/himself.
- Qualitative research studies aim to explore alternative perspectives of the existence of world.
- One of the integral part of the research process are the values.
- Values and facts are inseparably associated to each other.
- At the beginning of the study, it is requested to have uncertainty.
- In qualitative research, the aim is not to make generalizations instead to understand how individual construct their own meaning.

### 1.4.2 Assumptions regarding sample

The sample of this study was chosen purposefully. As Patton (2002) states "The logic and power of purposeful sampling lies in selecting of formation-rich cases from which one can learn a great deal about issues of central importance to the purpose of the research" (p.169). The underlying reason choosing these students were the assumption that they can more quickly adapt to new technology (Tablet PCs and the QAS

interface). In other words, students attending to the department of Computer Education and Instructional Technology were assumed to have background knowledge about how to technology (both hardware and software) and can evaluate their experiences from an instructional perspective with their knowledge. Moreover, since the context of the study was to explore the experiences of students enrolled in a lecture-based course, "*being enrolled in a lecture-based course*" was another criterion of sample.

## 1.5 Definitions of Terms

**Feedback for Learning:** Ramaprasad (1983) defined the feedback as the information, which is indicating the gap between existent and desired performance level, to be used to later to close this gap (as cited in Burke and Pieterick, 2010, p.13).

**Formative Assessment/ Assessment for Learning**: Formative assessment is elaborated by Greenstein (2010) as a way of understanding, during the instruction, "how well student understands and advances his/her understanding according to standards" also "how effective instructor design the instruction" in order to make adjustments to improve student learning (p.17).

**Interactive Lecturing:** Butler (1992) defines interactive lecturing as a way to taking the advantages of small group learning groups into large groups (as cited in Steniert, 1999, p.38)

**Mobile learning:** Ally (2009) defines mobile learning as use of wireless mobile technology in order to reach information and/or learning materials whenever and wherever learner wants.

**Behavioral Engagement:** This engagement type entails "positive conduct" (Finn, 1993; Finn, Pannozzo, & Voelkl, 1995; Finn & Rock, 1997), "student involvement in learning activities", (Birch & Ladd, 1997; Finn et al., 1995; Skinner & Belmont, 1993) and "participation in school related actvities" (Finn, 1993; Finn et al., 1995). (as cited in Fredricks, Blumenfeld and Paris, 2004, p.62).

**Emotional Engagement:** Connell and Wellborn (1991) and Skinner and Belmont (1993) define Emotional engagement as students' positive and negative emotional reactions in classroom (as cited in Fredricks, Blumenfeld and Paris, 2004, p.62).

**Cognitive Engagement:** Connell and Welborn (1991); Newmann et.al. (1992); Wehlage et. al., (1989) explain cognitive engagement as students' willingness to surpass the requirements, psychological commitment in learning and desire for challenge (as cited in Fredricks, Blumenfeld and Paris, 2004, p.62).

**Lecture Teaching Method:** Lecture is an oral presentation of information and ideas by synthesis of lecturer's own experiences and opinion in an environment with generally little or no active student participation (p.29).

**Question-Answer System:** QAS is a web-based platform enabling students to ask their questions and to answer the various types of questions of instructors anonymously through mobile devices.

## 1.6 Summary

The flaws of lecture teaching method and advents in mobile technologies were the reasons of conducting this research. Within the scope of the research, students' perceptions and evaluations about the implementation of a specific web-based QAS used via mobile devices in a lecture-based learning environment were explored to understand the context of the study and present implications for future research based on viewpoints of participants.

# CHAPTER 2

# LITERATURE REVIEW

This study includes two strands of literature, which are lecturing as a teaching method and mobile learning. First, the literature about the lecturing was elaborated with its different merits including active learning, interactive lecturing, asking questions and AFL. Second, the mobile learning was elaborated by focusing on the Question-Answer Systems with their benefits and challenges. Lastly, prior studies on the QAS use were described to be used as a basis for discussing the results of the current study from a broader view. Literature review in this chapter serves as a justification of the constraints in lecturing teaching method and the prominent gains of mobile technology and QASs. In the Conclusion and Discussion chapter, the results of the study were discussed with the prior studies, which were specifically mentioned details of researches in contexts similar to the current study.

## 2.1 Exposition Teaching Method: Lecturing

Moore (2009) states that "Exposition Teaching" is the best way to share a huge amount of information in a short time and the "lecturing" is one of the frequently used exposition teaching methods (p. 147). In fact, in 21st century, universities' amphitheaters are designed to give lectures. While researchers emphasize the importance of interaction, active learning and/or collaborative learning, the seating arrangements shows that interior designers might not be interested in what the researchers suggest (Moore, 2009). Actually, the huge amphitheaters are designed to reach crowded groups by taking the economic conditions into account. The interior design of a classroom reflects mind-sets of instructor in one respect. That is, it is not usual to see round tables in most classrooms. Partially, conventional seating

arrangement and other variables such as number of students and time confines the teaching method(s) that instructor might follow in class. In fact, classroom is not the only place where lecture method is conducted. Blight (2000) mentions that lecture is conducted even in churches or in the conference halls. Although the name of the action can vary such as sermon or speech, the underlying idea is to transmit information as lecturing in classroom.

### 2.1.1 When is lecturing effective or ineffective?

Bligh (2000) states that the purpose of giving lectures should be transmitting information. Instead of teaching behavioral skills, the main goal should be to give background knowledge, facts and etc. To illustrate, so as to teach how to shoot a basket in a physical education course, it is necessary to demonstrate how to do so; that is, a pure lecture with plenty of pictures and texts would not transcend theoretical information. White (2011) elaborates the purposes of lectures as below. Lecture method allows instructor to;

- show willingness for the content,
- scrutinize and enrich the content with his/her deep knowledge,
- get students to connect new information with their existing knowledge,
- finish the lesson in a shorter period of time,
- connect with students,
- demonstrate the style of expert approach.

Exley and Dennick (2009) also present reasons for giving lectures. In addition to the reasons listed by White, they say that lecturing provides a chance to share up-to-date information.

In addition to the advantages, lecture method has some disadvantages. Lecture is defined as a stand of passive learning during which students are required to listen to the instructor and take notes. Passive learning is one of the important flaws of lecturing method. When compared with student-centered teaching methods, student involvement is lower in teacher-centered teaching methods; indeed, instructor is the only authority presenting the information; that is, it is hard to observe overt interaction

in such learning environments (Exley and Dennick, 2009). Moore (2009) elaborates downsides of the lecture method as lower interaction, boring learning atmosphere and classroom management problems due to waning student interest and attention.

### 2.1.2 Active Learning

Pollio (1984) states that students generally do not participate into the lectures about 40 percent of the whole class time (as cited in Meyers & Jones, 1993, p.14). During a lecture, it is usual for students to listen all the class time while teacher is explaining all the time. Brookfield (1990) states that students need to think deeply in order to understand what the teacher explains; however, this "mulling over" period is ignored (p.50). Students need mulling over the content, generating questions, sharing their ideas in order to learn; in other words, students need being cognitively active during learning process.

Bonwell and Eison (1991) define active learning as a method in which students participate in learning process (as cited in Prince, 2004, p.226). In addition, Meyers and Jones (1993) states the four elements of active learning as talking and listening, writing, reading and reflecting. The reason for choosing these four elements was due to the fact that those elements are fundamentals of all learning strategies. For talking and listening, the problem is teacher' excessive talking periods; whereas, students sit in silence; however, so as to clear up what they experience and to expose the meaning they construct, it is essential to speak (p.19). Bonwell and Eison (1991) draw attention to a significant point; that is, trying to put thoughts into words might help someone realize how much s/he really knows about it. Writing and reading also provide a chance of following thinking process. Writing and reading assignments might help students to organize and elaborate their ideas. The fourth factor of learning strategies is given as reflecting. Bonwell and Eison (1991) say that though little is known about the brain functions during reformation and enhancement, brain need silence time to connect new information with existing one. In addition, Bonwell and Eison (1991) suggest that student activities should be prepared by taking critical reflection into account. Students should be involved into activities in which they use higher order skills such as detecting and criticizing uncontrolled assumptions. "Student Journals" and "Silence

in Classroom" are two ways to encourage reflection according to Bonwell and Eison (1991). Student journals mean providing a writing opportunity to student for sharing their thoughts, concerns and feelings about the issues discussed in class. Silence in Classroom is presented as a need of students to mull over during class time. In most of the lectures, the main concern of the teacher is to cover the content as much as possible in a pre-determined time period. Teachers generally finish one topic and immediately start to another one. Therefore, students are required to follow the content load synchronously. According to a study of Sanacore (1987), the wait time between asking a question and giving an answer is 0.9 second unless any student asks a question.

### 2.1.3 Interactive Lecturing

Stinert and Snell (1999) simply define interactive lecturing as a method enriched by students' active participation. The interactive lecturing, as the name implies, combines active learning components or interactivity with traditional lecturing methods.

Stinert and Snell (1999) state that there are some reasons of not using interactive lecturing. The fear of the losing control or fear of not handling the content in a predetermined duration might be other reasons for avoiding the use of interactive lecturing. Moreover, some personal reasons such as inadequateness in subject matter and anxiety of not knowing the answer might be other grounds. However, it is clear that presenting too much content by talking all the class time does not mean that students will learn better and/or more. On the contrary, too much information might create a cognitive over load. It is important to indicate that the use of interactive lecturing does not refer to a certain way of decreasing cognitive overload; nevertheless, the passive learning atmosphere of lecturing might be handled by blending suitable active learning strategies with conventional lecture method.

### 2.1.4 Questions and Questioning

Hunkins (1995) says that when students experience a learning environment in which good questions and questioning take place, they become aware of sharing the accountability of their own learning. Additionally, Walsh & Sattes (2005) state asking questions and questioning inevitably contribute to learning process. Asking questions

also show that the student is attentive and motivated by contrast with being absent minded. In other words, it exactly shows that student is an active learner.

In order to understand the importance of questioning, it is essential to clarify its definition. Fahey (1942) defines "question" as a spoken statement of a conflicted mind. He further specifies the purposes of questioning as providing information if there is deficiency of information or solving a problematic situation (as cited in Cifone, 2013, p.46). This definition limits the meaning of question to verbal expression; however, question might be nonverbal as well. Kearsley (1976) criticizes Fahey by underlining that asking question might be with the help of gestures; in addition, it might be asked to us or to other people, which means questions might be bi-directional. There are quite a number of definitions of "question". However, it is clear that when a person wants to ask a question, s/he explores meaning and more importantly becomes willing to learn.

#### 2.1.4.1 Constraints on Question Asking and Participation

Dillon et al. (1982) argued that students do not ask their questions in class as if it is an unwritten code among them (cited in Van Der Meij, 1988). Although asking questions support and deepen learning, attempts for stimulating question asking fall behind the desired question asking level. Therefore, it is essential to elaborate on the reasons for why students fail to ask questions.

According to the research conducted by Van Der Meij (1988), concerns of students regarding question asking were categorized as related to the help-giver, help-seeker and task/setting concerns (p.404).

*Help-giver concerns:* Instructor's competence about the content is an important factor of students' questions. If student thinks that instructor has sufficient knowledge about his/her question(s), s/he decides to ask them. In other words, student wants to ensure whether his/her expectations will be met before attempting to ask question. According to Van Der Meij (1988), attitude of instructor might be indicated as a factor though it is not adequate in itself to be interpreted as reason to ask or not to ask question.

*Help-seeker concerns:* Vast majority of the students who involved in the study of Van Der Meij (1988) were worried that they would appear as to rely on the teacher too much if they asked question in class. In addition, the researcher argued that students' concerns change according to the conditions. To illustrate, concern level is higher during seatwork than during instruction because students have already expected to ask question during instruction.

*Task/setting concerns:* In addition to the reasons regarding student and instructor, the atmosphere of class might be another reason inhibiting asking questions. Though Van Der Meij (1988) states that students could not state explicitly that classroom rules prevent question asking, he states that classroom conditions might create a difference on question asking behaviors of students.

### 2.1.5 Assessment for Learning

Questions during a lecture might be directed from the teacher to the students but also directed from the students to the teacher. In order to ensure that students attain learning objectives or they are ready for the next objective, it is beneficial to conduct assessments. This statement does not mean that the assessment is just a tool for the teacher to assess what s/he shared with students; in fact, students evaluate their own learning by the help of the assessment as well. Therefore, assessment has benefits to both teacher and learner.

Assessment strategies which support, improve and adjust learning process are called "Assessment for Learning" (AFL) (Gardner, 2012). In addition to insights, pure observations and personal experiences regarding the impact of AFL, Black and William (1998) analyzed 250 studies on student achievement. They revealed that achievement level of a student who is experiencing AFL in class is the same as the top 35 percent student who is not doing so. Furthermore, they stated that AFL lessens the attainment difference between low and high achievers and also increases the total achievement in class. Therefore, placing AFL in classroom with teaching methods provides improvement in learning (as cited in Arter, 2003, p.470).

Arter (2003) listed two benefits of AFL:

- AFL is way of informing students about the **learning objectives.** The questions asked during a course help students to realize what they are expected to learn.
- AFL provides a **self-assessment** opportunity for students. In the progress of a course, the feedbacks obtained from assessments make students able to evaluate their own learning. Due to this awareness, it becomes possible to compare their results with course objectives. In this way, students can adjust their learning.

Arter (2003) provided more statements than the possible plusses of AFL listed above. That is, the advantage might change according to type of AFL. Preparing a portfolio or term project during the course might help students to follow their progress during the course and control their own learning. This advantage was valid for other types of assessments as well. For example, quizzes implemented during the course might help students realize their weaknesses and strengths as a part of their learning process.

## 2.2 Mobile Technology

Vast majority of people decorate their tables with their elegant, stylish smartphones while having their drinks. In some cases, the number of these mobile devices exceeds the number of people (owners) since they are not satisfied with a single device. Via these devices, they check their social accounts, e-mails, share pictures, update their statuses, make comments etc. Moreover, once they forget their mobile phones at home, they feel like incomplete. Actually, the motto statement of Samsung Galaxy S4, "Life Companion", shown on the default screensaver picture, explains the real truth. Mobile phones really spread into our lives. According to data release of TurkStat (2013), the number of mobile telephone subscribers exceeded 69 million in 2013, while it was 34.7 million in 2004; that is, in 10 years period, the number of subscribers doubled in Turkey.

The popularity of mobile devices might be closely related with their specifications. Manufacturers upgrade mobile devices by keeping the demand of their consumers in mind. In fact, they go beyond the needs; that is, the use of mobile phones is not limited to giving a ring any longer. Gerard, Knott and Lederman (2012) discussed the

affordances of tablet technologies, by which they mean tablets and smartphones, into three headings, which are “digital ink”, “portability” and “unobtrusiveness” (p.93).

*Digital ink characteristic* of tablet technology makes users to write, edit, delete text, and draw pictures by enriching text with countless options. In addition, adding notes to PDFs, highlighting texts or handwriting recognition features make tablet technology more desirable.

As the name “mobile” implies, mobile devices helps to handle the space limitations. This *portability* characteristic of mobile devices provides a space-free, unsettled opportunity.

The *unobtrusiveness* refers the hat in hand feature of mobile devices. Gerard, Knott and Lederman (2012) say that the design of handheld devices decreases the distractions and helps to take benefits concerning learning. To illustrate, unlike desktop computers of which screen and keyboard components are separated, the tablet technology combines these two features in one; in this way, users can focus on the task instead of hardware components.

### 2.2.1 Mobile Learning

Mobile devices are not only used in leisure but also used in many fields for specific purposes. One of those fields is education, in which the affordances of mobile technologies attract the practitioners of the field to go beyond the conventional teaching methods by adapting mobile devices in or out class activities. As Ferscha (2002) states, the personalized features of mobile devices, such as “wireless, wearable, context awareness, ubiquitous and durable”, evolve learning characteristics to “learner centered, collaborative, situated, contextual, ubiquitous and life-long” (as cited in Leung & Chan, 2003, p.310).

Parsons and Ryu (2006) define m-learning (mobile learning) as providing learning content through mobile devices (as cited in Caudill, 2007, para.1). In addition, Ozdamli and Cavus (2011) elaborated the attributes of mobile devices from a learning perspective as below:

- **Ubiquity/Spontaneity:** Mobility of the devices provides context aware condition meaning that learner is not bounded to time and space conditions.
- **Portability:** Since the size the mobile devices is relatively small, learners are able to move with them during instruction.
- **Adaptability:** Mobile devices can be blended with other learning methods, and they can be used inside or outside of class.
- **Privacy:** Each learner can use personal mobile device to access learning material without depending on other learners.
- **Interactivity:** Mobile devices might be useful to keep learners active by engaging with mobile devices.
- **Collaboration:** Mobile devices present a second way of communication. In this manner, learner-learner and learner-instructor interaction might be increased.
- **Immediacy:** Mobile devices provide an opportunity to learner for immediately accessing to information and conducting research.

These attributes of mobile devices make the definition of mobile learning more comprehensible and specific. Mobile devices such as cell phones, tablets, PDAs eliminate the dependency; that is, learners become more independent from persons, time and space. At the same time, with collaboration and interaction attributes, learners become closer to their instructor and to their fellows (Ozdamli and Cavus, 2011).

### 2.2.2 Mobile Learning from an Instructional Perspective

Mobile devices are used for many purposes in the field of education. Both in informal and formal education environments, applications of mobile learning are used with the intention of supporting learning activities. Though mobile learning is comparatively new field, researchers classify mobile learning. Kukulska-Hulme and Traxler (2005) present the categories of mobile learning as below:

- **Technology-driven m-learning:** The advents in technology are implemented in learning environments to provide pedagogical plusses and technical applicability.

- **Miniature but portable e-learning:** The capabilities of mobile technology might be implemented in e-learning context by replacing the conventional e-learning technologies with mobile devices
- **Connected classroom learning**: Mobile technology might be used with preexisting classroom devices to provide collaboration.
- **Informal, personalized, situated m-learning:** The capabilities of m-devices like video recording, determining location are used to enrich learning.
- **Mobile training/performance support:** The affordances of mobile technology are used to support workers to develop their skills as they need to rich information.
- **Remote/rural/development m-learning:** When the existing technology is inadequate or unsuitable for the learning context, mobile devices are used instead of them (as cited in Ally, 2009, p.12).

The affordances of mobile technologies contribute to learning from many aspects; that is, the use of mobile technology is not confined to single settings; instead, it can be implemented inside/outside of the classroom, in formal/informal learning settings, solely or as blended with e-learning or traditional learning methods/devices. Regardless of these categories, the capacity of mobile devices is not limited to the mentioned affordances. That is, the current literature just shows how much of the capabilities mankind has explored about the m-devices not the total potential of m-devices. Mobil devices might be included in many instructional setting for various purposes; expressly, mobile devices might be used to motivate students, to increase engagement, to assess learning or to give feedback or many other practices waiting to be investigated.

## 2.3 Lecturing and Mobile Technology

Mobile technologies are used with conventional teaching methods as well. Lecturing as a traditional teaching method is one of them. The downsides of lecturing method and the affordances of mobile technology, which might dispose the flaws of lecturing, make it possible to blend this teaching method with m-technology.

The way of communication in lecturing is hardly bilateral; that is, in most of the lectures, instructor shares the information and students are required to listen to instructor.

Stovall (2003) broadly defines engagement as the willingness level of students in order to participate learning tasks and the time they spent for the activities (as cited in Beer, Clark & Jones, 2010). However, Fredricks, Blumenfeld & Paris (2004) claim that engagement comprises of many other interrelated components like emotions, behaviors and cognition of learners. The types of engagement and sample indicators are shown in the Table 2.1 below:

**Table 2.1** Engagement Types

| Behavioral Engagement | Indicators |
|---|---|
| Positive Conduct | Attending to class, observing the rules, regarding the norms of the school etc. |
| Involvement in Academic Tasks | Concentration, attention, motivation, asking/answering questions, participating in discussion etc. |
| Participating in school-related activities | Participating out class activities like school governance, student associations etc. |
| Emotional Engagement | Affective indicators such as anxiety, happiness, sadness etc. |
| Cognitive Engagement | Psychological considerations like self-regulation, problem-solving, being strategic etc. |

Although Fredricks, Blumenfeld & Paris (2004) give a categorization of engagement types, they states that the behaviors presented as indicators of each engagement type are interrelated. To illustrate, when a student ask a question, which is indicator of behavioral engagement, s/he also performs cognitively to prepare his/her question before asking.

Student engagement is a multidimensional concept. Dunleavy and Milton (2008) categorize student engagement as social, academic and intellectual engagement. Level by level, school engagement is defined as participation in students clubs, activities, which is defined as behavioral engagement by other researchers. Academic engagement is defined participation in order to meet achievement requirements such as student's individual effort. Lastly, the intellectual engagement comprises of deep cognitive effort for learning.

Though there is not exact categorization of engagement and also the definitions are blurred, the literature shows that engagement has meaningful implications with regard to learning. Dunleavy and Milton (2008) elaborate developmental outcomes of engagement as in Table 2.2 below:

**Table 2.2** Developmental Outcomes of Engagement

| Types | Sample Developmental Outcomes |
|---|---|
| Social Engagement | Friendships, social networks, sense of belonging, liking school and etc. |
| Academic Engagement | Academic Success, credit accumulation, graduation, orientation to good work and etc. |
| Intellectual Engagement | Knowledge builders, problem solvers, conceptual thinkers, confident learners and etc. |

Due to the potential outcomes of engagement on student learning, researchers and instructors conduct research on how to increase engagement in or out classrooms. Capie and Tobin (1981), Nystrand and Gamoran (1991) and Tobin and Capie (1982) state that engagement is a prominent indicator of learning (as cited in Wu and Huang, 2007, p.729).

One of the possible ways to increase student engagement could be "to take advantages of mobile technologies". Many studies show that mobile technology has impact on student engagement and learning; that is, m-devices enhances participation, experimental and active learning. Moreover, according to the research conducted by

Stephens (2005), m-devices effect student satisfaction by giving empowerment to them (as cited in Martin, 2011, p.50).

In lecture based environments, in order to increase student engagement, the use of question-answer systems become more popular parallel to popularity of mobile devices.

### 2.3.1 QASs on m-Devices

According to Nilson (2010), Prince and Felder (2006), even though developments in technology create changes in teaching methods and techniques, question- answering still keeps its significance in technology equipped classrooms (as cited in Larson & Lovelace, 2013). Actually, due to the fact that the requirements for learning do not change over time, the external variables do not create an alteration in the needs; that is, students need to ask their questions and they will need to do so in the future as well. Questioning and asking questions are the essentials of learning process. However, the way students perform asking or answering questions might change depending on the developments in technology.

The use of mobile devices for questioning/answering is a relatively new way of instruction. Therefore, the name of the Q-A systems differs in literature. Some of the researchers call them as;

- Student Response System (SRC),
- Mobile-phone-based Classroom Response System,
- Personal response system (PRS),
- Clickers,
- Zappers,
- Classroom Communication System (CCS)
- Electronic Voting System (EVS)
- Instructor-aided asynchronous question-answering system
- Mobile Response System (MRS)
- Mobile Lecture Interaction (MLI)
- Audience Response System (ARS)

#### 2.3.1.1 Benefits of QASs

Student Response Systems (SRSs) or QASs offer management opportunity for instructors. Although possible gain depends on how instructors include these tools in their teaching methods, the capabilities make it possible to have insights for possible benefits. There are many competing Q-A tools; however, most of them share common features, some of which might be listed as;

- Allowing students to respond questions immediately (Blood and Gulchak, 2013),
- Allowing students to compare their answers with their peers (Blood and Gulchak, 2013),
- Allowing students to get corrective feedback(Blood and Gulchak, 2013),
- Allowing students and instructors to get immediate feedback (Dunn, Richardson, McDonald & Oprescu 2012).

The features of QASs support learning from many aspects. The potential benefits of the Q-A Tools are elaborated by Kay &LeSage (2009) under three main headings, as shown in Table 2.3 (as cited in Gok, p.68).

**Table 2.3** Benefits of Student Response Systems

| Student Involvement | Learning | Assessment |
|---|---|---|
| Attendance | Interaction | Feedback |
| Attention | Discussion | Formative |
| Anonymity | Contingent teaching | Making comparison |
| Participation | Learning performance | |
| Engagement | Quality of learning | |

QASs support students' involvement, learning and present new opportunities regarding assessment. Gok (2011) states that plenty of research suggests that SRSs make lectures more interactive as compared with traditional lectures enhance learning and also put a new face to feedback through anonymity, response analysis features.

Blood and Gulchak (2013) state that clickers enable teachers to follow students' learning process. Teachers can easily check whether students understand the content or not; in other words, clickers provide immediate feedback to teachers. By the help

of clickers, students respond instructor questions during the lecture. Thus, as compared with traditional lectures, instructors do formative assessment, which provides instant evaluative feedback to instructors and helps instructors track learning. Sutherland and Wehby (2011) states that according to the results of research studies there is a relationship between task engagement and answering instructor's questions (as cited in Blood and Gulchak, 2013, 247). Moreover, according to the statements of Blood and Gulhack, research shows that providing students alternatives to respond to the questions of instructor enhances achievement and attention. Clickers create a learning atmosphere in which every student can respond the question s/he wants. For *Versatility and Ease of Implementation* feature, Blood and Gulhack (2013) state that clickers are the flexible tools which might be blended with any teaching method , with several question types such as multiple-choice, T/F or open-ended depending on the tool and for various course content. In addition, Clickers provide opportunities for students having learning disabilities; that is, Clickers present and interactive and funny environment both for instructor and for the students.

Though the benefits for teachers and students are interrelated, Clickers specifically provide plusses for students. Blood and Gulhack (2013) say that depending on the questions prepared by instructor to ask during the lecture, student can track the key point of the content since the aim of assessment is already to check whether students get the main ideas or not. The immediate and corrective feedback given during the formative assessment also helps students follow their own learning. Clickers provide benefits for particular students such as shy or unwilling students by allowing anonymous responding opportunity. Thus, each student has a chance to respond the questions, which support engagement and also makes the learning atmosphere funny. The summary of possible benefits of Clickers stated by Blood and Gulhack (2011) are given the Table 2.4:

**Table 2.4** Benefits of Clickers for Teachers and Students

| Benefits for Teachers | Benefits for Students |
|---|---|
| Instruction | Clarifies big ideas and main concepts |
| Assessment | Provides immediate feedback |

| | |
|---|---|
| Engagement and participation | Allows anonymous responding |
| Versatility and ease of implementation | Increases participation |
| Applications for students with disabilities | Makes learning fun |

2.3.1.2 QASs Challenges

Although it seems like integrating mobile technologies into classes is like bread and butter, they have some challenges. Kay and LeSage (2009) elaborates the challenges Q-A Systems or "Audience Response Systems (ARS)" as they called, into three heading, which are technology-based, student-based and teacher-based challenges, as shown in Table 2.5.

**Table 2.5** Challenges of ARSs

| Technology-centered | Teacher-centered | Student-centered |
|---|---|---|
| Bringing remotes | Responding to student feedback | New method of learning |
| ARS not work | Coverage | Increased confusion in discussion |
| | Developing questions | Being monitored |

For the technology-centered challenges, Caldwell (2007) Reay, Bao, Li, Warnakulasooriya and Baugh (2005) report that the functionality of the devices and the wireless connection problems pose challenges during instruction; in addition, El-Rady (2006), Hatch et al. (2005), Sharma, Khachan, Chan, and O'Byrne ( 2005) and Siau et al. (2006) state that students forget bringing their devices since they could participate in to the class anyway without depending on the remote devices (as cited in Kay and LeSage, 2009, p.821)

For the teacher-centered challenges, Kay and LeSage (2009) examined many studies and elaborated possible challenges as listed below:

- Though feedback from the students can provide teachers an opportunity to modify their instruction, novice teacher can have difficulty adapting their instruction due to the random flow of teaching.
- The before-class preparations to use ARSs and the load due to management of ARSs during the class time can cause covering less content in comparison with traditional lecturing.
- Developing quality questions for ARSs might be tiring and time-consuming for teachers

Students can also have difficulties in the learning environments where ARSs are used. Kay and LeSage (2009) elaborated the challenges that student might have as below:

- At the beginning of the implementations of ARSs, students might have difficulty adapting to the system. Also, Trees and Jackson (2007) state the implementation of ARSs require students to use up more cognitive effort.
- The in-class discussions on different perspectives of students, which were shared through ARSs, might distract students' attention and increase confusion about content.
- As anonymity not supported in learning environments where ARSs are implemented, students might feel uncomfortable while giving wrong answers to the questions and not want to be monitored by the system.

Orr (2010) also mentions about the constraints of mobile learning. He states the constraints under four headings:

- *Size of mobile devices:* Although the small mobile devices have advantages, small screen size, short battery life and slow text input are the constraints related with size of mobile devices.
- *Connection Issues:* Connection with a server is a requirement for most of the times. When mobile device cannot access to the server, it turns to a small computer without communication feature.
- *Inconsistent Platform:* The lack of cross platform consistency is a prominent problem related with the applications for mobile devices.

- *Distracted Mobile Learners:* Since using mobile devices in learning environment might require multi-tasking, it could be distracting for some of the learners (p.109).

## 2.4 Studies on QASs Use

The advents in mobile technologies help modifying the way of teaching, especially the way of conventional lecturing. Kay and LeSage (2009) summarized the strategies for using ARSs. They investigated the many studies and summarized the strategies as in the Table 2.6 below:

**Table 2.6** Strategies for Using ARSs

| | |
|---|---|
| General Strategies | • Studies about **explaining** students the reasons of using ARS,<br>• Studies about the **preparation** of effectives questions,<br>• **Type**s of questions,<br>• **Format** that questions, |
| Motivational Strategies | • Attendance<br>• Engagement<br>• Participation |
| Assessment Strategies | • Formative assessment<br>• Summative assessment<br>• Contingent teaching |
| Learning-based Strategies | • Attention<br>• Interaction<br>• Peer-based instruction<br>• Student preparation<br>• Class-based discussion<br>• Case studies<br>• Experiments |

Many other researchers include QASs in their classrooms for many other purposes in various disciplines. Though the merits of QASs are different, in order to have an understanding about the use of QASs, it is essential to review previous studies.

Simpson and Oliver (2007) examined the literature for use of electronic voting systems (EVS) in lectures. Their review includes studies, which are up to 2002 as review 1 and from 2002 to 2006 as review 2. Simpson and Oliver (2007) inspected the literature in terms of six themes, which are contexts, purposes, pedagogical practices, student perceptions, effects on staff and organization situation.

For the first theme "**context",** they stated that EVSs were highly used in the science and engineering subject matters with large groups. Psychology, philosophy, economics, management and medicine are the other disciplines cited in the first part of the review. On the other hand, for second part of the review, EVSs were also used in statistics and biology disciplines. Similar to Review 1, the studies from 2002 to 2006 were again done in large groups (from 100 to 400) though there were studies on small groups with about 20 students. The interaction problem in large groups was stated as a reason for this preference of large groups to include EVSs.

For the "**reasons of using"** were elaborated in Review 1 and Review 2 in different formats. In Review 1, the reasons were listed as below:

- In order to check background knowledge of learners or to check their preparedness for the lecture,
- To check understanding of learners,
- To assess learning outcomes and to make revise the content,
- To create a community by asking questions regarding background of students,
- To create a discussion atmosphere,
- To make peer assessments,
- To arrange precedency of events to be done in class and the needed time for those events,
- To make experiments concerning human responses especially in psychology field,
- To control the issues regarding the management such as student feedback on the lecture,
- To check attendance,

In Review 2, the reasons behind studies are listed in a more strategic way. The reasons behind the studies were listed as:

- Enhancing instructor' knowledge of students' learning,
- Enhancing students' knowledge about her/his own learning,

- Helping students' to understand the expectations of instructor,
- Enhancing students' knowledge of difficult content,

(Simpson and Oliver, 2009, p.17-18).

Simpson and Oliver (2007) stressed that while the studies in Review 1 mostly focused on small cases, studies in Review 2 are more holistic. To illustrate, in Review 1 researchers studied the discussion with EVSs whereas in Review 2, studies were regarded with the relationship between EVSs and discussion and also different dimensions of discussions. One other thing both reviews stressed was the importance of anonymity, which was stated to enhance students' contribution to increase desire to participate.

For the **pedagogical issues**, Simpson and Oliver (2007) stated sophisticated points. They identified three key principles, which are;

- Just trying to deliver content does not mean that effective learning occurs.
- Being actively engaged enhances learning.
- Giving quality feedback at a proper time and reinforcing students are significant for learning.

In addition to the elaborations above, Simpson and Oliver (2007) state that although interactivity is not a must for being an active learner, it is helpful for enhancing active learning and motivating learners. The researchers also referred another important pedagogic point from their reviews; that is, they said that the use of "I don't know option" for the questions sent via EVSs might be useful to eliminate swayed responses of students.

**Students' perceptions and reactions** were also elaborated by Simpson and Oliver (2007). From the review of many papers, they mentioned that students were generally positive. Moreover, it was stated that students were not prone to fiddling with the mobile devices. Students said that the use EVSs made classroom well organized and more intriguing and also help them to concentrate on the weaknesses without reflecting this situation to their friends. Also, they felt that EVS helped them to learn deeply and to think more critically. Perceived disadvantages were also stated in the reviews.

According to Draper (2002), students mentioned EVSs as disturbing. In addition, they felt that technology was used for its own sake and they doubted of their friends' responses during the implementation of EVSs (as cited in Simpson and Oliver, 2007, para.6). Regarding analysis of the responses after the implementation, Cutts and Kennedy (2005) indicated many of the students did not give any responses to the questions sent through EVSs. They also stated that students who used the EVSs performed better in assessments although there was no correlation between the correct answers given via EVSs and those in conventional assessments (as cited in Simpson and Oliver, 2007, para.12).

Concerning the **impact of EVSs on staff**, Simpson and Oliver (2007) noted that in order to include EVSs in lectures, content is needed to be adapted as covering less topics and allocating time and effort for question-answer activities. Instructors' capability of using the technology is another challenge concerning staff issues. Instructor will need to prepare appropriate question parallel to the course content and will be needed to give immediate feedback as a requirement of contingent teaching that the use of EVSs create.

One last theme from the reviews is the **organizational impact of EVSs.** Simpson and Oliver (2007) noted the use of EVSs in classes even changes the arrangement of classes. In addition, the time allocated for a lecture, the teacher-curriculum relationship are becoming concerns coming that come together with the use EVSs. The use of EVSs has impact on how to design the resources such as seats, subject matter and etc. Even management of mobile device distribution has become an issue studied in many papers. Different implementations were discussed in papers such as student purchase of devices, distributing devices to student for longer time, loan from library and etc., which are open to conduct further research to bring solutions and implementation suggestions.

In addition to the literature review written by Simpson and Oliver (2007), the studies between 2007 and 2014 were identified. However, due to the variety of terminology, the search includes many of keywords such as lecturing and Clickers, EVS, ARS or PRS.

Since the consistent terminology is still not available, there is possibility of excluding some of the papers that used different terminology. The 20 peer reviewed papers were coded according to the same six themes used in review conducted by Simpson and Oliver (2007).

### 2.4.1 Reasons for Using QAS

The papers regarding the use of QASs generally concentrate on enhancing learning, increasing engagement and interaction. Lyubartseva (2013) conducted a study on using responses of students as immediate feedback for instructors to check the understanding of students. Tong (2012) stated that he used Asynchronous Evaluation Surveys (AES) as an anonymous poll. He defined AES as a method to get feedback from students before and/or after the lectures. Tong (2012) conducted this study with undergraduate students taking geophysics. He stated that web-based AES was provided to students during the holiday to take an anonymous poll to be used in preparing students for the revision lecture and to help lecturer for understanding the needs of students. After students completed the poll, a follow-up revision lecture was conducted based on the polling results. Afterward, the results were demonstrated in bar graphs and related topics were discussed. In another study, a polling systems was used in order to enhance interaction and learning of students in large classes. Students were asked multiple-choice questions being answered either using a smartphone app or paper-pencil. Afterwards, students were provided immediate feedback (Nielsen, Hansen and Stav, 2013). Additionally, Immerwahr (2009) conducted a study on use of clickers to increase student engagement while students' attention have started to dim. As in similar studies, instructor projected the questions and students submit their answers by using clickers. Similarly, Morgan and Wakefiedl (2014) asked multiple choice questions to check students' understanding and to keep them engaged. After students answered the questions with their polling devices, they started to discuss the questions with peers. Afterwards, questions were re-asked and their responses were displayed with a bar-graph. In another comparison study, student response systems were used as a tool to improve learning. For the first year, course method was pure lecture; in the second year Socratic dialogs were included in lecture and in the third year, student response systems were used with peer-instruction pedagogy to improve

student learning (Kuo, Kohl and Carr, 2012). In the study conducted by Denker (2013) on Student Response Systems' use for increasing engagement and learning, impact of learner empowerment and teacher traits on students' use of SRSs were explored. The study was held with university students taking basic communication course in large lecture-based class. Trees and Jackson (2007) also carried on a study to explore student and course design preferences that can affect student engagement and learning in classroom settings where clickers were involved. Factors affecting students' positive perception of clickers were investigated to determine social and communication elements such as valuing of feedback, background knowledge of clickers and etc. that might be taken into consideration while using clickers in classroom settings. Masikunas, Panayiotidis and Burke (2007) conducted a research relating the perception of students about the use of EVSs in large-group lectures. In addition, they aimed to determine specific factors that can increase learning in such interactive lectures. The same researchers, Masikunis, Panayiotidis and Burke (2009) conducted another study two years later to explore how students perceive the impact of SRSs on their learning and on the role of the lecturer. They tried to transform traditional lecture-based classroom to an interactive lecture. In a Business and Management undergraduate degree program, they wanted students to discuss the questions in groups and submit a common answer by using their remote handsets. Afterward, the answers were displayed in the form of histograms and the lecturer gave feedback also explained the rationale behind the answers.

Some of researchers stated that they used QASs to share the responsibility of learning with students. Bunce (2009), for example, used Student Response Systems in chemistry courses to enhance student learning. Students used SRS in classes to take "ConcepTests", which comprised of questions related to the concepts. Instructor asked ConcepTests after s/he presented a concept. In addition to these tests, students discussed the rationale behind the right answers in their recitation hours with their peers, teachers and/or teaching assistants. Moreover, students were able to access the course materials on a Web Site, repository of handouts, slides, notes and etc. In this way, Bunce (2009) stated she aimed to share responsibility of learning with students. At the end of the study, students were interviewed to share how they felt about

chemistry. Bunce (2009) stated that this implementation turned the course from a teacher-driven to a student-centered one. She did not present the elaboration of the interview results.

The impact of QASs on achievement was also explored by many researchers. Nightingale (2010) explored the effect of SRS on student achievement. The participants of the study were undergraduate students taking Research and Information Skills course, in which the basic computer literacy was presented. Students were assigned two groups, one taking SRS integrated course and the other without it. Students' final exam scores were compared to investigate whether use of SRS had impact on final scores of students. Liu and Stengel (2011) used QASs in a comparative study to check student retention and exam performance. In class, instructor projected a multiple-choice question regarding the course content and allocated time for answering. After time ended, instructor presented the responses in a bar graph format. Interestingly, researchers stated that questions were provided to students at the beginning of the term to get them review the questions before the class; however, some extra questions were separated in case of needing additional questions. In another study, Laverty et al.(2012) explored whether increment in the number of exams cause more achievement, less cheating and less guessing on homework exams. Two groups of students, one groups taking 2 midterms and other group taking 13 weekly exams, were recruited. Exam questions were sent through a platform presenting different forms of the same questions to students in order to decrease cheating. The use of response systems is different than those in other studies. Instead of using in class time to provide immediate feedback, students reached the system out of class time. The data regarding cheating and guessing were gathered by questionnaires.

Some of the researches explored more specific answers regarding the use of QASs. To illustrate, Bunce, Flens and Neiles (2010) investigated a different impact of student response systems considering the attention problem of students in class. They conducted their study on measuring the frequency of attention lapses during a lecture, identifying the length of an attention lapse and the possible impact of pedagogy on attention lapses. Volunteer students used clickers' buttons to report their attention

lapses. Clickers had three buttons to indicate 1 minute or less, 2-3 minutes and 5 minutes and more attention lapses. In another study; Liu, Gettig and Fjortoft (2010) evaluated whether use of SRSs had impact on short and long-term learning of students taking Drug Literature Evaluation Course. Two groups of volunteer students enrolled in the course. Group 1 took the SRS involved course, while Group 2 involved into the course which SRS was not used. A pop quiz was administered two groups at the end of a course and about one month later, another pop quiz was administered to evaluate the long-term learning. In addition to function of QASs to measure learning outcomes, Turban (2011) explored the preferences of students about the use Audience Response Systems (ARSs) as course evaluation tool. At the end of medical lectures, students were asked whether they prefer to evaluate courses with paper-pencil or with ARSs. The study conducted by MacGeorge et al. (2008) aimed to evaluate the ARSs from many dimensions such as ease of use, effect on attendance, impact on class preparation and etc. in large lecture classes by using newly-developed Audience Response Technology Questionnaire. The questionnaire was used to measure the change in student response during the semester. Lastly,_Duggan, Palmer and Devitt (2007) evaluated the impact of EVSs on cognitive outcomes and potential classroom events in lectures relating women health topics. Traditional lecture group and EVS supported group were compared in terms of cognitive skills, student and instructor opinions.

To summarize, similar to the review conducted by Simpson and Oliver (2007), the main implementation reasons of QASs might be listed as:

- Verifying student comprehension,
- Checking student preparation,
- Checking attention,
- Increasing engagement and interaction,
- Increasing achievement
- Assessing learning outcomes,

Due to the similar capabilities of QASs, the researchers conducted on the use of QASs resembles to each other. However, it seems that research focuses have become more explicit than those of previous researches.

### 2.4.2 Contexts

Cleveland (2002) states that small classrooms consist of at most 30 students, medium sizes range from nearly 40 to 100 students and large classrooms consists of approximately (as cited in Denker, 2013, p.51) 100-150 students. The classes consists of more than 200 students are called mega classes.

**Table 2.7** Some of the Disciplines and Class Sizes of the Previous Studies

| Reference | Discipline | Group size |
|---|---|---|
| (Lyubartseva, 2013) | Organic chemistry | 40 students |
| (Turban, 2011) | Medical school | 391 students |
| (Nielsen, Hansen and Stav, 2013) | Physics, Mathematics, Social Science, Norwegian and English | 4 classes; each class 50-70 students |
| (Calma,Webster, Petry and Pesina, 2014) | Finance | 446 students |
| (Morgan and Wakefield, 2014) | Physics | 140 students, 70 in each section |
| (Kuo, Kohl and Carr, 2012) | Mechanics | 63, 55, 50 students in each year |
| (Liu and Stengel, 2011) | Quantitative Analysis, Business Statistics | Four sections; 67, 62, 58, 76 students in each section |
| (Immerwahr, 2009) | Philosophy | -not stated |
| (Bunce, Flens and Neiles, 2010) | Chemistry | Three courses; 74,68,44 in each lecture |
| (Trees, Jackson, 2007) | Astronomy, Physics, Communication | 2637 Students |
| (MacGeorge, Homan, Dunning, Elmore, Bodie, Evans and Geddes , 2008) | Art | 854 |
| (Tong, 2012) | Geophysics | 28 |
| (Denker,2013) | Basic Communication Course | 1600 |
| Bunce, D. M. (2009). | Chemistry | Not stated |
| (Laverty, Bauer, Kortemeyer and Westfall, 2012) | Calculus-based courses, Mechanics | 292,442,464 |
| Nightingale, 2010) | Business class; Marketing, Quantitative Science, Information System Management | 196 |
| (Liu, Gettig and Fjortoft, 2010) | Pharmacy | 187 |
| (Masikunis, Panayiotidis and Burke, 2009) | Business and Management | 500 |
| (Masikunis, Panayiotidis and Burke, 2007) | Marketing and Business | 500 |
| (Duggan, Palmer and Devitt 2007) | Medical | 127 |

As stated in Table 2.7 above, most of the studies were conducted with medium or large classes as in previous review conducted by Simpson and Oliver (2007), who argued

that the reason why to conduct QASs in mostly medium and large classes is the lack of interaction in larger groups.

### 2.4.3 Student Reactions and Perceptions

As in the review conducted by Simpson and Oliver (2007), students' perceptions were broadly positive; that is, According to the study conducted by Lyubartseva (2013), 94% of the students acknowledged that QASs increased their engagement in classroom. In addition, all of the students stated that they would like to use clickers for future course(s). In another study, medical students preferred using QAS as course evaluation tool. About 82% of them agreed or strongly agreed to use QASs more (Turban, 2011). Nielsen, Hansen and Stav (2013) stated that though students were generally positive about the use of QASs, some flaws had negative impact on students' experiencing QASs like technical. Other results of the study were categorized as:

- *Consistency when using QAS:* Students stressed that if teacher wants to use QAS, s/he should use it regularly.
- *Differences in teachers' QAS experience level:* Students stated that they learned better as an experienced teacher implemented QASs in class,
- *Time Usage:* Student stated that time (30 seconds) allocated for voting questions was too long. "Dead time" can have undesired effect.
- *Commitment, a two way street:* Students said that question should be well prepared with a rationale behind. In addition, instructor should be prepared.
- *Voting results: a false image of understanding:* In the cases where QASs were used for group discussions, dominant students can have impact on group decision. Thus, a teacher might have false image of student understanding.
- *Including "don't know" as an alternative:* Students stated that if this option did not exist, they would have been reluctant to answer question. Additionally, this option enabled teacher to give more explanation.
- *Teacher explanation:* Students stated teacher explanation as most important facet of QAS concerning their learning.

In another study, students stated that teacher explanation or giving instant feedback helped them to better comprehend the concepts. Further, they mentioned that they

would like to use QAS in other classes (Calma, Webster, Petry and Pesina, 2014). Liu and Stengel (2011) also mentioned that about 80% of students responded positively for use of QASs. Tong (2012) stated that students were positive toward the use of QASs. Students regarded QASs as an effective preparation tool for follow-up lectures. Simplicity, anonymity of QASs were also regarded by students. Simplicity enabled them to complete tasks in shorter time and anonymity was stated as encouraging them to answer honestly. Release of polling results were also stated as useful for checking their learning. Polling questions were stated as indicator of topics that students were required to focus on. Concerning the use of QASs for more courses, there were divergent opinions; that is, while some of the students would like to use them, rest said it might create a load for them. Lastly, Masikunas, Panayiotidis and Burke (2007) presented the results of a survey analysis under 5 headings, which are:

- *Enjoyment of the EVS (or QAS)-style lectures:* Most of the students expressed positive views on the use of QASs.
- *Consultation/participation:* According to the results, three types of consultation/participation came out, which are:
    - Being active in a large group lecture
    - Discussing with other students in small classes
    - Discussing with teacher during the lecture
- *Reinforcement/ feedback:* Students stated that feedback of teacher helped them to revise their understanding.
- *Team decision-making:* Team decision making was stated as providing an opportunity to see different perspectives for problem-solving.
- *Student interactivity:* Studying in groups was stated as enhancing interactivity.

Though the results of studies depend on how QASs were implemented in classroom, it is definite that the perceptions of students are overwhelmingly positive.

### 2.4.4 Pedagogy

As the review conducted by Simspon and Oliver (2007), the assumptions concerning what made learning better were elaborated in the second review of them as well. Most

of the researchers mentioned challenges of traditional lectures and emphasized the importance of student interaction and engagement.

Lyubartseva (2013) stated that the main aim of using QASs in classrooms was to enhance engagement and to keep students active. Further, it was stated that implementation of QASs enhance communication by enabling teacher to ask reflective questions and to provide feedback. Additionally, Turban (2011) stressed the importance of feedback. However, in this study, feedback was provided from students to the teacher on effectiveness of course. Further, Turban (2011) said that if more students evaluate the course, responses of those students might create a better representation, which enables teacher to adjust the course accordingly. Tong (2012) also said that obtaining instance student response is important in interactive lectures. Bunce (2009) mentioned that student feedback and teacher feedback are in loop and feed each other. Moreover, she stated that breaks as a sort of interaction can help students become alert and engaged.

Nielsen, Hansen and Stav (2013) stated the benefits of QASs as increased motivation and engagement. However, they stated that the main focus should be the student learning instead of technological tools. Crouch and Mazur (2001) stated that peer instruction improved learning and based their research of QASs on peer instruction. Liu and Stengel (2011) stressed the importance of active learning, including collaborative, cooperative and problem-based learning. Similarly, Stengel (2011) focused on “engagement” and student activity as core elements of active learning. Though most of the research focused on engagement, participation, active learning, Bunce, Flens and Neiles (2010) stated that waning student attention is a shared problems among lecturers. Thus, those researchers pointed out another assumption, attention, as a requirement for learning and also a rationale to implement QASs in class.

Denker (2013) indicated that lack of participation is a common problem and engagement is necessary for learning process. Masikunas, Panayiotidis and Burke (2007) stated the main problems with traditional lectures as well. Lack of student engagement, lack of opportunity to present ideas, to receive feedback and to follow

students' learning were stated some of the problems faced in traditional lectures. Moreover, Duggan, Palmer and Anderson (2007) stated that lecturing method focuses on shallow details rather than the principal and important points. Similarly, Trees and Jackson (2007) stressed pedagogical problems faced in large classes. The huge number students, physical environment were stated as creating impersonal space. Thus, students might be unwilling to participate in such learning environments. Other challenges due to the traditional lecture format were elaborated as lack of practice, feedback and active involvement. The researchers argued that the seating arrangements in lectures limit the interaction. They based the use of QASs on challenges of lectures. In the same way, Masikunis, Panayiotidis and Burke (2009) mentioned based their use of QASs on the pedagogical challenges faced in lectures. That is, attendance problems, disruptive student behaviors and concentration problems due to the duration of lessons were stated as challenges in traditional lectures. Lastly, Laverty, Bauer, Kortemeyer and Westfall (2012) asserted that formative assessment improve learning and performance.

### 2.4.5 Impact on staff

The use of QASs brings new roles for instructors. Trees and Jackson (2007) stated that the success of QASs depends on how these systems are implemented in the learning environments; that is, the implementation of QASs is not just a technological issue but rather a social issue. In order to use QASs, teachers are required to develop their technical skills such as uploading, modifying questions and coping with troubleshooting. Different from traditional classrooms, the use of QASs might require classroom management skills as well. In addition, it is crucial that instructors should help students focus on reasoning and learning rather than just answering the questions (as cited in Lyubartseva, 2013, p. 442). Nielsen, Hansen and Stav (2013) shared recommendations for instructors who want to use QASs. They stated that instructors should have a rationale behind using QASs; in other words, there should be consistency between the instructional goals and instructional methods. Instructor should be well-prepared in order not to waste time. In addition, instructor should be careful while interpreting results of students' questions. Denker (2013) states that though students feel more empowerment and motivation in the classrooms with the

use of QASs, instructors need to diminish the emotional and physical distance and also need to encourage engagement in the classrooms. Nightingale (2010) also stated the important of instructor training for the quality of instruction. Masikunis, Panayiotidis and Burke (2009) stated that the use of QASs bring many advantages for educational use of them, especially in more complex teaching and learning setting. In epitome, most of the researchers emphasized that the use of QASs bring with wider range responsibilities for teachers and require them to have/improve their technical skills in addition to pedagogical considerations.

### 2.4.6 Organizational impact

Simpson and Oliver (2007) mentioned last theme as organizational impact. Though most of the papers ignored this issue, some researchers shared their experiences about distribution and management of QASs. Turban (2011) stated that in order to increase student participation, an easy to use system should be implemented. Anonymity was also stressed as a crucial feature for enhancing participation. In addition to the software-related features of QASs, distribution of hardware components to students was stated as a challenge. Calma, Webster, Petry and Pesina (2014) stressed that students may not have mobile devices and can prefer to use paper-pencil. In their study, they allowed students to use paper-pencil or borrow their friends' devices. Unstable wireless connection was also reported as a problem by students. Immerwahr (2009) stated technological problems as well. Since faculty members and students used the same channel of RF technology, students complained about not registering their attendance and not submitting their answers due to connection problems. Moreover, Nightingale (2010) mentioned technical difficulties concerning software incompatibility. Schrodt and Turman (2003) and Schrodt and Witt (2006) argued that technology does not work as intended in classroom; credibility of instructor is damaged (as cited in Nighingale, 2010, p.39).

## 2.5 Summary

The literature shows that lecture teaching method has advantages and disadvantages. Though it is possible to share huge amount of information in a short period of time, lack of engagement and interaction are the downsides of this method. On the other

hand, QASs have being used through the mobile devices in lectures with various purposes. QASs are mentioned with diverse names and features. Concerning students' perceptions about these systems, students' evaluations are reported as positively.

# CHAPTER 3

# METHOD

In this part, research design of the study was presented with a detailed description of the qualitative methodology, data collection method, process of data analysis and ethical considerations. In sense of qualitative research, the context of the instructional setting was presented with rich descriptions.

## 3.1 Research Design

Qualitative and Quantitative methodologies are often discussed in terms of their way of interpreting events, issues, and people in any research context. The main difference between them is related to their basic assumptions. According to Creswell (2012), exploratory qualitative research deals with the opinions in a subjective way instead of collecting numerical data and conducting inquiry in an objective way. Additionally, Merriam (2009) states that meaning in qualitative research contexts is not fixed, but rather can be constructed by using different interpretations of people. Fraenkel, Wallen and Hyun (2012) stated the basic assumption of qualitative research as below:

- Individuals in the context of study construct meaning on their own. There is not independent reality.
- Research studies present alternative interpretations.
- Researcher is part of process.
- Values and facts are interrelated.
- Generalization is not possible.

“Basic Qualitative Research” as a qualitative theoretical framework was followed through the current study. Merriam (2009) lists the “Basic Qualitative Research” as

one of the six more commonly used approaches based on her thirty year experiences in qualitative research studies. Merriam (2009) says that this basic, interpretive research type is the most common one in education. Merriam (2009) elaborates the characteristics of Basic Qualitative Research as follow; that is,

- how participants interpret their experiences,
- how they construct their worlds,
- what meaning they give to their experiences

are the considerations in Basic Qualitative Research. Meriam (2009) says that though these listed characteristics are shared among all the qualitative research. The others have additional dimensions. That is,

- The unit of analysis is more bounded in "Case Studies",
- In "Phenomenological Study", the underlying structure of phenomena, essence is explored,
- "Ethnography" seeks for interactions among people and interaction of these people with the culture they lived.
- "Grounded Theory" seeks both for understanding and also for building a substantive theory,
- "Narrative Analysis" deal with the meaning in stories of people,
- "Critical Qualitative Research" emphasizes the societal critique to increase consciousness.

In this study, instead of dealing with additional dimensions of the qualitative research types listed above, the study was based basic common characteristics of qualitative research. Thus, the aim was to explore the opinions/ constructed meaning of students who experienced a QAS on mobile devices in a lecture-based classroom environment.

## 3.2 Research Questions

The main concern of the study was to explore the students' opinions about the QAS used on mobile devices in the classroom for a course in which, lecturing was the main teaching method.

"*Students*" in this context refer to participants who can easily adapt to QAS and mobile devices. These students had necessary background knowledge about the web based platforms and tablets. Students were sophomore students in department of Middle East Technical University (METU).

*"Mobile devices"* refers to tablets and smartphones.

More specific research questions with sub-research questions concerning these aspects can be elaborated as below:

1. What does engagement mean to students?
2. In students' opinion, what are the inhibiting factors for participating in a lecture?
3. In students' opinion, what are the inhibiting factors for asking questions?
4. What are the students' opinions about how the QAS affects their learning?
    - What do students think about the possible impacts of "asking questions through the QAS" on their learning?
    - What do students think about the possible impacts of "being asked questions through the QAS" on their learning?
5. What are the students' opinions about how the QAS affects their engagement?
    - What do students think about the possible impacts of "asking questions through the QAS" on their engagement?
    - What do students think about the possible impacts of "being asked questions through the QAS" on their engagement?
6. What are the students' opinions about the practices in the implementations of the QAS?
    - How do students compare asking/answering their questions verbally and through the QAS (in written form)?
    - What do students think about the question types used in the QAS?

- What do students think about the sharing of questions/answers in a screen during the lecture?
- What are the students' opinions about using nicknames through the QAS?
- What are students' opinions about the feedback provided for the questions/answers posted through the QAS?
- What might be the problems that students encounter during the use of QAS implementation?
- What are the students' opinions about the design of the QAS?

## 3.3 Sampling

The participants of the study were 42 undergraduate sophomore students (22 Female, 20 Male) who were studying at the Department of Computer Education and Instructional Technology in a public university (Middle East Technical University) of Turkey. The students were enrolled in two different sections of a mandatory computer hardware course. In section I, there were 14 students (7 females, 7 males) and in section II, there were 28 students (16 females, 12 males). The age range of students was 20-23. 27 of 42 students had smartphones and rest was provided by Tablet PCs (INCA-Astro with Android 4.1.1 OS). The list of devices that students had is given in Appendix E.

The sampling of the data collection was 25 of 42 sophomore students (Creswell, 2012). The reasons behind choosing this sample are explained below:

- *Characteristics of the Students and the Instructor:* In order to compensate for the possible novelty effect of technology and the system, students familiar with technology were chosen. It was assumed that these students can easily learn how to use QAS and tablets. In addition, since most of these students come from vocational high schools; they have been using computers for years. Therefore, it was assumed that they can adapt to new technology easily. In addition to the requirements from students, instructor was also willing and capable to integrate new technology in his own teaching method.

- *Teaching Method:* Lecturing as a direct teaching method has some weaknesses. As Moore (2009) states that "passive learning" is one of the important flaws of lecturing. By the word "passive", he means that students are expected to sit and listen to the course while teacher presents a large amount of content. Thus, instead of overt interaction between students and teacher, activities like listening, note-taking and questioning-answering takes place in the learning environments where direct teaching methods are followed.

Students and instructor's background knowledge about using technology, instructor's willingness to use the system in class and the teaching method followed through the course were the reasons of choosing this sample. However, it is important to indicate that availability of students who have already had background knowledge to use technology and an instructor wanting to use the system at the beginning of the study made the sampling somewhat convenient. For the sampling of the data collection; on the other hand, volunteer students who had experienced QAS in a lecture-based course were determined quite purposefully. The interviewee was chosen among those who experienced the QAS in a lecture-based course.

## 3.4 Instructional Setting

The main goal of the 3-credit Computer Hardware course was to share fundamental information about computer hardware components like CPU, RAM, BIOS and other input-output devices. Students were expected to learn about the functions of components, installation details, operation and maintenance of the computer system. The course consisted of two parts; lecturing and laboratory sessions. In lecturing part, the functions of the components and historical details were explained. During the course, the main teaching method was lecturing, in which presentations including textual and visual components were used. In laboratory sessions, the aim was to help students gain experience about installation and the maintenance of computer hardware components. As the objectives of the course, students were expected to be able to;

- describe and analyze the system architecture of a PC, including motherboard, RAM and CPU,

- compare the features and distinguish between various microprocessors and memory components,
- install, upgrade and manage memory and hard drives,
- compare the features of various storage units like, hard disk, CD ROM and bus structures as ISA, EISA, PCI and USB,
- troubleshoot basic PC hardware problems,
- connect and remove I/O Devices,
- make safety and preventive maintenance hardware components.

Q-A Tool implementation was conducted in the lecturing part of the course. In laboratory, students had already dealt with computer components actively. Indeed, they were free to make internet search or interact with their friends. Laboratory activities followed a learner-centered, flexible learning environment; whereas, in lecturing part, the teaching method was teacher-centered.

Students taking the Computer Hardware course have used a QAS actively for 4 weeks. Before the implementation, consent forms were distributed to each student and the purpose of the study was explained. In that manner, their demographic information and number of students having Smartphones were determined. In following week, orientation e-mails including 3 PowerPoint presentations were sent to students. They were informed about how to sign up to the system, how to ask questions and how to answer questions. In addition, they were expected to complete a trial activity, in which they were required to answer a question on the system. After distance orientation, in class time, tablets were distributed to students who do not have a smart phone or tablets in class time. Students were informed about how to use the tablets. Also, they were informed again about how to sign up to the system and how to send posts through the system. They were requested to send a trial post again. Since there were absent students in previous weeks, in-class orientation was repeated in order to make sure that each student signed up to the system and knew how to use the tablets and QAS. After 4 weeks orientation aiming to get students be familiar with the system and to decrease the novelty effect of the system, students were assumed as ready to use the system more easily. The following 4 weeks were devoted for the possible use of the QAS in

class time. At the beginning of 2 weeks, students were reminded that questions would be asked them and they were free to give their responses through the QAS or without the QAS. Similarly, for the other 2 weeks they were reminded that the system was ready for their questions if they wanted to ask them through the QAS (Flow of the instructions are shown in Appendix D ).

Taking the transferability issue into consideration, rich-thick descriptions of the questions of instructor and the questions of students asked through the QAS are shown in Appendix A & Appendix B. For two weeks, 12 questions were posted through the QAS by instructor. It is important to note that the number of responses indicated in the appendices for each question or the number of questions posted through the QAS by students do not mean that students preferred one question type to other. Due to the internet connection problems, students stated they could not send their answers from time to time.

The arrangement of the classroom is also an important part of instructional settings. There were 2 projection screens, one (Screen Y) for presenting lecture notes of instructor and the other (Screen X) for presenting the posts (answers or questions) of students. The classroom arrangement is given in Figure 3.1 below.

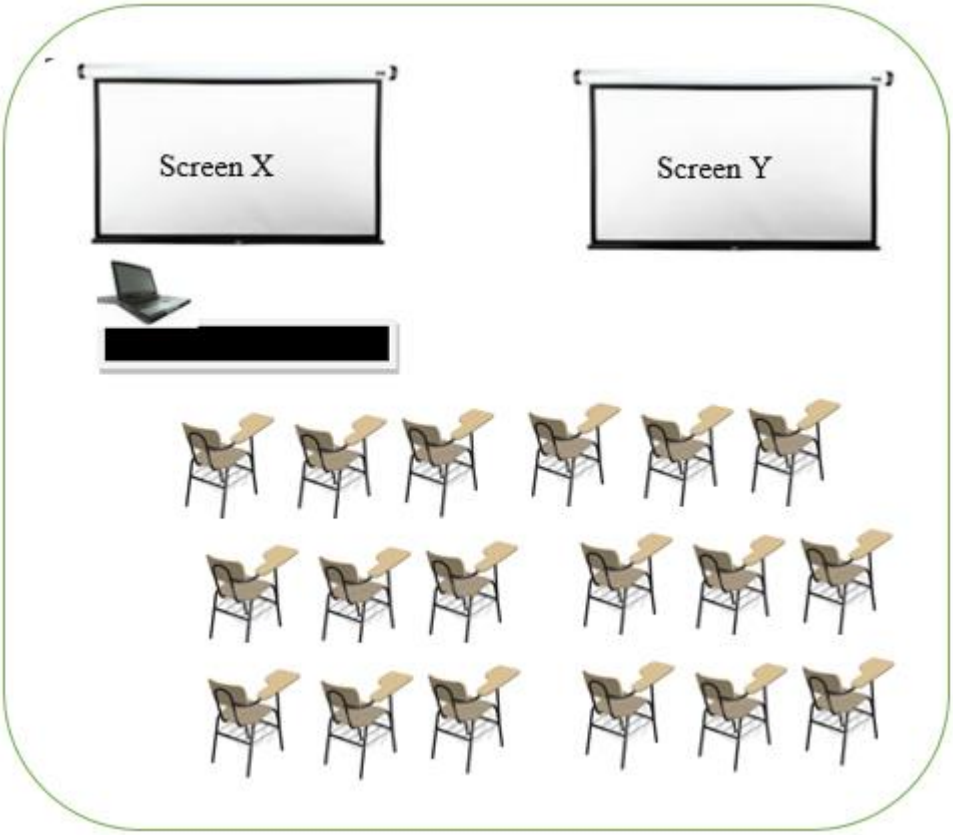



**Figure 3.1** Classroom Arrangement

## 3.5 Features of QASs

The question-answer tool used for this research was a web-based system. The reason for choosing a web-based system was to avoid compatibility problems due to the different range of devices having different operating systems. This QAS was developed in the scope of a project of which project number is BAP-05-05-2012-001. Though tablet PCs distributed to students had Android Operating system, most of the students used their own tablets or Smartphones having IOS or Symbian OSs.

The Q-A Tool provides two different user roles, which are “Student” and “Instructor”. The main page interface is given in Figure 3.2.

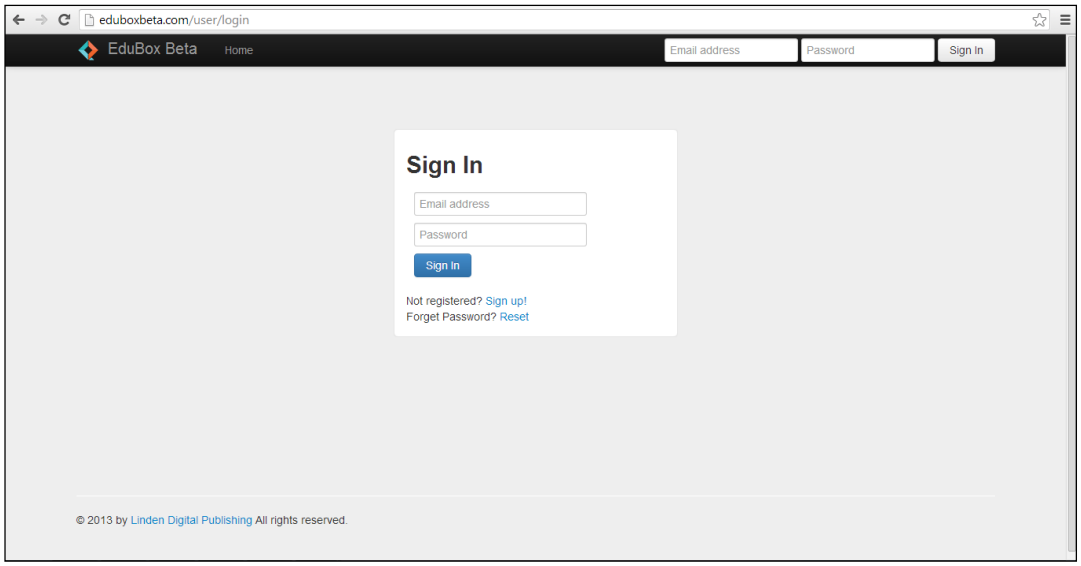



**Figure 3.2** QAS Sign up Window

In order to have a new account, user can press "Sign up!" option under the "Sign In" button. After option is clicked on, Figure 3.3 is opened.

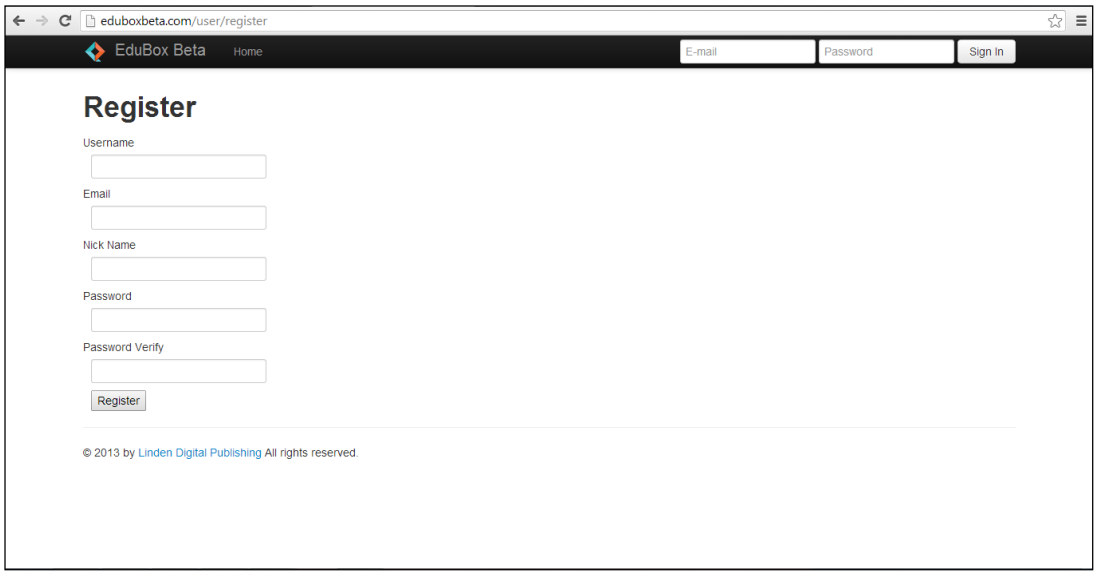



**Figure 3.3** QAS Registration Window

In the Figure above, the necessary information for registration is given. After completing this part, user role screen is opened as shown in Figure 3.4 below.

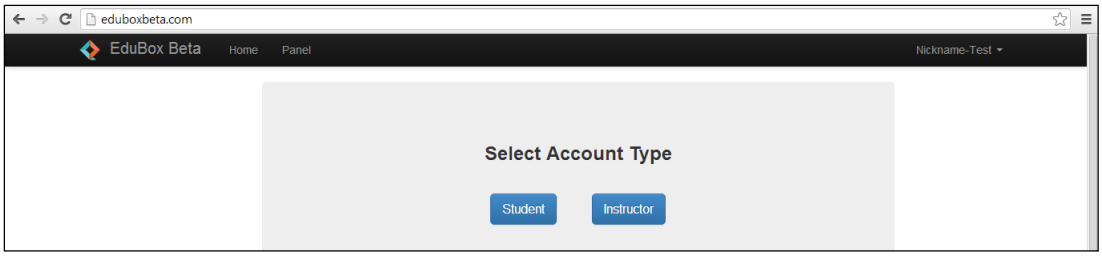



**Figure 3.4** QAS User Account Type Selection

On this page, the user defines his/her roles and continues with enrolling into the course s/he will attend. On the following Figure 3.5, user can choose the course(s) s/he wants to attend.

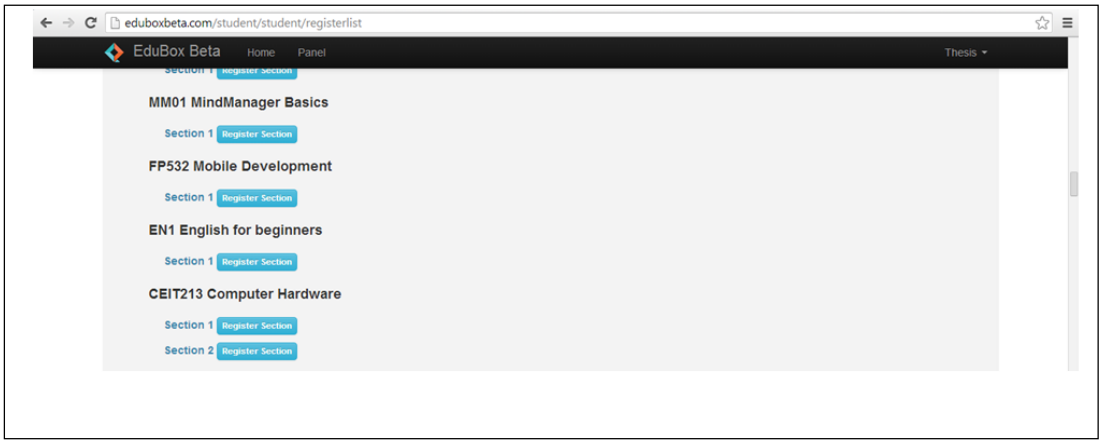



**Figure 3.5** QAS Course Enrollment Window

In addition to custom register information, the user is requested to determine a "Nickname" to hide his/her personal information while posting his/her answers/questions. The user is free to change his/her nickname during the course if s/he is concerned about privacy. The nickname change options are given in Figure 3.6 below.

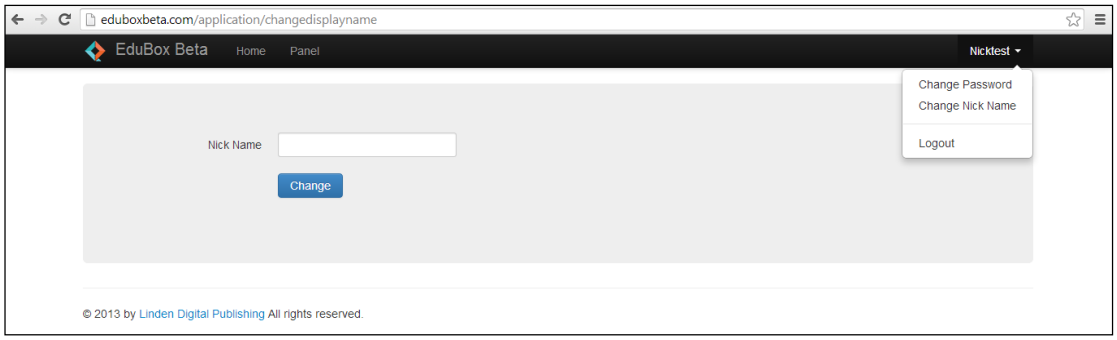



**Figure 3.6** QAS Nickname Change Window

### 3.5.1 Student Role

Signing up to the system, enrolling for the course and changing nickname/password features are the shared features for both "Student" and "Instructor" roles. The other features for "Student" role are:

- Posting questions
- Following posted questions
- Answering quiz questions

### 3.5.2 Posting Questions

The pop-up screen that students used to send questions is given in Figure 3.7 Students either used their real names or nicknames to send questions.

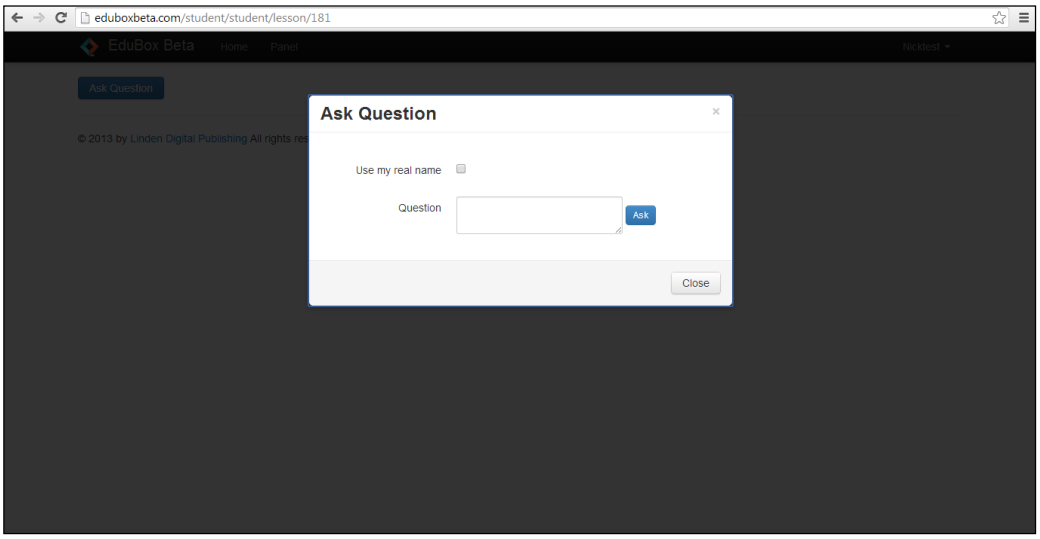



**Figure 3.7** QAS Asking Question Pop-up Window

The questions that students posted were projected on the Screen X given in Figure X. The Figure 3.8 below shows how the posted questions were demonstrated on the Screen X. As seen below, each question with its writer's nickname or real name is listed.

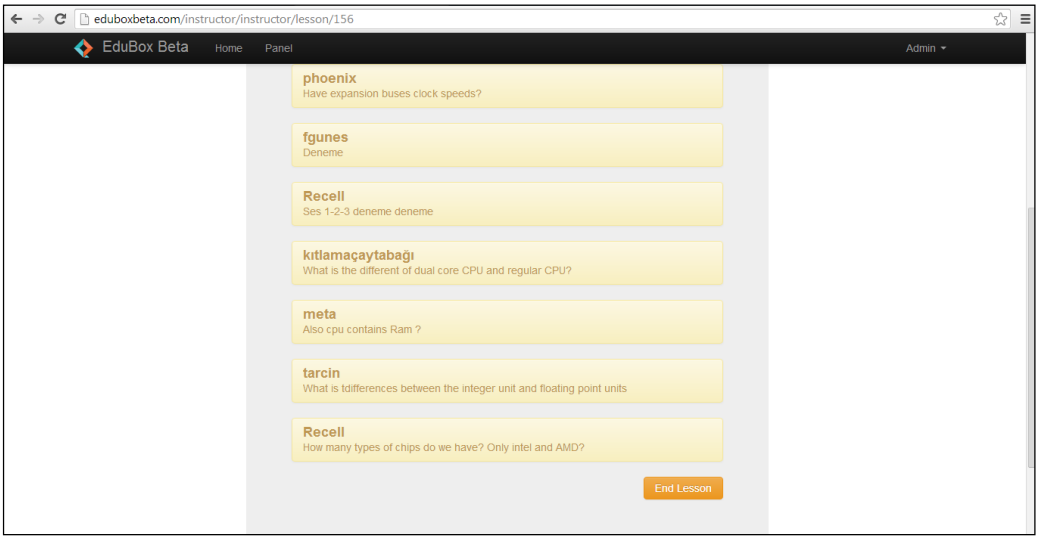



**Figure 3.8** QAS Students' Questions Window

The color of the posts also has a meaning. As shown in Figure 3.9, light green shows new questions, while light orange shows the answered question. By clicking on the cross sign on the left side of the each post, the status of the question might be changed to "answered". Also, the newest post is shown at the top of the list.

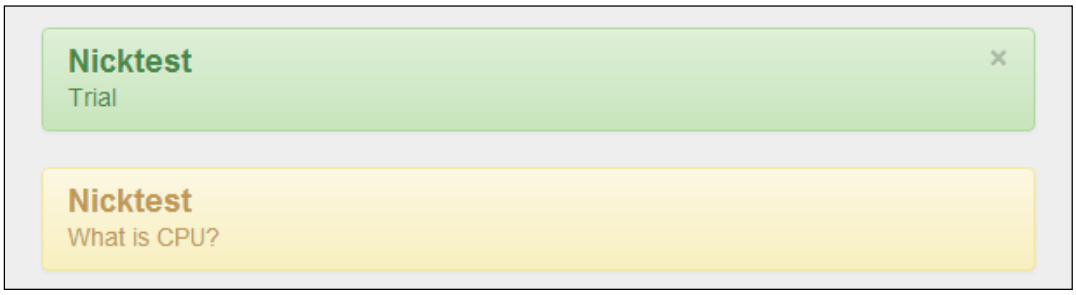



**Figure 3.9** QAS Status of Questions

#### 3.5.2.1 Following Posted Questions

Students were able to access to the quiz questions that instructor posted during the class only if time for each quiz was not terminated by the instructor. The screen view of the archive is given in Figure 3.10 below. Students were able to access to the questions they posted whenever they wanted.

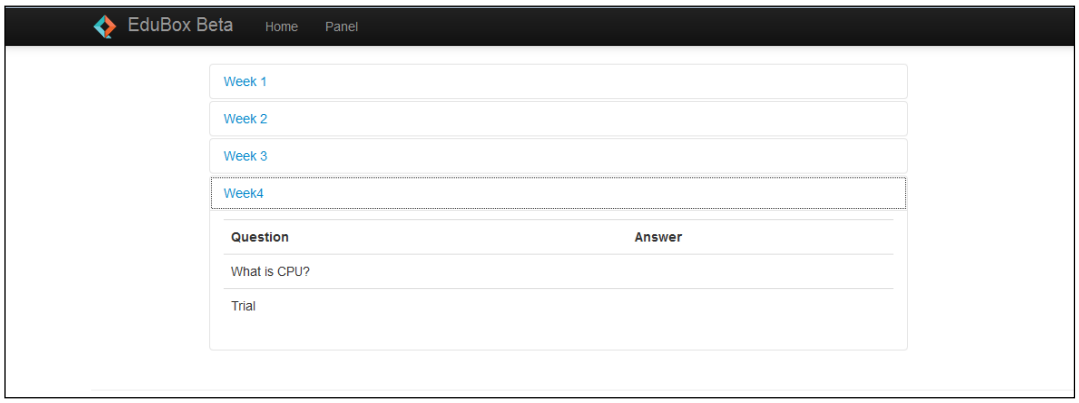



**Figure 3.10** QAS Archive Window

#### 3.5.2.2 Answering Quiz Questions

Quiz questions were created before the class time. One of the quiz questions that was posted on students' mobile devices is shown in Figure 3.11 below.

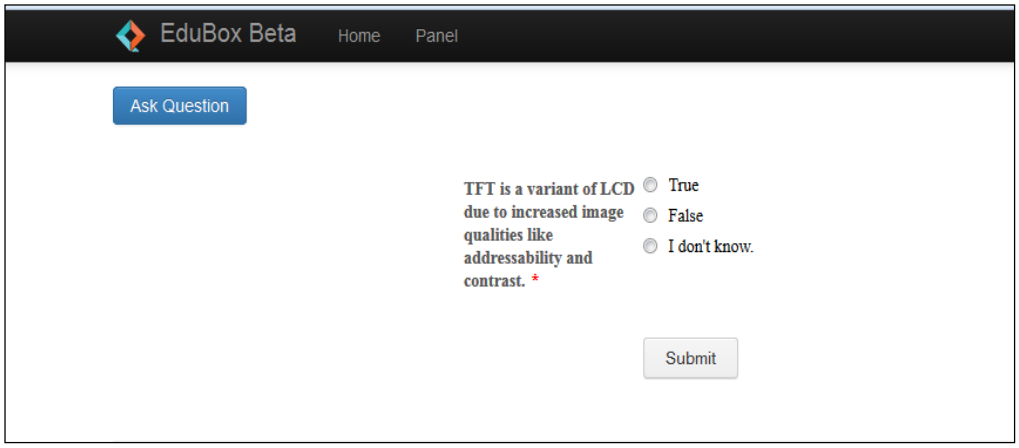



**Figure 3.11** QAS Sample Student Question

### 3.5.3 Instructor Role

The instructor (Admin) was authorized to manage the system. The features that "Instructor Role" has are:

- approving students' enrollment
- giving written feedback to the students
- forming quizzes

For this study, students' personal information was not shared with the course instructor/lecturer. The instructor role was conducted by the researcher. Moreover, students were not requested to submit their personal information.

#### 3.5.3.1 Approving students' enrollment

The instructor was able to follow the enrollments of students. After students registered for a course section, the registration information of them appeared on instructor panel. The Figure 3.12 below shows the enrolled students list. The instructor could see each student's username; e-mail address and display name (Nickname) also can activate or deactivate the account.

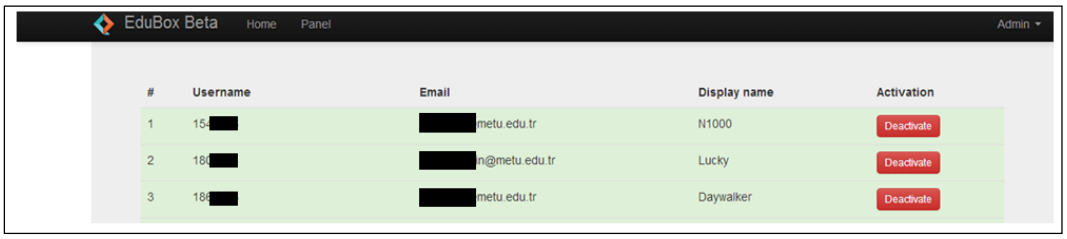



**Figure 3.12** QAS Registration Approval Panel

#### 3.5.3.2 Giving written feedback to students

The instructor was able to give written feedback to student asked questions in class time. This feature was not used because the students' questions were answered in class time. This feature can be used in case time problems. The screen view is given in the Figure 3.13.

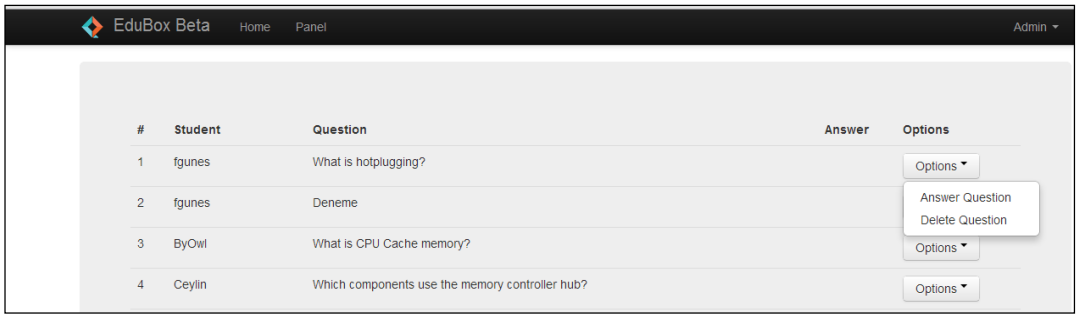



**Figure 3.13** QAS Feedback Options

After "Answer question" option is pressed, the pop-up window is opened as below, in Figure3.14.

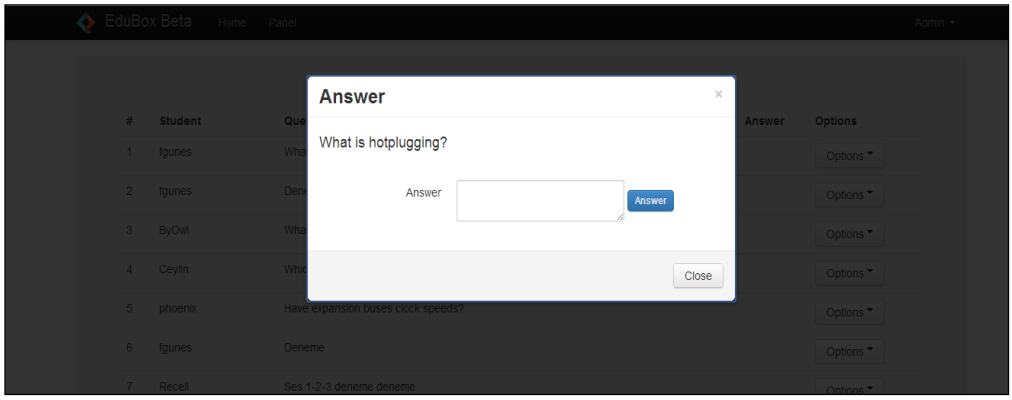



**Figure 3.14** QAS Feedback Pop-up Window

3.5.3.3 Forming Quizzes

The Q-A tool supports forming different types of questions. The instructor was able to form T/F, multiple choice, open-ended types of questions. The sample views of questions are given in Figure 3.16. The open-ended, multiple choice, T/F types of questions fitted into Smartphones' screens; however, questions having visuals as seen in Figure 3.16 fitted in landscape view and also, the amount of text or the size of pictures required students to use the scroll bar.

The each quiz question had different length of time depending on its difficulty. According to the students' pace of answering, the length of time varied. The screen view of the duration for answering the question given in Figure 3.15 below was projected on Screen X while they were answering the question. Students were observed during this period and the quiz was ended as they all submitted the answer.

If they could not submit the answer during the required time, the quiz question could also be opened outside the class hours.

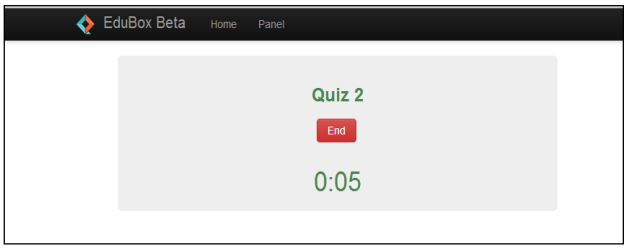



**Figure 3.15** QAS Starting-Ending Quizzes

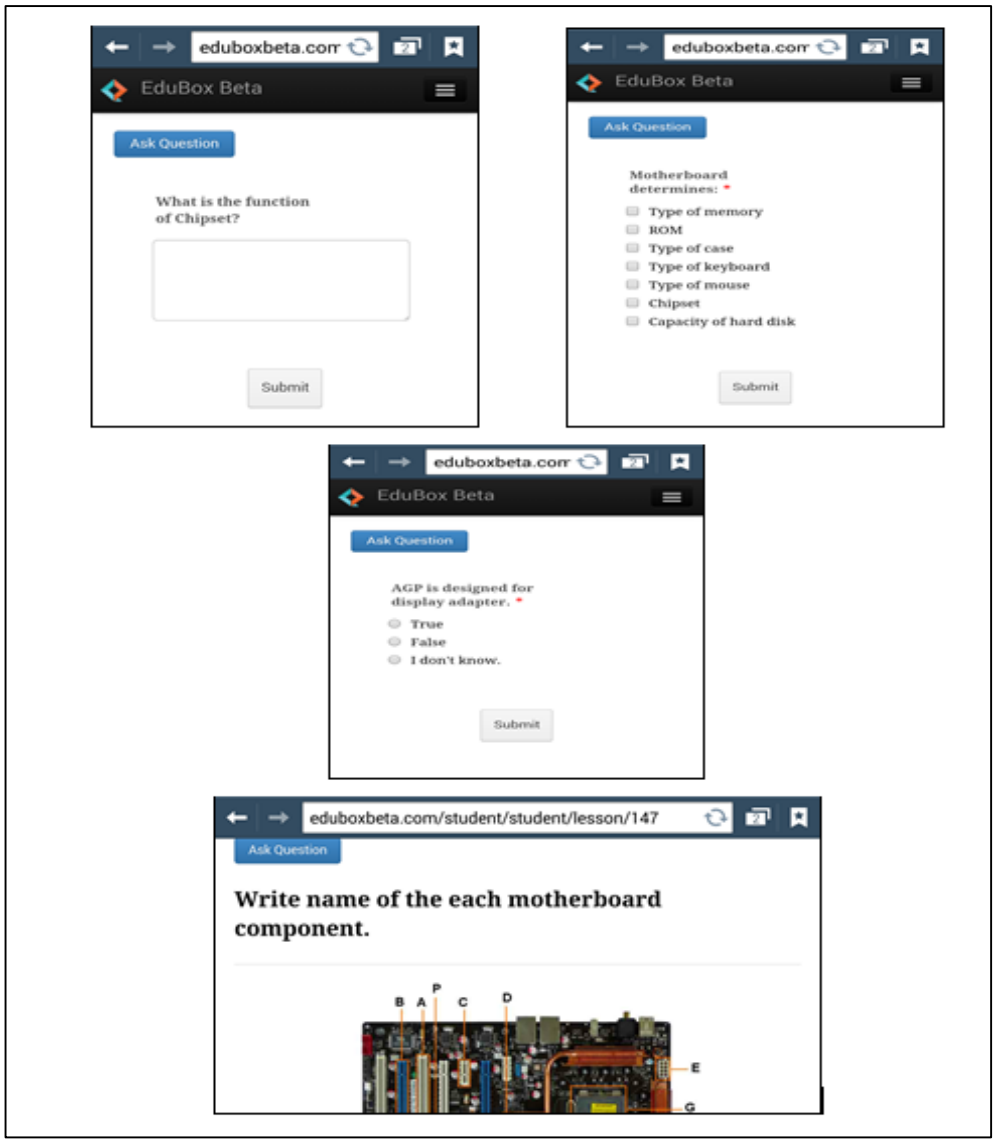



**Figure 3.16** Sample Question Types Asked by Instructor

## 3.6 Instrumentation

Seidman (2006) states that the main purpose of the interview is to explore what interviewees think about their experiences and how they give the meaning to their experience. In this study, the purpose of conducting interviews was to understand how the students interpreted QAS' features and how the implementation of it makes sense to them. Since the focused point was the opinions of participants as in all qualitative studies, there was not any predetermined hypothesis, which might limit the possible answers of interviewee. For example, they were asked about what they thought regarding the adequacy of the feedback but they shared their opinions and experiences about immediate or delayed feedback types. As Cresswell (2012) states, the open-ended questions helps to get interviewees elaborate their thoughts without being constrained by any viewpoints.

The interview form used for the study consisted of 13 questions regarding to the general view about engagement and asking questions, possible impact of the QAS on engagement and learning and about the practices of the QAS (See Appendix C).

The "thematizing" phase of the interview protocol starts with key questions, why (clarifying the purpose), what (knowledge about the interviewee) and how (conducting, deciding the way of interviewing) (Kvale and Brinkmann, 2009, p.105). Thus, the purpose of the study was clarified. Though the interview protocol was structured, it was open to investigate what students think about the QAS and how they construct their knowledge on their experiences. Since the questions were prepared to provide explanations for the research questions, the credibility and relevance of the questions were checked by an expert with regard to appropriateness for interviewees and research questions. Additionally, the experiences of the researcher from a similar qualitative research named as "Implementation of an Online Question-Answer (Q/A) System as a Mobile Learning Tool" eased the process of preparing interview protocol (Atas and Delialioglu, 2013).

The focus group interview questions were prepared by taking some important points, emphasized by Kruger and Casey (2000), into consideration (as cited by Yıldırım and

Şimsek, 2005, p.157). The essential points that interview questions should have listed as follow:

1. The form of questions should be suitable for informal conversation.
2. The terminology should be appropriate for sample.
3. The interview should include easily pronounceable words.
4. The questions should be meaningful and make the same sense to all.
5. The questions should be as short as possible.
6. The questions should be open ended. If needed, open ended questions might follow the closed end ones.
7. Each question should have a specific objective. Use of conjunctions should be avoided.
8. The interview form should include an open instruction.

In addition to these points, Kruger and Casey (2000) also state that focus group interview questions should follow a pattern from more general to more specific. Parallel to this view, the questions regarding what students think about participation and the importance of asking question in class were asked in the beginning and more deliberate and specific questions regarding what students think about QAS were asked later. The questions were about the possible impacts of the QAS on learning and engagement and lastly the questions were asked regarding the components of the QAS such as feedback, nickname use, questions types, sharing of responses, problems and suggestions. In total, 13 questions were prepared. By considering the possible number of the interviewees in in focus group, the number of questions was minimized in accordance with the research questions. For credibility of the questions, the questions were authenticated to an experienced subject-matter expert. Additionally, researcher's previous experiences with constructing an interview protocol for a similar study were influential in construction process.

According to Yıldırım and Şimşek (2005), some alternative questions and probes should be prepared in case of misunderstanding or to clarify questions. Therefore, during the interview, as the students started to talk about off-topic points or misunderstood the questions, the questions were paraphrased and clarified.

## 3.7 Data Collection

The data collection method in this study was interviewing. Willis (2008) states interviewing as one of the traditional methods of qualitative data collection tool in his book named "Qualitative Research Methods in Education and Educational Technology". Interviews can be conducted on one-to-one basis or in groups. The research design in this study was Focus-group interview based on convenient sampling. The open-ended questions asked during interviews allowed students to share their opinions without predetermined options as in surveys conducted in quantitative research. That is, students were not forced to choose one of responses that researcher might predict to hear; conversely, they were expected to share how they gave meaning to the situation and how they interpreted their experiences.

### 3.7.1 Focus-Group Interview

The type of interview conducted in the research was "Focus Group" interview. Focus group interview has some advantages. Stewart and Shamdasani (1990) provide a number of advantages of focus groups. They list advantages as;

- The cost and time of focus groups are less than the individual interview.
- In focus groups, interviewers can use probes to get more clear responses from interviewees.
- The researcher can get deeper and richer responses due to the open response format of focus groups.
- Group synergy can allow interviewees to add or to criticize others' responses. This creates the chance of building new ideas which might not be possible to have during individual interviews.
- Flexibility is another advantage of focus groups; that is, focus groups can be conducted with various topics, people in various settings.
- Whether interviewees are literate or not is not a problem.
- The results of focus groups might not be complex as the ones in some survey research. The researcher can understand the verbal responses easily.

From the advantages listed above, group synergy was the most important point taken into consideration to determine the research design of this study. That is, students built

their opinions on other interviewee's opinions or they criticized what other interviewers said. Stewart and Shamdasani (1990) elaborated on the respondent interaction advantages as *Synergism, Snowballing, Stimulation, Security* and *Spontaneity*. In order to understand the reasons behind choosing focus group interview, it is essential to elaborate on what Stewart and Shamdasani means with these keywords. *Synergism* was defined as a combined effort of the group. Synergy can produce richer and wider opinions. *Snowballing* is explained as a domino effect; that is, a word of an interviewee can trigger others' opinions. *Stimulation* is explained at the level in which interviewees start to express their ideas after a short introductory time. *Security* is defined as the feeling of interviewers in which they think their opinions are similar to those of other participants. They feel comfortable to express themselves in focus group interviews without fear of being identified as radical. Lastly, *Spontaneity* is explained as the keyword defining the situation in which interviewer expresses his/her opinions spontaneously; therefore, this situation helps to get more accurate data from the interviewer. These types of advantages made the focus group interview a suitable choice for this study.

Cresswell (2005) says that focus group interviews are suitable when interviewees' interaction may pose rich responses. In this study, since they used the system together, they reminded details to each other and discussed about them.

Conducting a focus group interview involves planning of the process from determining interview questions to turning off the tape. The considerations taken into account in the focus group interviewing process in this study are elaborated below:

- *Formulating Guidelines:* Although participants of the interview had already predicted the purpose of the study, "informing participants" was added to the list of guidelines. Participants were informed about the purpose and possible duration of the interview. They were asked about whether they mind if conversation was recorded. Also, the volunteer participation point was stressed; in other words, it was said that they were free to leave whenever they wanted. Another point decided before interviewing was the sequence of talking; that is, each student was assigned with a number; however, there was

not a predetermined talking turn; instead, they were free to talk whenever they wanted. The reason for assigning numbers was to ease the transcription process. Since it was not easy to remember the voice of each participant, the beginning of each participant's talk and the numbers were noted during the interview to distinguish them from each other.

- *Recruiting Participants:* The participants of the interview were the representatives of the sample (convenient sampling) involved in the study. 25 of 42 students participated in the interview voluntarily. They wrote the time when they were available to meet and interview schedules were arranged accordingly.
- *Determining number of sessions:* Yıldırım and Şimsek (2005) states that the number of the participants in focus groups changes according to the purpose of study; that is, the range of the groups may change from 4 to 15. The number of the participants in each group varied from 2 to 7.

**Table 3.1** Details of Interview Groups

| Groups | Gender of Interviewees | Length of Interviews |
|---|---|---|
| Group I | 2 females, 5 males | 00:58:48 |
| Group II | 4 females, 2 males | 00:49:28 |
| Group III | 3 females, 3 males | 01:13:29 |
| Group IV | 4 females | 00:34:10 |
| Group V | 1 female, 1 male | 00:30:24 |
| 5 Groups | 14 females, 11 males | About 4 hours |

- *Location:* A familiar place was chosen for the interview. The interviews were conducted in the department where students studied. The seats were arranged in a circular form to encourage discussion.
- *Making Contact:* Students were invited to the meeting via e-mail. The exact time and the place of the interview were sent to each participant.
- *Incentives:* Stewart and Shamdasani (1990) say that the structure of focus group might be incentive for participants due to the enjoyable atmosphere. On

the other hand, focus group interviews are tiring and time-consuming. Therefore, some snacks and drinks were served to the participants.

## 3.8 Data Analysis

Qualitative data were gathered from the focus group interviews conducted with 25 interviewees. Before starting to code the data, audiotape recordings were transcribed into text. In order to ensure transcription validity and reliability of transcriptions, second person independently type the name passage of record. Then, two transcriptions were compared for quantified reliability check. Though it is not possible to ensure correct valid transcription; "pauses", voice tones are noted in transcriptions as memos. For reliability and validity of transcriptions, recommendations of Kvale and Brinkman (2009) were followed.

Coding procedure was done according to recommendations of Creswell and Tesch (as cited in Cresswell, 2012, p.244). Mainly, six steps were followed during coding process. As a first step, in order to obtain general idea, transcription was read several times by writing some memos in the margins of the transcriptions. Then, the answer of each interviewee was further analyzed to get a more specific idea. In the third step, code words and phrases describing the underlying meaning of text segments were determined. In the fourth step, codes were listed and reduced to a manageable numbers. Then, as a fifth step, these code list were used to check whether there was possibility of new codes or not. After all the codes were determined, similar codes were categorized to get major idea. Categorization about the engagement construct was coded according to the NSSE (2014) engagement indicators.

## 3.9 Credibility

One of the basic assumptions of qualitative research is that reality is not fixed and single but ever-changing and holistic. Though it is not possible to capture reality, credibility of findings might be increased in some ways. Triangulation is way of shoring up credibility of a qualitative study (Merriam, 2009). Based on Patton's (2002) "*triangulation analysts"* strategy, the same interview records were transcribed by two people independently and transcriptions were compared with each other (as cited in Merriam, 2009, p.216). As another strategy of obtaining credibility, "*adequate*

*engagement in data collection*" was followed; that is, for the purpose of saturation all volunteers were interviewed in focus-groups. "*Looking for data that support alternative explanations*", as mentioned by Patton (2002), was considered during the coding process as well (as cited in Merriam, 2009, p.219). For alternative ways of interpretations, transcriptions were read many times. "*Researcher's position"* is another strategy mentioned by Lincoln and Guba (2000) (as cited in Merriam, 2009, p.219). Since the researcher is the main instrument of a qualitative research, the findings were discussed critically by comparing findings with the results presented in literature in a reflexive manner.

### 3.10 Researcher's Role

The researcher's role in this study was to facilitate the use of the QAS in the lectures. Orientations making students familiar with the QAS and hardware were conducted by the researcher. Additionally, the researcher attended the lessons to solve any possible problem that students might face concerning to the implementation of the QAS. Also, the delivery of the Tablet PCs was managed by the researcher. Charging the Tablet PCs after each was under the responsibility of the researcher. Besides being ready during the implementations, the researcher was the main instrument for the data collection process. Constructing the interview protocol and conducting interviews were all done by the researcher.

Kvale and Brinkmann (2009) emphasize the moral integrity of the researcher as a necessity for the quality of the qualitative research. Adherence to scientific quality of the research and being familiar with the values and ethical issues were stressed as the critical points for role of the researcher in a qualitative inquiry. With all this mind, points concerting to the consistency, credibility, trustworthiness and ethics were employed through the research.

### 3.11 Consistency

In quantitative studies, consistency refers to reliability .i.e., extent to which research findings can be replicated (Merriam, 2009). However, since the behaviors of people are not static and there is not fixed, single reality in qualitative studies, the mean of reliability changes in the context of qualitative studies. In this manner, consistency

means “whether the results are consistent with the data collected” (Merriam, 2009, p.221). Thus, for consistency, *audit trial* method, suggested by Lincoln and Guba (1985) was followed (as cited in Merriam, 2009, p.220-223). That is, two subject-matter experts, Delialioğlu (2014) from the department of Computer Education and Instructional Technology, Sumer (2014) from department of Psychology, authenticated the findings of the study and coding.

## 3.12 Transferability

Generalization of findings from one study to another is not a matter discussed in qualitative manners. In fact, Guba and Lincoln (1981) said that “there is no point in asking whether meaningless information has any general applicability” in page 115 (as cited in Merraim, 2009, p.223). Instead, there are ways to enhance the possibility of transferring results of one qualitative study to another. *Rich, thick description* is a method coined by Gilbert Ryle (1949) (as cited in Merriam, 2009, p.227). Wıth the purpose of transferability, the context of the research was detailed; that is, setting, participants were richly described. To illustrate, classroom arrangement was visualized with figures. Moreover, the user interfaces of the QAS were explained with screenshots. Concerning to the reporting of findings, each unique code was supported with a sample quotation from the interviews.

## 3.13 Ethics

As conducting research requires ethical sensitivity, it is essential to include ethical practices from planning of the research to the reporting phase. In this heading, the moral concerns involved in this research were discussed.

As all the researches, it is essential to start with meaningful research question(s); that is, the findings should contribute to the existing literature and improve the existing situation of humans. In this study, it was aimed to explore the experiences and opinions of participants relating the QAS. The significance of the research, the research questions and possible harms were shared with Ethical Committee to get the necessary consent. After the required consent was taken, the participants were informed both verbally and with a written form about the purpose of the study and also the process of the research. It was emphasized that they were expected to participate voluntarily

and they could leave whenever they wanted. After written agreement was constituted, they were signed up to the QAS. Students were signed up to the QAS by entering their personal information. Confidentiality was also an important consideration of the process. One of the features of the QAS was to support anonymous post sending; that is, each student could post his/her answers and questions by using nickname or real name. Therefore, students' personal information such as names, e-mails and nicknames were not disclosed; in fact, they were not shared with the course instructor.

Moral concerns were taken into consideration during the data collecting process. Kvale and Brinkmann (2009) elaborate the ethical issues concerning conducting an interview in seven research stages. In the first stage, *Thematizing*, they claim that the significance of the interview should be defined; that is, the reasons and the needs behind conducting interview should be taught. Parallel to this view, the overview of the interview inquiry was considered.

In the *Designing* stage, consent forms, confidentiality issues and probable consequences of the study should be thought. Concerning this stage, consent forms were taken from the students at the beginning of the study. Also, volunteer students were involved in the interviews. Students were informed that the recordings and transcriptions would not be shared with anybody with the aim of providing confidentiality. Indeed, while taking subject matter expert's opinions about the suitability of interview codes, students' names were closed and each student was assigned with a random number. *Interview situation* is another stage, where possible problems of the interviewees should be considered while interview is being conducted. For that purpose, a comfortable and silent atmosphere was arranged for the interview and snacks were offered to them. Furthermore, it was stressed that they could leave the interview whenever they wanted. As for the *Transcription* stage, confidentiality point was again taken into account. As they were informed in the beginning of the interview, recordings and transcriptions were not disclosed to anybody. Also, transcriptions were coded in parallel with the purpose of students' oral expressions with the purpose of ensuring loyalty. For the *Analysis* stage, Kvale and Brinkmann (2009) also state that researcher is supposed to provide an in-depth analysis of the

interview. So as to decide how to interpret the transcriptions, the necessary literature review was conducted. In the *Verification* stage, it is stressed that the researcher should share the knowledge as secured and verified. For that reason, subject-matter experts' opinions were taken. Lastly, in the *Reporting* stage, the researcher should be sensitive while reporting the private interviews. For this purpose, the results of the interviews were reported by hiding the private information of the participants.

To sum up, in all stages of the research not only issues concerning ethical considerations but also possible concerns of participants were taken into account. By taking participants' consents before the study and data collection process and also sustaining study as long as participants were willing to continue were the main considerations.

## 3.14 Summary

Within the scope of the qualitative research methodology, 25 students who experienced the QAS in a lecture-based course were interviewed in 5 focus-groups. Structured interview protocol was thematized for data collection and transcriptions of the audio recordings were coded inductively. Through the implementation of QAS, data collection, data analysis and reporting, credibility, consistency, transferability and ethical considerations were taken into account.

# CHAPTER 4

# RESULTS

In this chapter, the results of the data analysis were presented parallel to the research questions mentioned in method chapter. Each research question was elaborated with rich-thick descriptions of students' self-reported statements. For the quoted statements of the interviewees, the participants' code list is provided in Appendix F.

## 4.1 Research Question 1: What does engagement mean to students?

Students were asked about how they construct the meaning of engagement. They answered this question by specifying the situations in which they feel engaged in class time. Their views were categorized under three themes, which are:

- Academic Challenge/Higher-Order Learning
- Academic Challenge/Learning Strategies
- Experience with Faculty/ Effective Teaching Practices

Codes were categorized based on the indicators of engagement determined by NSSE (2014). Most of students stated "Higher-Order Learning" skills as indicators of engagement. When they answer and/or ask questions, they feel engaged. Most of the students mentioned about their "Learning Strategies"; namely, *listening, practicing* and *note-taking* as indicators of engagement. Lastly, some of the students stated making eye contact, one of "Effective Teaching Practices", as indicator of their engagement. In addition to these themes, one student stated that *commenting* is an indicator of his/her engagement and another student stated that *accommodating new information* is kind of engagement for him/her (Details are shown in Table 4.1)

**Table 4.1** Opinions about the Meaning of Engagement

| Theme 1: Academic Challenge/ Higher-Order Learning | | |
|---|---|---|
| Categories | f | Student Quotations |
| Asking questions | 7 | **FGII-5:** "*First I ask questions to myself to find an answer and if I cannot do so, I ask them to the instructor.*" |
| Answering questions | 6 | **FGV-2:** "*When I can answer the questions of instructor, I feel engaged.*" |
| Theme 2: Academic Challenge/ Learning Strategies | | |
| Categories | f | Student Quotations |
| Listening | 8 | **FGII-6:** "*I listen to the parts of the lecture that make sense to me*." |
| Doing practice | 4 | **FGIV-3:** "*Laboratory sessions are very effective, we open the computer cases, dealing with them…*" |
| Note-taking | 3 | **FGI-5:** "*Especially when I take notes…*" |
| Theme 2: Experience with Faculty/ Effective Teaching Practices | | |
| Categories | f | Student quotations |
| Making eye contact | 3 | **FGIII-6:** "*…while listening, I look into teacher's eyes…*" |

## 4.2 Research Question 2: In students' opinion, what are the inhibiting factors for participating in a lecture?

Students were asked about the factors inhibiting them from participating in a course. *Intensity of content*, *language problem* and *sitting time* as a result of block scheduling were stated as factors inhibiting them. Additionally, *giving access to the lecture notes out of class time* and *teaching strategies* were stated by students as disengaging factors (Details are shown in Table 4.2).

**Table 4.2** Opinions about the Inhibiting Factors for Participating in a Lecture

| Categories | f | Student Quotations |
|---|---|---|
| Intensive content | 7 | **FGII-6:** "*There were so many information and terms on the course slides. I got mixed up.* "<br>**FGII-3:** "*When instructor talked about the details such as required voltage level of something or so many numbers, I preferred not to participate.*" |
| Language problem | 6 | **FGIII-1:** "*Due to the medium of instruction, English…*" |
| Teaching strategies | 4 | **FGIV-2:** "*Last year, visitor were coming to our class, it was incentive.*" |
| Availability of lecture notes | 3 | **FGIV-1:** "*Since the instructor uploads all the lecture notes, I think read them later…*" |

4.3 Research Question 3: In students' opinion, what are the inhibiting factors for asking questions?"

Most of the interviewees stated the shyness is an important reason of not asking their questions during a course. The reactions/ judgments of their friends or instructors' were stated as reasons for abstaining from asking questions. Language problem was also indicated as a reason; that is, since the medium of instruction was English, students felt incompetent in expressing themselves. Additionally, some of the interviewees stated that they felt inadequate in having necessary background knowledge to be able to ask questions. Two interviewees stated that they could not concentrate in class and lastly three students affirmed that they preferred alternative ways to find answers to their questions like searching on the Internet or asking to their friends.

**Table 4.3** Opinions about the Inhibiting Factors for Asking Questions

| Categories | f | Student Quotations |
|---|---|---|
| Shyness | 10 | **FGI-2**: "*I think my questions might be ridiculous and easy for others.*"<br>**FGII-2**: *"...everybody doesn't have to know what I think about...*" |
| Alternative sources | 3 | **FGII-5:** *"...first, I search answer to my questions on internet...*"<br>**FGIV-2**: "*I prefer asking to my friends.*" |
| Language problem | 3 | **FGI-1:** "*Language has impact... When I want to ask questions, I translate the words and check the grammar; however, as I try to do so, lecture time becomes over*." |
| Concentration problem | 2 | **FGI-3:** "*I could not be sure whether I missed the part of the lecture or not.*" |
| Lack of background knowledge | 2 | **FGI-1:** "*I am getting mixed up with intensity of concepts. Since I do not understand, I cannot ask questions.* " |

In addition to these views, there were one single person opinions. Postponing asking questions by assuming that instructor would explain it later or not asking question in order not to be assigned with homework or not asking in any course as a kind of habit were stated as other reasons. To sum up, large majority of the students have an excuse/reason not to ask their questions to the teacher during the lecture.

## 4.4 Research Question 4: What are the students' opinions about how the QAS affects their learning?

Under this heading, students' opinions about the possible impacts of "asking questions through the QAS" and "being asked questions through the QAS" on their learning were presented.

### 4.4.1 What do students think about the possible impacts of "asking questions through the QAS" on their learning?

Students stated two different views concerning the possible impacts of asking questions through the QAS on their learning, which were "easing shyness" and "on demand asking". Due to these two benefits, they thought that the QAS is significant for their learning (See Table 4.4).

**Table 4.4** Opinions about the Impacts of "Asking Questions" through the QAS

| Categories | f | Student Quotations |
|---|---|---|
| Easing shyness | 6 | **FGII-2:** "*Since I am a shy person, the use of nickname encouraged me to ask question*." **FGII-3:** "*…we knew we would not be judged…*" |
| On demand asking | 2 | **FGII-5:** "*Everybody could ask questions whenever they wanted.*" |

In addition, some of students in focus groups agreed with their friends in the point of positive impact of asking question on learning; however, they did not express their opinions explicitly.

4.4.2 What do students think about the possible impacts of "being asked questions through the QAS" on their learning?

Students were asked whether "being asked questions" has impact on their learning or not. Some students claimed that feedback provided by instructor helped them to be aware of their learning. Other students said that such an implementation improved their understanding. It was also claimed that the QAS increased their attention and lastly two students mentioned the QAS as encouraging them to do search (See Table 4.5).

**Table 4.5** Opinions about the Impact of "Being Asked Questions" through the QAS on Learning

| Categories | f | Student Quotations |
|---|---|---|
| Providing feedback | 5 | **FGIII-6:** "*It helped us to be aware of how much we have learnt*." |
| Improving understanding | 4 | **FGII-4:** "*....although I do not know the answer of a question, once I learn, it becomes permanent…"* |
| Enhancing attention | 4 | **FGII-1:** "*...It encouraged me to listen to the instructor more carefully…* " |
| Encouraging searching | 2 | **FGIV-4:** "*When I did not know the answer of a question, I looked at to the lecture notes. If we did not use the QAS, I might not read them…*" |

4.5 Research Question 5: What are the students' opinions about how the QAS effect their engagement?

Under this heading, students' opinions about the possible impacts of "asking questions through the QAS" and "being asked questions through the QAS" on their engagement were presented.

4.5.1 What do students think about the possible impacts of "asking questions through the QAS" on their engagement?

Students were asked about how they evaluated the possible impacts of the asking questions through QAS on their engagement. Opinions of students were categorized as "Higher-Order Learning". Students stated that asking question through the QAS encouraged them to ask questions. Additionally, concerning single person opinions, they affirmed that such an implementation enabled them to follow their friends' opinions, to do search and also enhanced active learning. (See Table 4.6)

**Table 4.6** Opinions about the Impacts of the asking question through the QAS on Engagement

| Theme 1: Academic Challenge/ Higher-Order Learning | | |
|---|---|---|
| Categories | f | Student Quotations |
| Encouraging to ask questions | 6 | **FGI-1: "***Thanks to the QAS, we became active by asking questions instead of just listening to the course."* |

4.5.2 What do students think about the possible impacts of "being asked questions through the QAS" on their engagement?

Within this research question, it was aimed to explore what students think about the possible impact of experiencing a learning atmosphere in which instructor send questions. Contrary to previous research question which was aiming to explore the same question from a different aspect (students asked questions), students stated just positive views for this question. Students' opinions were categorized under four themes, which are;

- Student-faculty interaction
- Collaborative learning
- Reflective and integrative learning

The codes regarding each theme and the related quotations are given in Table 4.7. In addition to these views, students stated that the QAS implementation encouraged them to search and to take notes during the lecture. One of the students said that

"Once teacher asked a question, I realized that I could not remember what he explained 5 minutes before. Then I started to take notes. By this means, I could answer the questions."

**Table 4.7** Opinions about the Impacts of Being Asked Questions through the QAS on Engagement

| Theme 1: Learning with Peers/Collaborative Learning | | |
|---|---|---|
| Categories | f | Student Quotations |
| Enhancing student- student interaction | 6 | **FGII-6**: "*In order to find the answer of questions, we asked the questions each other.*" |
| Theme 2: Experience with Faculty/ Student-Faculty Interaction | | |
| Categories | f | Student quotations |
| Encouraging answering | 3 | **FGII-2:** "*Due to the exam format of the implementation, we tried to submit an answer; thus, it was beneficial*." |
| Enhancing attention | 3 | **FGV-1:** "*As we did for asking questions, we needed to listen to teacher carefully in order to answer questions. Answering questions made me happy*." |
| Theme 3: Academic Challenge/ Reflective and Integrative Learning | | |
| Categories | f | Student quotations |
| Making lesson interesting | 3 | **FGIV-1:** "*Due to the extensive content, lecture became boring* but the system made the lessons interesting" |
| Improving Understanding | 1 | **FGII-2:** "*…as I answered the questions, knowledge became more memorable and permanent.*" |

4.6 Research Question 6: What are the students' opinions about the practices in the implementations of the QAS?

Under this heading, students' opinions about 7 sub-research questions mentioned in the method chapter were presented. The main points are listed below:

- Asking/answering through the QAS versus without the QAS
- Question Types
- Sharing of questions/answers
- Use of nicknames
- Feedback
- Problems
- Suggestions

4.6.1 How do students compare asking/answering their questions through the QAS (in written form) or without the QAS?

Students' opinions about asking questions verbally and through the QAS are thematized as positive and negative comments. Regarding to "asking questions through the QAS", students stated on demand (any instant during the lecture) asking and easing the feel of shyness as positive sides; on the other hand, typing time and time/amount of feedback were stated as problematic sides of the asking questions through the QAS. (See Table 4.8)

**Table 4.8** Positive/Negative Opinions about Asking/Answering Questions through the QAS

| Positive Opinions about Asking Questions through the QAS | | |
|---|---|---|
| Categories | f | Student Quotations |
| On demand asking | 5 | **FGV-4:** *"…even though teacher explains another topic, we can ask question regarding previous points…"* |
| Easing shyness | 3 | **FGI-3:** *"…use of nickname was incentive…"* |
| Negative Opinions about Asking Questions through the QAS | | |
| Categories | f | Student Quotations |
| Delayed feedback | 5 | **FGV-2:** "*I asked the question but the teacher gave the answer after 15 minutes, I could not remember what I asked…"* |
| Typing time | 3 | **FGI-2:** "*as I write the questions, time was passing…"* |

In addition to these opinions, one of interviewees argued that he could better express yourself while writing his/her questions, another interviewee claimed that visual representation of questions make them more permanent. Concerning to asking questions without QAS (in conventional way), students stated the immediacy of feedback and reflecting emotions easily as advantages; on the other hand, interrupting nature of asking question verbally and shyness problem were stated as negative sides. (See Table 4.9)

**Table 4.9** Positive and Negative Opinions about Asking/Answering Questions without QAS

| Positive opinions about asking questions without QAS | | |
|---|---|---|
| Categories | f | Student Quotations |
| Immediate Feedback | 6 | **FGIV-3:** "*…When we asked questions verbally, they were answered immediately…"* |
| Reflecting emotions | 3 | **FGII-5:** "*Expressing questions in conventional way helps us to reflect our emotions…"* |
| Negative opinions about asking questions without QAS/verbally | | |
| Categories | f | Student Quotations |
| Posing shyness | 5 | **FGIV-1:** "*…when we ask questions verbally, others might think our questions as ridiculous or instructor might have explained the answer of our questions shortly before we have asked them…*" |
| Interrupting | 3 | **FGII-2:** "*…asking question verbally might be disturbing for instructor…Asking them through QAS was more suitable in terms of answering them at the end of the lecture, as a sort of summarization."* |

In addition to these views, one of interviewees argued that asking question verbally enhances interactivity. Another student said that they did not ask questions due to concentration problem.

### 4.6.2 What do students think about the question types used in the QAS?

Students were asked about how they evaluated the appropriateness of the questions types sent through the QAS. Their responses were categorized under two main themes. Great majority of students stated that they prefer "Selected Response" type questions such as multiple-choice and True/False, while some students stated they prefer "Constructed Response" type question like open-ended and short answer as given in Table 4.10.

**Table 4.10** Opinions about the Question Types

| Theme 1: Selected Response | | |
|---|---|---|
| Categories | f | Student Quotations |
| Multiple choice | 9 | **FGI-1:** "*Multiple choice questions were better. It was difficult to text sentences for answering open-ended questions.* " |
| True/False | 7 | **FGII-1:** *"…true/false questions were better."* |
| **Theme 2: Constructed Response** | | |
| Categories | f | Student Quotations |
| Open-ended questions | 4 | **FGIII-5:** *"…open-ended questions were enabling us to reflect our understanding*." **FGII-3:** "*I think open-ended questions more appropriate. Even if I couldn't give answer, I sought for answer; I read the notes and listened to the answers."* |
| Short answer | 3 | **FGIII-4:** "*…questions should be answered with one/two sentences…* " |

### 4.6.3 What do students think about the sharing of questions/answers on a screen during the lecture?

Students' questions and answers were shared on a screen through which students could read/follow the posts. Students were asked what they think about such an implementation. Most of the students said that such an implementation helped them to share their knowledge. Some students stated that it helped them to improve their understanding due to the visual representation of questions and answers. Two students claimed that this implementation provided a structure, which enabled them to follow the posts easily. Lastly, two students affirmed that sharing of posts served as a summary of the topics. (See Table 4.11)

**Table 4.11** Opinions about the Presentation of Students' Questions and Answers

| Categories | f | Student Quotations |
|---|---|---|
| Sharing knowledge | 10 | **FGIV-2:** "*My friends was asking questions that I have never thought about…*" |
| Improving understanding | 5 | **FGIII-4:** "*Visual representation makes information memorable* " |
| Providing structure | 3 | **FGV-1:** "*We can follow the next question that instructor will explain.*" |
| Providing summary | 2 | **FGI-6**: "*When I missed a part of the lecture, it was serving a kind of summary.*" |

### 4.6.4 What are the students' opinions about using nicknames through the QAS?

While posting questions and answers, students used nicknames to hide their personal information. Thus, interviewees' opinions about the use of nickname were explored. Most of the interviewees thought that the use of nickname helped them to ease their shyness while posting their answers and questions. Two students stated that use of nicknames to post something was funny. Although most of the interviewees argued that use of nickname eased their shyness, one student stated that use of nickname is not solution for shyness also another student said s/he though instructor could access

their personal information. However, only the researcher was able to see the personal information of students. (See Table 4.12)

**Table 4.12** Opinions about Nickname Use

| Categories | f | Student Quotations |
|---|---|---|
| Easing shyness | 10 | **FGIII-1:** "*We momentarily feel shy due to possible reaction of our friends or instructor.*" |
| Fun | 2 | **FGIII-6:** "*it is entertaining part of such an implementation. Normally, I don't use nickname but use of nickname makes the atmosphere as virtual. We can write name of cartoon character, for example…*" |

4.6.5 What are the students' opinions about the feedback provided for the questions/answers posted through the QAS?

Feedback was provided to students not immediately after the question was asked but at the end of the lecture part. Student answered these questions as stating their feedback type preferences. Most of the students prefer to take feedback immediately after they asked a question and some of students said they prefer delayed feedback (feedback given at the end of the lecturing part). Additionally, there were one single person opinions, which are feedback types depends on the question or each type might have downsides; that is, through the end of the lesson, students might want to go out as much as possible. Thus, delayed feedback might not beneficial for such a situation. On the other hand, providing immediate feedback might break the flow of the lecture. (See Table 4.13)

**Table 4.13** Opinions about Feedback Types

| Categories | f | Student quotations |
|---|---|---|
| Immediate feedback | 14 | **FGIII-1:** "*If I do not understand something at the very beginning of the lecture yet not learn the answer of it, it becomes as having a bee in my bonnet…*" |
| Delayed feedback | 8 | **FGV-1:** "*Giving feedback at the end is something good, it is like a summary*." |

4.6.6 What kind of problems might students encounter during the use of the QAS?

Students were asked whether they faced any problem during the lecture when the QAS was used. Students indicated mainly three problems. Most of the students stated they has internet connection problem while some students subscribed mobile internet package connected to the internet without any problem. Other two problems were related to the QAS. Students said that they repeatedly needed to log on to the system due to session time-out problem and also the domain name of the website changed a couple of time. Lastly, one student complained about scrolling problem. (See Table 4.14)

**Table 4.14** Problems with the QAS Implementation

| Categories | f | Student Quotations |
|---|---|---|
| Internet connection problem | 15 | **FGI-1**: "*Due the connection problem, pictures were loading slowly*" |
| Session time-out problem | 5 | **FGIII-4:** "*After a period of time, system made our accounts log out. Thus, we needed to log in repeatedly*" |
| Domain name problem | 3 | **FGI-1:** " *The domain name of the QAS was frequently changed*" |

4.6.7 What are the students' opinions about the design of the QAS?

Students were asked about what they thought about the interface of the QAS. Most of students stated that the QAS has a simple interface design. Sample quotations of students are as below:

> "*Explanations how to use the QAS was sufficient to use it easily; design was simple*."
> "*Design was simple; I didn't try to figure out how to use it."*
> "*If interface was complex, it could create problems."*

Additionally, students proposed some suggestions as given in Table 4.15. Thereto, one of students said there would be "search" feature. Another student suggested having a "discussion panel" and lastly one student said there should be password reset feature on the QAS.

## 4.7 Summary

Through this chapter, students' viewpoints about the QAS implementation were elaborated for each specific research question. The results of interviews revealed that students in this context think that the tasks concerning academic challenge are indicators of their engagement. Students specifically indicated asking questions and answering questions as indicators of their engagement. However, in students stressed the flaws of lecture method as inhibitor factors for their engagement. Students' statement showed positive views about the possible impacts of the QAS on their

learning and engagement in the context of lecture-based course. Regarding to the other components of the QAS such as sharing platform, feedback, questions types, and students stated both positive and negative views. As problems, they indicated technological downsides of the system and as suggestions they focused on design considerations like minimizing scrolling, adding archive and help feature.

**Table 4.15** Suggestions about the Design of the QAS

| Categories | f | Student Quotations |
|---|---|---|
| Minimizing scrolling | 5 | **FGIII-3:** "*While registering to the course, there were more than 50 course name through the page. There should be classification of courses according to grade level like 1st grade, 2nd grade…"* |
| Need for mobile application | 3 | **FGIII-3:** *"…it was good to have a web-based QAS but there could be separate applications for Android and IOS."* |
| Need for archive feature | 2 | **FGII-5:** "*we could not access to the questions asked during lectures."* |
| Need for help feature | 2 | **FGIV-2:** "*There could be page for introducing the features of the QAS*." |

# CHAPTER 5

# CONCLUSION AND DISCUSSION

In this part, concluding remarks and their discussion with the prior studies are presented with parallel to the research questions. Following the discussions, overall significance of the study was summarized. Lastly, recommendation for future research and limitations were presented.

## 5.1 Major Findings and Discussion

Under this main heading, the conclusions and discussion of six main questions were elaborated. The limitation and implication for future research are presented.

### 5.1.1 Research Question 1: What does engagement mean to students?

In order to explore how students understand engagement, they were asked what engagement means to them. The opinions were categorized according to engagement indicators of NSSE (2014) scale. Great majority of interviewees related their views of engagement to their "learning strategies" such as listening, doing practice or note-taking. Additionally, most of the students explained meaning of engagement by referring to "higher-order learning skills" such as asking and answering questions. Lastly, some of the students related the meaning to "effective teaching experiences"; that is, making eye contact during lecture means engaging in class for them. "Learning Strategies" and "Higher-Order Learning" are interrelated themes under the major theme named "Academic Challenge". Therefore, the results of the analysis revealed that students mostly ascribed the meaning of engagement to the tasks of academic challenge.

There are many definitions of engagement in literature. Stovall (2003) defines engagement as amount of time students devote on tasks and their desire to participate in class activities (as cited in Beer, Clark & Jones, 2010, p.76). Krause and Coates (2008) state that engagement is related with the quality of attempt students perform for educational outcomes. Bulger et. al., (2008) mention about other attributes like interest, motivation, devoted time for activities, academic achievement and etc. (as cited in Beer, Clark and Jones, 2010). Though there are plenty of definitions of engagement, Fredricks, Blumenfeld and Paris (2004) 'explanations help to see the meaning of engagement from different views. They say that engagement is "meta-construct" comprises of behavior, emotion and cognition aspects.

Comparison of students' sense of engagement and the explanations concerning the mean of engagement in literature show that students feel engaged while performing some "observable actions". Asking, answering questions, doing practice (classroom activities), note-taking, listening and making eye contact are all the indicators of behavioral engagement according to statements of Fredricks, Blumenfield and Paris (2004). In addition to these explanations and categorizations, it is important to look how students perceive engagement. Dunleavy and Milton (2008) mention powerful statement of students about the situations where they feel fully engaged. That is, solving real problems, dealing with the knowledge that make sense to them, seeing the interrelations among topics, connecting with experts, having dialogs with others were stated as the situations when students feel engaged. Thereto, *academic challenge and learning strategies* of students are again seen as important indicators of engagement from the viewpoints of students (p.10). Dunleavy and Milton (2008) reported that appropriate challenge in class is significant for intellectual engagement. Comparison of students' comments and opinions in this study and Dunleavy and Milton' report (2009 show that students are more focused on academic and intellectual engagement factors rather than social engagement factors. Only "*Making eye contact"* was stated as an indicator of social engagement. The underlying reason for such a distribution of comments might be due to the teaching methods conducted in the courses that the interviewees mostly attend. Students' honest perspectives about how engagement really occurs should be in the focus of measurement criteria of engagement. Moreover,

in such a qualitative study in which the perceptions of students explored regarding a QAS, it is important to include their understanding of engagement.

### 5.1.2 Research Question 2: In students' opinion, what are the inhibiting factors for participating in a lecture?

Students opinions about what might inhibit them from participating in class activities were related with situations like intensity of content, long sitting time and lecturing in a foreign language. Instructional methods comprising of teaching strategies and accessibility to course material before and after class were also stated as inhibiting factors for participating to class.

Concerning *language problem* of students, Durphy, for example, (1998) provided some reasons of non- participation under the name of "subtleties of English usage" (as cited in Sixsmith, Dyson and Nataatmadja, 2006, p.3.). Students involved in this study were mostly Turkish students; however, the medium of instruction was English. Thus, participating orally such as asking and answering questions were inhibited due to the lack of English proficiency according to students' viewpoints. Lack of English proficiency was stated by Xie (2010) as causes contributing to low interaction as well.

*Availability of lecture notes* was stated as another reason of non-participation. Students said that they have already access to lecture notes out of class time; thus, they could read and learn them on their own without participating in lectures. Conversely, Babb and Rose (2009) stated accessibility to lecture notes before class provides greater advantage than the one accessing only after class. Here, the teaching method comes into prominence. As White (2011) states when the content is already available in somewhere and lecture is just the recap of course materials, lecture method is not suitable. Actually, the content of the lecture should be more than lecture notes available in somewhere.

*The teaching strategies, intensity of content and long sitting time* were asserted as causes of low participation. It might be due to natural characteristic of teacher-centered lecture method. White (2011) claimed that teacher centered lectures, as opposed

interactive lectures, aims to devote time for content delivery; indeed, other activities are thought as loosing time.

### 5.1.3 Research Question 3: In students' opinion, what are the inhibiting factors for asking questions?

Students stated various reasons concerning factors inhibiting asking questions in class. "Shyness" was stated by many of the interviewees as an important factor inhibiting participation. Students generally mentioned about their problems like not being good at speaking English to ask questions or not having enough knowledge to construct questions or not being able to concentrate on listening. A few students stated that they preferred to ask their friends or to search on internet instead of asking directly to the instructor. Though they did not express the exact reason for seeking alternative sources, it might be related to shyness or lack of confidence; that is, they might think that instructor could judge them. Thus, the answer for this question might suggest to add a student-student question asking feature to the QAS.

Literature supports the viewpoints of students from many aspects. Since asking questions is a kind of oral participation, the reasons of non-participation or non-involvement, were elaborated to discuss on this research question. Personality characteristics of students were covered in many of the studies as a reason of non-participation. Sixsmith, Dyson and Natamadja (2006) stated that if a student feels confident, s/he will engage in class; however, shy students could not do so due to the lack of confidence. Fassinger (1995) stated that helping learners to develop confidence should be the first step to increase class participation. Additionally, Fassinger (1995) reported the dimensions of their confidence measurement as the fear of appearing unintelligent to friends and to instructor. Students' responses to questionnaires conducted by and Karp and Yoels (1976) showed that students' feelings about appearing unintelligent in the eyes of others are a long lasting problem. Fritschner (2000) also stated that if students think that their questions or comments are not appreciated by others, they will not participate verbally. CELT (1998) stressed the lack of confidence and fear of being judged by others are as reasons for remaining silent (as cited in Sixsmith, Dyson and Natamadja , 2006, p.3) Babb and Rose (2009)

also stated that shyness and “evaluation apprehension” were significant reasons of non-participation. Walsh and Sattes (200) also stated that being afraid of embarrassment is the reason of not asking questions.

Lack of background knowledge was also stated as a reason of not asking questions in class. Karp and Yoels (1976) reported that according to the student responses, coming to the class without reading the lecture notes before the class and not having enough knowledge about the topic prevents students from participating in the class. Howard and Henney (1998) also stated that lack of preparation for class is a reason of remaining quiet (as cited in Sixsmith, Dyson and Natamadja, 2006, p.3). Nor and Choo (2010) indicated unfamiliarity with the content as a reason for inducing reticence.

In this research, students said that they preferred to ask their questions to their friends or they wanted to search answers on internet. Concerning this issue, Van Der Meij (1988) listed reasons for why students do not want to ask questions. Help-seeker concerns might be related with why students do not ask their questions to instructor but seek for alternative ways to find an answer. Van Der Meij (1988) stated “internalized norm of independence” as a reason of not asking questions to instructor. Students said that when seeking for assistance from instructor, they feel dependent on him/her. Although students in our study did not explicitly stated they feel dependent while seeking help, their responses show that they similarly do not want to ask questions to instructor. Why students seek for alternative sources of information instead of asking their questions to instructor need being investigated further.

English proficiency was also stated as a reason of non-participation or more specifically not asking questions in class (or lack of oral participation). As stated previously (within research question 2) concerning the reasons of non-participation by Durphy (1988), not being good enough to construct questions might hinder students to ask questions. Chu and Walters (2013) stated English proficiency as one of students’ perceptions of asking questions in class. Here, it is essential to remind that not asking question might be related with learning preferences of students as in the case of Chu and Walters’ study; that is, not asking questions do not mean students are passive listeners.

### 5.1.4 Research Question 4: What are the students' opinions about how the QAS affects their "learning"?

Two questions were asked students to explore what students thought about the implementation of the QAS on learning, which were "asking questions" and "being asked questions". Concerning "asking question" aspect, students stated that the QAS helped them to ease their shyness and encourage them to ask questions. Moreover, students stated that such a system made on time asking possible; that is, students did not need to wait instructor to complete the part of the lecture or their friends to ask questions. On the other hand, concerning "being asked questions" aspect, students emphasized the impact of system on learning rather than the features of the QAS. They said that being asked question (instructor post questions to mobile devices of students through the QAS) helped them to organize their knowledge, motivate them by enhancing their attention and provided feedback. To conclude, while students focused on the learning outcomes of the QAS for "being asked questions" implementation, they did not emphasize learning for "asking question" implementation. The situations making students to feel shy might be investigated further. Comparison of opinions is given in Table 5.1:

**Table 5.1** Opinions about the Possible Impacts of the QAS on Learning

| Asking question through the QAS | Being asked questions through the QAS |
|---|---|
| Easing shyness | Improving understanding |
| Providing on time question asking opportunity | Encouraging searching |
| | Enhancing motivation |
| | Providing feedback |

Findings of this study are overwhelmingly positive especially in point of "being asked questions through the QAS". Though literature did not contain both aspects, "asking questions" and "being asked questions", great majority of both qualitative and quantitative studies show that use of the QAS (although the systems are different from each other) has prominently important in terms of enhancing learning. Gok (2011) reported that students liked the immediate feedback feature. Moreover, students explicitly stated the QAS (named clickers for this study) enhanced their learning.

Carnaghan and Webb (2007) reported that students perceived the use of the QAS (Clickers) has positive impact on their learning. According to students' perceptions:

- Clickers helped them to learn materials.
- Summarizing class answers helped them follow their progress.
- Clickers encouraged students working harder to give answer in class and to get prepared for class.

Origara and Keengwe (2013) reported the benefits of the QAS based on qualitative comments. Benefits concerning student attention, opportunity to follow classmates to get immediate feedback, anonymity and fun elements were highlighted. Similarly, John and Lillis (2010) indicated that the QAS implementation helped to sustain student attention. Students expressed that the QAS implementation helped them to learn material effectively, stay focused and verify their comprehension. Ray, Hugh and Su (2003) stated that from students' viewpoints personal responses systems (QAS) enhanced learning and developed the flexibility in teaching approaches by changing learning environment to student-centered. Terrion and Aceti (2012) also supported this view according to the students' positive reactions, which indicated this technology enhanced learning.

As a result, the perceptions of the students are consistent with the result of quantitative and qualitative results mentioned in the literature especially in point of being asked questions. Feedback opportunity of QAS was stated in most of the studies as in this one. However, the features of asking questions and being asked questions should be studied in the future.

### 5.1.5 Research Question 5: What are the students' opinions about how the QAS affects their "engagement"?

The comparison Table 5.2 below shows the summary of students' opinions about the positive impacts of the QAS on their engagement. While for "asking questions students referred to higher-order learning and reflective-integrative learning indicators, they stressed collaborative learning, student-faculty (instructor in this case)

interaction, reflective and integrative learning and learning strategies for "being asked questions" implementation (See Table 5.2).

**Table 5.2** Opinions about the Possible Impacts of the QAS on Engagement

| Asking Questions | Being asked questions |
|---|---|
| Encouraging to ask questions | Enhancing interaction |
| Following others' opinions | Encouraging answering questions |
| Enhancing out of topic learning | Enhancing attention |
| | Making lesson interesting |
| | Improving understanding |
| | Encouraging to do search |
| | Encouraging note-taking |

The results of previous studies, which aimed to include the QASs (even named differently) as an AFL tool, show similar results. Dun, Richardson, Oprescu, Christine and McDonald (2014) stated that students' perceptions of the impact of student engagement showed that the QAS (named VotApedia) in this study increased frequency of their direction in the course (70.7%), increased their in-class activity (77.9%) and helped them to pay attention (59.3%) and concentrate (47.9%). The results of study conducted by Terrion and Aceti (2012) showed that the use of clickers enhanced students' engagement, denoted by Wolter, Lundeberg, Kang and Herreid (2011), Johson and Lillis (2010) as well. Oigara and Keengwe (2013) mentioned that clickers increased attention base on qualitative comments in their study.

It is essential to note that though same tools were not used in these studies, the results showed that students are positive to use of such systems. However, it seems that these systems are generally used to answer the questions of instructors. The use of any QAS for asking questions to the instructor might be a direction for future research. Additionally, it might be beneficial to determine interface design details of such systems to suggest tips for designers and researchers.

### 5.1.6 Research Question 6: What are the students' opinions about the practices in the implementations of the QAS?

Under this heading, students' opinions about the asking questions through the QAS and without the QAS, questions types, sharing of posts on a second screen, anonymity feature, feedback use are discussed. Additionally, problems and suggestions of students are discussed.

#### 5.1.6.1 Asking/Answering Question through the QAS vs. without the QAS

Students could ask/answer questions either through the QAS by writing them or without the QAS in conventional way. Thus, students were asked to compare these two ways of communication. Previously, they were asked to share their opinions about sending questions through the QAS. They exactly repeated the same positive aspects of asking questions through the QAS, which are "providing on demand asking opportunity" and "easing shyness". On the other hand, they stated that when they asked their questions without the QAS, instructor gave immediate and detailed feedback. Furthermore, they said that it was easier to express their emotions while asking questions in conventional way. Thus, adding emotion icons and smileys features to QAS interface might be useful. As negative sides, interviewees stated asking questions during the lecture in conventional way (without the QAS) was interrupting and was posing shyness; on the other hand, asking their questions through the QAS posed typing time problem. Moreover, interviewees said feedback was not provided immediately (See Table 5.3).

**Table 5.3** Comparisons about Asking/Answering Questions through the QAS versus without the QAS

| Positive | Negative |
|---|---|
| *Asking/Answering Question through the QAS (written)* | |
| • On demand asking<br>• Easing shyness | • Delayed feedback<br>• Typing time<br>• Distracting attention |
| *Asking/Answering Questions without the QAS (verbal)* | |
| • Immediate/detailed feedback<br>• Reflecting emotions | • Posing shyness<br>• Distracting attention |

Although students were asked about their perceptions of the QAS implementation specifically concerning learning and engagement, they were asked to compare their experiences with their doings in traditional lectures. The comparisons of students show that they thought the QAS not just as an alternative but as a solution for easing shyness by means of anonymous posting. However, in the point of benefits conventional lectures, natural flow of the conventional communication was stressed by mentioning the importance of reflecting emotions. As a solution, adding smileys and emotion icons to system interface might be useful for encouraging students to use such systems.

According to summary of student response challenges prepared by Kay and Lesage (2009), students found challenging to adapt a new way of learning. Moreover, Kay and Lesage (2009) reported the study of Trees and Jackson (2007) in point of challenge concerning students' required level of effort for using response system (as cited in Gok, 2011, p.4). Dunn, Oprescu, Richardson and McDonald (2012) reported the reasons of students' not voting as below:

- Students couldn't be bothered.
- Since they didn't know the answer, they didn't want to vote.
- Their phone reception was generally poor.
- They did not believe in anonymity of posts.

In this study, one of the students also said that s/he thought their real names were seen by instructor albeit though instructor could not access to the system. Thus, earning trust of students is also an important point. As another important point, it seems that some of learners prefer conventional way of communication. Therefore, it might be useful to conduct a study regarding the learning styles. Perkins and Turpen (2009) stated the common categories of constraints as waste of time, inappropriate timing, babying (holding mobile devices for long time).

#### 5.1.6.2 Question Types

Students stated that they liked the multiple choice type questions due to the easy answer characteristics. They found it difficult to text their responses for open-ended questions. One of the interviews said that:

"*Multiple choice questions were better…It was difficult to text sentences for answering open-ended questions*."

On the other hand, students stated that they found open-ended questions more effective in respect to enhancing learning. One of the students said that:

*"…open-ended questions were better in terms of how much we understood the questions and how well we can reflect our understanding."*

Though there is not specific research on students' perceptions on the question types asked through the QASs, Keough (2012) mentions "ease of use" issue in her study. She says that only eight studies investigated student perception of Clickers' ease to use issue. However, the type of questions asked through the Clickers in these eight studies was stated as Likert-type scale questions. Thus, "ease of use" or usability of mobile devices and software becomes an important point to be investigated further since students explain their preferences of the question types with technological problems.

#### 5.1.6.3 Sharing of Questions/Answers

Concerning sharing of the questions and answers on a screen during the lecture, students stated positive opinions. For example, some of the students' comments are given below:

**"***My friends were asking questions that I have never thought about…"*

"*Visual representation makes information memorable.*"

"*If questions and answers are not written, I cannot remember them after 5 minutes."*

Such an implementation was stated to help them to share their knowledge with each other and improve their understanding because of the visual representation of questions and answers. Additionally, it provided a structure or an outline of the flow of the course and provided a summary of the content according to students' comments. In previous studies, there are not specific results on this issue. Thus, the sharing of question/answers based on different learning styles and whether second screen might create cognitive load or not should be investigated further.

5.1.6.4 Nickname Use/ Anonymity

About the use of nicknames, students stated that hiding their real names ease their shyness. Additionally, nickname use was stated as funny. Thus, adding personalization features such as avatar might attract students' attention.

Jackson and Tress (2003) stated that one of the features of the system students liked was anonymity feature (as cited in Gok, 2011, p.5). In another study, Stowell and Nelson (2007) revealed that though normally students showed tendency to conform to majority of class in conventional way of communication, QAS helped to increase variety in student opinions due to the anonymity feature (as cited in Stowell, Oldham and Bennett, 2010, p. 137-138). Additionally, Stowell, Oldham and Bennett (2010) stated that shy students showed greater preference for QAS. Ulbig and Notman (2012) mentioned that the use of QAS helped shyer students to take more advantage in attitudes and they showed more appreciation. Immerwahr (2009) stressed the honest answer opportunity of QASs. He stated those classrooms are not always comfortable places for students to share their opinions; moreover, students think so much about the possible reactions and expectations of others. Thus, QASs provide an opportunity to share honest answers. Denker (2013) also stated that anonymity of responses encourage student participation by hindering peer pressure or group think effect. Lastly, Guthrie and Carlin (2004) revealed that almost half of the students said the

anonymity feature encouraged participation. Indeed, student stated anonymity feature as exclusive one; decreasing fear of peer judgment and increasing feel of comfortableness. To sum up, most papers stressed that s fear of peer/instructor judgments and shyness inhibit students participating in class. In this point, the anonymity feature of QASs help students to participate in class activities.

#### 5.1.6.5 Feedback

Most of the interviewees stated that they preferred getting feedback immediately after they asked question because they did not want to wait for answer for uncertain time period. Students who preferred delayed feedback said getting feedback at the end of the lecture was a kind of summary.

Though there is not so much studies reporting the feedback time preferences, some of the studies revealed that immediate feedback affects student learning positively. Lantz and Stawiski (2014) stated that immediate feedback enhanced student engagement. Moreover, the reviewing answers after immediate feedback can be useful according to Lantz and Stawiski (2014). Holmes (2014) stated that the participants expressed that immediate feedback were beneficial in terms of following their track of improvement. Kalleta and Joosten (2007) said that immediate feedback with feedback enabled students to assess their own knowledge and also compare their own understanding with their friends (as cited in Terrion and Aceti, 2012, p.7).

Thereto, it is essential to note that immediate feedback might be given either along with the QAS or by instructor. In this research, immediate or delayed feedback were provided not through the system but by the instructor. However, studies in literature focused on system feedback indicating whether students gave correct answer or not. The feedback preferences of learners with QASs might be searched further.

#### 5.1.6.6 Problems and Suggestions

The problems students mentioned were all related to the maintenance of the systems. Due to the internet connection problem, change of domain name and session time-out problems, students' access was not resumed consistently. Besides these problems, students proposed some suggestions as listed below:

- Scrolling should be minimized
- It could be better to have mobile applications instead of accessing through web.
- There should be achieving feature for questions and answers.
- Help feature might be beneficial.

## 5.2 Overall Significance of the Study

The exploration of students' perceptions reveal that the mean of engagement according to the students are mostly related to observable behaviors regarding higher-order learning skills and learning strategies. The reason of stressing behavioral engagement indicators might be due to the lecture-based learning environment in which students are generally in the position of listener.

Students stated the intensive content and long sitting time as inhibiting factors for participation. At this point, instead of transferring huge amount of content, interactive lecturing method should be adapted by lecturers. QASs might be one of the alternatives to adapt the pure lecture to interactive one.

Thereto, what might make the QASs desirable? Anonymity feature of QASs enable to overcome factors inhibiting participation. Lack of English proficiency, lack of confidence, fear of being judged by others and shyness were stated as hindering students from expressing themselves. Students stated that the QAS system eased their shyness due to the anonymity feature. Although, more qualitative and also quantitative studies are required to investigate the impact of this feature on mentioned constructs like shyness and fear of being judged, this exploratory study verify the results of preexisting studies on account of students' positive evaluation with the QAS implementation.

Besides easing shyness, the QAS was stated to enhance learning and engagement as well. The pedagogical strategies such as type of questions (Multiple choice, True/False etc.), type of feedback (Immediate, delayed), and technology maintenance might affect the usefulness of the systems. Though the results are bounded to the context of this

study, the viewpoints concerning each implementation (Anonymity feature, sharing of posts, feedback) present valuable considerations for further exploration.

## 5.3 Limitations

This qualitative research had some limitations listed below:

- Technical difficulties were one of the main limitations of the research. Especially Wi-Fi connection problem had moderating impact on perceptions of students. Unstable DNS name of the QAS system was undoubtedly prominent as well. Due to the system requirements, the name of the website to access the QAS changed two times.
- Results of this study are largely self-reported.
- Though students were informed about the voluntarily use of the QAS either to response or ask questions, *Demand Effects* might have influenced students; that is, albeit though students did not like the system, they may have thought that expressing positively might be a desired outcome for researcher and instructor.
- Concerning Focus-groups interviews, moderating groups, following each interviewers' responses and most importantly transcribing responses by defining according to each interviewer were the troubles faced in the process. Due to the nature of focus-groups, student might have influenced each other's opinions. (Limitations of Focus group interview is elaborated below as well.)
- Though the implementation was held during a term, novelty effect was present and might cause to be interested more.
- The QAS system has also some limitations as well. System does not allow students to ask clarification questions.
- The perceptions of students are limited the context of the study. Learning atmosphere comprising of time, location, teaching method might have influenced the students' perceptions.
- Concerning to the data analysis, although subject matter experts controlled and acknowledged the codes, the results are highly depend on the interpretations of researcher.

In addition to many advantages of focus group interview, it has some limitations as Stewart and Shamdasani (1990) list as below:

- Interaction of respondents might be disadvantageous because they may pose impact on each other's opinions. Also, dominant respondent may affect others' opinions. Therefore, independency is a problem with focus groups.
- Since the atmosphere of interviews is closer to real-life-cases than the one in some quantitative studies, researcher may rely more on the data s/he gets from the respondents.
- Response type in interviews is open-ended. Hence, it may become a problem to interpret them for researcher.
- The moderator bias might be a problem while interpreting results.

## 5.4 Recommendations for Future Research

The purpose of exploratory research as indicated by Fraenkel, Wallen and Hyun (2012) is to investigate a circumstance and generate hypothesis for future studies. Thus, the exploration of students' viewpoints highlighted some important points to be explored more.

Based on focus-group interview results and comparison of these results with those mentioned in literature, the following points are recommended for future research:

- Students stated that they preferred to seek the answers of their questions on internet or to ask their friends rather than ask to the instructor. Thus, it is needed to further explore the reasons of students' question-asking preferences. Moreover, student to student asking question feature might be added to the systems and its possible impacts might be investigated. Literature also stresses the necessity of asking confirmation questions feature being added to the systems.

- One of the interesting viewpoints regarding to the anonymity feature of the QAS was the distrust of students in point of nickname invisibility to instructor. Both literature and the results of this study show that anonymous responding

is a great advantage of such systems. Therefore, ways for gaining student trust should be explored.

- Feedback is also inseparable part of such systems. However, in practice there are diverse implementations. QASs can be used with various types of feedback. Further study is needed on the impact of feedback types such as immediate, delayed and etc. Moreover, since feedback can be provided by instructor or along with the QAS system, studies might be conducted in point of better implementation alternatives.

- Further study is needed in point of suitability of question types as well. Due to the typing problems, students preferred selected response type questions. Nevertheless, some of the students liked open-ended questions. The learning preferences of students with question types might be investigated further. According to learning preferences of students, same questions might be prepared in different formats. Further, experimental and causal-comparative studies might be needed in this point.

- Students complained about the technological constraints of the system such as internet connection problem, dealing with typing and etc. the impacts of such problems might create additional cognitive load for students. Thus, further research is needed to investigate the issue creating cognitive load during the QASs implementations.

- There is not enough study concerning to sharing of responses on a screen in class; thus, further research is needed to explore the impact of such an implementation.

## 5.5 Summary

The results reveal that asking and answering questions are indicators of student engagement and are essential for learning. Flaws of lectures and some personal reasons like shyness and concentration problems were stated as inhibiting factors for participating in a lecture. In fact, shyness was stated as inhibiting factor for asking questions in lectures as well. For the implementation of the QAS, students mostly

stated positive viewpoints. They said that the QAS has positive impacts on their learning and engagement. For specific features of the QAS such as the question types send through the system or feedback types, they stated various opinions, which might be explained by individual differences and/or learning types. Additionally, it is essential that technological problems should be handled before integrating the QAS in learning environments.

## REFERENCES


Ally, M. (2009). Mobile Learning: Transforming the Delivery of Education and Training. Edmonton: AU Press.

Arter, J. A. (2003). *Assessment for Learning: Classroom Assessment to Improve Student Achievement and Well-Being*.

Atas, A.H. & Delialioglu, O. (2013). Implementation of an Online Question-Answer (Q/A) System as a Mobile Learning Tool. In T. Bastiaens & G. Marks (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2013* (pp. 581-586). Chesapeake, VA: AACE.

Babb, K. A., & Ross, C. (2009). The Timing of Online Lecture Slide Availability and Its Effect on Attendance, Participation, and Exam Performance. *Computers & Education*, *52*(4), 868-881.

Beer, C., Clark, K., Jones, D. (2010). Indicators of engagement. Proceedings from Ascilite: Curriculum, Technology & Transformation for an Unknown Future. Retrieved from http://www.ascilite.org.au/conferences/sydney10/procs/Beer-full.pdf.

Bonwell, C., & Eison, J. (1991). Active learning: Creating excitement in the classroom (ASHE-ERIC Higher Education Report No. 1). Washington, DC: George Washington University. Abstract online at http://www.ed.gov/databases/ERIC_Digests/ed340272.html Bligh, D. A. (2000). *What's the Use of Lectures?* San Francisco: Jossey-Bass

Blood, E., & Gulchak, D. (2013). Embedding “Clickers” Into Classroom Instruction: Benefits and Strategies. *Intervention in School & Clinic*, *48*(4), 246-253. Doi: 10.1177/1053451212462878

Brookfield, S. D. The Skillful Teacher: On Technique, Trust, and Responsiveness in the Classroom. San Francisco: Jossey-Bass, 1990.

Bunce, D. M. (2009). Teaching Is More Than Lecturing and Learning Is More Than Memorizing. 2007 James Flack Norris Award. .*Journal of Chemical Education*, *86*(6), 674-680

Bunce, D. M., Flens, E. A., & Neiles, K. Y. (2010). How Long Can Students Pay Attention in Class? A Study of Student Attention Decline Using Clickers. *Journal of Chemical Education*, *87*(12), 1438-1443

Burke, D. M., & Pieterick, J. (2010). *Giving Students Effective Written Feedback*. Maidenhead: Open University Press

Calma, A., Webster, B., Petry, S., & Pesina, J. (2014). Improving the quality of student experience in large lectures using quick polls. *Australian Journal of Adult Learning*, (1), 114.

Carnaghan, C., & Webb, A. (2007). Investigating the effects of group response systems on student satisfaction, learning, and engagement in accounting education. *Issues in Accounting Education*, 22(3), 391-409.

Caudill, J. G. (2007). The Growth of m-Learning and the Growth of Mobile Computing: Parallel Developments. *International Review of Research in Open and Distance Learning*, *8*(2), 1-13.

Cifone, M. (2013). Questioning and learning. *Curriculum & Teaching Dialogue*, 15(1/2), 41-55.

Chu, Y., & Walters, L. (2013). The question-asking behavior of Asian students in an American university classroom. *Journal of English as an International Language*, *8*(2), 10-29.

Creswell, J. W. (2012). Educational research: Planning, conducting, and evaluating quantitative and qualitative research. Upper Saddle River, N.J: Merrill.

Crouch, C. H., & Mazur, E. E. (2001). Peer Instruction: Ten years of experience and results. *American Journal of Physics*, *69*(9), 970-977.

Denker, K. J. (2013). Student Response Systems and Facilitating the Large Lecture Basic Communication Course: Assessing Engagement and

Learning. *Communication Teacher*, *27*(1), 50. doi:10.1080/17404622.2012.730622

Delialioglu, O., (E-mail: omerd@metu.edu.tr, July 20, 2014).

Draper, S. W., & Brown, M. I. (2004). Increasing Interactivity in Lectures Using an Electronic Voting System. *Journal of Computer Assisted Learning*, *20*(2), 81-94.

Duggan, P. M., Palmer, E., & Devitt, P. (2007). Electronic voting to encourage interactive lectures: a randomized trial. *BMC Medical Education*, *7*25. doi: 10.1186/1472-6920-7-25

Dunleavy, J., & Milton, P. (2008). Student Engagement for Effective Teaching and Deep Learning. *Education Canada*, *48*(5), 4-8.

Dunn, P. K., Richardson, A., McDonald, C., & Oprescu, F. (2012). Instructor Perceptions of Using a Mobile-Phone-Based Free Classroom Response System in First-Year Statistics Undergraduate Courses. *International Journal of Mathematical Education in Science and Technology*, *43*(8), 1041-1056.

Exley, K., & Dennick, R. (2009). Giving a lecture: from presenting to teaching. New York, NY: Routledge, 2009.

Fassinger, P. A. (1995). *Understanding classroom interaction*. Journal of Higher Education, 66(1), 82-96

Fraenkel, J., Wallen, N., & Hyun, H.H. (2012). How to design and evaluate research in education (8th Ed.). Boston: McGraw Hill.

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.

Fritschner, L. (2000). Inside the Undergraduate College Classroom: Faculty and Students Differ on the Meaning of Student Participation. *The Journal of Higher Education*, (3). 342.

Gardner, J. N. (2012). Assessment and Learning. London: SAGE

Gerard, J. G., Knott, M. J., & Lederman, R. E. (2012). Three Examples Using Tablet Technology in an Active Learning Classroom: Strategies for Active Learning Course Design Using Tablet Technology. *Global Education Journal*, 2012(4), 91-114.

Gok, T. (2011). An Evaluation of Student Response Systems from the Viewpoint of Instructors and Students. *Turkish Online Journal of Educational Technology - TOJET*, *10*(4), 67-83.

Greenstein, L. (2010). What Teachers Really Need to Know About Formative Assessment? Alexandria, Va: ASCD

Guthrie, R. W., & Carlin, A. (2004, August). *Waking the dead: Using interactive technology to engage passive listeners in the classroom*. Paper presented at the Tenth Americas Conference on Information Systems, New York.

Holmes, N. (2014): Student perceptions of their learning and engagement in response to the use of a continuous e-assessment in an undergraduate module, *Assessment &Evaluation in Higher Education.* doi: 10.1080/02602938.2014.881978

Hunkins, F. P. (1995) *Teaching thinking through effective questioning (2nd Ed.).* Boston: Christopher-Gordon Publishers.

Immerwahr, J. (2009). Engaging the "Thumb Generation" with Clickers. Teaching Philosophy, 32(3), 233-145.

Johnson, K., & Lillis, C. (2010). Clickers in the laboratory: Student thoughts and views. Interdisciplinary Journal of Information, Knowledge, and Management 5, 139-151. Retrieved from http://www.ijikm.org/Volume5/IJIKMv5p139-151Johnson445.pdf

Karp, D. A., & Yoels, W. C. (1976). The College Classroom: Some Observations on the Meanings of Student Participation. *Sociology & Social Research*, 60(4), 421-439.

Kay, R. H., & LeSage, A. A. (2009). Examining the benefits and challenges of using audience response systems: A review of the literature. *Computers and Education*, *53*(3), 819-827. doi:10.1016/j.compedu.2009.05.001

Kearsley, G. P. Questions and question asking in verbal discourse: A cross-disciplinary review. *Journal of Psycholinguistic Research*, 1976, .5, 355-375.

Keough, S. M. (2012). Clickers in the Classroom: A Review and a Replication. *Journal of Management Education*, *36*(6), 822-847.

Krause, K., L., & Coates, H., (2008). Students' engagement in first-year university. *.Assessment and Evaluation in Higher Education* 33.5 .493-505.

Krueger, R. A., & Casey, M. A. (2000). *Focus groups: A practical guide for applied research*. Thousand Oaks, Calif: Sage Publications.

Kukulska-Hulme A., and Traxler, J. (2005). *Mobile learning: a handbook for educators and trainers.* London and New York: Routledge.

Kuo, H., V., Kohl, P. B., and Carr, L. D (2012). Socratic dialogs and clicker use in an upper-division mechanics course. *AIP Conference Proceedings*, 1413, 235-238. doi:10.1063/1.3680038

Kvale, S., and Brinkman, S. (2009). Interviews learning the craft of research interviewing. United Stated of America: SAGE Publications, Inc.

Lam, J., Yau, J., & Cheung, S. K. (2010). A review of mobile learning in the mobile age. In Hybrid Learning (pp. 306-315). Springer Berlin Heidelberg.

Lantz, M. E., & Stawiski, A. A. (2014). Effectiveness of clickers: Effect of feedback and the timing of questions on learning. *Computers in Human Behavior*, *31*(1), 280-286. doi:10.1016/j.chb.2013.10.009

Larson, L. R., & Lovelace, M. D. (2013). Evaluating the Efficacy of Questioning Strategies in Lecture-Based Classroom Environments: Are We Asking the Right Questions? *Journal on Excellence in College Teaching*, *24*(1), 105-122.

Laverty, J. T., Bauer, W., Kortemeyer, G., & Westfall, G. (2012). Want to Reduce Guessing and Cheating While Making Students Happier? Give More Exams! *Physics Teacher*, *50*(9), 540-543.

Leung, C. H., & Chan, Y. Y. (2003). Mobile learning: A new paradigm in electronic learning. Proceedings - 3Rd IEEE International Conference On Advanced Learning Technologies, ICALT 2003, (Proceedings - 3rd IEEE International Conference on Advanced Learning Technologies, ICALT 2003), 76-80. doi:10.1109/ICALT.2003.1215030

Liu, F. C., Gettig, J. P., & Fjortoft, N. (2010). Impact of a Student Response System on Short- and Long-Term Learning in a Drug Literature Evaluation Course. *American Journal of Pharmaceutical Education*, *74*(1), 1-5.

Liu, W. C., & Stengel, D. N. (2011). Improving Student Retention and Performance in Quantitative Courses Using Clickers. *International Journal for Technology in Mathematics Education*, *18*(1), 51-58

Lyubartseva, G. (2013). Influence of audience response system technology on student performance in organic chemistry lecture class. *Education*, *133*(4), 439-443.

Martin, R. (2011). M-learning and student engagement: Factors that support students' engagement in m-learning (Unpublished doctoral dissertation). Murdoch University, Australia.

MacGeorge, E., Homan, S., Dunning, J., Elmore, D., Bodie, G., Evans, E., & Geddes, B. (2008). Student evaluation of audience response technology in large lecture classes. *Educational Technology Research & Development*, *56*(2), 125-145. doi: 10.1007/s11423-007-9053-6

Masikunas, G., Panayiotidis, A., & Burke, L. (2007). The use of electronic voting systems in lectures within business and marketing: a case study of their impact on student learning. *ALT-J: Research in Learning Technology*, *15*(1), 3-20. doi: 10.1080/09687760600837090

Masikunis, G., Panayiotidis, A., & Burke, L. (2009). Changing the nature of lectures using a personal response system. *Innovations in Education & Teaching International*, *46*(2), 199-212. doi:10.1080/14703290902843935

Mehdipour, Y. and Zerehkafi, H. (2013). Mobile Learning for Education: Benefits and Challenges. *IJCER*,3. Retrieved from http://www.ijceronline.com/papers/Vol3_issue6/part%203/P03630930100.pdf.

Merriam, S. (2009). Qualitative research: A guide to design and implementation. San Francisco, CA: Jossey-Bass.

Meyers, C and Jones, TB. Promoting Active Learning: Strategies for the College Classroom. 1993: Jossey Bass Pub; San Francisco.

Moore, K. D. (2005). Effective instructional strategies: from theory to practice / Kenneth D. Moore. Thousand Oaks: SAGE Publications, c2005.

Morgan, J. T., & Wakefield, C. (2014). Who Benefits From Peer Conversation? Examining Correlations of Clicker Question Correctness and Course Performance. Journal of College Science Teaching, 43(5), 51-56.

Mustapha, S., Rahman, N., & Yunus, M. (2010). Factors influencing classroom participation: A case study of Malaysian undergraduate students. *Procedia - Social and Behavioral Sciences*, *9*(World Conference on Learning, Teaching and Administration Papers, WCLTA-2010), 1079-1084. doi:10.1016/j.sbspro.2010.12.289

National Survey of Student Engagement. (2014*). From benchmarks to engagement indicators and high-impact practices*. Retrieved from http://nsse.iub.edu/pdf/Benchmarks%20to%20Indicators.pdf.

Nielsen, K. L., Hansen, G., & Stav, J. B. (2013). Teaching with student response systems (SRS): teacher-centric aspects that can negatively affect students' experience of using SRS. *Research in Learning Technology*, *21*1-13. doi:10.3402/rlt.v21i0.18989

Nightingale, J. (2010). Clicking for Comprehension: Do Personal Response Systems Measure up? International Journal of Education Research, 5(2), 30-43.

Nor, M. F. & Choo, H. L. (2010). An investigation into the factors affecting second language learners' classroom participation. pp. 1-8.

Oigara, J., & Keengwe, J. (2013). Students' perceptions of clickers as an instructional tool to promote active learning. *Education and Information Technologies*, *18*(1), 15-28. doi:10.1007/s10639-011-9173-9

Orr, G. G. (2010). A review of literature in mobile learning: Affordances and constraints. *6Th IEEE International Conference on Wireless, Mobile and Ubiquitous Technologies in Education, WMUTE 2010: Mobile Social Media for Learning and Education in Formal and Informal Settings*, 107-111. doi:10.1109/WMUTE.2010.20.

Ozdamli, F., & Cavus, N. (2011). Basic elements and characteristics of mobile learning. *Procedia - Social and Behavioral Sciences*, *28* (WCETR-2011 - World Conference on Educational Technology Researches), 937-942. doi:10.1016/j.sbspro.2011.11.173

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd Ed.). Thousand Oaks, CA: Sage.

Perkins, K. K., & Turpen, C. (2009). Student Perspectives on Using Clickers in Upper-division Physics Courses. *AIP Conference Proceedings*, *1179*(1), 225-228. doi:10.1063/1.3266721

Prince, M. (2004). Does Active Learning Work? A Review of the Research. *Journal of Engineering Education*, *93*(3), 223-231.

Prince, M. J., & Felder, R. M. (2006). Inductive teaching and learning methods: Definitions, comparisons, and research bases. Journal of Engineering Education, 95(2), 123-138.

Sanacore, J. (2013). 'Slow down, you move too fast': literature circles as reflective practice. The Clearing House, (3). 116

Sanou, B. (2014). International Telecommunication Union. *ICT Facts and Figures*. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Documents/facts/ICTFactsFigures2014-e.pdf

Seidman, I. (2006). Interviewing as qualitative research: a guide for researchers in education and the social sciences / Irving Seidman. New York: Teachers College Press, c2006.

Simpson, V., & Oliver, M. (2007). Electronic Voting Systems for Lectures then and Now: A Comparison of Research and Practice. *Australasian Journal of Educational Technology*, *23*(2), 187-208.

Sixsmith, A. A., Dyson, L. E., & Nataatmadja, I. I. (2006). Improving class participation in it tutorials and small lectures. *ACIS 2006 Proceedings - 17Th Australasian Conference on Information Systems*, (ACIS 2006 Proceedings - 17th Australasian Conference on Information Systems).

Steinert, Y. S. (1999). Interactive lecturing: strategies for increasing participation in large group presentations. Medical Teacher, 21(1), 37-42.

Steinert, Y., S., & Snell, L., S. (1999) Interactive lecturing: strategies for increasing participation in large group presentations. *Medical Teacher*, 21, 37-42. doi:10.1080/01421599980011

Stewart, D and Shamdasani, P. (1990). Focus groups: Theory and practice. Newbury Park: Sage Publications;

Stowell, J. R., Oldham, T., & Bennett, D. (2010). Using Student Response Systems ("Clickers") to Combat Conformity and Shyness. *Teaching of Psychology*, *37*(2), 135-140. doi: 10.1080/00986281003626631

Sutherland, T. (1976). The lecture method. *NACTA Journal.* Retrieved from http://www.nactateachers.org/attachments/article/1514/Sutherland_NACTA_Journal_September_1976-8.pdf

Sumer, N., E-mail:nsumer@metu.edu.tr, May 23, 2014.

Terrion, J., & Aceti, V. (2012). Perceptions of the effects of clicker technology on student learning and engagement: A study of freshmen Chemistry students. *Research in Learning Technology*, *20*(2), 1-11.

Tong, V. H. (2012). Using asynchronous electronic surveys to help in-class revision: A case study. *British Journal of Educational Technology*, *43*(3), 465-473. doi:10.1111/j.1467-8535.2011.01207.x

Trees, A. R., & Jackson, M. H. (2007). The learning environment in clicker classrooms: student processes of learning and involvement in large

university-level courses using student response systems. *Learning, Media & Technology*, *32*(1), 21-40. doi: 10.1080/17439880601141179

Turban, J. W. (2011). Students Prefer Audience Response System for Lecture Evaluation. *International Journal of Emerging Technologies in Learning*, *6*(4), 52.

TurkStat, Ministry of Transport, Maritime Affairs and Communications, Information and Communication Technologies Authority (2013). *Number of Fixed Telephone, Mobile Telephone and Internet Subscribers. Retrieved from* http://www.turkstat.gov.tr/

Ulbig, S. G., & Notman, F. (2012). Is Class Appreciation Just a Click Away?: Using Student Response System Technology to Enhance Shy Students' Introductory *American Government Experience. Journal of Political Science Education*, 8(4), 352-371. doi:10.1080/15512169.2012.729450

Van Der Meij, H. H. (1988). Constraints on Question Asking in Classrooms. Journal of Educational Psychology, 80(3), 401-405.

Walsh, J. A. & Sattes, B. D. (2005). Quality questioning: research-based practice to engage every learner. Thousand Oaks, CA: Corwin Press; [Charleston, WV]: AEL, c2005.

White, G. (2011). Interactive lecturing. *Clinical Teacher*, *8*(4), 230-235. doi:10.1111/j.1743-498X.2011.00457.x

Willis, J. (2008). Qualitative Research Methods in Education and Educational Technology. Charlotte, NC: Information Age Pu

Wolter, B. K., Lundeberg, M. A., Kang, H., & Herreid, C. F. (2011). Students' Perceptions of Using Personal Response Systems ("Clickers") With Cases in Science. *Journal of College Science Teaching*, *40*(4), 14-19.

Wu, Hsin-Kai, and Ya-Ling Huang. 2007. "Ninth-grade student engagement in teacher-centered and student-centered technology-enhanced learning environments." *Science Education* 91, no. 5: 727-749. *Education Research Complete*, EBSCO*host* (accessed August 24, 2014)

Xie, X. (2010). Why are students quiet? Looking at the Chinese context and beyond. *ELT Journal: English Language Teachers Journal*, *64*(1), 10-20. doi:10.1093/elt/ccp060

Yıldırım, A., & Simsel, H. (2005). Nitel araştırma yöntemleri (5th ed.). Ankara: Seçkin.

## APPENDIX A

## QUESTIONS ASKED BY THE INSTRUCTOR THROUGH THE QAS

**Table A.1** Questions Asked by the Instructor through the QAS

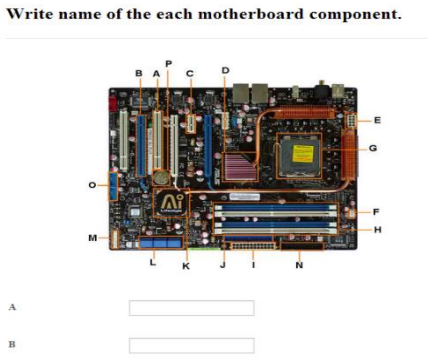
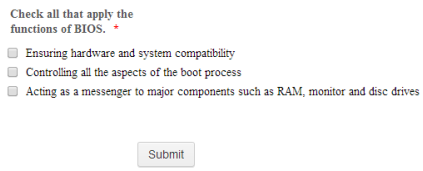
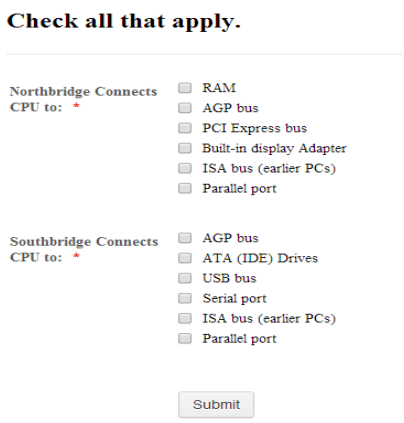
| Questions | Details |
|---|---|
|  | **Number of answers:** 18<br>**Question Type:** Short answer requiring 15 words<br>Sample Answer:<br>***Students A:***<br>***A*** *Pci*<br>***D*** *Chipset*<br>***G*** *Cpu*<br>***H*** *ram slots*<br>***I*** *power supply connector* |
|  | **Number of answers:** 33<br>**Question Type:** Multiple choice |

**Table A.1 (Continued)**




**Number of answers:** 34

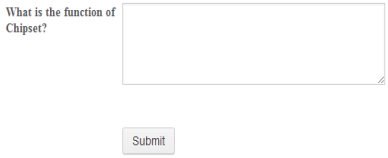
**Question Type:** Multiple choice

**Number of answers:** 16

**Question Type:** Open-ended

Sample Answers:

| | |
|---|---|
| *1* | *Dma channels provide communication* |
| *2* | *For Communication* |
| *3* | *Can Read and write without cpu* |
| *4* | *they are used by data transformission in a high speed.* |
| *5* | *For the communication* |




**Number of answers:** 22

**Question Type:** Open-ended

Sample Answers:

| | |
|---|---|
| 1 | Function of chipset is to communicate between all components of the modern PC, |
| 2 | A chipset is a set of electronic components in an integrated circuit that manages the data flow between the processor, memory and peripherals. It is usually found in the motherboard of a computer. Chipsets are usually designed to work with a specific family of microprocessors. Because it controls communications between the processor and external devices, the chipset plays a crucial role in determining system performance. |
| 3 | |
| 4 | It controls communications between processor and external devices...Determing system performance |

**Table A.1 (Continued)**

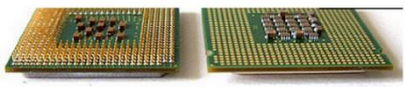
| | |
|---|---|
| Motherboard determines: *<br>☐ Type of memory<br>☐ ROM<br>☐ Type of case<br>☐ Type of keyboard<br>☐ Type of mouse<br>☐ Chipset<br>☐ Capacity of hard disk<br>Submit | **Number of answers:** 23<br><br>**Question Type:** Multiple choice |
| What is hotplugging? *<br>Submit | **Number of answers:** 15<br><br>**Question Type:** Open-ended<br><br>Sample Answers:<br><br>the device is added or removed without shutting down<br>The ability to add and remove devices to a computer while the computer is running and have the operating syst automatically recognize the change.<br>We don't have to put off pc when we use hotplugging such as usb. We can use and close it when operating sys run<br>The ability to add and remove devices to a computer while the computer is running<br>It provides us to plug some devices while system is working<br>It provides to plug or unplug devices without system off. |
|  <br>What is the difference between two designs given above? *<br>Submit | **Number of answers:** 27<br><br>**Question Type:** Open-ended<br><br>Sample Answers:<br><br>1 first one connect with pins. second connect with wage<br>2 First one connects to socket with pins. Second one connects to socket with electronic way<br>3 Pin grid Land grid<br>4 First one pin grid arrey Second one |

**Table A.1 (Continued)**

What is "Power-on self -test"? *

Submit

**Number of answers:** 23

**Question Type:** Open-ended

Sample Answers:

| | |
|---|---|
| 1 | Power on self-test post : checks to see that everything is present and functioning. Malfunctions are indicated by a series of beeps, the meaning of which depends on the BIOS manufacturer. |
| 2 | It is regular check while system boost |
| 3 | POST is a process performed by software routines after powered on. |
| 4 | POST |

Which hardware component is responsible for keeping time and date up to date even when computer is unplugged or off? *

Submit

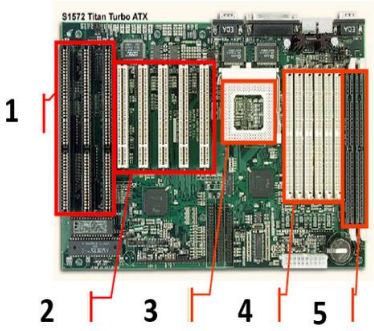
**Number of answers:** 22

**Question Type:** Short answer

Sample Answers:

| | |
|---|---|
| 1 | cmos- |
| 2 | cmos |
| 3 | ccmos |
| 4 | bios battery |
| 5 | cmos |

**Table A.1 (Continued)**

| | |
|---|---|
| FDD can store 1.44 MB. *<br>○ True<br>○ False<br>○ I don't know.<br><br>Blu-ray disc capacity is 25 GB for dual layer. *<br>○ True<br>○ False<br>○ I don't know.<br><br>Compact Disc capacity is 700 MB. *<br>○ True<br>○ False<br>○ I don't know.<br><br>Submit | **Number of answers:** 16<br><br>**Question Type:** T/F |
|  | **Number of answers:** 16<br><br>**Question Type:** Short answer<br><br>**Sample Answer:**<br><br>1 cpu<br>2 cpu<br>3 cpu socket<br>4 Cpu socket |

## APPENDIX B

## QUESTIONS ASKED BY STUDENTS THROUGH THE QAS

**Table B.1** Questions Asked by Students through the QAS

| Nickname | Questions/Comments |
|---|---|
| **Fgunes** | *"What is hotplugging?"* |
| **ByOwl** | *"What is CPU Cache memory?"* |
| **Ceylin** | *"Which components use the memory controller hub?"* |
| **Phoenix** | *"Have expansion buses clock speeds?"* |
| **Kıtlamaçaytabağı** | *"What is the different of dual core CPU and regular CPU?"* |
| **Meta** | *"Also cpu contains Ram ?"* |
| **Tarcin** | *"What is the differences between the integer unit and floating point units"* |
| **Recell** | *"How many types of chips do we have? Only intel and AMD?"* |
| **Intel CPU** | *"Sometimes the computer suddenly becomes slow or freezes is this problem due to malfunction of the cpu what are some if the hazards that affect the cpu?"* |
| **inek shaban** | *"What are the examples of some EEPROM"* |
| **inek shaban** | *"If I have a 2gb ram and 512 vram and I increase my ram to 4gb is it possible for my vram to be expanded from the ram?"* |
| **İbo** | *"What storage keeps information for the longest period of time?"* |
| **User5** | *"What decides where the CPU writes the data and what's this unit's role while the data is being written?"* |
| **Hydrazine** | *"What would be the effects on the speed of the cpu if the bits in the address bus are less than those in the data bus?* |
| **Şenerşen** | *what does microcode do?"* |
| **Hydrazine** | *"What is the capacity of the cache memory and can it be increased in order to increase the processing speed?"* |
| **TuzRuhu** | *"what decides microprocessor's speed?"* |

**Table B.1 (Continued)**

| | |
|---|---|
| **Şenerşen** | *"how will we draw 16k x 4 diagram ????"* |
| **inek shaban** | *"Hocam tekrar anlatabilirmisiniz"* |
| **Ladybird** | *"ben quizi yapmıstım fakat quiz tekrar girisimde karsıma cıktı submitte etmistim sizce bir sorun var mı?"*<br><br>**** Sent out of class time*<br>***Feedback sent to Ladybird:*** *Sorun yok Ladybird quizi almışsın sistemde görünüyor.* |

# APPENDIX C

## INTERVIEW PROTOCOL

Merhaba, adım Amine Hatun Ataş. ODTÜ BÖTE de Y.Lisans öğrencisiyim. *EduBox'*ın soru-cevap sisteminin mobil cihazlar aracılığıyla kullanıldığı öğrenme ortamlarındaki öğrenci görüşleri üzerine araştırma yapmaktayım. Bu görüşmenin amacı öğrencilerin sistemin kullanımına ilişkin tecrübelerinize dayalı görüş ve düşüncelerini belirleyebilmektir. Bu araştırmada ortaya çıkacak sonuçların sonraki çalışmaların niteliğini artırmada kullanılacığını umuyorum. Bu nedenle, katıldığınız etkinlik esnasında kullandığınız mobil cihazlar yardımıyla soru-cevap göndermeyle ilgili düşüncelerinizi ve önerilerinizi benimle paylaşırmışsınız?

Görüşme esnasında paylaşacağınız yorumlarınızı izninizle kaydetmek istiyorum. Bu bilgileri araştırmacı dışında bir kimse görmeyecektir. Sonuçlarda da her türlü kişisel bilgileriniz kesinlikle gizli tutulacaktır. Görüşmeye katılım gönüllülük esasına dayalıdır. Rahatsız olduğunuz soru olursa cevaplamayabilirsiniz ya da görüşmeyi yarıda bırakabilirsiniz.

- Görüşmeye başlamadan önce söylediklerimle ilgili olarak belirtmek istediğiniz düşünce ya da sormak istediğiniz soru var mı?
- Görüşmeyi izniniz olursa kaydetmek istiyorum, sakıncası var mıdır?

Görüşmenin aşağı yukarı 1 saat süreceğini tahmin ediyorum. İzninizle sorulara başlamak istiyorum.

GÖRÜŞME SORULARI

1. Derse katılım sizin için ne anlama geliyor? Açıklar mısınız?
2. Derse katılmanızı zorlaştıran durumlar var mıdır? Varsa bunlar nelerdir, açıklar mısınız?
3. Derste soru sormanızı engelleyen durumlar var mıdır? Varsa ne gibi durumlarda soru sormak istemiyorsunuz, açıklar mısınız?
4. Derste EduBox soru cevap sistemini kullanarak soru sorma olanağının sağlanmasının, öğrenmeniz üzerindeki etkisine ilişkin görüşleriniz nelerdir?
5. Derste EduBox aracılığıyla öğretmen tarafından sorulan sorulara sistem aracılığıyla da cevap verebilme olanağının sağlanmasının, öğrenmeniz üzerindeki etkisine ilişkin görüşleriniz nelerdir?
6. Derste EduBox soru cevap sistemini kullanarak soru sorma olanağının sağlanmasının, derse katılımınız üzerindeki etkisine ilişkin görüşleriniz nelerdir?
7. Derste EduBox aracılığıyla öğretmen tarafından sorulan sorulara sistem aracılığıyla da cevap verebilme olanağının sağlanmasının, derse katılımınız üzerindeki etkisine ilişkin görüşleriniz nelerdir?
8. Sorularınızı EduBox aracılığı soru sorma ya da sözlü olarak soruları sorma durumlarını nasıl değerlendiriyorsunuz, görüşleriniz nelerdir?
9. EduBox aracılığıyla sorulan soruların türleriyle (Çoktan seçmeli, açık uçlu, Doğru/Yanlış) ilgili görüşleriniz nelerdir?
10. EduBox sistemiyle soru ya da cevap gönderirken Rumuz kullanma olanağı sağlanmıştı. Bu uygulamayla ilgili görüşleriniz nelerdir?
11. EduBox sistemiyle sorulan sorulara ya da verilen cevaplara öğretmen tarafından geribildirim verilmişti. Geribildirimlerle ilgili değerlendirmeleriniz nelerdir?
12. Sistemi kullanırken yaşadığınız problem (varsa) nelerdi, açıklar mısınız?
13. EduBox sisteminin tasarımına ilişkin görüş ve önerileriniz nelerdir?

## APPENDIX D

## FLOW OF THE INSTRUCTIONS

**Table D.1** Flow of the Instructions

| Weeks | Explanations |
|---|---|
| Week 1 | **Consent/Demographics:**<br>Students were informed about the purpose of the study. Consent forms were distributed. Demographic information was collected and the number of students having mobile devices were determined. |
| Week 2 | **Before class Orientation/ Distance**<br>Students were informed about the system via email. 3 PowerPoint presentations were attached to the e-mails. The subjects of the tutorials were;<br>"How to sign up"<br>"How to take quiz"<br>"How to ask questions" |
| Weeks 3 & 4 | **In class Orientation/ Face to Face**<br>Tablets were distributed to students who didn't have a Smartphone or a tablet. Students were informed about how to use the tablets and how to enroll in the course through the system. They were requested to send a trial post. |
| Weeks 5 & 7 | **In class:**<br>Questions were sent through the QAS.<br>Instructor provided feedback for each question. |
| Weeks 6 & 8 | **In class:**<br>Students had opportunity to send their questions through the QAS or in conventional way |
| Weeks 9, 10 &11 | **After class:**<br>Focus Groups Interviews |

# APPENDIX E

## LIST OF MOBILE DEVICES

**Table E.1** List of Mobile Devices

| Make and Model | Number |
|---|---|
| Apple IPhone 5 | 1 |
| Apple IPhone 4 | 1 |
| Blackberry | 1 |
| General Mobile Discovery | 2 |
| HTC Explorer | 1 |
| HTC One S | 2 |
| Nokia Lumia 520 | 1 |
| Nokia Lumia 620 | 1 |
| Samsung  Galaxy ACE S5830 | 1 |
| Samsung  Galaxy Note2 | 1 |
| Samsung Ace5810 | 1 |
| Samsung Galaxy Ace | 1 |
| Samsung Galaxy Gio | 1 |
| Samsung Galaxy i8150 | 1 |
| Samsung Galaxy S3 | 3 |
| Samsung Galaxy S4 | 2 |
| Samsung Galaxy Wonder | 1 |
| Samsung S5570 | 1 |
| Samsung S7560 | 1 |
| Samsung Wave 2 | 1 |
| Sony Ericsson | 1 |
| TOTAL | 27 |

## APPENDIX F

## PARTICIPANTS' CODES USED FOR QUOTATIONS

**Table F.1** List of Participants' Codes used for Quotations

| Nickname of Interviewee | Gender |
|---|---|
| FGI-1 | M |
| FGI-2 | F |
| FGI-3 | M |
| FGI-4 | F |
| FGI-5 | M |
| FGI-6 | M |
| FGI-7 | M |
| FGII-1 | F |
| FGII-2 | F |
| FGII-3 | M |
| FGII-4 | M |
| FGII-5 | F |
| FGII-6 | F |
| FGIII-1 | M |
| FGIII-2 | F |
| FGIII-3 | F |
| FGIII-4 | M |
| FGIII-5 | M |
| FGIII-6 | F |
| FGIV-1 | F |
| FGIV-2 | F |
| FGIV-3 | F |
| FGIV-4 | F |
| FGV-1 | F |
| FGV-2 | M |
| 25 Interviewees | 11 M, 14 F |