THE INVESTIGATION OF UNDERGRADUATE STUDENTS' MOBILE PHONE USE IN THE ACADEMIC ENVIRONMENT: THE CASE OF MIDDLE EAST TECHNICAL UNIVERSITY

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ABSTRACT

THE INVESTIGATION OF UNDERGRADUATE STUDENTS' MOBILE PHONE USE IN THE ACADEMIC ENVIRONMENT: THE CASE OF MIDDLE EAST TECHNICAL UNIVERSITY

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The study aimed to investigate undergraduate students' educational mobile phone use; and explore the effect of certain learner characteristics (demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs) on mobile phone use in an academic environment (MPUAE) with respect to the facilitator, distractor, and connectedness sub-dimensions. A correlational research design was employed. The sample consisted of 1867 undergraduate students, which were selected by stratified sampling method from all departments of Middle East Technical University. The researcher developed MPUAE scale based on the Mobile Phone Affinity Scale (Bock et al., 2016). A three-factor structure with 18 items was proposed: facilitator, distractor, and connectedness. The results indicated that the scores obtained from the developed scale were valid and reliable in assessing undergraduate students' mobile phone use in the academic environment.

The results showed that students used their mobile phones firstly for communication and interaction, secondly for getting/searching information, thirdly for self-learning, fourthly for accessing materials, and lastly for using tools and generating artifacts. In order to predict the contribution of the aforementioned five personal factors on the total MPUAE scores and its three sub-dimensions, four separate hierarchical regression analyses were performed. The findings of regression analyses revealed that each model had a significant contribution to three sub-dimensions of the MPUAES. Except for self-directed learning, other four personal factors also significantly predicted undergraduate students' total MPUAE scores. The *motives of mobile phone use* and *mobile phone self-efficacy beliefs* were the most notable predictors in each analysis.

Keywords: Mobile Learning, Smartphones, Educational Use of Mobile Phones, Mobile-Learning in Higher Education, Undergraduate Students

ÖZ

LİSANS ÖĞRENCİLERİNİN AKADEMİK ORTAMDA MOBİL TELEFON KULLANIMININ ARAŞTIRILMASI: ORTA DOĞU TEKNİK ÜNİVERSİTESİ ÖRNEĞİ

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Bu araştırmanın amacı, lisans öğrencilerinin eğitsel cep telefonu kullanımını incelemek ve belirli öğrenci karakteristiklerinin (demografik özellikler, teknoloji kullanımı ile ilgili özellikler, mobil telefon kullanım amaçları, öz-yönetimli öğrenme becerileri, mobile telefon öz-yeterlik inançları) akademik ortamdaki mobil telefon kullanımına olan etkisini, kolaylaştırıcı, dikkat dağıtıcı ve iletişim alt boyutlarına göre araştırmaktır. Bu çalışmada ilişkisel araştırma metodu kullanılmıştır. Çalışmanın örneklemini Orta Doğu Teknik Üniversitesi'nin tüm bölümlerinden tabakalı örnekleme yöntemi ile seçilen 1867 lisans öğrencisi oluşturmaktadır. Akademik Ortamda Mobil Telefon Kullanımı Ölçeği araştırmacı tarafından, Mobil Telefon İlginlik Ölçeği (Bock ve arkadaşları, 2016) temel alarak geliştirmiştir. 18 maddeli üç faktörlü bir yapı elde edilmiştir: kolaylaştırıcı, dikkat dağıtıcı ve iletişim. Sonuçlar, geliştirilen ölçekten elde edilen puanların öğrencilerinin akademik ortamda mobil telefon kullanımının değerlendirilmesinde geçerli ve güvenilir olduğunu göstermiştir.

Sonuçlar öğrencilerin mobil telefonlarını öncelikle iletişim ve etkileşim, ikinci olarak bilgi almak/ bulmak, üçüncü olarak kendi kendine öğrenme, dördüncü olarak materyallere erişim ve son olarak da telefondaki çeşitli araçları kullanmak ve bu araçlarla üretim sağlamak için kullandığını gösterdi. Yukarıda belirtilen beş kişisel modelin Akademik Ortamda Mobil Telefon Kullanım ölçeğinden alınan toplam puanı ve bu ölçeğin üç alt boyutunu ne kadar yordadığını ölçmek amacıyla dört ayrı hiyerarşik regresyon analizi çalıştırılmıştır. Bu analizin sonuçlarına göre, her bir model Akademik Ortamda Mobil Telefon Kullanım Ölçeği 'inin üç alt boyutuna önemli bir katkısı olduğunu ortaya koymaktadır. Öz-yönelimli öğrenme dışında, diğer dört kişisel model de lisans öğrencilerinin toplam MPUAE puanlarını önemli ölçüde yordamaktadır. Her bir analiz sonucunda, *mobile telefon kullanım amaçlarının* ve *mobil telefon öz-yeterlik inançlarının* en dikkate değer yordayıcılar olduğu görülmüştür.

Anahtar Kelimeler: Mobil Öğrenme, Akıllı Telefonlar, Telefonların Eğitsel Kullanımı, Yüksek Öğrenimde Mobile Öğrenme

To my little elder sister Hilâl,

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LIST OF ABBREVIATIONS

CFA: Confirmatory Factor Analysis

EFA: Exploratory Factor Analysis

FRAME: The Framework for the Rationale of the Mobile Education

GPA: Grade-Point Average

ICT: Information and Communication Technologies

MoLeNET: The Mobile Learning Network project

MPAS: Mobile Phone Affinity Scale

MPUAES: Mobile Phone Use in Academic Environment Scale

MPSEF: Mobile Phone Self-Efficacy Scale

LMS: Learning Management System

OSN: Online Social Networking

PDA: Personal Digital Assistant

SDL: Self-Directed Learning

SEF: Self-Efficacy

UTAUT: The Unified Theory of Acceptance and Use of Technology Model

CHAPTER I

INTRODUCTION

The introduction section reveals a justification of the issue by presenting background information about the study, the purpose of the study, the significance of the study, research questions, and definition of the important terms used in the study.

1.1 Background of the Study

The effect of the digital revolution has been seen in every aspect of our life. Today's students are in the center of this revolution. They can easily adopt and use many different forms of technology such as desktop computers, laptop, tablet, gaming systems, mobile phones. Nowadays, particularly mobile devices are the new trend (Najmi & Lee, 2009), and smartphones are seen as the latest evolution of the mobile technologies (Qulasvirta, Rattenbury, Ma, & Raita, 2012). According to Digital in 2017 Global Overview report of We Are Social, over 66 percent of the world population have mobile phones while more than 50 percent have a smartphone. Similarly, in the 2016 Global Overview report, mobile phone owners in Turkey are 86 percent of the population whereas smartphone users are 56 percent (Kemp, 2016). Moreover, the smartphone ownership is popular especially among young adults. Anderson (2015) reported that 86 percent of smartphone users are aged between 18 and 29 years old. In fact, this age group mostly includes college students. According to Educause (2011), "nearly every college student has a mobile phone, and a student can be expected to check his or her phone once every six minutes" (p.18).

What makes a smartphone so popular among college students is that they offer many features and functionalities such as voice and video calling, texting, sending e-mails, storing, gaming, video players, application installation, numerous mobile Web 2.0 tools, and also navigational systems. "Mobility" feature of smartphones make these devices more preferable than computers (Caudill, 2007). Actually, smartphones are more than communication, information and entertainment seeking, which meet users' needs in regard to security, individual capability, relationship development, and learning (Kang & Jung, 2014). They have great potential as a learning tool in both formal and informal learning environment (Sung, Chang, & Liu, 2015). Related to the use of mobile technologies in education, a growing field of mobile learning has emerged. Mobile learning refers to "learning with the use of mobile devices and wireless technologies without limitations of time and place" (Ally, 2009, p. 1). Portability, immediacy, individuality, connectivity and accessibility provided through mobile devices are also important characteristics of mobile learning (Ally, 2009)

Smartphones provide various opportunities for learning, which were considered especially as a communication and collaboration tool both in the class and outside of the class (Ciampa, 2014; Barker, Krull, & Mallinson, 2005). They enhance the communication between learners and lecturers or among learners with the help of several communication tools such as instant messengers, e-mails, messages, etc. In addition to communication, mobile phones offer three other affordances: seeking information, collecting information, generating artifacts or content (Quinn, 2013). Despite providing such opportunities in learning environments, the opinions on the use of mobile devices in education vary. In other words, there are both proponents and opponents of the educational use of mobile devices in the literature. Correspondingly, Obringer and Coffey (2007) stated, "although mobile devices are the central of the students' life in terms of personal and educational purposes, they face inconsistent attitudes among teachers and administrators with regard to use in the school" (p. 43). Opponents consider those devices as disruptive and unsuitable tools in educational context, which cause a challenge for the universities' adoption and use of the mobile device in education (Losh, 2014). Different from these standpoints, some scholars think that mobile devices are both a distraction and facilitation of learning environments (Lockhart, 2016). There is a need for research that will elucidate this controversy by brining explanations about facilitation, distraction, and communication roles of mobile phones from a holistic perspective.

One main factor that can affect opinions about facilitator and distractor role of mobile devices in education can be personal or individual chracteristics. Accordingly, Koole (2009) emphasized that educational use of smart phones is associated with learners' prior knowledge, motivation, needs, and context. In addtion, technology acceptance models can provide further explanations about the influence of personal characteristics on the use of various technologies. According to Technology Acceptance Model (TAM) (Davis, 1989) and Unified Theory of Acceptance and Use of Technology (UTAUT) model (Vankatesh & Davis, 2000), personal factors including learners' motivation or goals are core components to explain crucial outcomes (e.g., intention to use and return, effort expectancy, perceived playfulness, satisfaction). There are several studies that corroborate the effect of personal characteristics on the use of mobile technologies. However, these studies are limited to the personal factors proposed by the aforementinoned models. It is necessary to use a broader view which including different learner charactersitcs for the explanation of the educational use of mobile devices. This issue was also indicated as a gap in the literature, and more research that concentrate on the learner perspective in the context of educational mobile phone use is proposed (Cochrane, 2013; Traxler & Vosloo, 2014).

On the whole, the literature reveals contradictory views regarding the use of mobile devies in educational context despite its popularity among undergraduate studens in daily life. Considering the personalized nature of smartphones, their use can be influenced by various individual factors. In this study, a comprehensive perspective is provided on undergraduate students' mobile phone usage in the academic environment by considering both positive and negative aspects. Moreover, the use of smartphones among undergraduate students is examined in connection with certain learner characteristics.

1.2 The Purpose of the Study

The main purpose of the present study is to provide an insight into undergraduate students' educational mobile phone use; and predict the contribution of certain learner characteristics on mobile phone use in an academic environment (MPUAE) with respect to the facilitator, distractor, and connectedness sub-dimensions. These learner characteristics were identified as follows: (1) certain demographics including gender, age, GPA, faculty, and study year; (2) certain technology-use related characteristics including smartphone use year, tablet owner, laptop owner, and the number of applications; (3) the motives for mobile phone use including communication and interaction, getting/searching information, tools and productivity, entertainment, and educational purposes; (4) self-directed learning; and (5) mobile phone self-efficacy.

More specifically, the present study aims to explore:

- the frequency of educational mobile activities that undergraduate students perform by their mobile phones,
- the usefulness of these educational mobile phone activities,
- the applications/services that undergraduate students used for academic purposes,
- the motives for mobile phone use,
- the factors that predict undergraduate students' educational mobile phone usage in terms of facilitator, distractor, and connectedness sub-dimensions.

1.3 Research Questions

1. How do undergraduate students use their mobile phones for educational purposes?
    a. What is undergraduate students' educational mobile activities usage frequency?

b. To what extent do undergraduate students consider educational mobile activities useful for their academic work?
c. Which mobile applications do undergraduate students use for academic purposes?
d. What are the undergraduate students' motives for using mobile phone?

2. How do five groups of variables (demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs) predict the undergraduate students' mobile phone use in regard of:

   a. Facilitator?
   b. Distractor?
   c. Connectedness?
   d. The total Mobile Phone Use in Academic Environment Scale score?

1.4 The Significance of the Study

The use of mobile phones among college students has increased rapidly in recent years. The "mobility" and "highly customizable" features of the mobile phones enable learners to take control of their own learning and engage in learning activities according to their own needs, interests, and curiosity (Kukulsha-Hulme & Shield, 2008). For this reason, there is a need to investigate how undergraduate students use their mobile phones for educational purposes in detail. Moreover, the study aimed to explore the potential personal factors that predict students' educational mobile phone use in terms of facilitation, distraction, and connectedness sub-dimensions. Hence, the present study is significant to focus on the whole picture rather than just one aspect. In other words, a comprehensive perspective is provided on undergraduate students' mobile phone usage in the academic environment by considering both positive and negative aspects.

As Quaglia and Corso (2014) stated, "in this era of prolific use and debate regarding the utility, integration, and efficacy of educational technology devices such as tablets and smartphones, one constant that is frequently missing from the purported ideologies and opinionated inferences is the perspective of the learner or user" (p.21). Thus, this study will shed light on the learner perspective on the use of mobile phones in an academic environment.

Furthermore, most of the studies of using mobile phones for educational purposes that conducted by using qualitative analyses in the literature (Ford, 2016; Guchun, 2016; Dukik & Chiu, 2015; Gikas & Grant, 2013). On the other hand, when the quantitative studies were examined in the field, it was seen that the majority of them were carried out through acceptance models such as TAM and UTAUT (e.g., Bryant, 2016; Cheon, Lee, Crooks, & Song, 2012; Abu-Al-Aish & Love, 2013; Pan, Chang, & Sun, 2013; Iqbal & Qureshi, 2012; Vankatesh, Thong, & Xu, 2012; Lownthal, 2010; Wang, Wu, & Wang, 2009). The present study is an attempt to offer a new measurement approach for the assessment of educational mobile phone use.

This study is important to better understand undergraduate students' current educational mobile phone use, and to unravel what motivates them to use their mobile phones for educational purposes. Thus, the university or policy makers will be able to see mobile phones from an academic standpoint, which may help develop a vision and plan in terms of using of mobile technology tools to support students in the academic environment.

Lastly, this study will be helpful for the sectors interested in educational technologies while designing or updating strategy and policy in terms of mobile phones and mobile learning. The results of the study may also be useful for the developers of mobile learning systems or applications while designing their products or systems.

1.5 Definitions of the Terms

To provide clarity of some terms, the definitions of them are given in this section. In support of the research questions and literature review, the following definitions are utilized in the study:

Academic Life

It corresponds to the school life including all school work, which is about professional life at university (i.e. courses, seminars, workshops, career days, university clubs, and all other university activities.).

Academic Environment

In the present study, the term "academic environment" is defined as used in the study of Jones (2011); "The setting in which an individual attempt to learn while accessing resources and materials provided at or through a formal institution of learning" (p. 13).

Connectedness

It is defined as "the state of being connected and having a close relationship with other things or people" by the Cambridge Dictionary (2018).

Distractor

It is defined as "something that prevents someone from giving their attention to something else" by the Cambridge Dictionary (2018).

Facilitator

It is defined as "someone who helps a person or organization do something more easily or find the answer to a problem, by discussing things and suggesting ways of doing things" by the Cambridge Dictionary (2018).

Mobile Device

The mobile device basically refers to any device that allows users to access information in anywhere and at any time. In a comprehensive way, Kainz (2011) defines the mobile device as “a contemporary paradigm for connecting, communicating and getting things done on mass-customized and yet personal relationship level that extends to the devices themselves” (p. 12).

Mobile Phone Self-efficacy

Bandura (1986) defined self -efficacy as “People's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances” (p. 391). According to this definition, mobile phone self-efficacy is people’s beliefs about their capabilities to successfully establish a given task or behavior using the mobile phone.

Motives for Mobile Phone Use

In the present study, this term refers to the motivation level of the students according to their priority in general mobile phone use. In other words, students identify their main purposes for the mobile phone use.

Smartphone

In this study, a smartphone is defined as a mobile phone with advanced computing ability which enables users to download various materials, high-speed access to the Internet, data storage, record videos, take photos, send/receive e-mails, install and operate third party applications. In the present study, “mobile phone” term was used for the “smartphone” instead of the cell phone.

1.6 Outline of the Study

In the present study, Chapter 1 explains the background of the study, the purpose of the study, the research questions, the significance of the study, the definitions of the terms, and the abbreviations used in the study.

Chapter 2 represents the literature of review, which includes mobile learning, the FRAME model as the theoretical framework of the study, mobile as the mobile learning device, research on the use of mobile phone in terms of facilitator, distractor, and connectedness aspects, and the predictors that affects the use of mobile phone in academic environment.

Chapter 3 presents the research design, research questions and sample of the study, data collection instruments, the procedure of the data collection, data analysis, limitations, and the assumptions of the study.

Chapter 4 represents the descriptive and inferential results of the study.

Lastly, the results of the study are discussed in Chapter 5. Then, the implications for practices and recommendations for further studies are presented.

CHAPTER II

LITERATURE REVIEW

The present study focuses on undergraduate students' mobile phone use behavior in the academic environment. The aim of this chapter is to give information about the review of relevant literature related to mobile learning, mobile learning in higher education, initial framework of the mobile learning, mobile phone as the mobile learning device, and predictors of mobile phone use in an academic environment, respectively.

2.1 Mobile Learning

The term "mobile learning" refers to the use of mobile technologies to deliver learning materials to the learners (Parsons & Ryus, 2006). Cell phones, smart-phones, palmtops, handheld computers, tablet PCs, laptops, and personal media players are the typical examples of the mobile devices. Since the definition of mobile learning varies among researchers, it is important to clarify how the term is used in the literature. According to Keegan (2005), mobile learning is "the provision of education and training on smartphones and mobile phones" (p. 3). Similarly, Peters (2007) defined mobile learning as a form of learning supported by mobile technologies. However, these definitions were considered technology-centric by some researchers (e.g., Traxler, 2007; Vosloo, 2012). Another definition was provided by Motiwalla (2007), who described mobile learning as individualized learning from anywhere at any time. Similar to this definition, El-Hussein and Cronje (2010) brought a comprehensive definition and stated that mobile learning "any type of learning that takes place in learning environments and spaces that take account of the mobility of technology, mobility of learners and mobility of learning" (p.21). In this definition, mobility is not only the feature of technology but also the feature of the learner and learning. In some studies, mobile learning is not regarded as one type of learning. Indeed, it was defined as learning facilitated by mobile devices (Herrington & Herrington, 2007; MoLeNET, 2007; Valk, Rashid & Elder, 2010). In the same way, O'Malley, Vavoula, Glew, Taylor, Sharples, and Lefrere (2005) defined mobile learning as "any sort of learning that happens when the learner is not a fixed, predetermined location, or the learner that happens when the learner takes advantage of the learning opportunities offered by mobile technologies" (p. 7). In the scope of this study, the definitions in which mobile devices are considered as a facilitator of learning in anywhere and at any time was taken into account since any mobile learning system was not used.

While some studies evaluated mobile learning as an independent learning platform (Nyiri, 2002; McLean, 2003), the majority think that it is an extension or evolution of e-learning (Harris, 2001; Shephard, 2001; Hoppe, Joner, Millard, & Sharples, 2003; Brown, 2005; Peters, 2007). Shepard (2001) also stated that it differs from traditional e-learning because mobile learning includes the mobile environment in addition to electronic environments. This means that the combination of e-learning and mobile device moves the educational process a step forward in terms of being "just in time, just enough, and just for me" (Peters, 2007). Thus, as an educational method, mobile learning has been accepted more recent and more flexible than the previous e-learning applications (Georgiev, Georgieva, & Trajkovski, 2006).

According to Sharples (2006), the key characteristics of mobile learning are as follows: firstly, it allows learners knowledge acquisition in different context; secondly, it is real and situated, which means that the gathered data is unique to the current location and time; thirdly, it is personalized, which means to be able to plan personalized learning path; fourthly, it provides connectivity and interactivity in the learning environment, and lastly, the context of mobile learning is beyond time and space. In a similar way, Ally (2009) put these aforementioned attributes on the center of mobile learning, which are portability, immediacy, individuality, connectivity, and accessibility.

According to Liu, Zhao, Zheng, and Jin (2008), mobile learning has brought three important advantages compared to traditional learning. Firstly, they stated that there is a shift from individual learning to social learning. Students can share and exchange information with each other easily. Secondly, mobile learning brings the advantage of informal learning which allows students to take their devices anywhere and at any time. Thirdly, by means of mobile learning, situated cognition has become a more widespread learning model, which provides deep understanding and better memory. Ahn (2018), in his study, categorized the advantages of mobile learning under six titles, which are portability, ubiquity, flexibility, collaboration, authentic and situated learning, and personalized learning. In the above, each category was explained in detail.

Instead of the advantages of mobile learning, it has some drawbacks which were divided into three categories by Stockwell and Hubbard (2013) as follows: physical, pedagogical, and psycho-social. First of all, physical limitations can occur since many mobile devices are not produced for educational purposes. Hence, as Miangah and Nezerat (2012) stated, this makes learning harder for users. Some physical issues indicated in some studies (e.g., Mehdipour & Zerehkafi, 2013; Miangah & Nezarat, 2012; El-Hussein & Cronje, 2010; Wang et al., 2009; Stockwell, 2008; Pettit & Kukulska-Hulme, 2007; Chinnery, 2006; Thornton & Houser, 2005) as follows: small screen size, connectivity, limited storage, limited input capabilities, reading difficulty, and power. Another technical issue is the compatibility of mobile phones, which is hard to perform mobile learning systems on all platforms. However, the aforementioned physical issues are reduced along with the development of the technology. Pedagogical issues are indicated as the second disadvantage of mobile learning, which is the related design of mobile learning content and activities. As Kukulska and Shield (2007) indicated, the full potential of mobile technologies is not used to support mobility and portability of the mobile learning systems. The other issue regarding pedagogical limitation was the evaluation of the learners (Wang & Higgins, 2006). Although being beyond time and space is the advantage of mobile learning, this feature makes hard to track learners in terms of their achievements. This means that learners should be highly self-disciplined, which is a rare skill among young students. Environmental factors such as being on the move or unsuitable circumstances affect negatively learning (Stockwell, 2008). As the third and last limitation is related psycho-social issues. Some studies showed that students did not use their mobile phones for educational purposes since they used for personal needs rather than educational purposes (Thornton & Houser, 2005; Stockwell, 2008; Wang & Higgins, 2006).

2.1.1 The Framework for the Rational Analysis of Mobile Education (FRAME) Model

In order to understand each component of mobile learning, the present study needed an over-arching framework. For this purpose, the FRAME model was chosen, which was developed by Koole (2005) and Koole and Ally (2006). This model was accepted as the first comprehensive theoretical framework for mobile learning. In this model, mobile learning was defined as a process resulting from the convergence of mobile technologies, human learning capacities, and the social interaction. It is helpful for educators in terms of planning and designing mobile learning environments (Parks, 2011). A Venn diagram was used to represent the FRAME model.

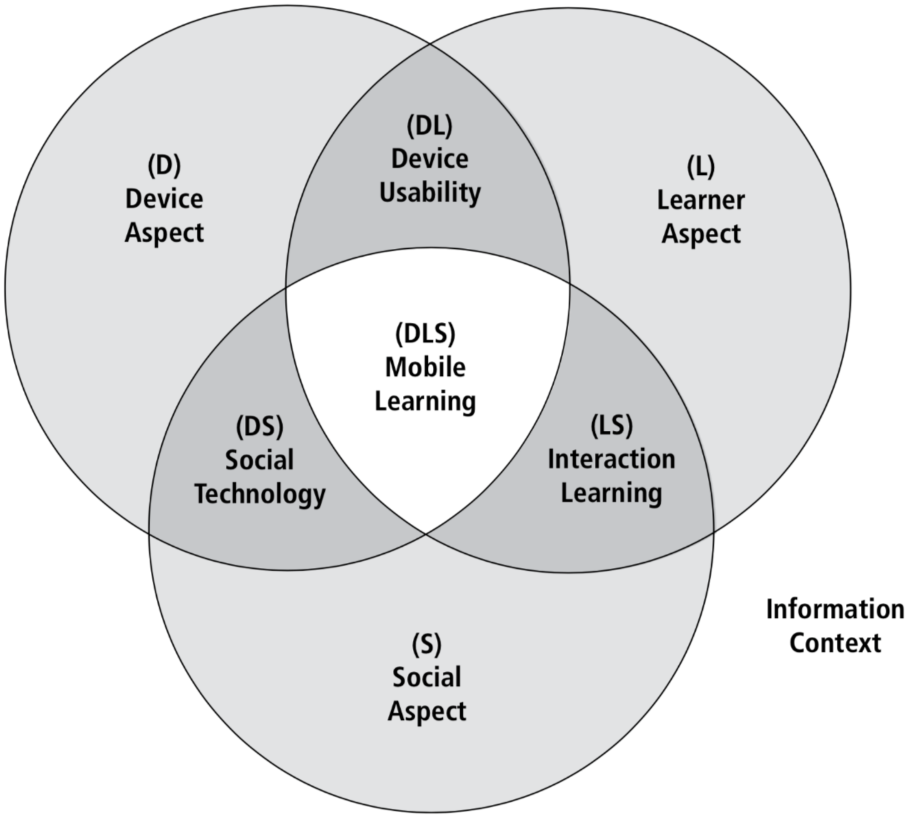

Figure 2. 1 The FRAME model

As seen in Figure 2.1, the three circles represented three main aspects, namely Device Aspect (D), Learner Aspect (L), and Social Aspect (S). There are also three intersection areas, which are comprised of two different aspects. It can be seen that combining Device Aspect with Learner Aspect forms Device Usability (DL) intersection. Social Technology (DS) intersection is composed of Device Aspect and Social Aspect. The other intersection region combines Learner Aspect and Social Aspect, which is called Interaction Learner (LS). Lastly, there is also a primary intersection called as Moble Learning (DLS), which represents a convergence of all three aspects in the model. Each aspect and intersection are explained as follows:

Device Aspect (D): Device Aspect (D) represents the mobile devices and their technical, physical features, and capabilities. It is important because of functioning as a bridge between the *learner* and *the learning task(s)* (Koole, 2009). In this aspect, several criteria are determined for the evaluation of the mobile learning such as physical characteristics, input/output capabilities, file storage and retrieval systems, processor speed, and error rates. These characteristics address the design of software and hardware, and significantly affect the physical and psychological comfort levels of the learners.

Learner Aspect (L): It refers to the situations and tasks that the student wants or needs to succeed. Learner aspect highlights the learner characteristics that include cognitive ability, memory, prior knowledge, emotions, and possible motivations (Koole, 2009). This aspect explains what learners already know and how they use, encode, store, and transfer information. Learning theories related to knowledge transfer and learning by discovery are also emerging in this aspect. Besides prior knowledge and past experience, learning environment, task authenticity, and different presentation formats affect learning (Koole, 2009). For instance, learning activites based on authentic situations in a mobile learning system are powerful pedagogical techniques to explore laws within physical and cultural environments.

Social Aspect (S): The social aspect defines social interaction and cooperation. The rules of cooperation to communicate are determined by culture or the culture where the interaction occurs. Moreover, Koole (2009) beleives that these pre-defined rules are important to provide effective communication. She also indicates that the way learners exchange knowledge influences the way for the acquisition of knowledge and sustaining of cultural practices.

Device Usability Intersection (DL): This intersection includes the elements of both Device Aspect (D) and Learner Aspect (L). Koole (2009) describes the characteristics of mobile devices which influence the learners' psychological comfort and satisfaction while interacting with them. In this model, four criteria are taken into account to evaluate device usability. Firstly, portability of the device is important since the learner is able to move the device to different places under different circumstances and climates. Secondly, the learner is able to retrieve the stored information anytime and anywhere. The psychological comfort is the third criteria, which refers to how quickly the user gets used to the mobile device in terms of learning the main functions to accomplish the required tasks. The last criterion is related to the users' satisfaction with the mobile device, which is hard to predict because of being subjective and personal. According to Koole (2006), the satisfaction and enjoyment are affected by the esthetics of the interface, functionality, physical appearance, and preffered cognitive style. In the overall, Device Usability (DL) intersection functions like a bridge between the characteristics and needs of the learner and technical features of the mobile device.

Social Technology Intersection (DS): It includes both Device Aspect (D) and Social Aspect (L). This intersection refers to how mobile devices provide communication and collaboration among multiple learners through multiple systems, and it is mostly based on the "philosophy of social constructivism". Device networking, system connectivity, and collaboration tools are determined as three main criteria for Social Technology intersection (Koole, 2006). Among the criteria, wireless networking is the most important feature in a mobile learning system since it enables learners to collaborate with each other regardless of whether they are physically in the sample place or not (Preece, Rogers, and Sharp, 2002).

Interaction Learning Intersection (LS): Both Learner Aspect (L) and Social Aspect (S) consitute of Interaction Learning intersection. According to Koole (2006), this intersection includes learning and instructional theories, but largely based on the philosophy of social constructivism. Regarding this view, "[learning] is collaborative with meaning negotiated from multiple aspects" (Smith & Ragan, 1999, p. 15). There are three criteria to evaluate Interaction Learning intersection in this model, which are interaction, situated cognition, and learning communities. This intersection highlights the importance of the needs of the learners. According to this model, each learner has a unique culture and environment, so their needs vary from person to person.

Mobile Learning Process (DLS): As the primary intersection of the FRAME model, it contains three elements that belong to Device Aspect (D), Learner Aspect (L), and Social Aspect (S). In an effective mobile learning process, it is expected to provide cognitive environments where learners can appropriately interact with each other, instructors, and course materials (Koole, 2006). By this way, the time for searching and efforts for evaluation of the information are reduced. The mobile learning process has the following three criteria: mediation, information access and selection, and knowledge navigation. The first criteria “mediation” is one of the key points to understand this process. A constant change does occur in the nature of interaction as long as learners interact with each other, materials, tools, and knowledge (Vygotsky, 1978). Thus, the mobile learning process is also reshaped and redefined in itself by the interaction between Device (D), Learner (L), and Social (S) aspects. The second crucial criterion is to access and select information. Since the number of available information increases, the learner must be more cautious to identify the accuracy and appropriateness of information. It can be said that there is a paradigm shift from knowledge production to knowledge navigation (Brown, 2005). Therefore, in a mobile learning process, knowledge navigation is determined as the third criterion. Accordingly, the teacher or expert acts as a mentor who assists learners in gaining skills to evaluate accurate knowledge and to apply it on their own or new situations. Overall, the FRAME model in which Device (D), Learner (L), and Social (S) aspects and their relationship with each other are considered in detail might provide a better insight into mobile learning systems.

2.2 Mobile Phone Use in the Academic Environment

Mobile phones, also known as cellular phones or simply cell phones, is a wireless handheld telecommunication tool that enables users to communicate vocally and send/receive text messages (Korucu & Alkan, 2011; Quinn, 2011). However, they have evolved into smartphones which have many additional features including voice

and video calling, web-surfing, storing, cameras, games, video players, application installation, numerous mobile Web 2.0 tools, and also navigational systems. That is, it can be said that mobile phones have reached the potential of computers in terms of functionality (Lepp, Barkley, & Karpinski, 2014). This extensive functionality has made mobile phones more preferable than computers, even the other mobile devices, because of being able to carry and access on a regular basis (Caudill, 2007). Moreover, the EDUCAUSE (2011) also reported that the sales of computers were declining and users were choosing mobile devices mostly.

The mobile phone ownerships are tremendously rising around the world due to continuously-strengthening network, ever-lowering cost, and ever-growing phone capacity (Motlik, 2008; Iqbal & Qureshi, 2012). According to the report of Statista, about 36% percent of the world's population uses a smartphone by 2018. And this number is 46% percent of Turkey's population. Moreover, the reports showed that the popularity of mobile phone use is mostly among young people such as university students. In line with the common usage of mobile devices among university students, researchers and practitioners have begun to take advantage of mobile devices in thr academic environment. Besides, some studies reported the potential drawbacks of mobile devices in higher education. In the following parts, mobile phone usage in an academic environment is discussed with regard to the facilitator, distractor, and connectedness roles.

2.2.1 Research on the Use of Mobile Phones as a Facilitator

In regard to facilitator role of mobile phone usage, Gikas and Grant (2013) reported the following themes: (1) accessing information quickly, (2) communication, (3) variety of ways to learn, and (4) situated learning. In the study of Chou, Block, and Jesness (2012), three important benefits of mobile devices were highlighted. Firstly, students actively engaged with the activities through several mobile applications. West (2012) also indicated the importance of mobile devices in terms of student engagement and collaborative learning environment. Secondly, students can save time by using their mobile devices in a project or a task. Lastly, students improved "information literacy" and "digital citizenship". This means that students can search or get information in a faster pace, and they discovered the features of digital citizenship during the process. Furthermore, Looi et al. (2009) indicated that "when compared to the wide range of technologies at our disposal, the highly personalized nature of mobile devices provides an excellent platform for the development of personalized learner-centric educational experiences marked by flexibility, customization, collaboration, active participation, and co-creation" (cited in Ciampa, 2013, p. 94). There are many studies that support the aforementioned points to emphasize the facilitator role of mobile phone usage. For example, in a meta-analysis study of exploring the effectiveness of integrating mobile technologies on student learning, Sung, Change, and Liu (2016) chose 110 studies published between 1993 and 2013 where experimental and quasi-experimental research designs were applied. The study showed that the use of mobile devices in students' learning was more effective than the use of a desktop computer or the use of any devices.

Some research showed that mobile technologies were used for informal learning by students. For instance, Clough, Jones, Andrew, and Scanlon (2008) investigated how mobile devices were used for informal learning. According to the results, many informal activities, such as sharing information, interacting with web forum and wiki entries through posting or answering questions, were performed by participants.

Another similar study was conducted by Cook et al. (2008), which aimed to explore the educational use of mobile technologies informally by master students. The participants in the study felt that mobile phones facilitate administrative issues, social interaction, and informal learning. The activities such as recording interviews, communicating via text and calls, and taking photos were mostly used by them.

Furthermore, mobile technologies provide a situated learning environment. For example, some studies aimed to explore the role of the mobile phone in a museum setting (Sharples et al. 2007; Pierroux, 2008). These studies showed that mobile phones play a role in data collection and communication among participants. Sharples et al. (2007) also indicated that the students took the advantages of mobile phones in terms of audio or video recording, taking photos, and searching for special information related to the museum.

In their study, Lopez Hernandez and Silva Perez (2014) investigated mobile technologies penetration into an online environment in Spain. The study included 460 university students. The results showed that 25% of students used their mobile devices to access the Learning Management System (LMS) for learning purposes.

Vazquez-Cano (2014), in his study, aimed to explore whether smartphones positively affected students' academic learning or not. For this purpose, data was collected from 388 university students through a descriptive and quantitative methodology. The results of the study indicated that smartphones and subject oriented applications were helpful for students to enhance their learning practices. Furthermore, smartphones provided collaborative learning environment among students and instructors.

A recent study was conducted by Bakay (2017), which investigated the effectiveness of mobile device supported learning environment on vocabulary acquisition. He especially chose English Preparatory School students for the study. Both quantitative and qualitative research methodologies were utilized. A quasi-experimental design and semi-structured interviews were carried out in the quantitative and qualitative phases, respectively. The results of the quantitative phase showed that mobile device supported learning environment had a positive effect on students' motivation and achievement in English vocabulary learning. These results were supported by the qualitative phase. However, the students indicated that although mobile devices facilitated their learning they found some disadvantages in mobile device supported the learning environment, which was lack of seriousness of learning by mobile devices, challenge to take photos in some environments, learning fewer words, and requesting more energy for completing the task.

2.2.2 Research on the Use of Mobile Phones as a Distractor

Although many studies advocate that mobile phones can be used as a learning tool, some studies showed they can be a distractor in an academic environment (Bellur, Nowak, & Hull, 2015; Dietz & Henrich, 2014; Junco, 2012; Ravizza, Hambrick, & Fenn, 2014; Sana, Weston, & Cepeda; Froese et al., 2012; Wood & Bell, 2008). For instance, End, Worthman, Mathews, & Wetterau, 2009) conducted an experimental study to investigate the effect of cell phone ringing on learning through video lecture. Seventy-one undergraduate students joined the study, which was randomly assigned to a “ringing” condition or a “no-ringing” condition. While participants watched an educational video lecture, the ones who were in “ringing” condition were exposed to cell phone ringing. After the video session, a multiple-choice exam related to the lecture was administrated. The results showed that participants who were in “no-ringing” condition got a better grade than those in the “ringing” condition.

Similarly, Shelton et al. (2009) conducted experimental research to demonstrate the distractive effect of the mobile phone ringing. They had four groups, two in a laboratory environment and the other in a real classroom environment. In both laboratory setting and real classroom setting, participants were exposed to a standard mobile phone ringing for 30 seconds while they were at an intense concentration moment. Results obtained from the laboratory experiments showed that mobile phone ringing negatively affected while performing cognitive tasks. Then, the real-world experiment was tested. The mobile phone rang for 30 s at an unexpected time during the lecture and the instructor carried out lecturing while the mobile phone was ringing. Participants were measured with a pop-quiz after five minutes from the ring of the mobile phone. The results generated by the real-classroom settings supported the results of laboratory experiments, which showed that students in the no-ringing condition had significantly higher scores that those in ringing condition.

A similar study was performed by Ellis, Daniels, and Jaregui (2010) by using a quasi-experimental research method. The study aimed to explore the effect of texting messages on academic achievement. Sixty-two business undergraduate students belonging a business course were randomly assigned to “non-texting” condition or “texting” condition. While the students in texting condition were asked to send three text messages to their instructor during the lecture, others were instructed to switch their cell phones off. All participants took a multiple-choice exam at the end of the semester. The results of the study showed that the students in texting condition significantly got worse grades than the ones in non-texting condition.

Recent research was conducted by Gingerich and Lineweaver (2014), which aimed to explore whether the impact of text messaging on learning was distractive or not during the lecture. For this purpose, they utilized an experimental research method. Two experiments with sixty-seven and fifty-six university students were conducted, respectively. Participants were randomly assigned to a “lecture-only” group or a “lecture-texting” group. After the lecture, a quiz was administrated, and also participants were asked to predict their quiz scores. The results showed that the students in the lecture-texting group had lower quiz scores than those in the lecture-only group. Moreover, they felt more confident about predicting their quiz performance. On the whole, these studies highlighted that the distracting features of mobile phones including calling and texting negatively affect students’ learning.

Furthermore, while cell phones only provide texting and calling, smart phones have many functions such as Internet connection, a variety of applications that meet users’ needs, and games. Thus, the distracting features of mobile phones show differences. According to the report by STATISTA (2018), while the number of active Internet users has reached 4.087 million, the number of the unique mobile Internet users is not very different which is 3.827 million. In the same report, it was indicated that 3.297 million people are active social media users while 3.087 million were active mobile social media users. The study conducted with college students showed that students spent nearly the same amount of time for social network sites and texting in a week (Hansni Drumheller, Mallard, McKee, & Schlegel, 2010). Many studies found that there was a negative relationship between time spent on social network sites and academic achievement (Pasek, More, & Hargittai, 2009; Kirschner & Karpinski, 2010; Paul, Baker, & Cochran, 2012).

A survey study by Paul, Baker, and Cochran (2012) aimed to explore the effectiveness of an online social network cites on students’ academic performance in higher education. The sample included 340 business undergraduate students. Structural equation modeling (SEM) was used for the purpose of the study. According to the results, there was a negative relationship between the use of online social networking

(OSN) and academic performance of the students. Furthermore, the study showed that the attention span of the students negatively correlated with the time spent on OSN.

In another study, Chou et al. (2012) indicated that although students improved their information search skills though mobile devices, they could get of track while searching information on the Internet, and they could occupy for longer than intended. Thus, students could not complete their task on time.

2.2.3 Research on the Use of Mobile Phones for Connectedness

Besides increasing student independence, the literature also revealed that mobile learning is helpful in the enhancement of student engagement and communication (Dunn, Richardson, Oprescu, & McDonald, 2013; Hamm, Saltsman, Jones, Baldridge, & Perkins, 2013; Junco, Heiberger, & Loken, 2011). Mobile technologies are considered as important tools for communication because of providing interaction among learners in the classroom and also outside of the classroom (Ciampa, 2013). Not only peer-to-peer, but they also facilitate learner-to-instructor communication. This helps to create a collaborative learning environment, which is accepted as a requirement of "information-age educational system" (Reigeluth, 2009). With these technologies, lecturers can monitor the learning process of their students and can give feedbacks to them easily. Furthermore, learners can reach the learning materials and discuss them with each other.

Many studies supported that mobile technologies were used as a communication tool in order to encourage communication and collaboration among teachers and students (Barker, Krull, & Mallinson, 2005; Clough, 2005; Pattern et al., 2006; Cheung and Hew, 2009). For instance, Thornton and Houser (2004) investigated Japanese university students' pattern of mobile phone use in informal learning situations. The results showed that students most frequently used an email application to mutually exchange course materials with each other. Similarly, Shippe and Keengwe (2014) found that the use of mobile technologies in the classroom enabled a new way of collaboration and connectivity among students. Thus, they recommended educators to reevaluate current instructional models.

A recent study by Alioon and Delialioglu (2017) investigated the effect of authentic collaborative m-learning activities on undergraduate students' engagement and motivation by utilizing mixed method research design. The activities were applied for two consecutive semesters. At the end of the second semester, it was seen that collaboration among students and interaction with instructors increased through the use of mobile learning activities. Students' motivation was also affected positively by the activities in both semesters. Moreover, students' perceptions about authentic activities were positive and they identified them as an appropriate tool for enhancing communication and collaboration with each other.

Viberg and Grönlund (2013), in their study, aimed to explore students' attitudes towards the use of mobile technologies in the second and foreign language in higher education. The sample included 345 students from two different universities, in which students were from different countries. The results of the study showed that the students had positive attitudes towards mobile learning especially in terms of individualization (83%), collaboration (74%), and authenticity (73%). Participants reported that they could collaborate with peers, teachers and other experts and also exchange information through their mobile devices. Overall, the aforementioned studies indicated that mobile phone use increased connection and collaboration among students and teachers in higher education.

2.3 Factors that Affect Academic Use of Mobile Phone

As mentioned in the previous parts, according to FRAME model of Koole (2006), mobile learning had three main aspects such as Social (S), Device (D), and Learner (L) aspect. These aspects intersect with each other, which forms three intersections such as Device Usability (DL), Social Technology (DS), and Interaction Learner (LS) intersection. This model is displayed in a Venn diagram. The conceptual framework of the present study was based on the Learner Aspect (L) and related intersections called Device Usability (DL) and Interaction Learner (LS). Accordingly, the five components related to Learner Aspect were included in the study, which were undergraduate students' (1) demographic characteristics, (2) technology-use related characteristics, (3) motives for mobile phone use, (4) self-directed learning, and (5) self-efficacy beliefs. Figure 2.2 showed the model of the study. Each component of the model is explained in the following parts.

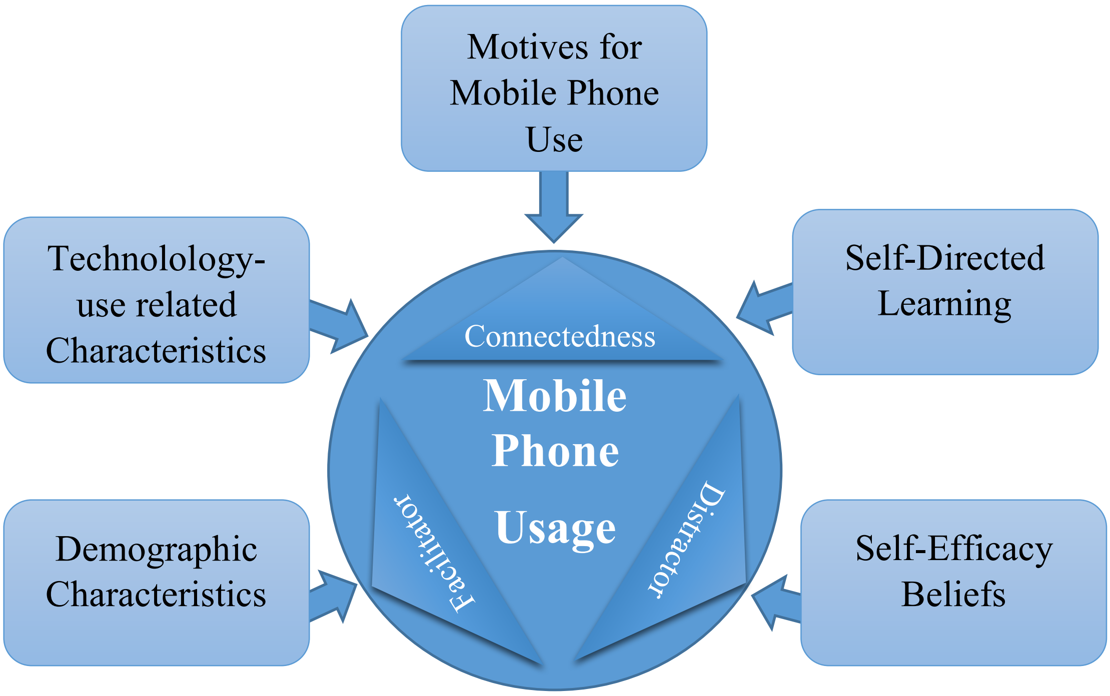

Figure 2. 2 The model of the study

2.3.1 Demographic Characteristics

Several demographic characteristics can predict the use of mobile phone or any technology use in an academic environment such as gender, age, GPA, faculty, study year, family, and socio-economic status etc. A recent study conducted by Pauley (2015) aimed to explore students' perceptions about the academic use of cell phones in higher education. Moreover, the study investigated whether there was a significant difference between the students' perceptions and their certain demographics including gender, study year, and socioeconomic status, and other technology-use related characteristics. The sample included 175 undergraduate students. The results of the study indicated there was no significant difference between the determined demographics and students' perceptions of cell phones in terms of using as an academic tool. Moreover, only study year among other determinants showed a significant difference in students' perceptions of cell phones in terms of possessing as a classroom distraction. More specifically, seniors tended to see their devices less distractive than the sophomores, and sophomores found less distractive than freshman students.

Similarly, Bryant (2016) investigated graduate students' perceptions in terms of multi-modal tablets usage to access e-course materials, and whether there was any significant difference according to students' gender, age, faculty, and tablet owner year. A quantitative research design was applied with 434 graduate students enrolled from different colleges. The results of the study showed that there was not any significant difference among the age groups, faculties, and gender.

Junco (2015) aimed to explore whether the study year affects the relationship between Facebook use and academic performance. The study was conducted with 1649 students from different study years. The results showed that while there was a negative relationship between Facebook use and academic performance for freshman, sophomore, and juniors, there was not any relationship for senior students.

Moran, Hawkes, and El Gayar (2010) examined student acceptance of mobile computing devices through "Unified Theory of Acceptance and Use of Technology (UTAUT)" model. The main objective of the study was to identify the factors affecting behavioral intention to use tablet among undergraduate students. Gender and age were two demographic characteristics included in the model, which did not significantly affect the constructs of the model. On the other hand, it was seen that freshman students had a higher "determination of acceptance" than the students in the other study years.

2.3.2 Technology-use related Characteristics

In addition to demographic characteristics, there are technology-use related factors that affect the use of mobile phone in an academic environment. As indicated in the previous section, the study of Pauley (2015) aimed to investigate the relationship between students' perceptions in term of the use of mobile phones in an academic environment and student' demographics and technology-use related characteristics such as the type of cell phone owned and computer ownership at home. The results related to demographics were presented in the previous section. Concerning technology-related factors, the results showed that smart phone owners tended to see their devices more useful for academic purposes than cell phone owners. Similarly, the smart phone owners found their devices less distractive than the cell phone owners. On the other hand, computer ownership did not have any significant effect in the study.

Bryant (2016), as mentioned in the previous section, aimed to explore graduate students' perceptions in terms of multi-modal tablet usage for accessing electronic materials and the perceived difference based on certain demographics and tablet use year. The results showed that tablet use year resulted in a significant difference in the score of Behavioral Intention. This means that the students with more experience in using tablet had a higher intention to use the multi-model tablet in the future than those with less experience in using tablets.

As mentioned in the previous part of the study, Moran et al. (2010) investigated the factors affecting undergraduate students' behavioral intention to use of tablet by modifying UTAUT model. As another learner characteristics, computer experience was also included in the study, which had a significant effect on the acceptance of mobile computing devices.

In another study, Badwelan and Bahaddad (2017) aimed to investigate the effect of gender and experience on the factors of UTAUT model as a moderator. The study was carried out with 400 college students from several universities of Saudi Arabia. For the experience variable, there were two groups as follows: (1) students with three years or less of mobile experience, and (2) students with more than three years of mobile experience. The results showed that performance expectancy and lecturers' influence were stronger predictors of mobile learning adoption for the students with three years or less of mobile experience than those students with more than three years of mobile experience. On the other hand, it was found that there was no significant difference between these two groups for the lecturers' influence.

2.3.3 Motives for Mobile Phone Use

Along with the development of the mobile technologies, people use their devices for several purposes. While cell phones have only calling and texting features, smart phones let users do almost everything accomplished by computers such as accessing the Internet, downloading applications, note taking, taking photos, video recording, music player, etc. Thus, it can be said that communication and interaction are not the only motivation for the use of mobile phones at all. After a review of the literature, the researcher observed that there were four main motives for mobile phone use as the following: (1) Communication and Interaction, (2) Getting/Searching Information, (3) Tools and Productivity, and (4) Entertainment. The researcher added one more motive called "educational purposes" as the fifth motive to evaluate the role of mobile phone use in the academic environment. This study aimed to examine undergraduate students' major motives for the mobile phone use under these five categories. There were a few studies in the literature examining students' mobile phone use motivations under different categories. For instance, Kang and Jung (2014) stated that major motivations of mobile phone use were information and entertainment seeking, relationship development, security, and relaxation. On the other hand, in the study of Ford (2016), while communication was indicated as the major motives by 86 percent of the students, social media and entertainment were the other important motives of mobile phone use. In another study, Junco (2013) stated that female students used technologies such as cell phones and the Internet for communication while male students used for entertainment. In the study of Kibona and Mgaya (2015), a survey was applied with 100 university students in order to explore the effect of mobile phones on academic performance in higher education. The results showed that 65 percent of the students used their mobile phones for social purposes while 20 percent of them used for academic purposes. 15 percent of them indicated that they used for both purposes.

2.3.4 Self-Directed Learning

Along with the digital revolution in an education setting, self-directed learning has become one of the important constructs in adult education (Williamson, 2007). According to Knowles (1975), the meaning of the self-directed learning is "… a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating goals, identifying human and material resources for learning, choosing and implanting appropriate learning strategies, and evaluating learning outcomes" (p.18). Simply put, self-directed learners can identify their learning needs, set goals, choose the right strategies and resources to achieve these goals, and finally assess their learning outcomes. There are also similar concepts such as self-management learning and self-regulated learning in the literature. Related to the instrument used in the present study, self-directed learning and self-management of learning can be used synonymously. The "self-management of learning" was developed by McVay (2000, 2001) as a factor of Readiness for Online Learning questionnaire. Smith (2005) stated that this factor was obviously similar to the "self-directed learning" factor of the Canfield Learning Styles inventory developed by him in his previous study (Smith, 2001). Then, this factor, namely "self-directed learning" or in "self-management learning", were separately used in some research (Smith et. al., 2003; Wang, Wu, & Wang, 2009; Hung, Chou, Chen, & Own, 2010).

Self-regulated learning is another concept which shows some similarities to self-directed learning (Zimmerman & Lebeau, 2000). Self-regulated learning defined by Pintrich (2000) as "an active, constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behavior, guided and constrained by their goals and the contextual features in the environment” (p. 453).

As seen in both definitions, self-directed learning and self-regulated learning are used to define the ability to manage the learning process. In some studies, these two terms were used interchangeably (Dinsmore, Alexander, & Loughlin, 2008; Boekaerts & Corno, 2005; Bolhuis, 2003; Schreiber, 1998). However, Jossberg, Brand-Gruwel, Boshuizen, and Wiel (2010) stated that self-directed learning could not be used synonymously with and in a similar way to self-regulated learnings since they have the different theoretical background and empirical methods. They proposed that “self-directed learning is situated at the macro level and basically refers to the planning of the learning trajectory, while self-regulated learning concerns the micro level that deals with the execution of a task” (pp.417-418).

As indicated above, self-directed learners have four skills, which are determining learners’ needs, identifying learners’ resources, choosing the right strategies, and evaluate their outcomes. The first two skills –determining needs and identifying resources- are special to self-directed learning (Kicken, Brand-Gruwel, van Merriënboer, & Slot (2009). On the other hand, self-regulated learners control their learning process in a given task. From this point of view, self-directed learning is more comprehensive than self-regulated learning. Thus, self-regulated learning can be thought as a subset of self-directed learning (Loyens, Magda, & Rikers, 2008; Jossberg et. al., 2010). In other words, a self-directed learner is a self-regulated learner as well, but the opposite may not be true. Pilling-Cormick and Garrison (2007) distinguish these terms as covert and overt regulatory schemes. While self-regulated learning is situated as covert regulatory schemes referring internal learning environment; self-directed learning is identified as overt regulatory schemes which correspond external learning environment. Thus, the design features of the learning environment are also considered for development of self-directed learning skills (Loyens et al., 2008).

In this sense, the relationship between technology and self-directed learning was explored in many studies. For example, Huang, Jang, Machtmes, and Deggs (2012) aimed to explore the roles of several learner characteristics including self-management learning (or self-directed learning) on mobile English learning outcomes (MELOs). The data was collected from 167 undergraduate students. The results of the study showed that self-management learning significantly and positively associated with MELO. Similarly, in another study of Huang (2014), the role of self-management of learning in mobile English learning was explored with the sample of 389 undergraduate students.

Similarly, Wang et al. (2009) aimed to explore the possible factors affecting intention use of mobile learning based on UTAUT model. The sample consisted of 330 undergraduate students. The results showed that self-management was one of the significant determinant of behavioral intention to use of mobile learning.

On the other hand, in the study of Yang (2013), a negative relationship was found between self-management learning and mobile learning acceptance. The study aimed to explore the effect of several factors on undergraduate students' mobile learning acceptance through UTAUT2 model. The data was collected from 182 college students in China. The results of the study showed that while hedonic motivation, performance expectancy, social influence, and price value had a positive effect on adoption of mobile learning, self-directed learning had both direct and indirect negative effect on students' mobile learning adoption.

In a recent study, Ahn (2018) aimed to explore how college students used smartphone applications for English language learning (SAELL), and which factors affected college students' behavior intention to use SAELL through UTAUT model. For this purpose, the data was collected from 675 Korean undergraduate students. The results showed that self-directed learning was one of strong predictor of SAELL use among the students.

In the study of Badwelan and Bahaddad (2017), the cultural factors that affect m-learning were explored based on the Unified Theory of Acceptance and Use of Technology (UTAUT) model. The data was collected from 400 undergraduate students in Saudi Arabia. The results showed that self-directed learning was one of the major factors influencing students' intention to use m-learning.

In a recent study, Al-Adwan, Al-Adwan, and Berger (2018) aimed to explore the predictors that affect students' behavioral intention to use mobile learning based on UTAUT model in a developing country such as Jordan. The study was conducted with 444 undergraduate students from four different Jordanian universities. According to the results, self-management learning with other factors, namely, effort expectancy, performance expectancy, trust expectancy, system functionality, and social influence, were the important factors of acceptance of mobile learning in Jordan. Moreover, all these factors accounted for 64.8 percent of the variance in the behavioral intention of mobile learning adoption.

2.3.5 Self-Efficacy

Being one of the affective characteristics situated within the social cognitive theory, self-efficacy is defined by Bandura (1986) as "people's judgments of their capabilities to arrange and execute courses of action required to attain designated types of performance" (p. 391). Simply put, self-efficacy is people's beliefs about their abilities to successfully establish a given task or behavior required to reach a goal. While defining self-efficacy, it is also essential to consider relevant self-evaluation constructs such as self-concept, and self-esteem. At this point, it is essential to define similar self-evaluation constructs such as self-concept and self-esteem in order to avoid any misconception. Self-concept is defined by Rosenberg (1965) as "…the totality of the individual's thought and feelings having reference to himself as an object" (p. 7). Self-efficacy resembles self-concept in predicting people's thought, emotion, and action (Bong & Skaalvik, 2003). However, the major difference is revealed in the target part. While efficacy judgments concern one's perception about his or her capabilities to accomplish a specific task or situation, self-concept represents one's perception of the self in the domain-based. For example, one's expectation about 6 feet in high-jump is an efficacy judgment (Bandura, 1986). On the other hand, being competent or not in high-jumping, in general, is a judgment of self-concept. Difference between self-efficacy and self-esteem is also discussed in the literature. Basically, self-esteem is defined as a person's general feelings of self-worth (Bong & Clark, 1999) and in fact, it is accepted as an affective component of self-concept. Both represent one's perception toward the self. However, while self-esteem consists of more subjective perceptions rather than factual perceptions, self-concept includes all these perceptions (Anderson & Bourke, 2000). In the light of this information, self-efficacy is distinguished from self-concept and self-esteem as it is a more predictive and a rather task-specific construct (Bandura, 1986).

According to Bandura (1977), there are four major sources of self-efficacy as follows: performance accomplishment, vicarious experience, verbal persuasion, and physiological states. *Performance accomplishment* is built on personal mastery experiences, which was emphasized particularly influential by Bandura (1977). Individuals can enhance their self-efficacy beliefs through successful experiences, besides that failures decrease their efficacy beliefs. *Vicarious experience*, as the second source of efficacy information, is basically modeling achievements of other people. Namely, people observe others' performances while coping with threatening activities without negative consequences and compare themselves with others' accomplishments. By persuading themselves that if others can do they can also a success. However, the key point in this source is the models or observed people should be similar to themselves. If the model and the observer are different from each other, the self-efficacy beliefs are not affected by the models' behaviors. *Verbal persuasion* is the third source for strengthening the self-efficacy beliefs. If a person is verbally persuaded by others about his or her capabilities in a realistic boundary, this may help to develop self-efficacy beliefs. However, verbal persuasion (alone) is not effective as much as performance accomplishments and vicarious experience. The last source is the *emotional and physiological state* that can influence self-efficacy beliefs. A person who is depressed cannot judge his/her capabilities accurately, adversely depression mood dampens confidence. The physical situation, like extreme tiredness, also affect personal self-efficacy beliefs. Thus, the fourth way of changing perceived self-efficacy is to decrease people’s level of stress, modify their negative emotional moods and alter their physical states in a positive way (Bandura, 1994). Although the influence of successful experiences is stronger than other sources, change in self-efficacy beliefs reveals a difference in different personal context and outcomes (Zimmerman, 2000).

Self-efficacy is peoples’ judgments about their capabilities to establish a given task so that it has an important effect on people’s choices, actions, and eventually their lives. People with high self-efficacy are eager to set difficult tasks to achieve and they try to overcome obstacles they encounter instead of avoiding them. However, since people with low self-efficacy beliefs view the challenges as their personal deficiencies, they do not persist longer when met with negative outcomes. As stated in the study of McCoach, Gable, and Madura (2013), there is a causal relationship between self-efficacy and student academic variables such as academic achievement, academic motivation, occupational interests, and career choices.

In the field of educational use of technology, self-efficacy was subjected to many studies (e.g, Aypay, Çelik, Aypay & Sever, 2012; Moran, Hawkes, & Gayar, 2010; Venkatesh & Bala, 2008; Teo, 2009; Wong,Teo & Russo, 2012; Vankatesh, Morris, Davis, and Davis, 2003; Yi & Hwang, 2003; LaRose, 2003; Venkatesh & Davis, 1996). For example, Moran, Hawkes, and El Gayar (2010) aimed to investigate students’ acceptance of tablet by using UTAUT model. Moreover, the factors affecting behavioral intention to use table were explored with the sample of 263 university students. Self-efficacy was one of the predictors in the study. The results showed that self-efficacy was one of the strong predictor of behavioral intention to use of tablet.

In another study, Cheon et al. (2012) aimed to explore undergraduate students’ perceptions towards mobile learning. The study was conducted with 177 participants. Attitude, subjective norm, and behavioral control were three predictors for intention to adopt m-learning. Self-efficacy was one of the behavioral control variable, which was found as the strongest predictors.

In another study, Chung, Chen, and Kuo (2015) examined the determinants of acceptance of mobile vocabulary learning applications of Taiwanese EFL college students. The sample consisted of 84 towards participants. The results showed that self-efficacy was significantly associated with the undergraduate students' behavioral intention to acceptance of mobile vocabulary learning apps.

The study of Poong, Yamaguchi, and Takada (2017) aimed to explore the predictors of m-learning acceptance among young adults based on "the Unified Theory of Acceptance and Use of Technology (UTAUT)". The sample of the study consisted of 339 undergraduate students from two different universities in Luang Prabang, Tokyo. The study applied structural equation modeling (SEM) analysis. The results showed that perceived usefulness, perceived ease of use, and perceived enjoyment had a direct relationship with behavioral intention to use mobile learning while self-efficacy and social influence indirectly influenced students' behavioral intention.

CHAPTER III

METHODOLOGY

This chapter comprised of the design of the study, research questions, participants, data collection instruments and data collection procedure, data analysis processes, validity and reliability issues, ethical protection of participants, and assumptions and limitations of the study.

3.1 Overall Research Design

The purpose of this study is to investigate undergraduate students' mobile phone usage in an academic environment. The study also examined the effect and contribution of certain demographics, certain technology-use related characteristics, the motives for mobile phone use, self-directed learning, and mobile phone self-efficacy. In line with this aim, the study utilized a correlational research design in which the researchers aim to explore the possible association between two or more variables with no attempt to control them (Frankel, Wallen, & Huyn, 2012; Creswell, 2012). In the present study, a questionnaire was used by the researcher to gather data from undergraduate students in order to explore mobile phone usage in the academic environment. For this purpose, Mobile Phone Use in Academic Environment Scale (MPUAES) and Educational Mobile Activities Questionnaire were developed by the researcher. Before the data collection, ethical approval was granted from the Applied Ethics Research Center of Middle East Technical University (METU). The data collection instruments were administrated 1924 undergraduate students in 35 different departments of METU. Figure 3.1 presented the overall research design.

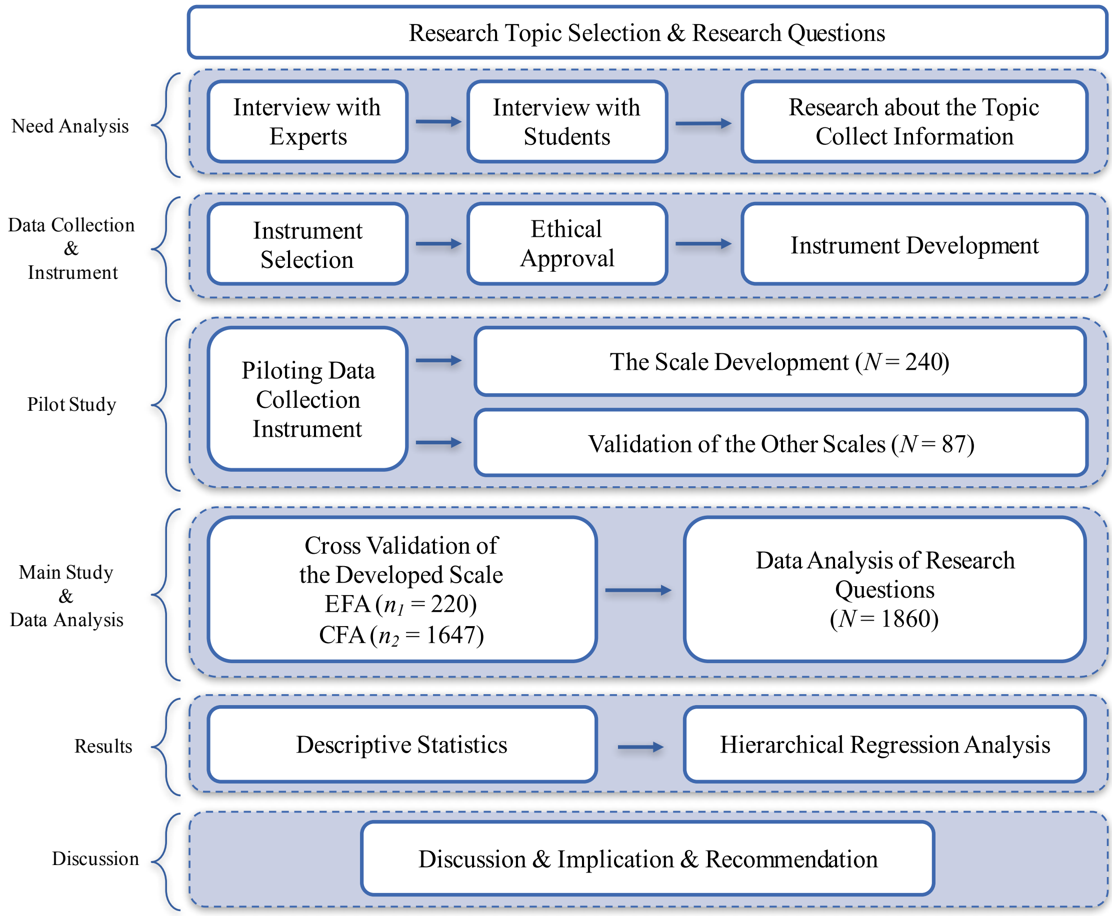

Figure 3. 1 Overview of the study

3.2 Research Questions

In line with the aim of the present study, following specific questions are addressed:

1. How do undergraduate students use their mobile phones for educational purposes?

   a. What is undergraduate students' educational mobile activities usage frequency?
   b. To what extent do undergraduate students consider educational mobile activities useful for their academic work?

c. Which mobile applications do undergraduate students use for academic purposes?
d. What are the undergraduate students' motives for using mobile phone?

2. How do five groups of variables (demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs) predict the undergraduate students' mobile phone use in regard to the following aspects:

    a. Facilitator?
    b. Distractor?
    c. Connectedness?
    d. The total Mobile Phone Use in Academic Environment Scale score?

3.3 Participants

The target population of the current study was all undergraduate students currently enrolled in the all departments of Middle East Technical University. There were 5 public universities in Ankara. Among these universities, Middle East Technical University was the only public university in which language of instruction was English. Since the medium of the instrument in the present study was English, Middle East Technical University was chosen as an accessible population. The stratified random sampling method was applied for the selection of the sample. The advantage of this sampling method is providing more representativeness since the population is divided into certain subgroups, or *strata* and the sample is selected from each stratum of the population in the same proportion (Frankel, Wallen, & Huyn, 2012).

The Middle East Technical University has five faculties and 35 departments in the undergraduate programs. According to the report of the Middle East Technical University *Strategic Plan Office*, there were 14.271 undergraduate students (5.966 females and 8.305 males) in the fall semester of 2016-2017. Table 3.1 indicated the distribution of these students according to the faculties and the departments.

Table 3. 1

Frequency Distribution of Undergraduate Students in METU by Department and Faculty

Faculty	f	Department	f
Architecture	*909*		
		ID	226
		ARCH	426
		CRP	257
Arts & Science	*2819*		
		BIO	238
		GENE	166
		PHIL	192
		PHYSC	476
		STAT	217
		CHEM/CHED	307
		MATH	367
		PSY	330
		SOC	347
		HIST	179
ECON & ADM Sci.	*1978*		
		ECON	574
		BA	528
		PADM	485
		IR	391
Education	*1219*		
		CEIT	177
		FLE	474
		ESE	195
		EME	197
		ECE	176
Engineering	*7346*		
		CENG	618
		ENVE	289
		EEE	1125
		IE	491
		FDE	345
		AEE	482
		CE	1123
		GEOE	303
		CHE	551
		MINE	314
		ME	1033
		METE	393
		PETE	279
TOTAL	*14271*		*14271*

Considering the size of the accessible population and the number of items on the instruments, a rate of 10 % from each department was selected for the sample. As seen in Table 3.2, the percentage of each faculty in the university and in the selected sample had a similar number.

Table 3. 2

Percentage of Undergraduate Students by Faculty in the Middle East Technical University and in the Sample

Faculty	Percent in METU (%)	Percent in the Sample (%)
Architecture	6.4	5.8
Arts & Science	19.8	18.7
ECON & ADM Sci.	13.9	14.5
Education	8.5	14.6
Engineering	51.4	46.3

The data were collected from 1928 students. The inclusion criteria for this study was defined as any undergraduate student who was still studying at METU and owned a smart phone. The students who had cell phones were requested not to continue the questionnaire after the sixth question. In data screening, 12 of them were removed because of violation of the criteria "having a smartphone". Moreover, 49 of them were discarded since those students left most of the items in the questionnaire blank, created a pattern, or filled the same option. Finally, the study comprised 1867 questionnaires as shown in Table 3.3.

Table 3. 3

Frequency Distribution of Undergraduate Students in the Sample by Department, and Faculty

Faculty	*f*	Department	*f*
Architecture	*109*		
		ID	41
		ARCH	32
		CRP	34
Arts & Science	*340*		
		BIO	31
		GENE	34
		PHIL	41
		PHYSC	56
		STAT	33
		CHEM/CHED	42
		MATH	47
		PSY	32
		SOC	44
		HIST	33
ECON & ADM Sci.	*270*		
		ECON	54
		BA	70
		PADM	73
		IR	58
Education	*273*		
		CEIT	35
		FLE	46
		ESE	79
		EME	44
		ECE	43
Engineering	*865*		
		CENG	59
		ENVE	30
		EEE	108
		IE	96
		FDE	67
		AEE	51
		CE	147
		GEOE	33
		CHE	46
		MINE	32
		ME	119
		METE	39
		PETE	38
TOTAL	*1867*		*1867*

The first part of the survey was for the students' demographic profiles including gender, age, GPA, faculty, department, year of the study; and for technology use-related characteristics including the kind of mobile device, the year of owning certain mobile devices, the number of applications, the type of operating systems, and the frequency of the Internet use.

Table 3. 4

Characteristics of the Sample (N = 1867)

Variable		*f*	%
Gender			
	Female	962	51.5
	Male	896	48.0
	Other	9	.5
Faculty			
	Architecture	109	5.8
	Arts & Science	350	18.7
	ECON & ADM Sci.	270	14.5
	Education	273	14.6
	Engineering	865	46.3
Study Year			
	Freshman	529	28.3
	Sophomore	542	29.0
	Junior	457	24.5
	Senior & Senior (+)	339	18.1
Age			
	<19	18	1.0
	19	162	8.7
	20	366	19.6
	21	412	22.1
	22	381	20.4
	23	304	16.3
	24	118	6.3
	25	51	2.7
	26+	55	2.9
GPA			
	0.00-1.00	19	1.2
	1.01-1.50	43	2.6
	1.51-2.00	128	7.8
	2.01-2.50	422	25.6
	2.51-3.00	481	29.2
	3.01-3.50	325	19.7
	3.51-4.00	229	13.9

Of 1867 undergraduate students, 962 were female (51.5 %) and 896 (48 %) were male, and 9 of them indicated gender item as “other” as seen in Table 3.4. The data were collected from five different faculties of the Middle East Technical University. The undergraduate students were distributed as follows: 109 (5.8%) from the faculty of architecture, 350 (18.7%) from the faculty of arts and science, 270 (14.5%) from the faculty of economics and administrative sciences, 273 (14.6 %) from the faculty of education, 865 (46.3%) from the faculty of engineering. The students were chosen from all study years and almost equal distribution was observed with 529 (28.3%) freshman, and 542 (29.0) sophomore students. Then, 457 (24.5%) students were junior, and 339 (18.1%) of them were senior and senior plus (studying more than four years). The age of the participants was divided into nine categories in the survey. Table 3.4 showed that more than half of the participants of the survey was 20, 21, 22, and 23 years old with the percentage of 19.4% (n = 320), 22.3% (n = 366), 16.7% (n = 334), respectively. A rate of 8.7% (n = 162) of the participants was 19 years old, while 6.8% of them (n = 118) was 24 years old. The students whose age 25 years old (n = 51), and above 26 years old (n = 55) formed 2.7% and 2.9% of the sample, respectively. The students whose age under 19 years old was only 1.0% of the sample (n = 18). With regard to GPA, most of the participants had a GPA between 2.51 and 3.00 (29.2%), then between 2.01 and 2.50 (25.6%). The students whose GPA between 3.01 – 3.50 (19.7%) and 3.51 – 4.00 (13.9%) also comprised of the majority of the sample. The students who had a GPA between 1.51 – 2.00 constituted of 7.8% of the sample. As indicated in Table 3.4, the lower GPA groups 1.01 – 1.50 (2.6%) and 0.00 – 1.00 (1.2%) had lower percentages.

3.4 Data Collection Instruments

In this study, multiple data collection instruments were used (see Appendix L): (1) Demographics Part, (2) Educational Use of Mobile Phone Part, (3) The Mobile Phone Use in the Academic Environment Scale (MPUAES), (4) Self-Directed Learning (SDL) Scale, Mobile Phone Self-Efficacy (MPSEF) Scale. Detailed information about these instruments was shown in Table 3.5.

Table 3. 5

Data Collection Instruments

Instruments	Variables	References for the item sources
Demographic Information Part (9 questions)	▪ Gender, Age, GPA, Faculty, Department, Study year - (5) ▪ Technology-related questions - (4): The kind of mobile device and year of use, number of total applications, operating systems in a mobile phone, Internet use through mobile service package, Wi-Fi at school, Wi-Fi at home	Self-developed
Educational Use of Mobile Phone (3 sections)	▪ Frequency/ Usefulness of several educational activities done by mobile phones (29-item) ▪ 36 applications/services that students use for educational purposes. ▪ The motives for mobile phone use	Self-developed Self-developed Suki and Suki (2007); Altıntaş (2012)
Mobile Phone Use in Academic Environment (18-item)	▪ Facilitator ▪ Distractor ▪ Connectedness	- Self-developed - Items based on Mobile Phone Affinity Scale developed by Bock, Lantini, Thind, Walaska, Rosen, Fava, Barnett & Scott-Sheldon, (2016)
Self-Directed Learning (4-item)	▪ Perception of the ability to manage the learning process	McVay (2000, 2001)
Mobile Phone Self-Efficacy (5-item)	▪ Beliefs about the capability to establish a given task via mobile phones.	Compeau and Higgins (1995)

3.4.1 Demographic Information Part

In this part, there were nine questions including gender, age, GPA, faculty, department, year of study. This part also had technology-related questions such as the kind of mobile devices that participants have, the number of mobile applications that they use, the operating system of their mobile phones, and the frequency of Internet use through mobile service package, the Wi-Fi at school and at home.

3.4.2 Educational Use of Mobile Phone

The second part of the instrument divided into three sections. The first section included 29-item asking frequency and usefulness of the educational activities that the students perform with their mobile phones. For both frequency and usefulness, a 5-point Likert type scale was used. While frequency was ranged from (1) Never to (5) Very frequently, usefulness was ranged from (1) Not at all useful to (5) Extremely useful. The second section of this part was a list of the applications/services used for educational purposes. The students were asked to indicate the one(s) that they use mostly on this list. Both of these two sections were developed by the researcher based on literature (Clough, Jones, & Scanlon, 2007; Son, 2007; Pollara, 2011; Bomhold, 2013; Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013; Ng, Hassan, Nor, & Malek, 2017) and the results of interviews with undergraduate students. Informal interviews were done with 25 undergraduate students within five different faculties. Unlike structured and semi-structured interviews, informal interviews are less formal, and this type of interview aims to figure out "what people think and how the views of one individual compare with those of another." (Fraenkel, Wallen & Hyun, 2012, p. 451). These sections were checked by five research assistants doing Ph.D. and two professors in different departments of the faculty of education. Cognitive interviews were also done with the students in order to determine possible response errors of the items.

As can be seen from the Table 3.6, out of 25 interviewees, 8 of them were from the faculty of engineering, the number of the participants (*n* = 5) was the same for both the faculty of architecture and the faculty of education, 4 of them were continuing in the faculty of arts & science, and 3 of them were from the faculty of economic and administrative sciences.

Table 3. 6

Characteristics of the Interviewees (N = 25)

Faculty/ Department	*f*	%
Architecture	5	20
Arts & Science	4	16
ECON & ADM Sci.	3	12
Education	5	20
Engineering	8	32

The interview consisted of 9 questions such as “Which features of your mobile phone do you use for educational purposes?”, “Which applications do you use for educational purposes?”, “Which of these applications do you use mostly in the classroom or out of the classroom? And how do you use?”, and “Do you use METU-Class through your mobile phone?” (for the whole instrument, see Appendix A). The data obtained from the interviews provided important insight into the researcher about the students' educational mobile phone use.

In the last section, the motives for mobile phone use were categorized into five as follows: ‘Communication & Interaction’, ‘Getting/Searching Information’, ‘Tools & Productivity (calendar, notes, flashlight, alarms)’, ‘entertainment’, and ‘Educational (academic) Purposes’. The students evaluated their motivation level for each category between 1 (lowest) and 10 (highest) considering their priority in general mobile phone use. This section was developed by the studies of Suki and Suki (2007) and Altıntaş (2012), who investigated students’ perceptions about the motivation of web 2.0 usage in her study. Different from the reference studies, the last option “educational purposes" was added by the researcher. This motive corresponds to the 29-item questionnaire in the first section of the part two, for which additional information was given within parentheses in the instrument.

3.4.3 Mobile Phone Use in Academic Environment Scale

The Mobile Phone Use in Academic Environment Scale (MPUAES) was adapted from the Mobile Phone Affinity Scale (MPAS) (Bock, Lantini, Thind, Walaska, Rosen, Fava, Barnett & Scott-Sheldon, 2016).

The scale was a 5- point scale ranging from 1 = "*not at all true*" to 5 = "*extremely true*". The initial version of the scale consisted of 57 items with seven constructs. There were not any negatively stated items, all were positively stated. After conducting Confirmatory Factor Analysis (CFA), some items with poor loadings (<.4) or with high cross-factor loadings were removed. The final scale consisted of 24-item with a six-factor model. Unlike previous studies, Bock et. al (2016) assessed both negative and positive aspects of mobile phone use. Thus, 6-factor of the MPAS was assigned as follows: *Connectedness*, *Productivity*, and *Empowerment* as positive sub-dimensions, *Anxious Attachment*, and *Addiction* as negative sub-dimensions, and *Continuous Use* as a neutral sub-dimension. Each factor (Connectedness, Productivity, Empowerment, Anxious Attachment, Addiction, and Continuous Use) was measured with four items (see Appendix D). Cronbach alpha coefficient for each subscale were $\alpha = .78$ for connectedness, $\alpha = .85$ for productivity, $\alpha = .88$ for empowerment, $\alpha = .86$ for anxious attachment, and for $\alpha = .86$ for addiction.

As indicated, the Mobile Phone Affinity Scale (MPAS) assesses both the good and bad aspects of mobile phone use in the work environment. The present study developed the Mobile Phone Use in Academic Environment Scale (MPUAES) based on the 24-item of the MPAS, of which adapted to the academic environment (see Appendix E). The following sections explained the development process of the MPUAES, in detail.

3.4.3.1 The Development Process of the Mobile Phone Use in Academic Environment Scale

Before starting to the development process of the MPUAES, the researcher asked permission to use the items of the Mobile Phone Affinity Scale. For this, the researcher communicated with Beth Bock, the first author of the article (Bock, Lantini, Thind, Walaska, Rosen, Fava, Barnett & Scott-Sheldon, 2016) via e-mail (see Appendix B). After obtained permission, the researcher worked with three experts in the field of Computer Education and Instructional Technology, with one expert in the field of Curriculum and Instruction, and lastly with one expert in the English language. Besides excluding some words related to work environment, some words were included to create an instructional environment.

Furthermore, Cognitive interviews with three undergraduate students were done before piloting the scale, which is important for detecting possible response errors and to find the reasons for these errors in the survey (Willis, 2004). The students evaluated the items to avoid misunderstanding and hence unintended responses. With the guidance of student comments, to make them more understandable, some items were revised by adding a more prevalent verb near some rather less-known ones. For example, one of the items was revised to: “My phone helps me keep track of –follow- my academic life.”. Moreover, an operational definition was given at the beginning of the survey to clarify the meaning of “academic life”.

3.4.3.2 Pilot Study

For the pilot study, the data were collected from 240 undergraduate students who were still studying in any departments of Middle East Technical University in the fall semester of 2015-2016. The demographic information part included gender, current GPA, age, faculty, department, and graduate level.

Of 240 students, 140 were female (58.3%), 99 were male (41.3), and one student responded gender item as other. The participants were from four different faculties.

The distribution was as follows: the majority of the students (n = 84) was from the faculty of Arts & Science (35%); 72 of them were from the faculty of Education (30%); 70 of them from the faculty of Engineering (29.2%); and 14 of them were from the faculty of Economics and Administrative Sciences. The students from all study years were included in the study. 87 of the sample were the freshman (36.3%), 70 of them were sophomore (29.2%), 50 of them were junior (20.8%), and 33 of them were senior and senior plus (13.8%). In Table 3.7, demographic information of the pilot study was presented.

Table 3. 7

Distribution of the Participants in Pilot Test by Gender, Departments, and Study Year (N = 240)

Faculty	Department	Frequency (*f*)	Percent (*%*)
Arts & Science		84	35.0
	SOC	60	25.0
	MATH	13	5.4
	PHIL	7	2.9
	CHEM/CHED	4	1.7
ECON & ADM Sci.		14	5.8
	PADM	14	5.8
Education		72	30.0
	FLE	39	16.3
	CEIT	32	13.3
	ESE	1	.4
Engineering		70	29.2
	AEE	24	10.0
	CENG	12	5.0
	CHE	18	7.5
	IE	10	4.2
	FDE	6	2.5
Study Year			
Freshman		87	36.3
Sophomore		70	29.2
Junior		50	20.8
Senior & Senior (+)		33	13.8
Gender			
Female		140	58.3
Male		99	41.3
Other		1	.4

3.4.3.2.1. Investigation of the Factorial Structure of MPUAES (a)

Exploratory Factor Analysis

The Exploratory Factor Analysis (EFA) was conducted through SPSS 22.0 to validate the factor structure of the scale. Before performing the EFA, the assumptions which were metric variable, missing data, sample size, univariate normality, multivariate normality, correlation matrix, Barlett's of sphericity, and outliers were checked.

Since a 5-point Likert type was used in the Mobile Phone Use in Academic Environment Scale, the scores obtained were continuous. Thus, the requirement of metric variable was met. Missing data was examined in the data. Because of being less than five percentage on a single variable, it was ignored based onthe suggestion of Hair, Anderson, Tatham, and Black (2010). There are several methods to handle missing values such as deleting cases, single imputation, and multiple imputations (Kline, 2011). The researcher used multiple imputations methods, which is "the most respectable method to deal with missing data" (Tabachnick & Fidell, 2013, p. 72). The sample size for conducting EFA was checked in two ways. Firstly, according to Hair et al. (2010), 10:1 rule, which means ten cases for each item, or being above 100 cases (Hatcher, 1994) was acceptable to run the EFA. The rules were met for 24 items with 240 cases. Secondly, Kaiser-Meyer-Olkin (KMO) is an alternative way to check the adequacy of sample size. Since KMO value (.92) was above .60, it was accepted as a great value for sampling adequacy according to Hutheson and Sofroniou (1999). On the other hand, the data was screened to detect outliers. Firstly, each item converted standardized z-scores. Any value exceeding absolute 3.29 is determined as an outlier (Tabachnick & Fidell, 2013). Three cases (15., 39., and 99. cases) were found above the threshold. As the recommendation of Tabachnick and Fidell (2013), the researcher examined whether three cases were suitably part of the sample. Then, the researcher decided not to remove from the data set since each case might be part of the sample. Moreover, box plots were examined. There were only a few dots far from the box, which were ignored. Moreover, multivariate outlier was checked to guarantee the absence of outliers. The Mahalanobis Distance (D^2) and chi-square were calculated for each case. Seven out 240 participants (34., 56., 98., 103., 135., 142., and 197.) were detected as multivariate outliers with the critical value of 51.179 (df = 24, p = .001). According to Tabachnick and Fidell (2013), "Mahalanobis distance can either 'mask' a real outlier (produce a false negative) or 'swamp' a normal case (produce a false positive). Thus, it is not a perfectly reliable indicator of multivariate outliers and should be used with caution" (p.108). Hence, they were not removed from the dataset. As another assumption, univariate normality was checked by Skewness and Kurtosis values, Kolmogorov Smirnov and Shapiro Wilk tests, histograms, and Q-Q plots. Firstly, z scores of Skewness and Kurtosis were calculated and it was found that absolute values of z score less than 1.96. They were not significantly different from the null hypothesis at $p > .05$ (Field, 2009). Thus, the variables showed a normal distribution. Moreover, histograms and Q-Q plot were examined. It was not observed any serious concern to prevent normality. Lastly, Kolmogorov Smirnov and Shapiro Wilk tests were found significant at $p < .00$, which is an indicator of non-normal distribution (Field, 2009). However, it was concluded that the normality assumption was met based on Skewness and Kurtosis values, histogram and Q-Q plots. Multivariate normality was also checked through Mardia's Test. It was found significant (p = .00), which means the multivariate normality was violated. Lastly, the appropriateness of EFA was checked through a correlation matrix and Barlett's test of sphericity. According to Tabachnick and Fidell (2009), if correlation coefficients are under .30, there is no need to conduct EFA. After examining the correlation matrix, it was seen that many correlations exceeded this threshold. Moreover, Barlett's test of sphericity was found significant (χ^2 (153) = 2252.40, $p < 0.05$) at the .05 level, which indicates the presence of nonzero correlations. Both the results of the correlation matrix and Barlett's test of sphericity were the indicators of suitability for performing EFA.

The preliminary analysis showed that it was appropriate to conduct factor analysis. Eventually, the first run EFA was performed with 24-item. Since the multivariate normality assumption was not met, Principal Axis Factoring was selected as the extraction method (Costello & Osborne, 2005). Moreover, oblique rotation, more specifically direct oblimin, was chosen as a factor rotation method because of the presence of correlated factors (Preacher & McCallum, 2003).

In order to determine the number of factors, the scree test and eigenvalues were checked. When EFA was firstly run, the pattern matrix with 5 factors was observed (see Appendix F). With the rule of .30 factor loadings (Fidell, 2006; Hair et. al, 2010), Item 12 "*I rely on my phone 24/7 for academic purposes*" and Item 13 "*My mobile phone helps stay up-to-date with school activitie*s". After removing those 2 items, the EFA was run again (the pattern matrix of the second run was presented in Appendix G). Item 18 "*When I study, I am never bored if I have my phone with me*" and Item 21 "*I use my phone all day for academic purposes*" were omitted because their communality values were lower than .40 (Costello & Osborne, 2005). Since Item 14 "*In my academic life, I feel isolated without my phone*." and Item 17 "*Without my mobile phone, I feel detached –out of touch, isolated- to my academic life."* had similar meanings, the lower loaded one, Item14, was deleted. Moreover, item 8 "*I feel anxious in school or doing school work when I do not have my phone with me.*" loaded on the first factor. Although the factor loading of this item was above .30, it was extracted because of being not appropriate for that factor. Lastly, the EFA was performed. The pattern matrix was screened and it was observed that all factor loadings were above .40, and there was not any cross loaded item. As seen in Figure 3.2, in the scree pilot, an approximately horizontal line started at the third factor, which indicated the presence of three factors.

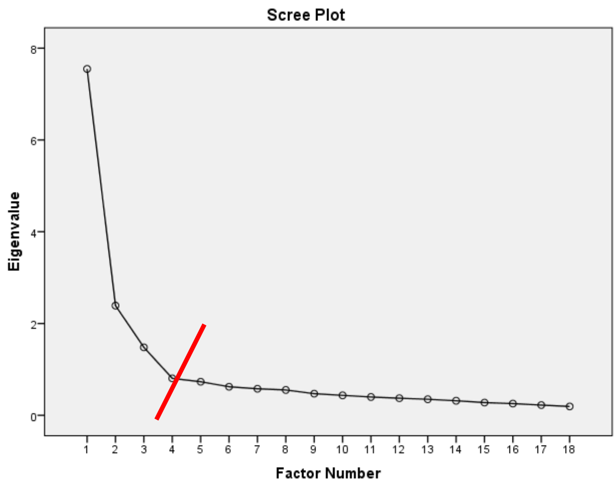

Figure 3. 2 Scree plot of eigenvalues of factors in mobile phone use in academic environment scale

However, depending on the researcher's judgement, the scree plot is not enough for the interpretation of the numbers of factors (Tabachnick & Fidell, 2009). Thus, eigenvalues were also examined to decide a reliable estimation on the number of factors. According to Tabachnick and Fidell (2009), eigenvalues less than 1 are not important for variance. There were three factors explaining 63.42% of total variance in the study. As seen in Table 3.8, factor 1, 2, and 3 accounted for 41.93, 55.21, and 63.43 of total variance, respectively.

Table 3. 8

Pattern Coefficient for Mobile Phone Use in Academic Environment Scale

Item	Factor 1	2	3
i16. My phone is necessary for my academic life.	**.86**	-.08	-.02
i15. I feel in control of my academic life when I have my phone with me.	**.83**	.07	-.14
i22. In my academic life, my phone gives me a sense of comfort.	**.79**	-.07	.06
i17. Without my mobile phone, I feel detached *-out of touch, isolated-* to my academic life.	**.72**	.15	-.18
i11. Having my phone with me makes it easier to sort out – *resolve, handle-* the critical situations related to my academic life.	**.71**	-.09	.20
i7. For my academic life, I feel dependent on my phone.	**.69**	.09	.03
i23. My phone helps me be more organized for my academic life.	**.67**	.01	.20
i4. When it comes to the academic life, my phone is my personal assistant.	**.61**	-.07	.26
i6. I feel more comfortable in doing my school work when I have my phone with me.	**.57**	.08	.14
i5. When I should be doing the school work, I find myself occupied with my phone.	.02	**.80**	-.03
i10. I find myself occupied on my phone even when I'm with my classmates or instructors (during the class or studying).	.07	**.73**	.01
i9. In class or whenever I study, I read/send text messages that are not related to what I am doing.	.04	**.72**	.05
i3. I would get more school work done if I spent less time on my phone.	-.12	**.66**	.00
i24. I find myself engaged with my mobile phone for longer than I intended.	.09	**.58**	.11
i2. I use my phone to connect with my classmates or instructors	-.12	.05	**.79**
i1. My phone helps me keep track of *-follow-* my academic life.	.18	.00	**.62**
i19. My phone helps me stay close to my classmates and instructors.	.16	.14	**.58**
i20. My phone makes it easy to cancel the arranged plans with classmates or instructors.	.23	.17	**.53**
Eigenvalues	7.55	2.40	1.48
% of Variance	41.93	13.28	8.22

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. The items above .30 were signed in bold.

Based on the aforementioned rules, it was concluded that the number of factors to be retained was three. Items 16, 15, 22, 17, 11, 23, 4, and 6 were loaded on Factor 1 labeled as Facilitator; items 5, 10, 9, 3, and 24 were loaded on Factor 2 labeled as Distractor; items 2, 1, 19, and 20 were loaded on Factor 3 labeled as Connectedness as shown in Table 3.9.

Table 3. 9

The Sub-Dimensions and Items in the Mobile Phone Use in Academic Environment Scale

Sub-Dimensions	Number of items	Items
(F): Facilitator	9	*i16, i15, i22, i17, i11, i7, i23, i4, i6*
(D): Distractor	5	*i5, i10, i9, i3, i24*
(C): Connectedness	4	*i2, i1, i19, i20*

Furthermore, it was found that correlation among four factors between |.37| and |.51|, which indicated that the choice of using oblique rotation method for EFA was proper as seen in Table 3.10.

Table 3. 10

Factor Correlation Matrix

Factor	1	2	3
1	1.00	.36	.48
2	.36	1.00	.32
3	.48	.32	1.00

According to the results of factor analysis, three factors were obtained, which were labeled as *facilitator, distractor*, and *connectedness*, upon a theoretical model of the Framework for the Rational Analysis of Mobile Education (FRAME) model developed by Koole (2006). According to this model, mobile learning consists of three aspects: (1) Device, (2) Learner, and (3) Social. That is, besides technical specifications of the mobile devices, social and personal dimensions of learning should be considered in the context of mobile learning. Furthermore, in the FRAME model, each aspect intersected with the other one formed three intersections, which are device usability (device and learner aspect), social technology (social and device aspect), and interaction learning (learner and social aspect). The intersections of three aspects generate the ideal mobile learning. In the literature review part, Chapter 2, this model was explained in more detail.

In the MPUAES, the three factors, *facilitator, distractor,* and *connectedness*, covered the aforementioned three main aspects and three intersections of the FRAME model. More specifically, the factors were assigned as follows: technical features of smartphones as device aspect; *facilitator* and *distractor* sub-dimensions as learner aspect; and *connectedness* sub-dimension as the social aspect. For instance, the item 2 "*I use my phone to connect with my classmates or instructors*" corresponds the social aspect of the FRAME model. Besides association of the items with the main aspects of the model, they were also related to the intersections. For instance, the item 23 loaded on *facilitator* factor *"My phone helps me more organized for my academic life*" consisted of both device and learner aspect, so it corresponds the intersection of device usability as well. Similarly, the item 9 under *distractor* factor "*In class or whenever I study, I read/send text messages that are not related to what I am doing*" was associated with all three intersections because of including functionality of the device, social relationship, and learner characteristics. Although all items were associated with all aspects and intersections of the model in some way, the learner aspect was the essential for the MPUAE scale because of focusing on students' experiences with their mobile phones in the academic environment such as prior knowledge, skills, emotions, and motivations etc. Thus, it can be concluded that Mobile Phone Use in Academic Environment Scale (MPUAES) was primarily based on the learner aspect of FRAME model, and also as the characteristics of the FRAME model, the scale was a convergence of mobile technologies, learner characteristics, and social interaction.

3.4.3.2.2 Structural Model Validation (b)

A measurement model refers to the linear or nonlinear statistical functions involving the relation between items and constructs to be measured (Yurdugül & Aşkar, 2008). In order to evaluate the proposed measurement model and alternative models, first-order confirmatory factor analysis was performed. The data consisted of 240 undergraduate students. In order to investigate factorial validity, five measurement models were used, which were given in the explanations below.

- <u>*Model I*</u> indicated a 24-item with a unidimensional construct measurement model.
- <u>*Model II*</u> indicated a six-factor measurement model as proposed in the original scale. These factors were as follows: *Connectedness, Productivity, Empowerment, Anxious Attachment,* and *Continuous Use.*
- <u>*Model III*</u> indicated a three-factor measurement model which was obtained in the present study. Principal Axis Factoring was selected as the extraction method. The model included 18 items; and the factors were as follows: *Facilitator, Distractor, and Connectedness.* In this model, the three latent factors were considered to be correlated.
- <u>*Model IV*</u> indicated a three-factor measurement model which was obtained in the present study, where the latent factors were considered to be uncorrelated.
- <u>*Model V (Empirical Measurement Model)*</u> indicated a three-factor measurement model which was obtained in the present study; and the factors were correlated. Differently, in order to improve model-fit, some error variances were allowed to covary in this model

The following fit indices were chosen to compare alternative models (Yurdugül, 2007): root mean square error of approximation (RMSEA), goodness of fit index (GFI), comparative fit index (CFI), and non-normed fit index (NNFI). The model-data fits were computed for all of the measurement models, which were presented in Table 3.11. The table also shows the criteria for good-fit-indices with their references.

Table 3. 11

Good-of-fit Indices and Comparison of the Measurement Models

		RMSEA	GFI	CFI	NNFI
		<0.08	≥0.90	≥0.90	≥0.90
Model I:	Unidimensional Model	.12	.66	.71	.68
Model II:	Six-Factor Structure	.10	.77	.81	.78
Model III:	3-factor Structure (Correlated)	.10	.82	.87	.85
Model IV:	3-factor Structure (Uncorrelated)	.12	.78	.80	.77
Model V:	3-factor Structure (correlated- covaried)	.06	.92	.96	.95

References*:* Hair et al. (2010), Kline (005), and McDonald and Ho (2002)

Firstly, Model I was built, which was a unidimensional model with 24-item. According to fit indices of the model, Model I showed a poor model fit. This can be interpreted as an indicator that the scale consisting of 24 items did not confirm the one-factor structure model, but it should have more than one sub-construct. Secondly, Model II was based on the six-factor structure model as the original scale, which included 24-items. Although an improvement was observed in the fit indices compared to Model I, it was not sufficient for a good model fit. This was also proof that the scale was not suitable for the six-factor structure model with 24-item. Thirdly, the present study proposed Model III, in which a three-factor structure (correlated) model was obtained from the pilot study. In this model, the number of items dropped from 24 to 18 items. Again, the fit indices showed an improvement, but insufficient level. Similar to Model III, Model IV indicated a three-factor structure model obtained from the present study, but the latent factors were assumed to be uncorrelated. As seen in Table 3.X, a decline was observed in the good-of-fit indices of the model. Finally, Model V was built, which was a three-factor measurement model with 18 items. The latent factors were correlated; and some error variances which were found highly correlated were allowed to covary in the model. According to the fit indices, Model V was found as the most appropriate among five measurement models. Consequently, it was continued with

Model V based on these results in the current study. Figure 3.3 presented the factor loadings of a three- factor solution model (Model V). The abbreviations in the figure as follows: F: Facilitator, D: Distractor, and C: Connectedness.

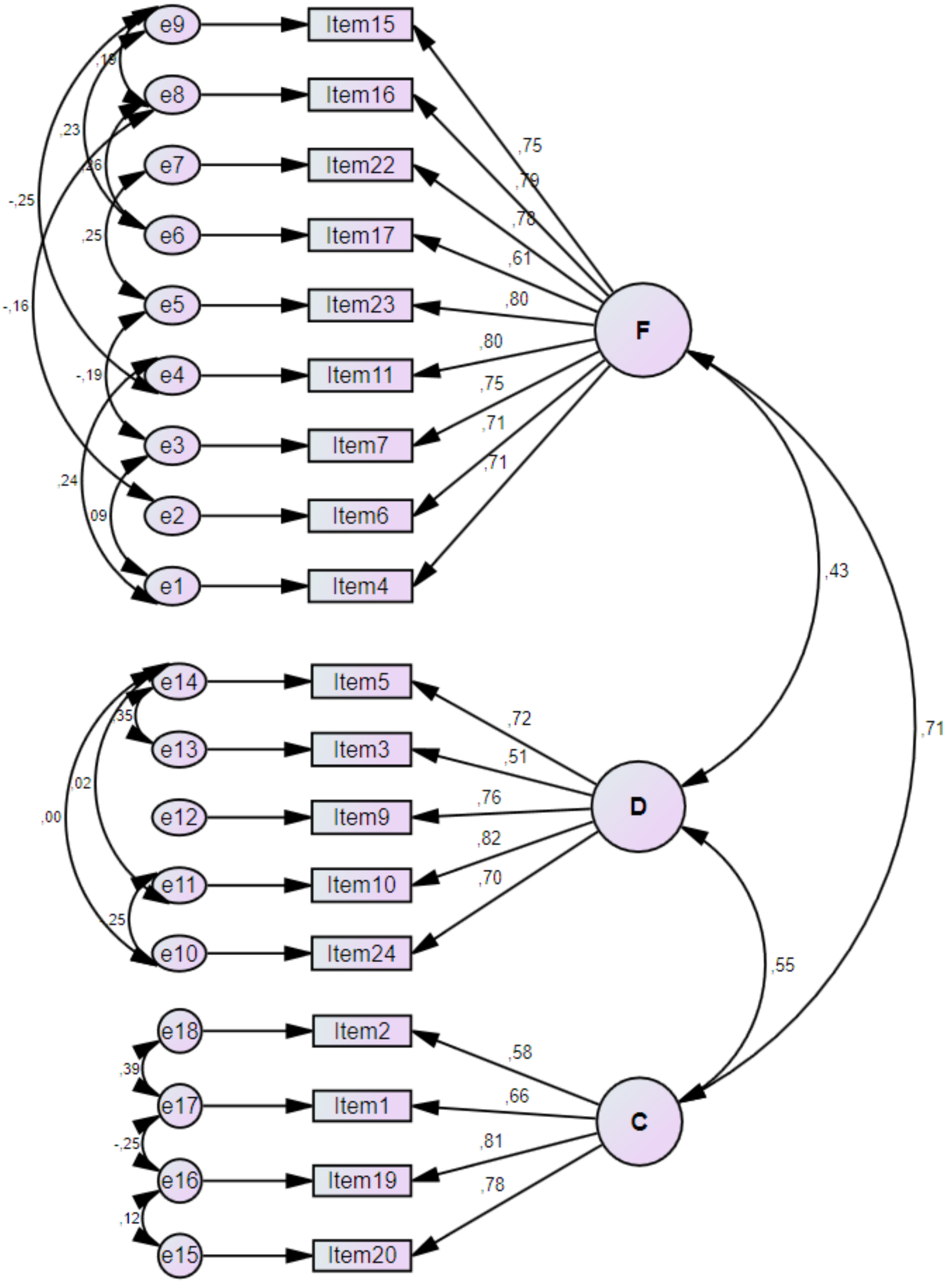

Figure 3. 3 The measurement model

3.4.3.2.3 Validity and Reliability (c)

The development scale, Mobile Phone Use in Academic Environment (MPUAES), proposed three constructs, namely, *facilitator, distractor,* and *connectedness.* To evaluate validity and reliability issues of the measurement tool, construct validity (convergent validity and discriminant validity) of the interpretations and internal consistency of the scores were examined.

Construct Validity

Construct validity is defined as "the extent to which a set of measured items actually reflects the theoretical latent construct those items are designed to measure" (Hair et al., 2010, p. 618). Therefore, it is related to "*accuracy of measurement*". In the present study, construct validity was examined by two ways: (1) convergent validity, and (2) discriminant validity. (Yurdugül & Sırakaya, 2013)

(1) Convergent Validity corresponds that "the items that are indicators of a specific construct should converge or share a high proportion of variance in common" (Hair et. al, 2010, p. 618). The present study used three ways to estimate convergent validity of the measurement model. Firstly, the size of factor loadings was checked. As seen in Figure 3.2, the factor loadings were between .51 and .82, which met the rule that standardized factor loadings should be greater than .050 (Hair et al., 2010). Secondly, average variance extracted (AVE) was calculated with the following formula.

$$\mathrm{AVE} = \frac{\sum_{i=1}^{n} L_i^2}{n}$$

In the formula, while L_i indicates the standardized factor loading, n represents the number of items. The sum of squared factor loadings was computed. The AVE values were calculated between .51 and .56 by the calculator provided by Gouveia & Soares (2015). The rule of thumb for AVE is that .50 or higher suggest good validity (Hair et al., 2010). Thus, it can be concluded that the AVE values for each factor were acceptable.

Lastly, composite (construct) reliability (CR) was calculated as an indicator of convergent validity. The following formula was used to calculate composite reliability for each factor:

$$\mathrm{CR} = \frac{\left(\sum_{i=1}^{n} L_i\right)^2}{\left(\sum_{i=1}^{n} L_i\right)^2 + \left(\sum_{i=1}^{n} e_i\right)}$$

In the formula, the squared sum of factor loadings (L_i) and the sum of the error variance terms for each construct was computed (Hair et al., 2010). As seen in Table 3.12, CR values were obtained between .80 and .91, which were acceptable according to the rule of thumb greater .70.

Table 3. 12

Convergent Validity for the Measurement Model

	L Interval (a)	AVE (b)	CR (c)
Facilitator	.61 – .80	.56	.92
Distractor	.51 – .82	.50	.83
Connectedness	.58 – .81	.51	.80

L: Factor Loadings, AVE: Average Variance Extracted, CR: Composite Reliability

(*2) Discriminant Validity* means that “the extent to which a construct is truly distinct from other constructs” (Hair et. al, 2010, p. 618). For discriminant validity, the correlations among the subscales of the MPUAES and the square root of AVE were used. According to this, the square root of AVE calculated for each dimension must be greater than correlations coefficients between the corresponding sub-dimension and remaining sub-dimensions, and must be higher than .50 as well (Fornel & Larcker, 1981).

Table 3. 13

Discriminant Validity for the Measurement Model

	Facilitator (1)	Distractor (2)	Connectedness (3)
Facilitator (1)	**(.75)**		-
Distractor (2)	.43	**(.71)**	-
Connectedness (3)	.71	.55	**(.71)**

*The values in parentheses are the square roots of AVE

For example, the square root of AVE was calculated as .75 for facilitator dimension, which is higher than correlation coefficients between this sub-dimension and other sub-dimensions. On the other hand, as seen in Table 3.13, the square root of AVE for distractor dimension was .71. At the same time, its correlation with connectedness dimension was .71. However, when these values were not rounded, it was seen that the square root of AVE was .7135 and correlation coefficient was .7090. It implies that the square root of AVE is higher than the correlation coefficient. Therefore, the discriminant validity was ensured.

Reliability

Internal consistency reliability coefficients for each factor were computed. The Cronbach alpha coefficients of factors are .92, .84, and .81, respectively (see Table 3.14). The rule for acceptable reliability coefficients is determined above .70 (Field, 2009; Kline, 1999). Thus, it can be concluded that subscales had acceptable internal consistency.

Table 3. 14

Item-total Statistics of Factors

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha of Factors
Factor 1	i15	24.21	43.82	0.74	0.91	.92
	i16	24.07	43.28	0.77	0.91	
	i22	24.17	43.51	0.76	0.91	
	i17	24.00	44.41	0.74	0.91	
	i23	24.58	44.94	0.62	0.92	
	i11	24.03	44.19	0.76	0.91	
	i7	24.50	44.32	0.71	0.91	
	i6	24.18	43.73	0.65	0.92	
	i4	23.99	44.89	0.69	0.91	
Factor 2	i5	12.49	14.20	0.55	0.83	.84
	i3	12.62	13.28	0.73	0.78	
	i9	12.92	13.59	0.66	0.80	
	i10	12.34	14.06	0.59	0.82	
	i24	12.61	13.34	0.67	0.79	
Factor 3	i2	10.97	6.18	0.62	0.77	.81
	i1	11.24	6.16	0.59	0.79	
	i19	11.58	5.26	0.67	0.75	
	i20	11.41	5.65	0.66	0.76	

3.4.3.3 Cross-Validation of the Scale

In order to validate the three-structure of the Mobile Phone Use in Academic Environment Scale among undergraduate students, cross-validation analysis was used. According to Byrne (2010), this method gets the advantage of examining the factorial structure of the scale across different samples of the same population. Thus, the sample of the main study was split into two random samples for conducting both EFA and CFA analyses (Cudeck & Browne 1983).

3.4.3.3.1. Exploratory Factor Analysis

For exploratory factor analysis, 220 undergraduate students were randomly selected from the main data. The rate of the faculties was similar to the main data sample. As presented in Table 3.15, the big majority of the students were from the faculty of engineering (n = 79, 36.1%). Then, the distribution was as follows: 55 of them were from the faculty of education (25.1%), 39 of them were the faculty of economics and administrative sciences (17.8%), 35 of them were from the faculty of arts and science (16.0%), and 11 of them were from the faculty of architecture (5.0 %). Moreover, the students were from all study years as follows: 81 students were the freshman (37 %); 73 students were sophomore (73 %); 37 students were junior (16.9 %); and 28 were senior and senior plus (12.8%).

Table 3. 15

Distribution of the Gender, Departments, and Study Year (N = 220)

Faculty	*f*	%
Architecture	11	5.0
Arts & Science	35	15.9
ECON & ADM Sci.	39	17.7
Education	56	25.5
Engineering	79	35.9
Study Year	***f***	**%**
Freshman	82	37.3
Sophomore	73	33.2
Junior	37	16.8
Senior & Senior (+)	28	12.7

Before conducting EFA, the assumptions were checked; outlier, sample size, normality, and appropriateness of EFA. In order to check outlier, standardized z-scores were calculated. There were not found any case exceeding absolute 3.29. Box-plot also checked. There were a few dots fall away from the box, which was ignored. Apart from the univariate outlier, multivariate outliers were also checked. Only one case was found with the critical value of 42.312 ($df = 18$, $p = .001$), which were retained in the data cause of not effect on the results. Then, the sample size was checked in order to conduct EFA in two ways. Firstly, based on the rule of 1:10), 220 students for 18-items were found enough. Secondly, the value of Kaiser-Meyer-Olkin (KMO) was .92, which was accepted as a great value for sample adequacy. The appropriateness of EFA was checked by correlation coefficients and Barlett's test of sphericity. There were many correlation coefficients above .30. The result of Barlett's test of sphericity was found significant (χ^2 (153) = 1954.185, p <0.05) at the .05 level, which means of the presence of nonzero correlations. That means it was appropriate to perform EFA. Then, normality was checked. For univariate normality, skewness and kurtosis values were between absolute 1.96. The rule was met. Kolmogorov and Shapiro Wilk test found significant which means a non-normal distribution. The histogram was nearly normal and bell-shaped. The dots in the Q-Q plot were in the line. Thus, it was assumed that it had a normal distribution upon histogram and Q-Q plots. For multivariate normality, Mardia's test was checked and found significant ($p = .00$). By the violation of the multivariate normality, PAF was used for the extraction method. Moreover, assuming correlation among three factors, EFA was performed with the oblique rotation method. For the factor-structure, the scree plot and eigenvalues were observed. As seen in Figure 3.4, the breakpoint of the plot indicated a three-factor structure.

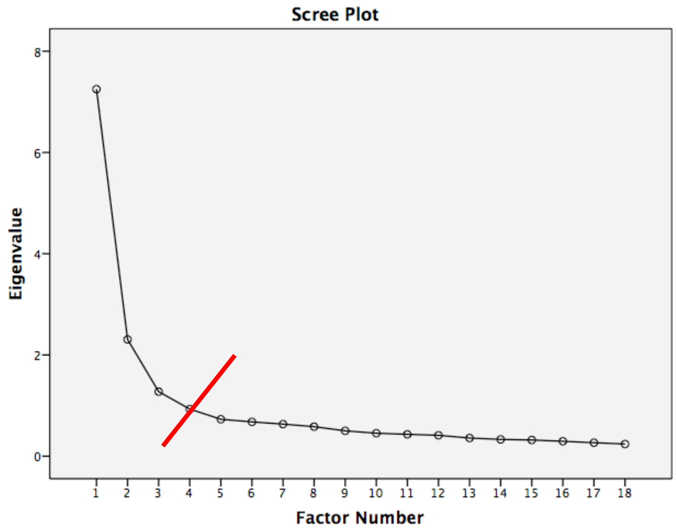

Figure 3. 4 Scree plot for EFA-2

However, the scree plot is not enough for determining the number of the factors. Thus, eigenvalues greater one rule was also used. According to Tabachnick and Fidell (2009), eigenvalues less than 1 are not important for variance. As seen in Table 3.17, there were three factors explaining 60.18 % of total variance in the study. Factor 1, 2, and 3 accounted for 40.28, 12.82, and 7.08 of total variance, respectively. Based on the aforementioned rules, it was concluded that the number of factors to be retained was three. As seen in Table 3.16, the correlations among three factors were between |.30| and |.50|, which approved that the choice of using oblique rotation method was proper for the analysis (Costello & Osborne, 2005).

Table 3. 16

Correlation among Factors

Factor	1	2	3
1	1.00	.33	.50
2	.33	1.00	.30
3	.50	.30	1.00

As seen in Table 17, three factors were obtained. Factor loadings were ranged from .41 to .84, which were acceptable as being above .30 (Hair et al, 2010). Items 11, 12, 16, 10, 17, 7, 6, and 4 were loaded on Factor 1 labeled as *facilitator*; items 9, 18, 5, 8, and 3 were loaded on Factor 2 labeled as *distractor*; items 15, 14, 2, and 1 were loaded on Factor 3 labeled as *connectedness.* The cross-loading problem occurs when the difference between two factor loadings is lower than .15. According to this rule, item 4 cross-loaded both on *facilitator (first)* and *connectedness (third)* factors (.41 - .31 = .10). These two factors were theoretically similar. Thus, the researcher decided to assign item 4 under facilitator factor, in which factor loading was higher.

Table 3. 17

Pattern Coefficient and Communalities for MPUAES

Item	Factor 1	2	3	Communality
i11. I feel in control of my academic life when I have my phone with me.	**.84**	-.01	.03	.66
i12. My phone is necessary for my academic life.	**.81**	-.02	.04	.64
i16. In my academic life, my phone gives me a sense of comfort.	**.61**	.08	.23	.60
i10. Having my phone with me makes it easier to sort out the critical situations related to my academic life.	**.55**	.10	.21	.51
i17. My phone helps me be more organized for my academic life.	**.51**	-.09	.39	.55
i7. For my academic life, I feel dependent on my phone.	**.50**	.38	-.04	.47
i13. Without my mobile phone, I feel detached - to my academic life.	**.48**	.25	.06	.44
i6. I feel more comfortable in doing my schoolwork when I have my phone with me.	**.42**	.23	.22	.48
i4. When it comes to the academic life, my phone is my personal assistant.	**.41**	-.03	.31	.44
i9. I find myself occupied on my phone even when I'm with my classmates or instructors (*during the class or studying*).	.28	**.76**	-.20	.62
i18. I find myself engaged with my mobile phone for longer than I intended.	.13	**.73**	.03	.58
i5. When I should be doing the schoolwork, I find myself occupied with my phone.	.03	**.72**	.08	.55
i8. In class or whenever I study, I read/send text messages that are not related to what I am doing.	.09	**.69**	-.07	.53
i3. I would get more schoolwork done if I spent less time on my phone.	-.30	**.64**	.26	.44
i15. My phone makes it easy to cancel the arranged plans with classmates or instructors.	-.01	.15	**.64**	.44
i14. My phone helps me stay close to my classmates and instructors.	.08	.02	**.63**	.43
i2. I use my phone to connect with my classmates or instructors	.11	-.01	**.55**	.35
i1. My phone helps me keep track of -*follow*- my academic life.	.28	-.07	**.49**	.43
Eigenvalues	7.25	2.31	1.28	
% of Variance	40.28	12.82	7.08	

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. The items above .30 were signed in bold.

According to the results of factor analysis, three factors, labeled as *facilitator, distractor, and connectedness* were extracted. Internal consistency reliability coefficients for each factor were computed. The Cronbach alpha coefficients of factors were .90, .84, and .74, respectively (Table 3.18). The rule for acceptable reliability coefficients is determined as higher than .70 (Field, 2009; Kline, 1999), which proved that the subscales had reliable scores.

Table 3. 18

Item-total Statistics of Factors

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha of Factors
Factor 1	i11	25.64	42.42	.78	.88	.90
	i12	25.51	43.89	.74	.88	
	i16	25.40	43.79	.75	.88	
	i10	25.43	45.31	.68	.89	
	i17	25.47	46.77	.66	.89	
	i7	25.82	44.91	.60	.89	
	i13	25.99	45.21	.60	.89	
	i6	25.37	44.58	.63	.89	
	i4	25.52	47.59	.54	.90	
Factor 2	i9	12.97	13.40	.71	.80	.84
	i18	12.59	13.92	.72	.80	
	i5	12.85	14.20	.69	.80	
	i8	12.87	13.68	.63	.82	
	i3	12.78	14.28	.52	.85	
Factor 3	i15	11.42	4.50	.56	.66	.74
	i14	11.55	4.26	.57	.65	
	i2	10.96	5.27	.52	.69	
	i1	11.56	4.75	.48	.71	

3.4.3.3.2 Confirmatory Factor Analysis

In order to confirm three-factor structure of MPUAES, Confirmatory Factor Analysis was performed with the rest of the data, in which there were1647 students. The majority of the students (*n* = 786) were from the faculty of engineering (47.7%); 325 students were from the faculty of arts and science (19.7 %); 231 students were from the faculty of economics and administrative sciences; and 207 students were from the faculty of education. All level of students was included in the study. The number of freshmen sophomore, and junior was almost same, 447, 468, and 421, respectively. There were also 311 senior and senior plus students as shown in Table 3.19.

Table 3. 19

Frequency Distribution of Participants by Faculty and Study Year (N = 1647)

	f	%
Faculty		
Architecture	98	6.0
Arts & Science	325	19.7
Economics & Administrative Sciences	231	14.0
Education	207	12.6
Engineering	786	47.7
Study Year		
Freshman	447	27.1
Sophomore	468	28.4
Junior	421	25.6
Senior & Senior (+)	311	18.9

Before performing confirmatory factor analysis, the following assumptions were checked, separately: sample size, normality, and absence of outliers (Tabachnick & Fidell, 2013) Firstly, the adequacy of sample size was checked. The thumb rule 1:10 was met with 18 items and 1647 participants (Hair, Black, Babin, & Anderson, 2010). Secondly, both univariate and multivariate outliers were screened. For univariate outliers, standardized z-scores and box-plot were checked. 10 cases were detected which exceeded the absolute value of 3.29. Box-plot were also examined. There were a few univariate outliers, which were possible for the studies with the large sample size (Pallant, 2007; Tabachnick & Fidell, 2007). As being a multivariate analysis, SEM studies take into consideration multivariate outliers instead of univariate ones. Thus, they were not deleted. For multivariate outliers, Mahalanobis distance (D^2) was calculated for each case. Out of 1647, thirty-seven cases were detected as multivariate outliers with the critical value of 42.312 ($df = 18$, $p = .001$). After omitting these cases, the analysis was performed again. It was observed that the results were not substantially affected. That is, 37 cases were determined as possible outliers, which were remained in the data. Thirdly, univariate normality was also checked. Kolmogorov-Smirnov and Shapiro-Wilk test results were found significant, which was a sign of non-normal distribution. However, these tests cannot be considered as only indicators for normality because of being very sensitive to sample size. Skewness and kurtosis values were also checked, which were between -3 and +3. The visual inspection of histogram and Q-Q plots were also observed, in which there was not any evidence for violation of normality. Thus, the univariate normality of the data was assured by skewness and kurtosis values, histogram, and Q-Q plots.

The Results of CFA

The Mobile Phone Use in Academic Environment Scale was administrated to 1647 students in order to validate the factor-structure obtained from the pilot study. More specifically, for confirming the three-factor solution model suggested by the EFA, the second-order confirmatory factor analysis was performed by using AMOS 20.0 software (Arbuckle & Wothke, 1999). The preliminary analysis supported performing confirmatory factor analysis. As an estimation method, the maximum likelihood (ML) was chosen upon the recommendation of Tabachnick and Fidell (2013) for medium to large sample sizes and plausible assumptions. The following fit indices were selected to assess the goodness-of-fit of the model: Chi-square, comparative fit index (CFI), adjusted goodness of fit index (AGFI), goodness of fit index (GFI), non-normed fit index (NNFI) or called as aka Tucker Lewis index (TLI), normed fit index (NFI), root mean square error of approximation (RMSEA), root mean square residual (RMR), and standardized root mean square residual (SRMR) (Jöreskog & Sörbom, 1993, Kline, 2011). The model fit indices which selected for the current study were presented in Table 3.20. The references for each fit index were also indicated in the table.

The second-order CFA resulted a significant chi-square, $\chi 2$ (132, n = 1647) = 1684.21, p = .00, which indicated an unacceptable model. However, according to Tabachnick & Fidel (2013), chi-square is sensitive to sample size. Thus, other fit indices were examined and the following results were found: CFI = .89, NNFI = .87, GFI = .89, AGFI = .86, RMR = .08, RMSEA = .09, and SRMR = .06. CFI, and NNFI values showed poor model fitting, which should be greater than .95 for a perfect model fit, and at least .90 for a good model fit (Tabachnick & Fidell, 2013; Jöreskog & Sörbom, 1993; Kline, 2011). The same rule was in use for the values of GFI and AGFI, which were also showed poor fitting due to being less than .90 (Hair et al., 2010). In addition, RMSEA value greater than .08 indicates a poor fitting model (Browne & Cudeck, 1993). The values SRMR and RMR were only indicatives of a good fit (Jöreskog & Sörbom, 1993; Kline, 2011). Thus, CFA was performed again to modify the model. Before performing the CFA, modification indices were examined. Eight error covariance (ε_1-ε_{14}, ε_1-ε_{15}, ε_3-ε_5, ε_8-ε_9, ε_4-ε_{13}, ε_{16}-ε_{17}, ε_{12}-ε_{13}, and ε_7-ε_{13}) were found highly relatively, which were allowed to covary in the model.

Table 3. 20

The Model Fit Indices Used for Confirmatory Factor Analysis

Model Fit Index	Acceptable Fit		Sample Statistics	Decision	References
	Moderate Fit	Good Fit			
NNFI	.95 - .97	.97 – 1.00	.93	Moderate	1, 2, 5, 7
CFI	.90 - .95	.95 – 1.00	.94	Moderate	1, 2, 4, 5, 8,
GFI	.90 - .95	.95 – 1.00	.94	Moderate	6, 4, 8
AGFI	.90 - .95	.95 – 1.00	.92	Moderate	2, 5, 8,
SRMR	.05 - .08	≤ .05	.05	Good	3, 4
RMR	.05 - .08	≤ .05	.07	Moderate	3, 4
RMSEA	.05 - .08	≤ .05	.06	Moderate	3, 6, 8

* Reference: [1]Tabachnick & Fidell (2013), [2]Jöreskog and Sörbom (1993), [3]Browne and Cudeck (1993), [4]Hu and Bentler (1999), [5]Kline (2011), [6]Hooper, Coughlan, and Mullen (2008), [7]Thompson (2008), [8]Hair et al. (2010)

The results revealed a close fit model in the second run of confirmatory factor analysis. The fit indices of the model were as follows: CFI = .94, NNFI = .93, GFI = .94, AGFI = .92, RMR = .07, SRMR = .05 and RMSEA = .06. Chi-square was found significant despite of decreasing the value $\chi 2$ (124, n = 1647) = 942.09, p = .00. Since this value is expected to be significant for large sample sizes, other fit indices should be taken into consideration (Tabachnick and Fidell 2007). All other fit indices, except SRMR value, indicated a good model fit. The SRMR value was found .05, which was an indicator of the perfect fitting model (Hu & Bentler, 1999).

The proposed second-order factor model of Mobile Phone Use in Academic Environment was shown in Figure 3.5. The standardized estimates of the second-order factors were .98, .55, and .69. Their standardized factor loadings varied between .66 and .81 for the *facilitator* factor, varied between .52 and .78 for the *distractor* factor, and .68 and .82 for c*onnectedness* factor. Thus, it can be concluded that all items had a significant contribution to the proposed model since the cut-off point of the standardized estimates of the items was .40 (Stevens, 2002).

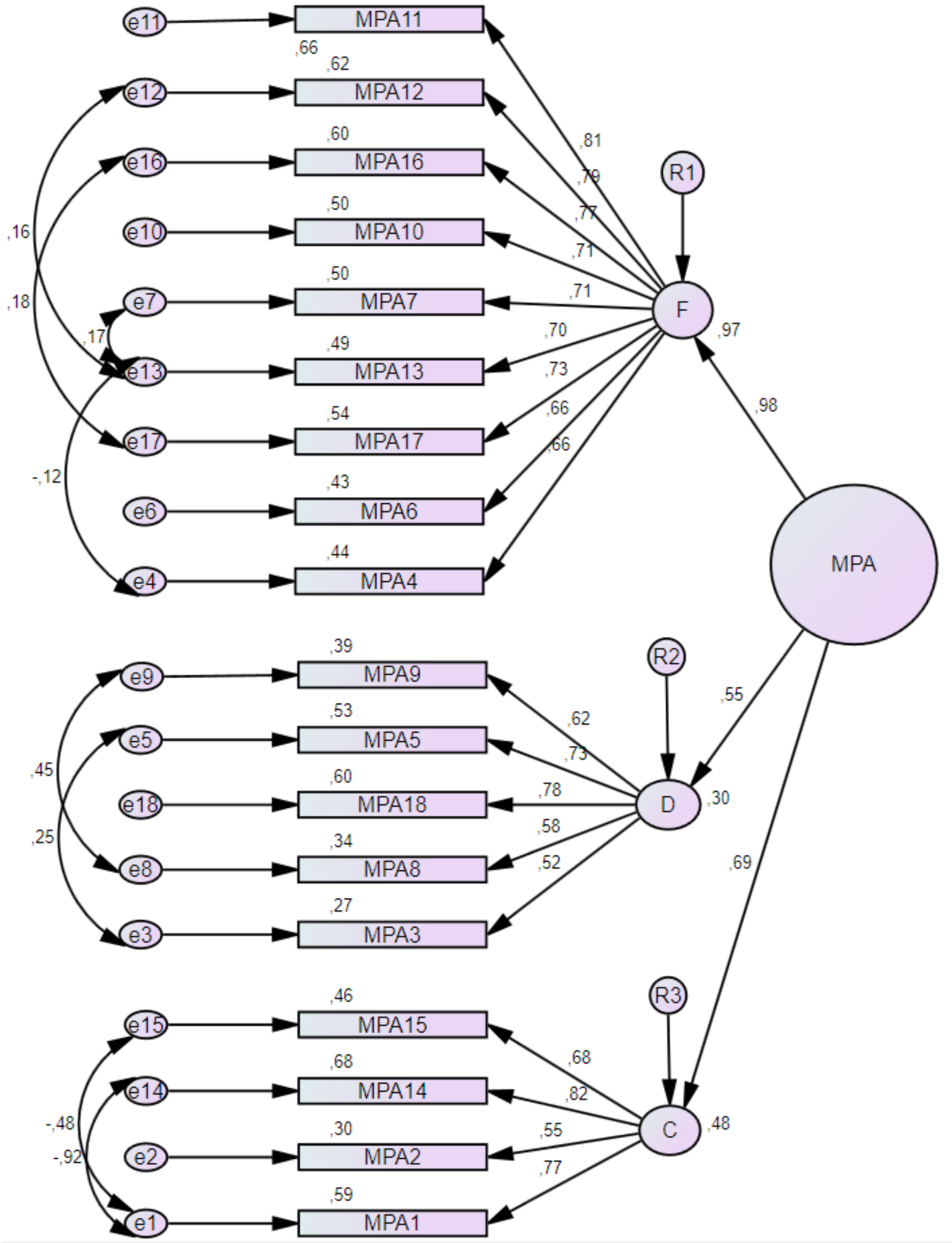

Figure 3. 5 The factor structure of mobile phone use in academic environment scale with standardized estimates

For internal consistency, Cronbach alpha coefficients were examined for each factor, which was found as .92 for *facilitator* factor (9 items), .82 for *distractor* factor (5 items) and .73 (4 items) for *connectedness* factor. Being greater than .70, these values were acceptable (Nunally, 1978). The coefficients for each item are displayed in Table 3.21.

Table 3. 21

The Reliability of the Items

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha of Factors
Factor 1	i11	24.78	50.97	.79	.90	.92
	i12	24.61	50.68	.77	.90	
	i16	24.46	52.18	.76	.90	
	i17	24.38	52.71	.71	.91	
	i10	24.48	53.81	.68	.91	
	i7	25.00	51.58	.69	.91	
	i13	25.09	51.61	.68	.91	
	i6	24.53	52.54	.64	.91	
	i4	24.50	54.15	.62	.91	
Factor 2	i18	11.86	13.31	.63	.77	.82
	i5	12.04	13.16	.66	.77	
	i9	12.31	13.36	.63	.77	
	i8	12.03	13.52	.60	.78	
	i3	11.89	13.65	.51	.81	
Factor 3	i14	11.50	4.71	.58	.64	.73
	i1	11.35	5.80	.42	.73	
	i15	11.42	5.10	.56	.65	
	i2	10.85	5.90	.56	.67	

Finally, the results of the study showed that the scores obtained from the developed scale Mobile Phone Use in Academic Environment (MPUAES) are valid and reliable in assessing undergraduate students' mobile phone use in an academic environment.

3.4.4 Self-Directed Learning (SDL) Scale

Self-directed Learning Scale or Self-Management of Learning Scale were developed by McVay (2000, 2001). Actually, he developed the "Readiness for Online" questionnaire, which had a two-factor structure with 13 items. In order to test this questionnaire, Smith, Murphy, and Mahoney (2003) conducted a reliability and factor analysis. They obtained a good reliable result and a two-factor structure as "Comfort with e-learning" and "Self-management of learning" or "Self-directed learning". The instrument of McVay was again confirmed by Smith (2005), in which the results were consistent with the previous study performed by Smith et al. (2003). Then, the second factor was separately used in several studies (Wang, Wu, & Wang, 2009; Lowenthal, 2010; Hung, Chou, Chen, & Own, 2010). There were four items with 5-Likert type from (1) "Strongly disagree" to (5) "*Strongly Agree*". Cognitive interviews were done with three students. Based on students' comments, the phrase "self-directed" was clarified with an operational definition at the beginning of the survey. Moreover, some items in Self-directed Learning Scale was revised by adding a more prevalent verb near some rather less-known ones. For example, one of the items was revised to "In my studies, I set goals and have <u>a high degree of initiative</u> - *have high motivation to start*".

3.4.5 Mobile Phone Self-Efficacy (MPSEF) Scale

The items of the Mobile Phone Self-Efficacy Scale were taken from the Computer Self Efficacy Scale (CSEA), which was developed by Compeau and Higgins (1995). The scale originally consisted of 11 items with a 10-point scale and it was for software package use. In the other studies (Vankatesh, Morris, Davis, and Davis, 2003; Moran, Hawkes, & Gayar, 2010; Laver, George, Ratcliffe & Croty, 2012), some specific items for their purposes were chosen and they adapted the scale by changing the word "software package" to the technology they used in their studies such as table use, new technology use, and Internet use. For the present study, the adaptation for tablet use (Moran et al., 2010) was applied by changing the word "Tablet PC" to "Mobile Phone". The reliability of the scale was acceptable with .89 Cronbach's alpha (Moran et al., 2010). The scale consisted of five items with 5-Likert type (1) "Strongly disagree" to (5) "Strongly agree".

3.4.6 Pilot Applications of Self-Directed Learning and Mobile Phone Self-Efficacy Scales

The pilot study was applied to 87 undergraduate students from Middle East Technical University. The students were chosen from different faculties of Middle East Technical University. Some departments and certain study year of these departments were chosen to prevent inclusion the same participants into the main study. Out of 87 students, 53 were female (60.9%), and 34 were male (39.1%). As seen in Table 3.22, students from all study years were included to the study as following: 14 of them were freshman (16.1%), 50 of them were sophomore (57.5%), 9 of them were junior (10.3%), and 14 of them were senior (16.1%). While most of the students (*n* = 50) were from the faculty of education (57.5%), 23 of them were from the faculty of engineering, and 14 of them were from the faculty of economics and administrative sciences (16.1%).

Table 3. 22

Frequency Distribution of Undergraduate Students by Department, Faculty, and Percent in the Pilot Study

	Frequency *(f)*	Percent *(%)*
Gender		
Female	53	60.9
Male	34	39.1
Faculty		
Economics & Administrative Sciences	14	16.1
Education	50	57.5
Engineering	23	26.4
Study Year		
Freshman	14	16.1
Sophomore	50	57.5
Junior	9	10.3
Senior	14	16.1
Total	87	100

Before performing a Confirmatory Factor Analysis, the assumptions were checked for both two scales: sample size, an outlier, and normality. Firstly, the students filled all items of both two scales. Thus, there were not any missing data. The sample consisted of 87 students, which were enough to conduct confirmatory factor analysis for both two scales. The rule of thumb 1:10 was met for Self-Directed Learning Scale with 4 items, and for Mobile Phone Self-Efficacy Scale with 5 items. For both two scales, univariate outliers were examined through standardized z-scores and box-plot. There were not any z-scores exceeds absolute 3.29, and not any dots fall away from the box-plot. Beside univariate outliers, multivariate outliers were also checked by calculating Mahalanobis distance. For SDL and MPSEF scales, there was not any case with the critical values of 18.47 (df = 4, p = .001) and 20.52 (df = 5, p = .001), respectively.

Normality was also checked for both two scales. Kolmogorov-Smirnov and Shapiro's Wilk tests were found significant, which was an indicator of non-normal distribution. However, these tests were statistically conservative tests (Field, 2013). Thus, the normality assumption was checked by examining Skewness and Kurtosis values, histogram, and Q-Q plots. For both two scales, Skewness and Kurtosis values were not exceeding absolute 1.96. Histogram showed nearly normal distribution. Q-Q plots were also examined, and there was not any serious concern to prevent normality. Thus, it was deemed that the normality assumption was met. Lastly, linearity was checked by the scatter plot, which showed a linear.

3.4.6.1 Confirmatory Factor Analysis for Self-Directed Learning Scale

A confirmatory factor analysis was performed by using AMOS 20.0. A first run of CFA results showed a significant chi-square value, other fit indices were also as follows: $\chi 2$ (2, n = 87) = 11.297, p = .004, CFI = .93, NNFI = .803, RMSEA = .23, and SRMR = .052. All fit indices indicated a poor fitting model, except CFI value which showed a good model fit due to being between .90 and .95. Then, modification indices were checked, and one error covariance (ε_1-ε_2) was found highly relatively. These two terms were meaningfully close to each other. Thus, they were allowed to covary in the model. After performing CFA again, the results demonstrated a good fitting model with the following fit indices: $\chi 2$ (1, n = 87) = 1.13, p = .29, CFI = 1.00, NNFI = .99, GFI = .99, RMR = .02, RMSEA = .04, and SRMR = .02. Table 3.23 displayed the sample statistics and decisions for each selected fit index.

Table 3. 23

Selected Fit Indices for Self-Directed Learning Scale

SDL	CFI	NNFI	GFI	SRMR	RMR	RMSEA
Sample Statistics	1.00	.99	.99	.0154	.015	.04
Decision	Good	Good	Good	Good	Good	Good

As seen in Figure 3.6, the factor loadings of items were ranged .54 and .75. Because of being above the cut-off point of .40, it can be concluded that all items significantly contributed to the model.

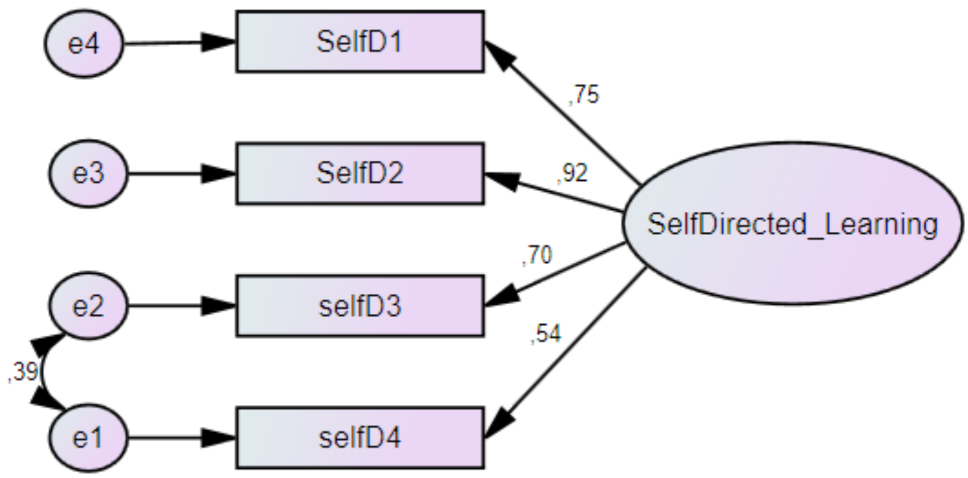

Figure 3. 6 Model fitting for self-directed learning scale

The reliability coefficients were calculated, which was found .84 as seen in Table 3.24. The values above .70 were accepted as a high degree of reliability (Kline, 2011).

Table 3. 24

Item-total Statistics of Factors

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha of Factors
	i1	10.31	6.75	.64	.81	
Factor 1	i2	10.60	6.24	.73	.78	
	i3	10.70	5.75	.72	.77	.84
	i4	10.77	6.09	.60	.82	

3.4.6.2. Confirmatory Factor Analysis for Mobile Phone Self-Efficacy Scale

CFA results indicated a significant chi-square value, fit indices were as follows: $\chi 2$ (5, n = 87) = 8.00, p = .16, CFI = .97, NNFI = .94, GFI = .96, RMR = .05, RMSEA = .08, and SRMR = .05. All fit indices indicated a good fitting model (see Table 3.25), except the value of NNFI which showed a good fitting model due to being between .90 and .95.

Table 3. 25

Selected Fit Indices for Mobile Phone Self-Efficacy Scale

SDL	CFI	NNFI	GFI	SRMR	RMR	RMSEA
Sample Statistics	.97	.94	.96	.0451	.046	.08
Decision	Good	Moderate	Good	Good	Good	Moderate

The factor loadings showed in Figure 3.7, which ranged from .48 to .73. Each item highly contributed the model.

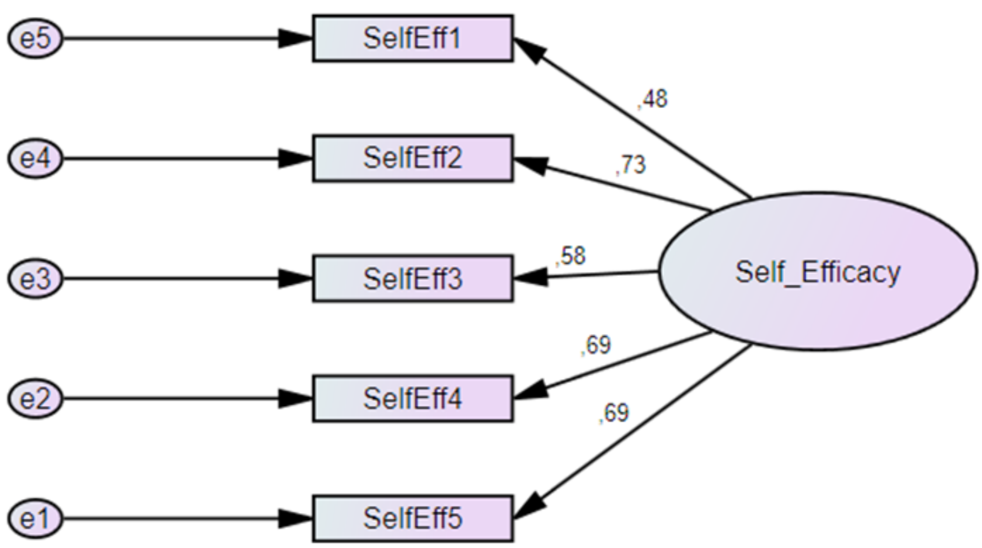

Figure 3. 7 Model fitting for mobile phone self-efficacy scale

As seen in Table 3.26, the reliability coefficients were found .77, which was satisfactory as being above .70 (Field, 2009; Kline, 1999).

Table 3. 26

Item-total Statistics of Factors

		Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted	Cronbach's Alpha of Factors
	i1	13.67	9.46	.41	.77	
	i2	13.76	7.98	.64	.68	
Factor 1	i3	13.53	8.69	.49	.74	.77
	i4	13.72	9.09	.58	.71	
	i5	13.83	8.82	.58	.71	

3.5 Data Collection Procedure

The data collection of the study started in the spring semester of the 2016-2017 academic year. Before administration of the instruments, ethical approval was granted from the Applied Ethics Research Center of METU (see Appendix C). The data was collected three times as shown in Figure 3.8. In the first stage, a pilot study was conducted for the Mobile Phone Use in Academic Environment Scale with 240 undergraduate students from all faculties of Middle East Technical University. Then, Self-Directed Learning Scale and Mobile Phone Self-Efficacy Scale were included the study, which pilot-tested with 87 undergraduate students. At the last stage, the main study was conducted with 1928 students. In this stage, in order to reach all departments of the METU with the same percentage (10 %), the researcher e-mailed to the Computer Center of METU to get information about the current number of undergraduate students according to the departments. Then, the researcher communicated with instructors via e-mail to make arrangements about the time of their courses.

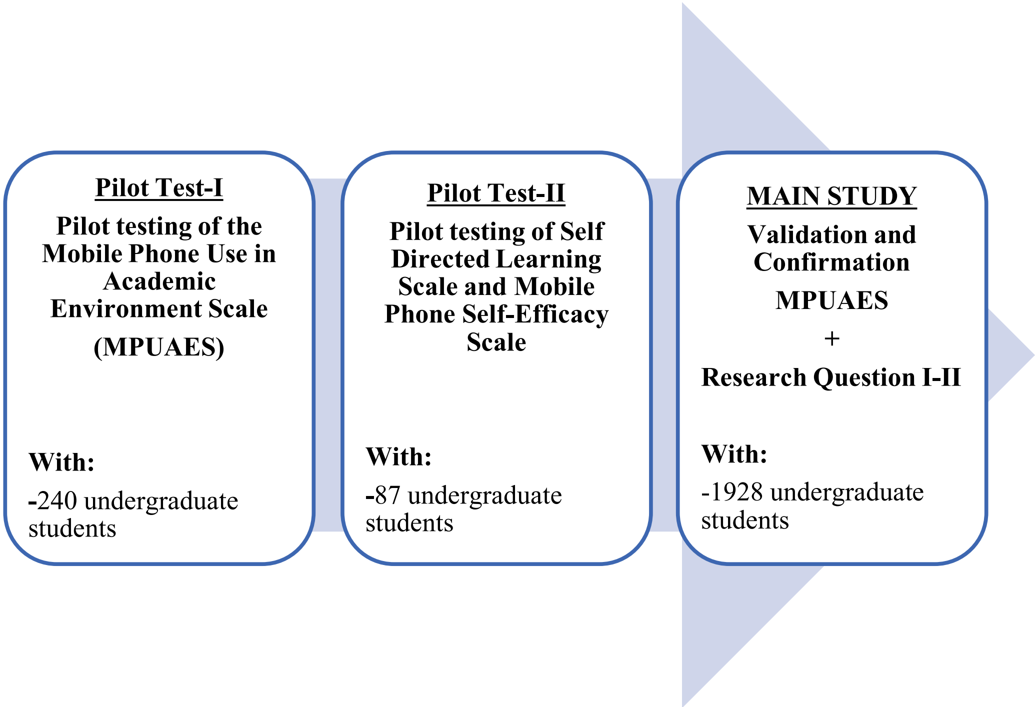

Figure 3. 8 Summary of the data collection procedure

The research was supported by Scientific Research Project Coordinator of METU as an OYP Project (*No:1416*). With this grant, data collection instruments were prepared as optical forms by a private firm. Optical forms provided several advantages. Firstly, the researcher observed that participants were more motivated and seriously interested in responding to the questionnaire. Moreover, the collected data were automatically entered to excel files. This prevented a possible instrument decay which is a threat to internal validity (Fraenkel et al., 2012). Since a unique ID was assigned to each form, the researcher had an opportunity to check the responses of participants. The data were collected mostly in the classroom, which prevented the location internal validity threat (Fraenkel et al., 2012). Moreover, the researcher collected the data to avoid data collector characteristics internal validity (Fraenkel et al., 2012). Since the data collection procedure consisted of three different stages, the researcher was also very careful about the selection of participants, which avoided history internal validity threat (Fraenkel et al., 2012). Thus, certain departments with certain study years were chosen for each stage.

The length of time to complete the data collection instruments was approximately 30 minutes. Before the administration, the researcher again reminded students that their participation was voluntary and they had the right to leave at any time they like. The researcher also emphasized the importance of participants' answers for the study. They were also informed about the confidentiality of all their responses. At the end of May 2016, data collection was completed with 2255 participants in total.

3.6 Data Analysis

Data analysis of the study explained as three main parts in the below:

- In the first part, the instruments used in the study were subjected to validity and reliability issues. First of all, the Mobile Phone Affinity Scale (MPAS) was adapted to the academic environment, and the items of which were used in the development of the Mobile Phone Use in Academic Environment Scale (MPUAES). Thus, a pilot study was conducted to determine the factor structure of the instrument through exploratory factor analysis via SPSS 22.0. For structural model validation, five alternative models were built; and confirmatory factor analysis was performed for each model by using AMOS 20.0. To evaluate validity and reliability issues of the measurement tool, construct validity (convergent validity and discriminant validity) of the interpretations and internal consistency of the scores was examined. Then, cross-validation analysis was used to validate and confirm the gathered factor structure of the scale. The sample of the main study was split into two random samples for conducting both exploratory and confirmatory factor analyses. For confirming the factor solution model suggested by the EFA, the second-order confirmatory factor analysis was performed. In order to treat each subscale of the MPUAES independently, the second-order confirmatory factor analysis was intentionally chosen. Moreover, confirmatory factor analyses were performed to confirm the factor models of both Self-Directed Learning (SDL) and Mobile Phone Self-Efficacy (MPSEF) scales.

- In the second part, descriptive statistics analyses were performed in order to answer the first research questions. The results were presented based on three instruments: (1) Educational Mobile Activities, (2) Mobile applications/services used for educational purposes, and (3) The Motives for mobile phone use. The descriptive results were interpreted by using frequencies, percentages, mean values, and standard deviations. Moreover, correlational analyses were conducted to explore the relationship between mobile phone use with its three factors (facilitator, distractor, and connectedness), self-directed learning, and self-efficacy beliefs. Although there was not such a research question in the study and correlational analyses were performed during multiple regression analyses, it was added to observe the relationship among these five variables more clearly. In other words, it would be hard to see this relationship among 25 predictors in the regression analyses.
- In the last part, the second research question of the study was answered via SPSS 22.0. Three separate hierarchical multiple regression analyses were conducted to investigate the predictors of total Mobile Phone Use in Academic Environment Scale (MPUAES) score, and its three sub-dimensions, namely facilitator, distractor, and connectedness. Before performing the analyses, the dummy coding procedure was applied for the categorical variables which have more than two levels. Then, preliminary analyses were conducted to check the assumptions of multiple regression analyses, which are stated as missing data, adequate sample size, homoscedasticity and linearity, independence of errors, multicollinearity, the normality of residuals, and influential observations (outliers).

3.7 Limitations of the Study

The present study had several limitations as follows:

- The first limitation of the study stems from the inclusion of only undergraduate students of Middle East Technical University. As Merriam (2009) indicated, "the inclusion of multiple cases is, in fact, a common strategy for enhancing the external validity or generalizability of your findings" (p. 50). Because of including only one university, the findings of the study might show limited inferences for generalizability and pose a threat to the external validity.
- In the study, self-reported usage data was gathered from the participants. Thus, there were some limitations that arise from the nature of the self-report data. Firstly, the items of the instruments may not be truly understood by the participants. In addition, the responses may be distorted as a result of guilt, social desirability, ego enhancement, and denial (Ross et al., 2003). Thus, the main assumption of the present study was that participants responded to the questions in the instruments honestly and accurately.

CHAPTER IV

RESULTS

This chapter consisted of the results of the present study. Firstly, the characteristics of the participants related to technology use were given. Then, their educational use of mobile phone was given in detail. Lastly, how certain variables predict the undergraduate students' mobile phone use was presented.

4.1 Profile of Participants Related to Technology Use

Demographic information was presented in the methodology chapter. In this part, participants' characteristics associated with mobile device use was given. Firstly, what kind of mobile device students have and how long they used these devices were asked. In this study, "mobile phone" term was used for a "smartphone" instead of a cell phone. To be clearer, the distinction between a cell phone and smartphone was explained in the instrument as well. While a cell phone is used basically only for calls and texts, a smartphone has advanced computing ability and connectivity. The students who had only cell phones did not fill out the rest of the instrument.

Table 4. 1

Mobile Device Preferences of the Participants (N = 1867)

Mobile Device	I do not have…	0 – 3 years	4 – 6 years	7 - … years
	f	*f*	*f*	*f*
Cell Phone	1867	-	-	-
Smart Phone	12	475	907	485
Tablet PC	1192	341	209	125
Laptop	192	408	577	690
Other	1777	59	22	9

The results showed that 1867 of the students used a smartphone while only 12 of them had a cell phone. As seen Table 4.1, laptops were also the second mostly used mobile device among the university students (*n* = 1675), most of whom (*n* = 1267) used their laptops for more than 3 years. Out of 1867 students, only 675 of them owned a tablet PC, half of whom (*N* = 341) used their devices for between 0 and 3 years. Moreover, 90 students indicated that they had other mobile devices such as kindle, smart-watch, iPod or e-reader. The graphical presentation of the distribution of mobile device use among undergraduate students was shown in Figure 4.1

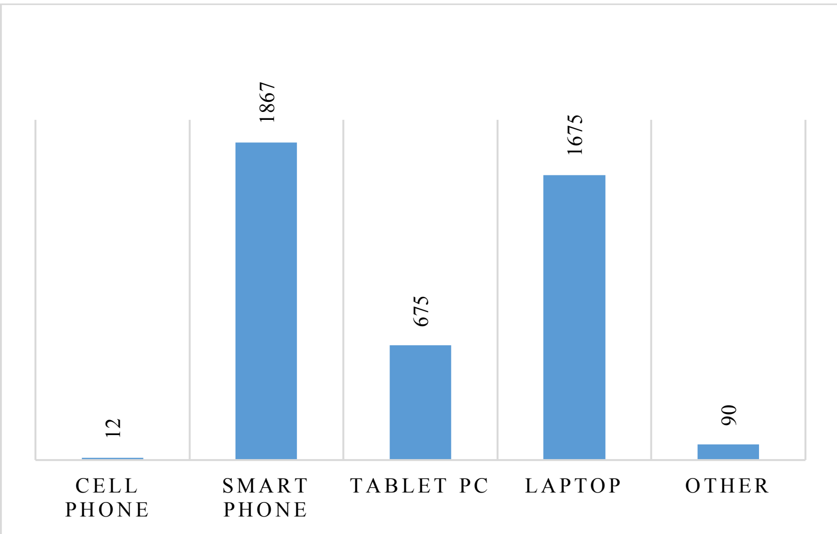

Figure 4. 1 The distribution of mobile device use among undergraduate students

Table 4.2 showed the number of applications and the kind of operating systems that the students used in their mobile phones. The number of applications was categorized into six groups. The majority of the students were in the 10-20 range (39.0%), and followed by under 10 (<10) range (32.5%). 294 of the students (15.7%) who had applications between 21 and 30. The students with more than 30 applications were the minority of the sample, which were distributed as following: 95 of the students (5.1%) in the 31-40 range; 49 of them (2.6%) in the 41-50 range; and 93 of them (5.0%) in the above 50 (>50) range. As seen in Table 4.2, most of the students (60.6%) had a mobile phone with an Android operating system, followed with the iOS (37.1%) operating system. These two operating systems constituted of the two highest groups (97.7%) of the whole participants. While 12 of participants (.6%) did not know their operating systems, 4 of them (.2%) indicated as other.

Table 4. 2

The Number of Applications and Operating Systems that Participants Used in their Mobile Phone (N = 1867)

	Frequency (*f*)	Percent (*%*)
Number of Applications		
<10	607	32.5
10 – 20	729	39.0
21 – 30	294	15.7
31 – 40	95	5.1
41 – 50	49	2.6
>50	93	5.0
Operating Systems		
Android	1131	60.6
iOS	693	37.1
Windows	27	1.4
I don’t know	12	.6
Other	4	.2

The participants were also asked how frequently they use the Internet through the mobile service package and the Wi-Fi at school/home. As seen in Table 4.3, the majority of the students used the Internet every day through mobile service package (*n*=1570, 84.1%). Only 12 students did not have Internet access on their mobile phone. Furthermore, 89.2% of the students used the Internet every day through the Wi-Fi at school, and 83.2% of them used the Internet every day through the Wi-Fi at home. While 77 of the students who did not have Internet access at home constituted of 4.1% of the sample, 2 of them did not use the Internet through Wi-Fi at school. It was clear that undergraduate students mostly had Internet access.

Table 4. 3

Internet Use of the Participants through Mobile Service Package and Wi-Fi at School/Home (N = 1867)

	Mobile service package		Wi-Fi at school		Wi-Fi at home	
	f	%	*f*	%	*f*	%
Never	24	1.3	10	.5	42	2.2
Rarely	77	4.1	50	2.7	88	4.7
Monthly	114	6.1	15	.8	62	3.3
Every week	70	3.7	125	6.7	45	2.4
Every day	1570	84.1	1665	89.2	1553	83.2
No Internet Access	12	.6	2	.1	77	4.1

4.1 Research Question 1: Educational Use of Mobile Phone among Undergraduate Students

Research Question 1: How do undergraduate students use their mobile phones for educational purposes?

In this part, Research Question 1 and its sub-questions were addressed to provide an overview of how undergraduate students use their mobile phone for educational purposes. For this purpose, the second part of the instrument was analyzed, which consisted of three sections: (1) frequency/usefulness of educational mobile activities, (2) mobile applications, and (3) motives for mobile phone use. Each section was presented in tables and figures.

4.1.1 The Frequency of Educational Mobile Phone Activities

Descriptive statistics analysis was performed to investigate the frequency of educational mobile activities that undergraduate students perform with their mobile phones. The educational mobile activities that the students perform with their mobile phone were asked with 29 items on a five-point rating scale. The students ranked each item for both frequency and usefulness.

Accordingly, the first column of the scale was used for the frequency of the educational activities, as *never* and *rarely* (1), *occasionally* (2), *frequently* and *very frequently* (3) as seen in Table 4.4; and the second column in the same scale was ranked for usefulness of the items, as *not at all useful* and *slightly useful* (1), *moderately useful* (2), *very useful* and *extremely useful* (3) as seen in Table 4.6.

The researcher categorized these 29 items under six main titles based on the literature, which were (a) communication and interaction, (b) accessing academic materials, (c) self-learning, (d) getting/searching information, (e) using tools and applications, and (f) generating content/artifacts. The categorization of the items was also checked by three experts in the field of Computer Education and Instructional Technology.

Table 4. 4

Frequency of Educational Mobile Phone Activities Performed by Undergraduate Students (N = 1867)

Items	*M*	*SD*	1*	2*	3*
(A) COMMUNICATION AND INTERACTION					
i9. Instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers).	4.54	.90	4.8	6.5	88.6
i7. Checking social media related to university/academic life (e.g. Facebook, Twitter, Instagram, LinkedIn).	3.91	1.30	16.2	16.0	67.8
i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes (e.g. course projects, assignments).	3.78	1.25	17.0	18.7	64.3
i11. Checking and/or sending e-mails for your academic work.	3.70	1.15	15.6	23.9	60.4
i19. Online sharing and concurrent editing (e.g. Google Docs).	2.84	1.40	42.7	23.2	34.1
i25. Interacting with -like/comment- an academic post on social media.	2.58	1.34	49.8	22.9	27.3

Table 4.4 (continued)

Items	*M*	*SD*	1*	2*	3*
i10. Instant messaging with instructors.	2.26	1.22	61.3	22.3	16.3
i26. Sharing academic information on social media.	2.20	1.26	63.3	19.4	17.2
i28. Participating in a video call/chat for academic purposes.	1.82	1.16	77.0	11.1	11.9
(B) ACCESSING ACADEMIC MATERIALS					
i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.18	1.03	6.6	16.2	77.2
i22. Visiting the university website (e.g. for daily updates, e-mail, getting information).	3.58	1.23	20.0	24.3	55.7
i24. Joining courses and educational content from outside of your university (e.g. iTunes-U, Khan Academy, Coursera).	2.51	1.40	53.2	20.7	26.1
(C) SELF-LEARNING					
i8. Looking up words in dictionaries.	4.06	1.04	8.2	18.3	73.5
i21. Looking up something that you didn't' understand during lectures.	3.74	1.10	13.3	25.0	61.7
i23. Listening to/watching videos related to academic learning (e.g. lectures in YouTube/podcasts).	3.37	1.21	23.1	31.0	45.9
i15. Downloading applications –*specific to your study area-* that help you learn something new.	2.82	1.33	42.8	24.0	33.2
i27. Studying language via specific apps (e.g. Duolingo).	2.45	1.36	54.7	19.9	25.4
i12. Playing educational games.	1.86	1.13	74.4	15.3	10.3
(D) GETTING/SEARCHING INFORMATION					
i1. Browsing the web for academic purposes.	3.85	.99	8.1	26.2	65.7
i4. Reading other content (e.g. newspaper, blogs).	3.78	1.17	14.4	21.4	64.2
i3. Reading academic content (e.g. article, e-book, e-journals, course materials.)	3.19	1.19	27.8	31.2	41.0
i2. Searching literature via library's electronic databases.	2.59	1.29	49.8	24.7	25.5
(E) USING TOOLS/APPLICATIONS					
i17. Using the calendar or setting up reminders (alert/alarm) for your academic works.	3.59	1.36	23.1	18.4	58.5
i18. Using cloud storage for academic purposes (e.g. Dropbox, iCloud, Google Drive).	3.25	1.41	31.2	21.8	47.0
i6. Performing mathematical calculations.	2.94	1.30	37.5	27.4	35.0
i29. Using reference tools (e.g. Mendeley, EverNote).	1.94	1.27	72.0	13.3	14.6
(F) GENERATING CONTENT/ARTIFACTS					
i14. Taking photos for academic purposes.	3.00	1.33	36.2	26.4	37.4
i16. Note taking for academic purposes.	2.64	1.40	49.4	20.2	30.3
i13. Recording audio/video for academic purposes.	2.33	1.30	59.6	20.1	20.4

*(1) Total percentage of "Never" and "Rarely", (2) "Occasionally", (3) "Frequently" and "Very Frequently"

According to the findings, the mean scores ranged from 1.82 to 4.54. More specifically, while 15 of 29 items had a mean range between 3.00 and 4.54; the remaining items were between 1.82 and 2.94. The results showed that the most frequently used educational mobile activity among undergraduate students was Item 9 “Instant messaging with classmates” (*M* = 4.54, *SD* = .90), followed by Item 5 “Accessing Moodle or course websites to find lectures notes, reference readings, videos, announcements etc.” (*M* = 4.18, *SD* = 1.03), Item 8 “Looking up words in dictionaries” (*M* = 4.06, *SD* = 1.04), Item 7 “checking social media related to university/academic life” (*M* = 3.91, *SD* = 1.30), and Item 1 “browsing the web for academic purposes” (*M* = 3.85, *SD* = .99) as seen in Figure 4.2. Furthermore, Item 20 “Joining WhatsApp or FB groups (or other messengers) for academic purposes (e.g. course projects, assignments)” (*M* = 3.78, *SD* = 1.25) and Item 4 “Reading other content (e.g. newspaper, blogs)” (*M* = 3.19, *SD* = 1.19) were the other two activities that students most frequently performed with their mobile phones. As a collaboration activity like Items 9, 7, and 20, Item 11 “Checking and/or sending e-mails for your academic work” (*M* = 3.70, *SD* = 1.15) was also ranked most frequently by the undergraduate students. It might be said that mobile phones had an important role in collaboration among undergraduate students in an academic environment. Furthermore, the following three items showed that students used their mobile phones as a facilitator for their academic learning, which was among high mean scores: Item 21 “Looking up something that you didn’t understand during lectures” (*M* = 3.74, *SD* = 1.10), Item 23 “Listening to/watching videos related to academic learning (e.g. lectures in YouTube/podcasts)” (*M* = 3.37, *SD* = 1.21), and Item 3 “Reading academic content (e.g. article, e-book, e-journals, and course materials)” (*M* = 3.19, *SD* = 1.19).

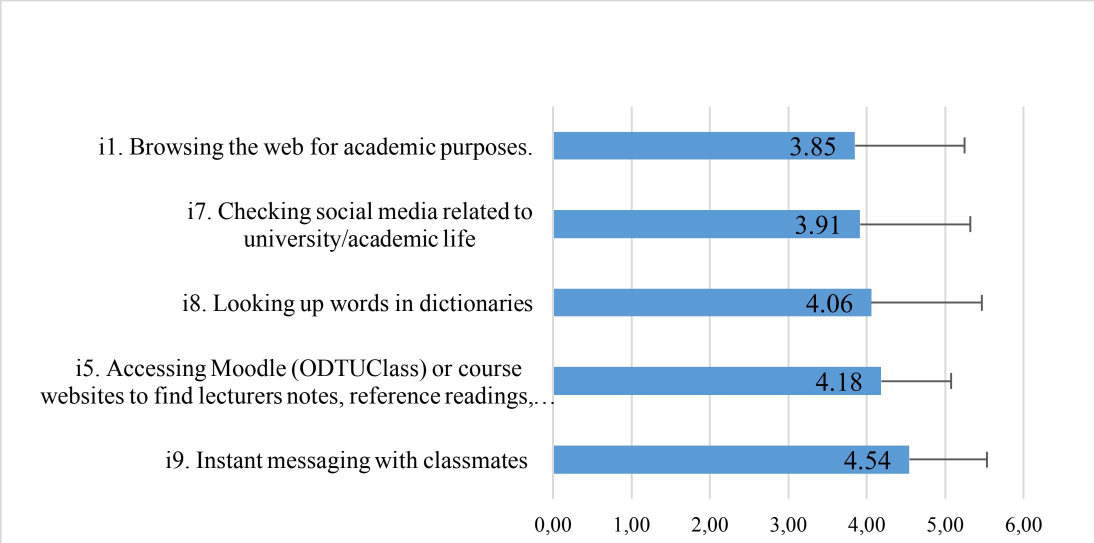

Figure 4. 2 The five most frequently used educational mobile activities with mean scores and standard deviations

Furthermore, undergraduate students reported the five least frequently used educational mobile phone activities as Item 28 "Participating in a video call/chat for academic purposes" (*M* = 1.82, *SD* = 1.16); Item 12 "Playing educational games" (*M* = 1.86, *SD* = 1.13); Item 29 "Using reference tools (e.g. Mendeley, EverNote)" (*M* = 1.94, *SD* = 1.27), Item 26 "Sharing academic information on social media" (*M* = 2.20, *SD* = 1.26); and Item 10 "instant messaging with instructors" as seen in Figure 4.3. Although the students use their mobile phones for checking social media related to university/academic life (*M* = 3.91, *SD* = 1.30), it was seen that they did not share academic information (*M* = 2.20, *SD* = 1.26) or interact with –like/comment- an academic post on social media (*M* = 2.58, *SD* = 1.34). In general, the participants did not frequently use their mobile phones for generating content/artifacts for academic purposes such as taking photos (*M* = 3.00, *SD* = 1.33), note taking (*M* = 2.64, *SD* = 1.40), and recording audio/video (*M* = 2.33, *SD* = 1.30). Thus, apart from generating content/artifact group, it was observed that the most and least frequently used educational mobile activities were not grouped into a particular category, but instead were distributed to different categories.

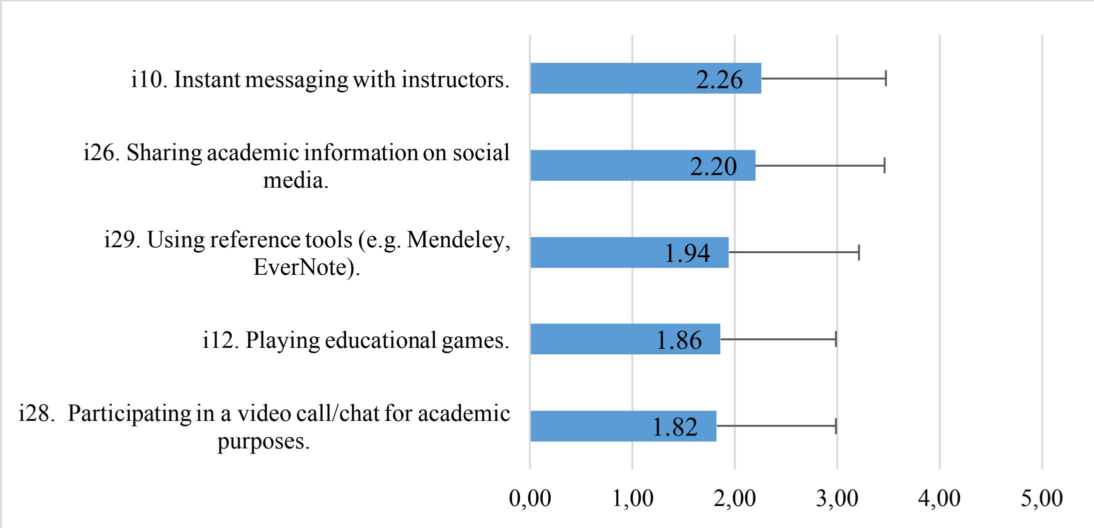

Figure 4. 3 The five least frequently used educational mobile phone activities with mean scores and standard deviation

The students were from five different faculties. Thus, it was also assessed how the frequency of educational mobile phone activities differed according to the faculty. As seen in Table 4.5, the results were similar to the general table. For each faculty, Item 9 "Instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers)." had the highest mean score. Unlike the other three faculties, the students from the faculty of Architecture and Education used their mobile phones for Item 20 "Joining WhatsApp or Facebook groups (or other messengers) for academic purposes". In the pre-interviews, the students especially indicated that this activity was a kind of collaboration among the students for their academic works.

Table 4. 5

The Frequency of Educational Mobile Phone Activities Performed by Undergraduate Students according to the Faculties (N = 1867)

Faculty	5 Highest Mean Scores Items (Frequency)	*M*	*SD*
ARCH (*N* = 109)	i9. Instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers).	4.61	.94
	i7. Checking social media related to your academic life/university (e.g. Facebook, Twitter, Instagram).	4.07	1.24
	i8. Looking up words in dictionaries.	4.02	1.05
	i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes.	3.95	1.19
	i1. Browsing the web for academic purposes.	3.90	.92
ARTS&SCIENCES (*N* = 350)	i9. Instant messaging with classmates.	4.43	1.02
	i8. Looking up words in dictionaries.	4.18	1.00
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.14	1.10
	i1. Browsing the web for academic purposes.	4.01	.95
	i21. Looking up something that you didn't understand during lectures.	3.92	1.06
ECON&ADM (*N* = 270)	i9. Instant messaging with classmates.	4.54	.82
	i8. Looking up words in dictionaries.	4.25	.99
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	3.99	1.02
	i4. Reading other content (e.g. newspaper, blogs).	3.93	1.09
	i7. Checking social media related to university/academic life.	3.90	1.24
EDUCATION (*N* = 273)	i9. Instant messaging with classmates.	4.51	.92
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.33	.94
	i8. Looking up words in dictionaries.	4.31	.93
	i7. Checking social media related to university/academic life.	4.20	1.12
	i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes.	4.03	1.05

Table 4.5 (continued)

Faculty	5 Highest Mean Scores Items (Frequency)	*M*	*SD*
ENGINEERING (*N* = 865)	i9. Instant messaging with classmates.	4.59	.85
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.25	1.01
	i7. Checking social media related to university/academic life.	3.88	1.32
	i8. Looking up words in dictionaries.	3.87	1.06
	i1. Browsing the web for academic purposes.	3.81	1.01

Contrary to the other four faculties, two faculties had different items reported as most frequently used: The students studying the faculty of Economics and Administrative Sciences reported that they most frequently used their mobile phones for Item 4 "Reading other content (e.g. newspaper, blogs)" (M = 3.93, SD = 1.09); and the students from the faculty of Arts and sciences mostly used their mobile phones for Item 21 "Looking up something that you did not understand during lectures." (M = 3.92, SD = 1.06). For the rest, it was observed that most frequently used activities were the same as the general results as indicated above, but each faculty had a different order in itself.

4.1.2 The Usefulness of Educational Mobile Phone Activities

Besides the frequency of educational mobile phone activities, students were also asked how much they found them useful for their academic work. The results showed that mean scores ranged between 2.54 and 4.50. While the mean scores of 24-items were higher than 3.00 corresponding to *very useful* and *extremely useful*, the rest of them were between 2.54 and 2.97, which refers to *not at all useful* and *slightly useful*. Thus, it might be said that students found most of the educational mobile activities useful for their academic work. Moreover, the distribution of the items with high mean scores into the categories did not show a major difference so that it can be said that all categories had similar importance. As seen in Table 4.5 and Table 4.6, the perceived usefulness of the activities was parallel to the frequency, but ranked higher than the scores of frequencies. It was also seen that undergraduate students used their mobile phones to communicate and collaborate with each other, and found these activities useful for their academic work. They also reported that mobile phones were useful in terms of self-learning, searching for information, reading academic or other content, and providing various tools and application.

Table 4. 6

Perceptions of Undergraduate Students in terms of Usefulness of Educational Mobile Phone Activities (N = 1867)

Items	*M*	*SD*	1*	2*	3*
(A) COMMUNICATION AND INTERACTION					
i9. Instant messaging with classmates.	4.50	0.87	4.2	8.1	87.7
i11. Checking and/or sending e-mails for your academic work.	4.24	0.97	6.1	13.3	80.6
i20. Joining WhatsApp or FB groups for academic purposes.	4.15	1.06	8.9	14.0	77.1
i7. Checking social media related to university/academic life.	3.74	1.27	18.1	19.3	62.7
i19. Online sharing and concurrent editing tools.	3.65	1.28	19.3	20.3	60.4
i10. Instant messaging with instructors.	3.45	1.39	24.8	20.5	54.7
i25. Interacting with an academic post on social media.	2.97	1.31	36.1	28.5	35.4
i26. Sharing academic information on social media.	2.84	1.36	40.0	26.9	33.1
i28. Participating in a video call/chat for academic purposes.	2.82	1.33	40.4	27.4	32.2
(B) ACCESSING ACADEMIC MATERIALS					
i5. Accessing Moodle (ODTU Class) or course to find lecturers notes, reference readings, videos, announcements etc.	4.37	0.93	4.6	11.2	84.2
i22. Visiting the university website	3.95	1.11	10.9	19.7	69.5
i24. Joining courses and educational content from outside of your university.	3.48	1.35	23.0	22.6	54.4
(C) SELF-LEARNING					
i8. Looking up words in dictionaries.	4.51	0.82	3.4	7.2	89.3
i21. Looking up something that you didn't' understand during lectures.	4.15	1.01	7.9	14.6	77.6
i23. Listening to/watching videos related to academic learning.	4.03	1.05	9.3	17.4	73.3
i15. Downloading applications *–specific to your study area-* that help you learn something new.	3.48	1.25	21.4	25.4	53.2
i27. Studying language via specific apps.	3.30	1.38	28.0	24.4	47.6
i12. Playing educational games.	2.54	1.38	50.8	23.9	25.3
(D) GETTING/SEARCHING INFORMATION					
i1. Browsing the web for academic purposes.	4.14	0.92	5.0	17.1	77.9
i4. Reading other content (e.g. newspaper, blogs).	3.98	1.05	9.3	20.2	70.5
i3. Reading academic content.	3.88	1.09	11.2	21.3	67.4
i2. Searching literature via library's electronic databases.	3.54	1.26	20.9	22.6	56.5

Table 4.6 (continued)

Items	*M*	*SD*	1*	2*	3*
(E) USING TOOLS/APPLICATIONS					
i17. Using the calendar or setting up reminders for your academic works.	4.05	1.19	12.1	14.8	73.1
i18. Using cloud storage for academic purposes.	3.99	1.22	13.2	15.5	71.3
i6. Performing mathematical calculations.	3.64	1.3	20.5	19.5	60.0
i29. Using reference tools (e.g. Mendeley, EverNote).	2.78	1.41	43.0	24.9	32.1
(F) GENERATING CONTENT/ARTFACTS					
i14. Taking photos for academic purposes.	3.66	1.29	19.3	20.9	59.7
i16. Note taking for academic purposes.	3.21	1.42	32.2	20.8	46.9
i13. Recording audio/video for academic purposes.	3.18	1.37	31.3	24.7	44.0

*1) Total percentage of "Not at All Useful" and "Slightly Useful," 2) "Moderately," 3) Total percentage of "Very Useful" and "Extremely Useful"

As seen in Figure 4.4, students reported the most useful five educational mobile phone activities as follows: Item 8 "Looking up words in dictionaries" (*M* = 4.51, *SD* = .82), Item 9 "Instant messaging with classmates" (*M* = 4.50, *SD* = .88), Item 5 "Accessing Moodle or course to find lecturers' notes, reference readings, videos announcements etc." (*M* = 4.37, *SD* = .93), and Item 11 "Checking and/or sending e-mails for your academic work" (*M* = 4.24, *SD* = .97). In the fifth number, there were two items having same mean score: Item 20 "Joining WhatsApp or FB groups for academic purposes" (*M* = 4.15, *SD* = 1.06), and Item 21 "Looking up something that you did not understand during lectures" (*M* = 4.05, *SD* = 1.01). It was observed that the five items (except Item 20) which perceived most useful and performed most frequently were the same, but the order was different.

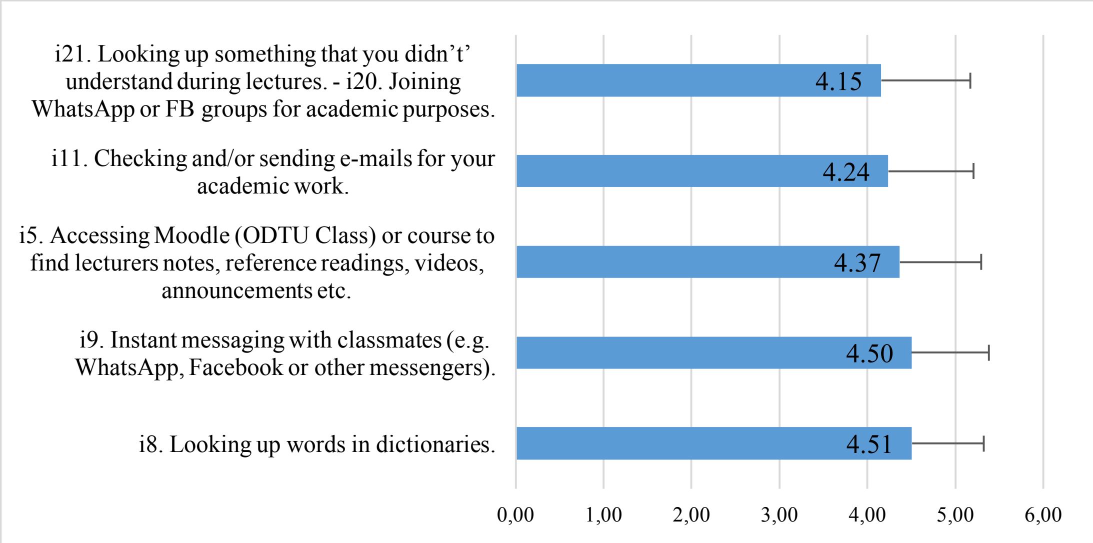

Figure 4. 4 The five most useful educational mobile phone activities with mean scores and standard deviations

On the other hand, the five least useful educational mobile activities were reported by undergraduate students as follows: Item 12 "Playing educational games" (*M* = 2.54, *SD* = .88), Item 29 "Using reference tools" (*M* = 2.78, *SD* = .88), Item 28 "Participating in a video call/chat for academic purposes" (*M* = 2.82, *SD* = .88), Item 26 "Sharing academic information on social media" (*M* = 2.84, *SD* = .88), and Item 25 "Interacting with –like/comment- an academic post on social media (*M* = 2.97, *SD* = .88). Here as well, it was seen that the five items which perceived least useful and performed least frequently were the same, but the order was different. Related to perceived usefulness and frequency results, a controversial issue in social media use was observed. Although students checked social media frequently and found it useful for their academic work, they rarely interacted with or shared any academic information and perceived those activities slightly useful.

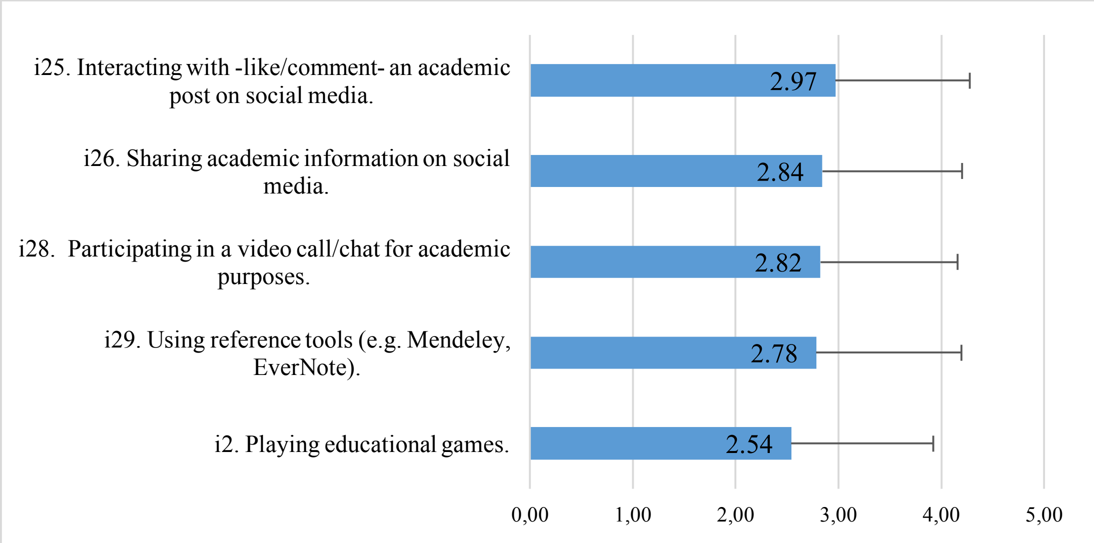

Figure 4. 5 The five least useful educational mobile phone activities with mean scores and standard deviations

Perceived usefulness of educational mobile activities performed by undergraduate students was also assessed according to the faculty. As seen in Table 4.7, the results indicated the same six items in the general table, but the order of these items for each faculty was different in itself. Unlike the other faculties, the faculty of engineering had a different item in the five-highest mean score item list: instead of Item 20 or Item 21, Item 1 "Browsing the web for the academic purposes" (M = 4.13, SD = .94) was ranked as the most useful activity for their academic work.

Table 4. 7

Usefulness of Educational Use of Mobile Phone according to Undergraduate Students (N = 1867)

Faculty	5 Highest Mean Scores Items (Usefulness)	*M*	*SD*
ARCH (*N* = 109)	i8. Looking up words in dictionaries.	4.74	.48
	i9. Instant messaging with classmates.	4.54	.96
	i11. Checking and/or sending e-mails for your academic work.	4.30	.91
	i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes.	4.28	.95
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.24	.98
ARTS&SCIENCES (*N* = 350)	i8. Looking up words in dictionaries.	4.62	.72
	i9. Instant messaging with classmates.	4.42	.95
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.27	1.05
	i11. Checking and/or sending e-mails for your academic work.	4.26	.98
	i21. Looking up something that you didn't understand during lectures.	4.22	1.01
ECON&ADM (*N* = 270)	i8. Looking up words in dictionaries.	4.57	.79
	i9. Instant messaging with classmates.	4.51	.81
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.29	.94
	i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes.	4.20	1.02
	i11. Checking and/or sending e-mails for your academic work.	4.20	.95
EDUCATION (*N* = 273)	i9. Instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers).	4.53	.82
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.50	.74
	i8. Looking up words in dictionaries.	4.49	.85
	i20. Joining WhatsApp or FB groups (or other messengers) for academic purposes.	4.36	.91
	i11. Checking and/or sending e-mails for your academic work.	4.27	.94

Table 4.7 (continued)

Faculty	5 Highest Mean Scores Items (Usefulness)	*M*	*SD*
ENGINEERING (*N* = 865)	i9. Instant messaging with classmates.	4.52	.87
	i8. Looking up words in dictionaries.	4.41	.87
	i5. Accessing Moodle (ODTUClass) or course websites to find lecturers notes, reference readings, videos, announcements etc.	4.40	.91
	i11. Checking and/or sending e-mails for your academic work.	4.22	.98
	i1. Browsing the web for academic purposes.	4.13	.94

To sum up, it might be said that students used their mobile phones to communicate and collaborate with each other through instant messages and e-mails. Then, the following items "looking up words in a dictionary", "looking up something that they did not understand during lectures", and also "accessing ODTUCLASS to find lecture notes" showed that students used their mobile phones for meeting their instant needs in the academic environment.

4.1.3 The Applications/Services Used for Academic Purposes

The students were also asked to indicate the applications/services that they use for academic purposes. Out of 36 applications/services, the six ones were chosen by more than half of the students as seen in Table 4.8. These applications/services were as follows: WhatsApp (73.1%), YouTube (70.6%), Google Search (57.3%), Wikipedia (55.8%), Google Drive (55.3%), and Dictionary (54.8%). Related to these results - especially YouTube, Google Search, and Wikipedia- it might be said that mobile phones were considered as a study tool for undergraduate students.

Table 4. 8

The Applications Used for Academic Purposes by Undergraduate Students (N=1867)

Applications	Used		Not Used	
	f	%	*f*	%
WhatsApp*	**1364**	**73.1**	**503**	**26.9**
YouTube*	**1318**	**70.6**	**549**	**29.4**
Google Search*	**1069**	**57.3**	**798**	**42.7**
Wikipedia*	**1042**	**55.8**	**825**	**44.2**
Google Drive*	**1032**	**55.3**	**835**	**44.7**
Dictionary*	**1023**	**54.8**	**844**	**45.2**
PDF Reader	894	47.9	973	52.1
Dropbox	771	41.3	1096	58.7
Facebook	698	37.4	1169	62.6
MS Office App	667	35.7	1200	64.3
Facebook Messenger	641	34.3	1226	65.7
Google Docs	573	30.7	1294	69.3
Khan Academy	559	29.9	1308	70.1
TED Conference	538	28.8	1329	71.2
Safari	425	22.8	1442	77.2
Duolingo	379	20.3	1488	79.7
LinkedIn	350	18.7	1517	81.3
Twitter	294	15.7	1573	84.3
iCloud	269	14.4	1598	85.6
E-book Reader	123	230	87.7	1637
Pinterest	185	9.9	90.1	1682
Yandex	162	8.7	1705	91.3
Quora	143	7.7	92.3	1724
Evernote	128	6.9	1739	93.1
Coursera	125	6.7	1742	93.3
edX	103	5.5	1764	94.5
Yahoo**	**89**	**4.8**	**1778**	**95.2**
Podcasts**	**85**	**4.6**	**1782**	**95.4**
WordPress**	**84**	**4.5**	**1783**	**95.5**
Edmodo**	**64**	**3.4**	**1803**	**96.6**
Blogger**	**62**	**3.3**	**1805**	**96.7**
Udemy**	**58**	**3.1**	**1809**	**96.9**
iTunes University**	**50**	**2.7**	**1817**	**97.3**
Mendeley**	**39**	**2.1**	**1828**	**97.9**
Be Focused**	**13**	**.7**	**1854**	**99.3**
LibAnywhere**	**11**	**.6**	**1856**	**99.4**

**The applications used more than 50% **The applications used less than 5%*

On the other hand, out of 36 applications/services, 10 were used by less than five percent of undergraduate students. These applications/services were as follows: Yahoo (4.8%), Podcasts (4.6%), WordPress (4.5%), Edmodo (3.4%), Blogger (3.3%), Udemy (3.1%), iTunes University (2.7%), Mendeley (2.1), Be Focused (.7%), and LibAnywere (.6%).

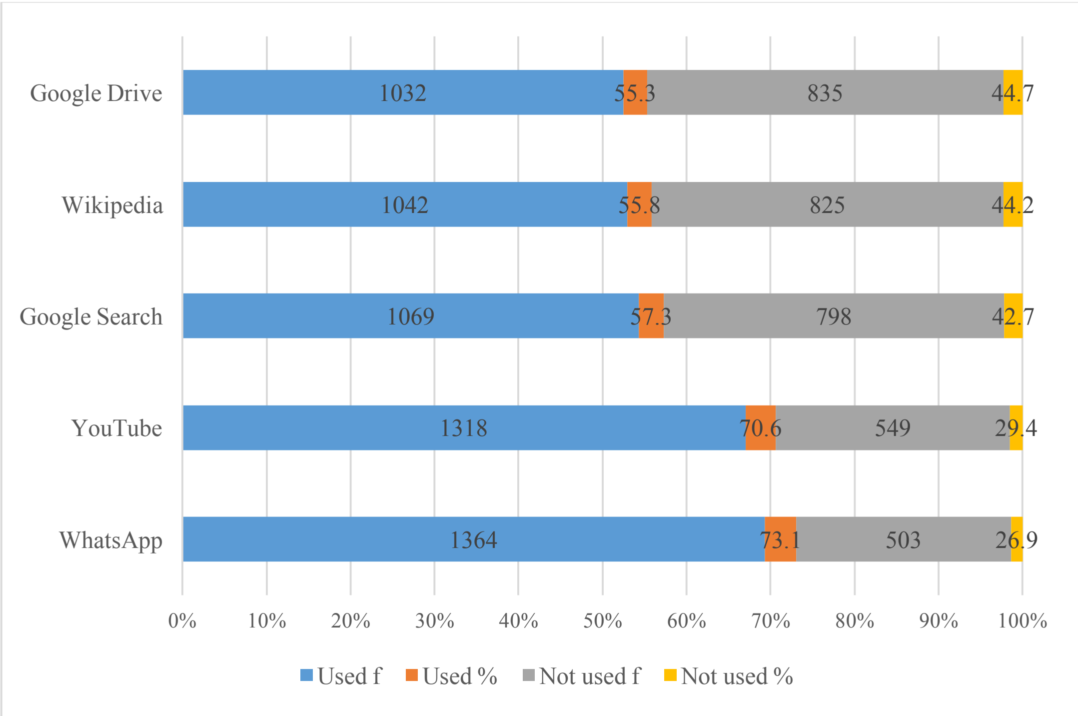

Figure 4. 6 Five most used applications among undergraduate students

Figure 4.6 and Figure 4.7 illustrated five most and least used applications/services among undergraduate students with frequencies and percentages.

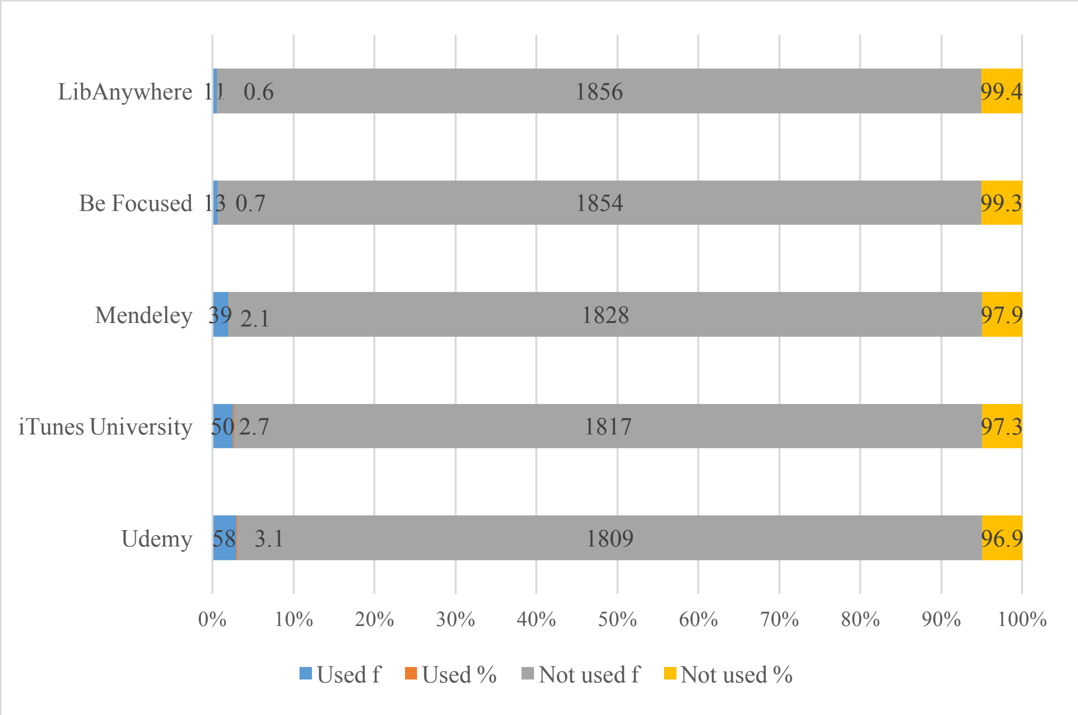

Figure 4. 7 Five least used applications among undergraduate students

As seen in Table 4.9, the applications/services used for academic purposes was reported according to the faculty. Again, the same five most used applications/services in the general table were reported, but a few differences were observed: WhatsApp, YouTube, Google Drive, Google Search, and Wikipedia. Unlike the other faculties, PDF reader was only in the five most used lists of the faculty of architecture and the faculty of education. Moreover, while the faculty of economics and administrative and the faculty of arts and sciences did not have Google Drive in their lists, the rest had. It was also observed that Dictionary application was in the list of social science-oriented faculties: arts and sciences, economics and administrative, and education. Unlike others, the faculty of education had six applications in their five most used lists since PDF reader and Google Drive had the same ratio (59.71% used).

Table 4. 9

The Five Most Used Applications/Services according to the Faculties

Faculty (N)	Applications	Used		Not Used	
		f	%	f	%
ARCH (109)	WhatsApp	52	47.71	57	52.29
	YouTube	51	46.79	58	53.21
	Google Drive	48	44.04	61	55.96
	Google Search	43	39.45	66	60.55
	PDF Reader	42	38.53	67	61.47
ARTS&SCIENCES (350)	YouTube	257	75.59	83	24.41
	WhatsApp	253	74.41	87	25.59
	Dictionary	241	70.88	99	29.12
	Google Search	234	68.82	106	31.18
	Wikipedia	224	65.88	116	34.12
ECON (270)	WhatsApp	165	61.11	105	38.89
	YouTube	163	60.37	107	39.63
	Wikipedia	130	48.15	140	51.85
	Google Search	129	47.78	141	52.22
	Dictionary	125	46.30	145	53.70
EDUCATION (273)	WhatsApp	244	89.38	29	10.62
	YouTube	232	84.98	41	15.02
	Dictionary	201	73.63	72	26.37
	Google Search	182	66.67	91	33.33
	PDF Reader, Google Drive	163	59.71	110	40.29
ENGINEERING (865)	WhatsApp	650	75.14	215	24.86
	YouTube	615	71.10	250	28.90
	Google Drive	532	61.50	333	38.50
	Wikipedia	503	58.15	362	41.85
	Google Search	481	55.61	384	44.39

As seen in Table 4.10, the five least used applications/services were also examined according to the faculty. The results were not very different from the general table. The list of each faculty had one of the five least used applications/services: LibAnywhere, Mendeley, Udemy, Be focused, and iTunes University. Except for the faculty of education, Edmodo was the common unused application among four faculties. Mendeley, Blogger, Yahoo, Coursera, Quora, EdX, and Evernote were the other least used applications, which were not chosen by undergraduate students for their academic purposes.

Table 4. 10

The Five Least Used Applications/Services according to the Faculties

Faculty (*N*)	Applications	Used		Not Used	
		f	%	*f*	%
ARCH (109)	LibAnywhere	0	0.0	109	100.0
	Mendeley	0	0.0	109	100.0
	Udemy	0	0.0	109	100.0
	Edmodo	0	0.0	109	100.0
	Be Focused	0	0.0	109	100.0
ARTS&SCIENCES (350)	iTunesUnv., Mendeley	8	2.29	342	97.71
	Udemy	6	1.71	344	98.29
	Edmodo	5	1.43	345	98.57
	LibAnywhere	3	.86	347	99.14
	Be Focused	3	.86	347	99.14
ECON (270)	Blogger, Edmodo,Yahoo	5	1.85	265	98.15
	iTunesUniversity	3	1.11	267	98.89
	Udemy, LibAnywhere	2	.74	268	99.26
	Be Focused	1	.37	269	99.63
	Mendeley	0	.0	270	100.0
EDUCATION (273)	Coursera	11	4.03	262	95.97
	iTunesUniversity	10	3.66	263	96.34
	Quora, Udemy,EdX	9	3.30	264	96.70
	Mendeley	3	1.10	270	98.90
	LibAnywhere, Be Focused	2	0.73	271	99.27
ENGINEERING (865)	Evernote	23	2.66	842	97.34
	Blogger	20	2.31	845	97.69
	Edmodo	10	1.16	855	98.84
	Be focused	7	.81	858	99.19
	LibAnywhere	4	.46	861	99.54

4.1.4 Research Question 1-d: The Motives for Mobile Phone Use

The undergraduate students were reported their motivation level for mobile phone use under five categories, which were as follows: (1) for communication and interaction, (2) for getting/searching information, (3) for tools and productivity, (4) for entertainment, and (5) for educational purposes as indicated in the previous educational activities table. Students marked between *1(lowest) - 10 (highest)* by considering their priority in general mobile phone use. As seen in Table 4.11, the results showed that the major motivation for mobile phone use among undergraduate students was communication and interaction (*M* = 9.06, *SD* = 1.47), 93.8 percent of the students evaluated this motivation between *7* and *10*. As the second major motivation, 88.1% percent of the students chose getting/searching information (*M* = 8.36, *SD* = 1.75). It was observed that students had similar motivations for tools & productivity (*M* = 7.78, *SD* = 2.10) and the entertainment (*M* = 6.81, *SD* = 2.39). Lastly, it was seen that the lowest motivation for mobile phone use was the educational purposes (*M* = 6.81, *SD* = 2.09). Moreover, 64.3% percent of the students marked this motive between 7 and 10. This means that more than half of the students performed several educational activities through their mobile phones. However, there was an interesting point that while getting/searching information was the second higher motive, the motive for educational purposes was the last.

Table 4. 11

The Motives of Mobile Phone Use (N = 1867)

The Motives	*M*	*SD*	1*	2*	3*
For Communication & Interaction	9.06	1.47	.9	5.3	93.8
For Getting/Searching Information	8.36	1.75	1.5	10.4	88.1
For Tools & Productivity (Calendar, notes, flashlight, alarm)	7.78	2.10	4.8	19.6	75.6
For Entertainment	7.56	2.39	8.3	20.1	71.6
For Educational Purposes (for activities between 1-29)	6.81	2.09	6.9	28.8	64.3

*1) Total percentage of category between 1 and 3, 2) Total percentage of category between 4 and 6, 3) Total percentage of category between 7 and 10.

Figure 4.8 showed percentages and frequencies of each motivation. In the highest (10) point, the results were as follows: out of 1867 students, 1071 of them for communication and interaction, 583 of them for getting/searching information, 507 of them for tools and productivity, 500 of them for entertainment, and lastly 216 of them for educational purposes. On the other hand, the order of the motives was different at the lowest (1) point as follows, respectively: 32 of the students for entertainment, 13 of them for educational purposes, 12 of them for tools and productivity, 5 of them for getting/searching information, and 4 of them for communication and interaction.

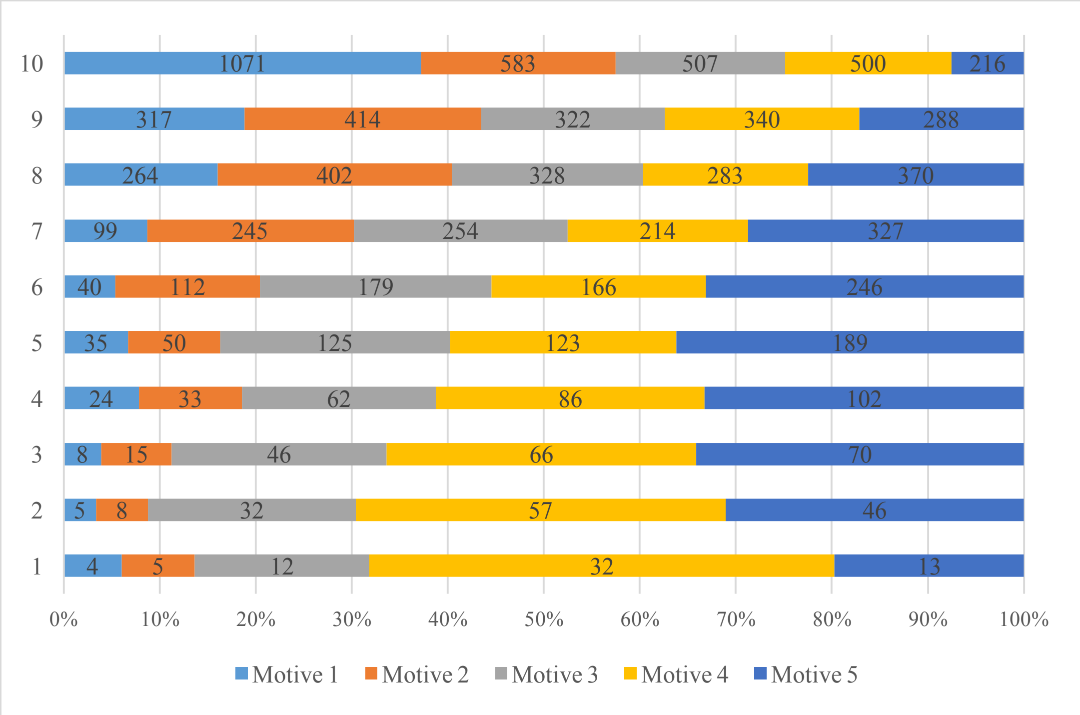

Figure 4. 8 The distribution of the motives

How the motives for mobile phone use changed according to the faculty was also examined. As seen in Table 4.12, the motives were in the same order as the general results. More specifically, the faculty of architecture had the highest means scores for both communication & interaction (M = 9.24, SD = 1.43) and getting/searching information (M = 8.54, SD = 1.75). Furthermore, while the faculty of education had the highest mean scores for both tools & productivity and entertainment, the faculty of arts and sciences had the highest mean score for educational purposes (M = 7.44, SD = 2.39). It was also observed that the faculty of engineering had the lowest mean scores for both getting/searching for information and educational purposes.

Table 4. 12

The Motives of Mobile Phone Use according to the Faculty

The Motives	Faculty	*M*	*SD*	*Min.*	*Max.*
For Communication & Interaction	ARCH	9.24	1.43	1	10
	ECON	9.18	1.35	1	10
	ENGINEERING	9.04	1.45	1	10
	EDUCATION	9.02	1.54	1	10
	ARTS&SCIENCES	9.01	1.56	1	10
For Getting/Searching Information	ARCH	8.54	1.75	1	10
	ARTS&SCIENCES	8.48	1.73	1	10
	ECON	8.46	1.53	1	10
	EDUCATION	8.37	1.68	1	10
	ENGINEERING	8.25	1.63	1	10
For Tools & Productivity (Calendar, notes, flashlight, alarm)	EDUCATION	8.08	1.92	1	10
	ARTS&SCIENCES	7.94	2.13	1	10
	ARCH	7.88	1.91	1	10
	ENGINEERING	7.68	2.13	1	10
	ECON	7.58	2.18	1	10
For Entertainment	EDUCATION	7.98	2.16	1	10
	ECON	7.79	2.36	1	10
	ARCH	7.52	2.41	1	10
	ARTS&SCIENCES	7.52	2.50	1	10
	ENGINEERING	7.39	2.40	1	10
For Educational Purposes (for activities between 1-29 items)	ARTS&SCIENCES	7.44	2.03	1	10
	EDUCATION	7.33	2.07	1	10
	ECON	7.02	2.11	1	10
	ARCH	6.93	1.96	1	10
	ENGINEERING	6.81	2.09	1	10

4.2 Descriptive Statistics

4.2.1 Mobile Phone Use in Academic Environment Scale (MPUAES)

In order to investigate students' mobile phone use in an academic environment, means and standard deviations were calculated. A 5-point Likert type scale was used to measure mobile phone use with its three subscales (facilitator, distractor, and connectedness). Students rated the items how true for them as follows: *Not at all true* (1), *a little true* (2), *somewhat true* (3), *very true* (4), and *extremely true* (5). The results showed that students had a moderate mobile phone use level in total (M = 3.28, SD = .68). Among the sub-dimensions of the scale, facilitator (M = 3.08, SD = .89) and distractor (M = 3.02, SD = .91) subscales had similar mean scores, which were lower than the connectedness (M = 3.75, SD = .75). Moreover, each item of the connectedness subscale had a higher mean score than the rest of the items. Then, the facilitator factor had high mean scores. Students believed that their mobile phone helped them to be more organized for their academic life (M = 3.33, SD = 1.11). Moreover, they reported that mobile phones gave a sense of comfort in their academic life (M = 3.27, SD = 1.13), and especially their mobile phones made it easier to sort out critical issues related to their academic life (M = 3.26, SD = 1.07). The mean and standard deviation values for each item and each subscale of MPUAES were presented in Table 4.13.

The descriptive statistics for each scale of the study were presented in this part, which is important to draw a general picture regarding (1) undergraduate students' mobile phone use in an academic environment with its subs-dimension (facilitator, distractor, and connectedness), (2) their mobile phone self-efficacy beliefs and self-directed learning, and (3) correlational analyses among those variables. The results were given with the mean scores (M), standard deviations (SD), minimum (*Min.*) –maximum (*Max.*) values, frequencies (f) and percentages (%).

Table 4. 13

Mean and Standard Deviations for the Mobile Phone Use in Academic Environment (N = 1867)

Items	*M*	*SD*
Facilitator	**3.08**	**0.89**
i17. My phone helps me be more organized for my academic life.	3.33	1.11
i16. In my academic life, my phone gives me a sense of comfort.	3.27	1.13
i10. Having my phone with me makes it easier to sort out *–resolve, handle-* the critical situations related to my academic life.	3.26	1.07
i4. When it comes to the academic life, my phone is my personal assistant.	3.22	1.1
i6. I feel more comfortable in doing my schoolwork when I have my phone with me.	3.22	1.24
i12. My phone is necessary for my academic life.	3.13	1.22
i11. I feel in control of my academic life when I have my phone with me.	2.96	1.19
i7. For my academic life. I feel dependent on my phone.	2.73	1.24
i13. Without my mobile phone. I feel detached -*out of touch, isolated*- to my academic life.	2.64	1.25
Distractor	**3.02**	**.91**
i18. I find myself engaged with my mobile phone for longer than I intended.	3.20	1.18
i3. I would get more schoolwork done if I spent less time on my phone.	3.14	1.27
i5. When I should be doing the schoolwork. I find myself occupied with my phone.	3.01	1.16
i8. In class or whenever I study. I read/send text messages that are not related to what I am doing.	3.01	1.18
i9. I find myself occupied on my phone even when I am with my classmates or instructors (during the class or studying).	2.74	1.18
Connectedness	**3.75**	**.75**
i2. I use my phone to connect with my classmates or instructors	4.16	0.86
i1. My phone helps me keep track of *-follow-* my academic life.	3.67	1.00
i15. My phone makes it easy to cancel the arranged plans with classmates or instructors.	3.62	1.05
i14. My phone helps me stay close to my classmates and instructors.	3.54	1.12
Total MPUAE	**3.28**	**.68**

How mobile phone use in an academic environment and its subscales changed according to the faculty was also investigated. Firstly, when addressed the facilitator dimension, it was observed that the faculty of education (*M* = 3.24, *SD* = .80) had higher mean scores than the other four faculties, and the faculty of architecture (*M* = 3.14, *SD* = .93) had the second-high mean score. Other three faculties, arts and sciences (*M* = 3.00, *SD* = .99), economics and administrative (*M* = 3.06, *SD* = .88), and engineering (*M* = 3.07, *SD* = .88) showed similar mean scores as seen in Table 4.14. In the distraction dimension, the faculty of economics & administrative (*M* = 3.16, *SD* = .95) and the faculty of education (*M* = 3.15, *SD* = .76) had higher mean scores than the others. The faculty of arts and sciences showed the lowest mean score (*M* = 2.85, *SD* = .95). Lastly, it was seen that the faculty of arts and science (*M* = 3.88, *SD* = .67) had the highest mean score in the connectedness dimension. Then, the faculty of education (*M* = 3.82, *SD* = .68) had the highest connectedness mean score.

Table 4. 14

Mean and Standard Deviations for the Mobile Phone Use in Academic Environment according to the Faculty (N = 1867)

3 Constructs of MPUAES		*N*	*M*	*SD*
Facilitator	ARCH	109	3.14	.93
	ARTS&SCIENCES	350	3.00	.99
	ECON	270	3.06	.88
	EDUCATION	273	3.24	.80
	ENGINEERING	865	3.07	.88
Distractor	ARCH	109	3.04	.87
	ARTS&SCIENCES	350	2.85	.95
	ECON	270	3.16	.95
	EDUCATION	273	3.15	.76
	ENGINEERING	865	3.00	.91
Connectedness	ARCH	109	3.88	.67
	ARTS&SCIENCES	350	3.65	.88
	ECON	270	3.74	.79
	EDUCATION	273	3.82	.68
	ENGINEERING	865	3.75	.71
Total MPUAE	ARCH	109	3.35	.62
	ARTS&SCIENCES	350	3.17	.72
	ECON	270	3.32	.60
	EDUCATION	273	3.41	.65
	ENGINEERING	865	3.27	.68

To sum up, the results showed that the faculty of education had the highest mean scores, and the faculty of arts and sciences had the lowest mean scores, in all sub-dimensions and in total as well.

4.2.3 Self-Directed Learning Scale

Self-directed learning was measured with four items on a 5-point Likert scale. Here, self-directed person means that the person who has the ability to manage his/her own learning process. The mean score of the self-directed learning was 3.57 (*SD* = .75). This indicated that students had a moderate level perception regarding self-directed learning. Moreover, each item had a moderate mean score, ranged from 3.45 (*SD* = .98) to 3.85 (*SD* = 1.3). As seen in Table 4.15, while more than half of the students indicated their agreement by rating all items as 4 or 5, about less than a quarter of them indicated as 1 or 2. This demonstrated that they perceived their selves as a "self-directed person". There was another interesting point that about 30% percentage of the participants neither agreed nor disagreed about all items, which means that the students could not evaluate their ability to manage their own learning process.

Table 4. 15

Descriptive Statistics of the Self-Directed Learning Scale Items

Items	*M*	*SD*	Percentage (%) strongly disagree				strongly agree
			1	*2*	*3*	*4*	*5*
1. When it comes to learning and studying, I am a self-directed person.	3.85	.88	1.3	5.5	22.7	47.9	22.5
2. In my studies, I am self-disciplined and find it easy to set aside reading and homework time.	3.52	.94	2.2	12.1	30.0	42.4	13.2
3. I am able to manage my study time effectively and easily complete assignments on time.	3.45	.98	3.7	12.2	31.9	39.7	12.5
4. In my studies, I set goals and have a high degree of initiative.	3.47	1.02	4.0	12.7	30.4	38.4	14.5
Total	3.57	.75	-	-	-	-	-

4.2.4 Mobile Phone Self-Efficacy Scale

Data about students' self-efficacy beliefs were collected through the Mobile Phone Self-Efficacy Scale, which consisted of 5 items on a 5-point Likert scale. The mean score of the mobile phone self-efficacy was 3.40 (*SD* = .69). Furthermore, the mean scores of all items were higher than the midpoint (3.00), and ranged from 3.29 (*SD* = .95) to 3.53 (*SD* = 1.01). It was observed that more than half of the participants indicated their agreement by rating 3 or 4, which means that they had a moderate self-efficacy level in completing a task by the mobile phone (see Table 4.16).

Table 4. 16

Descriptive Statistics of the Mobile Phone Self-Efficacy Scale Items

Items			Percentage (%)				
	M	*SD*	strongly disagree				strongly agree
I could complete a task using the mobile phone…			*1*	*2*	*3*	*4*	*5*
1. If there was no one around to tell me what to do as I go.	3.47	1.02	3.9	12.3	31.9	36.7	15.3
2. If I had seen someone else demonstrates how it could be used.	3.32	.98	4.8	12.6	38.9	33.2	10.4
3. If I could call someone to help if I got stuck.	3.53	1.01	3.3	12.6	27.0	41.4	15.6
4. If I had a lot of time to complete the job.	3.36	1.02	4.2	15.0	33.9	34.3	12.6
5. If I had just the built-in help facility for assistance.	3.29	.95	3.6	14.4	40.4	32.5	9.2
Total	3.40	.69	-	-	-	-	-

4.2.5 Correlational Analyses

In this part, correlations analyses were performed to investigate relationship: (1) between the sub-dimensions of the Mobile Phone Use in Academic Environment scale (MPUAES) and self-directed learning perception, (2) between the sub-dimensions of MPUAES and mobile phone self-efficacy beliefs, and (3) between the sub-dimensions of MPUAES and the motives for mobile phone use.

Before performing Pearson-Product Moment Correlation analyses, the following assumptions were checked: level of measurement (interval or ratio), independence of observations, and absence of outliers, normality, linearity, and homoscedasticity (Pallant, 2007). All assumptions were met.

4.2.5.1 Relationship between the Sub-Dimensions of MPUAES and Self-Directed Learning

The results showed that there was a weak, yet significant, correlation between the sub-dimensions of MPUAES and self-directed learning. While self-directed learning was negatively correlated with the distractor sub-dimension (r = -.16, p < .01), it was positively correlated with the facilitator dimension (r = .12, p < .01), and connectedness dimension (r = .15, p < .01). On the other hand, there was not found any correlations between the total MPUAES and self-directed learning as seen in Table 4.17.

Table 4. 17

Correlation between the Sub-Dimensions of MPUAES and Self-Directed Learning

Scale	1	2	3	4	5
1. Total MPUAE Score	-	.86**	.75**	.78**	.03
2. Facilitator		-	.43**	.62**	.12**
3. Distractor			-	.32**	-.16**
4. Connectedness				-	.15**
5. Self-Directed Learning					-

**p < .01 (2-tailed)

4.2.5.2 Relationship between the Sub-Dimensions of MPUAES and Mobile Phone Self-Efficacy Beliefs

As seen in Table 4.18, mobile phone self-efficacy beliefs positively and significantly correlated with the total MPUAE score and its sub-dimensions. While students' self-efficacy beliefs had a small relationship with the distractor dimension (r = .25, p < .01), it had a medium relationship with the total MPUAE score (r = .38, p < .01), the facilitator dimension (r = .35, p < .01), and the connectedness dimension (r = .32, p < .01).

Table *4. 18*

Correlation between the Sub-Dimensions of MPUAES and Mobile Phone Self-Efficacy

Scale	1	2	3	4	5
1. Total MPUAE Score	-	.86**	.75**	.78**	.38**
2. Facilitator		-	.43**	.62**	.35**
3. Distractor			-	.32**	.25**
4. Connectedness				-	.32**
5. Self-Efficacy					-

***p* < .01 (2-tailed).

4.2.5.3 Relationship between the Sub-Dimensions of MPUAES and the Motives for Mobile Phone Use

According to the results of correlational analyses, it was observed that there were positive relationships between three sub-sub-dimensions of MPUAES and the motives for mobile phone use (see Table 4.19). The correlations ranged between .09 and .37. More specifically, while the facilitator dimension had a moderate relationship with motive 4 "*entertainment*" (r = .32, p < .01), and motive 5 "*educational purposes*" (r = .34, p < .01), it had a weak relationship with motive 1 "*communication and interaction*" (r = .20, p < .01), motive 2 "*getting/searching information*" (r = .29, p < .01), and motive 3 "*tools and productivity*" (r = .26, p < .01). Moreover, while the distractor dimension had a medium correlation with motive 2 (r = .38, p < .01) and motive 5 (r = .38, p < .01), it had a small correlation with motive 1 (r = .13, p < .01), motive 3 (r = .24, p < .01), and motive 4 (r = .23, p < .01). The connectedness dimension had a medium relationship with only motive 4 (r = .30, p < .01), its relationships with other motives was small. Lastly, while the total MPUAE score had a medium relationship with motive 1 (r = .30, p < .01), motive 2 (r = .32, p < .01), and motive 5 (r = .34, p < .01), it had a small relationship with motive 3 (r = .26, p < .01) and motive 4 (r = .22, p < .01).

Table 4. 19

Correlation between the Sub-Dimensions of MPUAES and the Motives for Mobile Phone Use

Scale	1	2	3	4	5	6	7	8	9
1. Facilitator	-	.86**	.75**	.78**	.20**	.29**	.26**	.32**	.34**
2. Distractor		-	.43**	.62**	.13**	.30**	.24**	.23**	.37**
3. Connectedness			-	.32**	.08**	.09**	.13**	.30**	.11**
4. Total MPUAE				-	.30**	.32**	.26**	.22**	.34**
5. Motive1					-	.38**	.30**	.24**	.17**
6. Motive2						-	.46**	.26**	.54**
7. Motive3							-	.32**	.38**
8. Motive4								-	.26**
9. Motive5									-

**p < .01 (2-tailed). Motive 1 "*Communication & Interaction*", Motive 2 "*Getting/Searching Information*", Motive 3 "*Tools & Productivity*", Motive 4 "*Entertainment*", Motive 5 "*Educational Purposes*"

4.3 Research Question 2: Hierarchical Regression Analyses

Research Question 2: How do five groups of variables demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs predict the undergraduate students' perception in regard of:

a. Facilitator?
b. Distractor?
c. Connectedness?
d. The Total Mobile Phone Use in Academic Environment Scale Score?

The present study performed hierarchical multiple regression analyses to investigate to what extent participants' certain demographic characteristics, certain technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs would predict students' mobile phone use in academic environment regarding the sub-dimensions of facilitator, distractor, and connectedness. To examine each factor of the dependent variable, a separate regression analysis was performed. As seen in Table 4.20, the predictor variables consisted of five blocks, which were entered as the following order: (1) demographic characteristics –*gender, age, faculty, study year, GPA*-, (2) technology use characteristics –*smart phone use year, tablet owner, laptop use year*-, and (3) the motives of mobile phone use, (4) mobile phone self-efficacy beliefs, and (5) self-directed learning.

Table 4. 20

The Predictors of Hierarchical Regression Analyses

Block I Demographic Characteristics
Gender
Age
GPA
Faculty
Study year
Block II Technology-related Characteristics
Smart phone use year
Tablet owner
Laptop owner
The number of applications
Block III Motives for Mobile Phone Use
Motive1: Communication & Interaction
Motive2: Getting/Searching Information
Motive3: Tools & Productivity
Motive4: Entertainment
Motive5: Educational Purposes
Block IV Metacognition Domain
Self-directed learning
Block V Affective Domain
Mobile phone self-efficacy

Although descriptive characteristics were given in the previous parts, they were again presented in Table 4.21, but some different categorizations were made for some variables. Before the dummy coding process, the group numbers of some variables were decreased to interpret the results of the analyses more concisely. Firstly, there were three gender groups as female, male, and other. "*Other*" groups were removed from the data because of including only seven students. Secondly, the age variable consisted of nine groups, which regrouped into three as follows: (1) <19 – 19: the students who have just started university, (2) 20 – 22: the students whose study years were between 1 and 4 – it was also decided on some studies, and (3) 23 – 26+: the students who expected to be graduate. Then, GPA had seven groups, which formed into three groups based on the Middle East Technical University grading system: (1) 0.00 – 2.00: students whose Cumulative Grade Point Average (GPA) is below 2.00 are considered as unsatisfactory, (2) 2.01 – 2.99: the students whose Cumulative Grade Point Average (GPA) were between 2.00 – 2.99 are considered as satisfactory, and (3) 3.01 – 4.00: the students Cumulative Grade Point Average (GPA) were between 3.01 and 4.00 are qualified as honor or high honor students. Study year was also regrouped into four by considering senior and senior plus as one group. Tablet and laptop owner were formed into two groups as have or not have laptop/tablet. Lastly, the number of applications variable had six groups, which were formed into three groups. The students who had; (1) less than 10 applications, (2) between 10 and 30 applications, and (3) more than 30 applications.

Table 4. 21

Descriptive Statistics of the Predictors

Variable	*M*	*SD*	*f*	%
Mobile Phone Self-Efficacy	3.40	.75	-	-
Self-directed Learning	3.57	.69	-	-
Motives for Mobile Phone Use				
Motive1: Communication & Interaction	9.06	1.47	-	-
Motive2: Getting/Searching Information	8.36	1.65	-	-
Motive3: Tools & Productivity	7.78	2.10	-	-
Motive4: Entertainment	7.56	2.39	-	-
Motive5: Educational Purposes	7.04	2.09	-	-

Table 4.21 (continued)

Variable	*M*	*SD*	*f*	%
Gender				
Female	-	-	967	52.0
Male	-	-	893	48.0
Age				
<19 – 19	-	-	180	9.7
20 – 22	-	-	1155	62.1
23 – 26 +	-	-	525	28.2
GPA				
0.00 – 2.00	-	-	221	11.9
2.01 – 3.00	-	-	1028	55.3
3.01 – 4.00	-	-	611	32.8
Faculty				
ARCH	-	-	109	5.9
ART&SCI	-	-	350	18.8
ECON&ADM	-	-	269	14.5
EDU	-	-	271	14.6
ENG	-	-	860	46.2
Study Year				
Freshmen	-	-	528	28.4
Sophomore	-	-	538	28.9
Junior	-	-	456	24.5
Senior/Senior+	-	-	338	18.2
Smart Phone Use				
0 – 3 years	-	-	475	25.5
4 – 6 years	-	-	903	48.5
> 6 years	-	-	482	25.9
Tablet owner				
Not Have	-	-	1187	63.8
Have	-	-	673	36.2
Laptop owner				
Not Have	-	-	191	10.3
Have	-	-	1669	89.7
Number of App.				
<10	-	-	607	32.6
10-30	-	-	1020	54.8
>30	-	-	233	12.5

For the present study, while gender, age, GPA, faculty, study year, smart phone use year, tablet owner, and laptop owner were categorical variables; mobile phone self-efficacy beliefs, self-directed learning, and the motives for mobile phone use were continuous variables. Accordingly, 16 factors with five blocks were entered in the analyses as independent variables. While the independent variables with two levels were directly entered as predicted variables in regression analyses, the others having more than two levels were subjected to dummy coding process. Basically, dummy coding is a representation of groups by using zeros and ones (Field, 2009). The dummy coding process was presented in Table 4.22. The bold ones were chosen as reference groups.

Table 4. 22

Dummy Variable Coding System

	Code Variables			
Age	AgeD1	AgeD2		
<19 – 19	1	0		
20 – 22	0	1		
23 – 26 +	**0**	**0**		
GPA	GPAD1	GPAD2		
0.00 – 2.00	1	0		
2.01 – 3.00	0	1		
3.01 – 4.00	**0**	**0**		
Faculty	FacultyD1	FacultyD2	FacultyD3	FacultyD4
ARCH	0	0	0	1
ART&SCI	0	0	1	0
ECON&ADM	0	1	0	0
EDU	**0**	**0**	**0**	**0**
ENG	1	0	0	0
Study Year	YearD1	YearD2	YearD3	
Freshmen	1	0	0	
Sophomore	0	1	0	
Junior	0	0	1	
Senior/Senior+	**0**	**0**	**0**	
Smart Phone Use	SmartD1	SmartD2		
0 – 3 years	**0**	**0**		
4 – 6 years	0	1		
>6 years	1	0		
Number of App.	AppD1	AppD2		
<10	**0**	**0**		
10-30	0	1		
>30	1	0		

**Bold one indicated the reference dummy groups*

4.3.1 Assumptions of Hierarchical Regression Analysis

Before performing hierarchical multiple regression analysis, the assumptions which are stated as missing data, adequate sample size, homoscedasticity and linearity, independence of errors, multicollinearity, the normality of residuals, and influential observations (outliers) were checked (Fraenkel et al, 2012). They were explained below in detail.

4.3.1.1 Missing Data

The data was screened at the beginning of the analysis. There were 1928 cases; however, 45 missing data and 7 students who indicated their gender as "other" not included data. Thus, the final number of the sample was 1860.

4.3.1.2 Adequate Sample Size

The adequacy of sample size is important to obtain a reliable regression model. For the present study, it was examined in two ways. Firstly, according to Green (1991), overall fit regression model and individual predictors are examined for the minimum acceptable sample size. For testing the model overall, the minimum sample size was calculated as 250 by the formula $50 + 8k$, where k corresponds the number of predictors (Green, 1991). For testing the individual predictors, it was calculated as 129 by the formula $104 + k$. Then, the largest value, which was 120 for the study, was recommended. Considered of both formulas, the sample size (n = 1860) was adequate in a good deal. Secondly, according to Field (2009), there should be 10 cases or 15 cases of data for each predictor. 250 or 375 cases are needed respectively based on the aforementioned rule as the number of predictors of the current study is 25. Thus, a sample with 1860 participants was accepted considerably enough.

4.3.1.3 Homoscedasticity and Linearity

For both homoscedasticity and linearity, the scatterplots were checked, which were presented in Figure 4.9, 4.10, 4.11, and 4.12 in Appendix H. Linearity means that there should be a linear relationship between the dependent (outcome) and the independent variables (Field, 2009). According to Tabachnick and Fidell (2013), a rectangle form of the scatterplot is the indicator of linearity. It was observed that the scatterplots for each dependent variable represented a rectangle despite some misfits. Thus, it can be concluded that the linearity assumption was met. Homoscedasticity refers to the variance of error that is the same across all levels of the independent variables (Odborne & Waters, 2002). In order to check this assumption, residuals scatterplot was visually examined. It was seen that there was no any systematic pattern that caused to the violation.

4.3.1.4 Independence of Errors

Another assumption of regression analysis is the independence of errors means that errors of prediction are independent or uncorrelated of one another (Tabachnick and Fidell, 2013). It was assessed by Durbin-Watson statistic, in which values should be between 1 and 3 (Field, 2009). In the current study, the Durbin-Watson values were found between 1.95 and 2.10. Thus, it can be concluded that the assumption was met.

4.3.1.5 Multicollinearity

Multicollinearity refers to predictors that are highly correlated with other predictor variables. That is to say, an intercorrelation among predictors is an unacceptable situation for the regression analysis. The assumption was checked by three methods. Firstly, according to Field (2009), a correlation between outcome variables should not be above .80 or .90. The correlation matrices presented in Table 4.29, 4.30, 4.31, and 4.32 (see Appendix I) were scanned. It was seen that there was no multicollinearity problem because absolute values of correlations among predictor variables were between .00 and .54. The other two ways are produced by SPSS, which are no variance inflation (VIF) values greater than 10 (Hair, Black, Babin & Anderson, 2010), and no tolerance values less than .20 (Menard 1995, as cited in Field, 2009). The aforementioned rules with the highest VIF value of 3.31 and with the lowest tolerance value of .30 were met. On the whole, it can be said that multicollinearity was not a threat in the data set.

4.3.1.6 Normality of Residuals

It refers to whether an error of prediction around each dependent variable score is normally distributed or not (Tabachnick & Fidell, 2013). The assumption of normality was checked by Skewness and Kurtosis values, histogram and P-P plot. Firstly, Skewness and Kurtosis values were checked for each predictor. It was seen that the values were between +1 and -1, which indicated the normality (Tabachnick & Fidell, 2013). Then, histograms and p-p plots were examined. According to Tabachnick and Fidell (2013), "the residuals scatterplot should reveal a pileup of residuals in the center of the plot at each value of predicted score and a normal distribution of residuals trailing off symmetrically from the center" (p. 198). P-P plotted residuals should reveal a straight 45-degree line for the normality assumption (Hair et al., 2010). Histogram of residuals presented in Figure 4.13, 4.14, 4.15, and 4.16 (see Appendix J); and p-p plots presented in Figure 4.17, 4.18, 4.19, and 4.20 was observed (see Appendix K). It was seen that the histogram of residuals for each dependent variable almost shows a normal distribution and most of the residuals lie along diagonal in P-P plot. Thus, it can be concluded that the normality assumption appears tenable.

4.3.1.7 Outliers

As a general rule, the statistical procedure can be quite sensitive to outliers (Stevens, 2009). In order to identify outliers in multiple regression, there are several numerical and graphical diagnostics as follows: Leverage (or *hat*) values, DFBeta values, Cook's Distance, and Mahalanobis distance.

Leverage (or hat) values: According to Steven (2002), the leverage values should be smaller than the criteria of 3(k + 1)/ n, where k is the number of predictors and n is the number of participants. For the current study, the values were between .005 and .042, which were not higher than .044 calculated value based on the criteria. This means that there were no outliers.

DFBeta values: Although the absolute values of DFBeta are expected smaller than absolute 1 according to Fidell (2009), Steven (2002) suggests smaller than 2. In the present study, DFBeta values of all cases were less than 2, which indicated that influential observation did not exist.

Cook's Distance: According to Cook and Weisberg (1982), Cook's distance values should be smaller than 1 not to be caused any concern. The results showed that no values greater than 1, in which the maximum values were observed as .009. This indicates that the data set showed the absence of influential cases. In the present study, it can be said that there was not any influential case because all of Cook's distance values were not greater than 1.

Mahalanobis distance: For the present study, the critical value was calculated at 52.62 with $df = 25$ at $p < .001$ by using the Chi-square table presented by Tabachnick and Fidell (2013). The Mahalanobis values should be smaller than the obtained value, which was ranged from 8.94 to 77.42. Accordingly, 18 values were detected above the obtained value. However, according to Tabachnick and Fidell (2013), "Mahalanobis distance can either 'mask' a real outlier (produce a false negative) or 'swamp' a normal case (produce a false positive). Thus, it is not a perfectly reliable indicator of multivariate outliers and should be used with caution" (p.108).

To sum up, the 18 extreme cases based on calculating Mahalanobis distance were not removed from the data set. The regression analyses were performed with the data obtained from 1860 cases.

4.3.2 Predictors of Facilitator

After being ensured that the assumptions of multiple linear regression analysis were met, a hierarchical regression analysis was performed to answer the following sub-research question.

> RQ2-a How well do demographic characteristics, technology use characteristics, the motives of mobile phone use, mobile phone self-efficacy beliefs, and self-directed learning predict undergraduate students' perception in regard to the facilitator sub-dimension of MPUAES?

The outcome variable was the facilitator dimension. The predictor variables were entered in 5 blocks labeled as presented in 4.20.
In the following part, the results of the hierarchical regression analysis regarding the addressed research question are explained in detail.

4.3.2.1 Findings of Regression Analysis

As seen in Table 4.23, the first model consisted of undergraduate students' demographic characteristics including gender, age, GPA, faculty, and study year. This model investigated the effects of the variables on the facilitator dimension of the mobile phone use in an academic environment (MPUAE). According to the results, it was seen than the model significantly predicted undergraduate students' mobile phone use regarding the facilitator dimension, F (12, 1847) = 4.14, p = .00. For this model, R^2 value was found .03, which indicates that demographic characteristics explained only 3% of the variation in the facilitator dimension of the MPUAES. When the contribution of each variable was assessed, it was seen that gender's individual contribution significantly affected the facilitator dimension, t (1847) = 4.78, p = .00. This indicates that female students' perceptions in terms of facilitator dimension were higher than male students. Moreover, faculty predicted the facilitator dimension. Among four dummy coded variables, the comparison in between the faculty of education and the faculty of arts and sciences was the only predictor had a significant contribution to the model, t (1847) = -2.33, $p < .05$. This means that the students from the faculty of education perceived their mobile phones as a facilitator more than the students from the faculty of arts and sciences. On the other hand, it was seen that age, GPA, and study year had no significant contribution to the model.

The second model belonged to technology-use related characteristics such as smart phone use year, tablet owner, laptop owner, and the number of applications. This model also significantly predicted the facilitator dimension of the MPUAES, F (6, 1841) = 12.13, p = .00. The technology-use related characteristics with the demographic variables explained 6% of the variation of facilitator dimension (R2 = .06). Thus, the variation of the model increased from 3% to 6%. Smart phone use year was the other significant predictor. Comparison in between the groups of 0-3 years and 4-6 years and between 0-3 years ($\beta = .06$, $p < .05$) and >6 years showed that the students ($\beta = .11$, $p < .05$) who had smart phones for long years had higher level perceptions in terms of facilitator dimension than the others. Tablet owner was also a significant predictor (t (1841) = 2.09, $p < .05$), which indicated that tablet owners perceived their mobile phones as a facilitator more than the others. The number of applications had a significant contribution to the model. More specifically, the first group was the comparison of the <10 and 10-30, and the second group was the comparison of <10 and <30. First group recorded a higher Beta value ($\beta = .14$, $p < .05$) than the second group ($\beta = .11$, $p < .05$), which means that students who had more mobile applications had higher level perceptions in terms of facilitator dimension, and who had applications between 10 and 30 had the highest perceptions.

The third group included five motivations of mobile phone use as follows: for communication and interaction labeled as “Motive 1”, for getting/searching information labeled as “Motive 2”, for tools and productivity labeled as “Motive 3”, for entertainment labeled as “Motive 4”, and for educational purposes labeled as “Motive 5”. This model also had significant contribution to the facilitator dimension of the MPUAES, F (5, 1836) = 64.32, $p = .00$. Furthermore, it made a substantial increase in the variation of the model, which accounted for 20% of the variation with the other two models ($R^2 = .20$). Contributed motivations were as follows: For getting/searching information (t (1836) = 3.36, $p < .05$) and for educational purposes (t (1836) = 10.61, $p < .05$). This means that the student who used their mobile phones getting/searching information (Motive 2) and for educational purposes (Motive 5) perceived their mobile phones as a facilitator in an academic environment more than the others whose motivations were communication and interaction (Motive 1), tools and productivity (Motive 3), and entertainment (Motive 4). Among these contributed motivations, Motive 5 was the highest perceptions ($\beta = .27$, $p < .05$)

The model 5 with self-directed learning was significant, F (1, 1835) = 5.36, $p < .05$, in which the variation of the model increased from 20% to 21% The contribution of self-directed learning predictor was significant, (t (1835) = 2.32, $p < .05$), which means that students with high self-directed learning level perceived their mobile phones as a facilitator more than the ones with the low level self-directed learning.

Lastly, the model 6 with mobile phone self-efficacy was significant F (1, 1834) = 151.67, $p < .05$, where the variation of the model reached 27% from 21%. Self-efficacy beliefs were a significant predictor of the model, (t (1834) = 12.32, $p < .05$). This indicates that students with high self-efficacy beliefs used their mobile phones as a facilitator in an academic environment more than the others with low self-efficacy beliefs.

Table 4. 23

Regression Analysis Summary for Facilitator

Variable	*B*	*SE B*	β	sr^2	*R*	R^2	ΔF
Model I					.16	.03	4.14*
Gender	.22	.05	.12	0.015*			
23-26+vs.<19-19	.11	.10	.04	0.001			
23-26+vs.20-22	.12	.06	.06	0.004			
0.00-2.0vs.3.01-4.00	.03	.07	.01	0.000			
2.01-3.0vs.3.01-4.00	.08	.05	.04	0.002			
Seniorvs.Fresh	-.09	.08	-.04	0.002			
Seniorvs.Soph	.04	.08	.02	0.000			
Seniorvs.Junior	-.04	.07	-.02	0.000			
EDUvs.ARCH	-.06	.10	-.02	0.000			
EDUvs.ART&SCI	-.17	.07	-.07	0.006*			
EDUvs.ECON	-.10	.08	-.04	0.002			
EDUvs.ENG	-.06	.07	-.04	0.001			
Model II					.25	.06	12.13*
SmartPhoneYear(0-3)vs.(4-6)	.10	.05	.06	.003*			
SmartPhoneYear(0-3)vs.(>6)	.23	.06	.11	.013*			
TabletOwner	.12	.04	.07	.004*			
LaptopOwner	-.08	.07	-.03	.001			
(<10)vs.(10-30)	.25	.05	.14	.020*			
(<10)vs.(>30)	.29	.07	.11	.012*			
Model III					.45	.20	64.32*
MOTIV1	.00	.01	.00	.000			
MOTIV2	.05	.01	.09	.009*			
MOTIV3	.01	.01	.03	.001			
MOTIV4	.03	.01	.09	.008*			
MOTIV5	.12	.01	.27	.074*			
Model IV					.45	.21	5.36*
SDL	.06	.03	.05	.003*			
Model V					.52	.27	151.67*
SEF	.33	.03	.26	.066*			

*N = 1860, *p* < .05, Motive 1 "*Communication & Interaction*", Motive 2 "*Getting/Searching Information*", Motive 3 "*Tools & Productivity*", Motive 4 "*Entertainment*", Motive 5 "*Educational Purposes*"

4.3.3 Predictors of Distractor

A hierarchical regression analysis was performed to answer the following sub-research question.

> RQ2-b How well do demographic characteristics. Technology-use related characteristics, the motives of mobile phone use, mobile phone self-efficacy beliefs, and self-directed learning predict undergraduate students' perception in regard to distractor sub-dimension of MPUAES?

The dependent variable was the distractor dimension. The predictor variables were entered in 5 blocks labeled as presented in 4.20.

In the following part, the results of the hierarchical regression analysis regarding the addressed research question are explained in detail.

4.3.3.1 Findings of Regression Analysis

To begin with, the first model included undergraduate students' gender, age, GPA, faculty, and study year. The results of the hierarchical analysis were presented in Table 4.24. This model examined to observe the effects of the demographics variables on the distractor dimension of the mobile phone use in an academic environment (MPUAE). The results showed that the model had a significant contribution to undergraduate students' mobile phone use regarding the distractor dimension, F (12, 1847) = 8.11, p = .00. Also, this model explained 5% of the variation in the distractor dimension of the MPUAES. The contribution of each predictor was assessed, gender's unique contribution significantly predicted the facilitator dimension, t (1847) = 5.39, p = .00. This means that female students' perceptions regarding the distractor dimension were higher than male students. Age was also a significant predictor. More specifically, the comparison in between the age groups of 20-22 and 23-26+ for the distractor dimension showed that students whose age were between 20 and 22 were disturbed by their mobile phones in an academic environment more than the students whose age were greater 22 years old, t (1847) = 2.80, $p < .05$. However, the comparison between the age groups of <19-19 and 23-26+ did not show any significant contribution. As a demographic characteristic, the faculty was the other significant predictor for the distractor dimension. Among four dummy coded variables, the comparison in between the faculty of education and the faculty of arts and sciences was the only predictor had a significant contribution to the model, t (1847) = -2.43, $p < .05$. This indicates that the students from the faculty of education perceived their mobile phones as a distractor in an academic environment more than the students from the faculty of arts and sciences. GPA was also a significant predictor with its two groups: the *first group* comparing 0.00 – 2.00 with 3.01 – 4.00, and the *second group* comparing 2.01 – 3.00 with 3.01 – 4.00. It was seen that the second group had a higher Beta value ($\beta = .09$, $p < .05$) than the first group ($\beta = .08$, $p < .05$), which indicates that mobile phones disturbed the students with low GPA more than the ones with high GPA in an academic environment. As a demographic characteristic, it was seen that study year had no significant contribution to the model.

The second model labeled technology-use related characteristics also significantly predicted the distractor dimension of the MPUAES, F (6, 1841) = 9.57, $p = .00$. This model with the demographic variables accounted for 8% of the variation of distractor dimension ($R^2 = .08$). Thus, the variation of the model increased from 4% to 8%. Both smart phone use year and the number of applications had a significant contribution to the model. Related to smart phone use year, while comparison in between 0-3 and 4-6 had no significant contribution, the comparison in between 0-3 and >6 had. This means that students who had their mobile phones for more than 6 years perceived their mobile phones as a distractor more than the others. Furthermore, the students with more applications in their mobile phones had higher level perceptions in terms of facilitator dimension. It was seen that comparison in between <10 and 10-30 ($\beta = .12$, $p < .05$) had higher Beta value students who had mobile applications between 10 and 30 ($\beta = .10$, $p < .05$). On the other hand, a tablet owner and laptop owner did not affect the model.

The third group included five motivations of mobile phone use as follows: for communication and interaction labeled as “Motive 1”, for getting/searching information labeled as "Motive 2", for tools and productivity labeled as "Motive 3", for entertainment labeled as "Motive 4", and for educational purposes labeled as "Motive 5". This model with Motive 4 and Motive 5 also had a significant contribution to the facilitator dimension of the MPUAES, F (5, 1836) = 27.68, p = .00, which increased the variation of the model from 8% to 14%. Namely, the students whose motivations were entertainment and educational purposes perceived their mobile phones as a distractor in an academic environment. However, the motive for educational purposes (β = .04, p < .05) had a substantial lower Beta value than the motive for entertainment (β = .25, p < .05).

The model 5 including self-directed learning was statistically significant, F (1, 1835) = 52.10, p < .05, where the variation of the model increased from 14% to 17%. The contribution of self-directed learning predictor was negatively significant (β = -.16, p < .05), which means that highly self-directed learner did not use their mobile phones in the academic environment in regard to the distractor sub-dimension.

In the final model, the only predictor "mobile phone self-efficacy" had a positive significant contribution, F (1, 1834) = 93.66, p < .05. The variation of the model reached 21% from 17%. This indicates that students with high self-efficacy beliefs perceived their mobile phones as a distractor in an academic environment more than the others with low self-efficacy beliefs.

Table 4. 24

Regression Analysis Summary for Distractor

Variable	*B*	*SE B*	*β*	sr^2	*R*	R^2	Δ*F*
Model I					.22	.05	8.11*
Gender	.25	.05	.14	.018*			
23-26+vs.<19-19	.10	.10	.03	.001			
23-26+vs.20-22	.17	.06	.09	.008*			
0.00-2.0vs.3.01-4.00	.22	.07	.08	.006*			
2.01-3.0vs.3.01-4.00	.16	.05	.09	.008*			
EDUvs.ARCH	-.03	.10	-.01	.000			
EDUvs.ART&SCI	-.18	.07	-.08	.006*			
EDUvs.ECON	.13	.08	.05	.002			
EDUvs.ENG	.04	.07	.02	.000			
Seniorvs.Fresh	.06	.08	.03	.001			
Seniorvs.Soph	.13	.08	.07	.004			
Seniorvs.Junior	.00	.07	.00	.000			
Model II					.28	.08	9.57*
SmartPhoneYear(0-3)vs.(4-6)	.05	.05	.03	.001			
SmartPhoneYear(0-3)vs.(>6)	.17	.05	.08	.010*			
TabletOwner	.06	.04	.03	.001			
LaptopOwner	.11	.07	.04	.001			
(<10)vs.(10-30)	.22	.05	.12	.015*			
(<10)vs.(>30)	.26	.07	.10	.009*			
Model III					.38	.14	27.68*
MOTIV1	.01	.01	.01	.000			
MOTIV2	-.02	.02	-.04	.002			
MOTIV3	.01	.01	.02	.000			
MOTIV4	.10	.01	.25	.063*			
MOTIV5	.02	.01	.04	.002*			
Model IV					.41	.17	52.10*
SDL	-.20	.03	-.16	.027*			
Model V					.46	.21	93.66*
SEF	.28	.03	.21	.044*			

*N = 1860, *p* < .05, Motive 1 "*Communication & Interaction*", Motive 2 "*Getting/Searching Information*", Motive 3 "*Tools & Productivity*", Motive 4 "*Entertainment*", Motive 5 "*Educational Purposes*"

4.3.4 Predictors of Connectedness

A hierarchical regression analysis was performed to answer the following sub-research question.

> RQ2-c How well do demographic characteristics, technology use characteristics, the motives of mobile phone use, mobile phone self-efficacy beliefs, and self-directed learning predict undergraduate students' perception in regard to connectedness sub-dimension of MPUAES?

The dependent variable was the connectedness dimension. The predictor variables were entered in 5 blocks labeled as presented in 4.20.
In the following part. The results of the hierarchical regression analysis regarding the addressed research question are explained in detail.

4.3.4.1 Findings of Regression Analysis

The results of the hierarchical analysis for the connectedness dimension were presented in Table 4.25. The first model was statistically significant, F (12, 1847) = 8.64, p = .00, accounted for 5% of the variation in the distractor dimension of the MPUAES. The unique contribution of each demographics predictor was assessed. Firstly, gender significantly predicted the connectedness dimension, t (1847) = 5.39, p = .00. This means that female students' perceptions regarding the connectedness dimension were higher than male students. Age was also a significant predictor. More specifically, the comparison between the age groups of 20-22 and 23-26+ showed that students whose age were between 20 and 22 connected their mobile phones in an academic environment more than the students whose age were greater 22 years old, t (1847) = 3.39, $p < .05$. On the other hand, the comparison between the age groups of <19-19 and 23-26+ did not show any significant contribution. Lastly, GPA, as a demographic characteristic, was the other significant predictor for the connectedness dimension. Comparison between the GPA groups of 0.00 – 2.00 and 3.01 – 4.00 showed that students with low GPA had a higher perception in terms of connectedness dimension than the others with high GPA, t (1847) = -3.54, $p < .05$. Related to demographic predictors, it was seen that faculty and study year had no significant contribution to the model.

The second model with the technology-use related characteristics also significantly predicted the connectedness dimension of the MPUAES, F (6, 1841) = 11.03, $p = .00$. This model with the first model explained 9% of the variation of connectedness dimension ($R^2 = .09$). Except for laptop owner, all predictors of the second model had a unique contribution to the model. Firstly, smart phone use year was a significant positive predictor, which means that the longer students used their mobile phones the more they connected their mobile phones in an academic environment. Secondly, tablet owner was a significant predictor (t (1841) = 2.23, $p < .05$), which indicated that tablet owners had higher perceptions in terms of connectedness dimension than the others. Lastly, the number of applications had a significant contribution to the model. More specifically, the first group was the comparison of the <10 and 10-30, and the second group was the comparison of <10 and >30. First group recorded a higher Beta value ($\beta = .15$, $p < .05$) than the second group ($\beta = .10$, $p < .05$), which means that students who had more mobile applications had higher level perceptions in terms of connectedness dimension, and who had applications between 10 and 30 had the highest perceptions.

In the third group, five motivations of mobile phone use were significantly affected the model, F (5, 1836) = 66.23, $p = .00$. Furthermore, a substantial increment was occurred by the inclusion of the third group in the variation of the model, which reached to 24% from 9%. Each motive uniquely contributed to the model as follows: For communication and interaction (t (1836) = 7.88, $p < .05$), for getting/searching information (t (1836) = 2.14, $p < .05$), for tools and productivity (t (1836) = 2.07, $p < .05$), for entertainment (t (1836) = 1.98, $p < .05$), and for educational purposes (t (1836) = 9.41, $p < .05$). This means that the connectedness dimension of MPUAES was essential for each motive. Among the motivations, Motive 5 was the highest Beta value ($\beta = .24$, $p < .05$), and Motive 4 was the lowest ($\beta = .4$, $p < .05$).

The model 5 with self-directed learning was significant, F (1, 1835) = 10.52, $p < .05$. However, it was a slight contribution, which increased the variation of the model from 23.7% to 24.2%. This means that a self-directed learner had high perceptions in terms of connectedness dimension, even it was a small effect.

Lastly, the model 6 with mobile phone self-efficacy was significant F (1, 1834) = 64.25, $p < .05$. There was an increment in the variation of the model from 24% to 28%. A significant predictor of the model, self-efficacy beliefs ($\beta = .23$, $p < .05$), the students with high self-efficacy beliefs had higher perceptions regarding the connectedness dimension more than the others with low self-efficacy beliefs.

Table 4. 25

Regression Analysis Summary for Connectedness

	B	*SE B*	*β*	sr^2	*R*	R^2	Δ*F*
Model I					.23	.05	8.64*
Gender	.27	.04	.18	.031*			
23-26+vs.<19-19	.14	.08	.05	.003			
23-26+vs.20-22	.17	.05	.11	.012*			
0.00-2.0vs.3.01-4.00	-.21	.06	-.09	.008*			
2.01-3.0vs.3.01-4.00	.00	.04	.00	.000			
EDUvs.ARCH	.09	.09	.03	.001			
EDUvs.ART&SCI	-.09	.06	-.05	.002			
EDUvs.ECON	.01	.06	.00	.000			
EDUvs.ENG	.08	.06	.05	.003			
Seniorvs.Fresh	-.02	.07	-.01	.000			
Seniorvs.Soph	.01	.06	.01	.000			
Seniorvs.Junior	-.08	.06	-.05	.002			
Model II					.29	.09	11.03*
SmartPhoneYear(0-3)vs.(4-6)	.10	.04	.06	.004*			
SmartPhoneYear(0-3)vs.(>6)	.17	.05	.10	.010*			
TabletOwner	.08	.04	.05	.003*			
LaptopOwner	.00	.06	.00	.000			
(<10)vs.(10-30)	.22	.04	.15	.021*			
(<10)vs.(>30)	.23	.06	.10	.010*			
Model III					.49	.237	66.23*
MOTIV1	.09	.01	.18	.032*			
MOTIV2	.03	.01	.06	.003*			
MOTIV3	.02	.01	.05	.003*			
MOTIV4	.01	.01	.04	.002*			
MOTIV5	.09	.01	.24	.056*			
Model IV					.49	.242	66.06*
SDL	.07	.02	.07	.005*			
Model V					.53	.28	64.25*
SEF	.23	.02	.21	.045*			

*N = 1860, *p* < .05, Motive 1 "*Communication & Interaction*", Motive 2 "*Getting/Searching Information*", Motive 3 "*Tools & Productivity*", Motive 4 "*Entertainment*", Motive 5 "*Educational Purposes*"

4.3.5 Predictors of the Total Mobile Phone Use in Academic Environment Scale Score

A hierarchical regression analysis was performed to answer the following sub-research question.

> RQ2-d How well do demographic characteristics, technology use characteristics, the motives of mobile phone use, mobile phone self-efficacy beliefs, and self-directed learning perceptions predict undergraduate students' perception in regard to the total MPUAE score?

The dependent variable was the total MPUAE score. The predictor variables were entered in 5 blocks labelled as presented in 4.20.

In the following part, the results of the hierarchical regression analysis regarding the addressed research question are explained in detail.

4.3.5.1 Findings of Regression Analysis

As presented in Table 4.26, the first model included undergraduate students' demographic predictors had a significant contribution to undergraduate students' total mobile phone use perceptions, $F\,(12, 1847) = 8.96, p = .00$. Also, this model explained 6% of the variation in the total MPUAE score. Among the predictors, gender ($\beta = .18$, $p < .05$), age ($\beta = .11, p < .05$), and faculty ($\beta = -.08, p < .05$), had a unique contribution to the model, respectively. Accordingly, female students' perceptions regarding the total mobile phone use were higher than male students. Age was also a significant predictor. More specifically, the comparison between the age groups of 20-22 and 23-26+ for the total MPUAE score showed that students whose age were between 20 and 22 had higher mobile phone use perceptions than whose age were greater 22 years old. However, the comparison between the age groups of <19-19 and 23-26+ did not show any significant contribution. The faculty was the other significant predictor for the total MPUAE score. Among four dummy coded variables, the comparison between the faculty of education and the faculty of arts and sciences was the only predictor had a significant contribution to the model, t (1847) = -2.65, $p < .05$. This indicates that the students from the faculty of education had higher mobile phone use perceptions in an academic environment than the students from the faculty of arts and sciences.

The second model included technology-use related characteristics also significantly predicted the total MPUAE score, F (6, 1841) = 17.02, $p = .00$. In this model, the variation of the model increased from 6% to 11%. Except for laptop owner, smart phone use year, tablet owner, and the number of applications had a significant contribution to the model. Related to smart phone use year, it was seen that the students who had smartphones for long years had higher perceptions in terms of the total MPUAE scorer than the others. Compared group of (0-3 years) with (10-30) years ($\beta = .06$, $p < .05$) had lower Beta value than compared group with (0-3) years with (>30) years ($\beta = .13$, $p < .05$). Lastly, the students with more applications in their mobile phones had higher level perceptions in terms of the total MPUAE scores than the other with fewer ones. It was seen that students who had mobile applications between 10 and 30 had the highest perceptions.

The third group included five had significant contribution to the total MPUAE score, F (5, 1836) = 67.38, $p = .00$. Furthermore, it made a substantial increase in the variation of the model, which accounted for 24% of the variation with the other two models. Contributed motivation predictors were as follows: For communication and interaction (t (1836) = 3.22, $p < .05$), for entertainment (t (1836) = 7.50, $p < .05$), and for educational purposes (t (1836) = 8.96, $p < .05$). This means that the student who used their mobile phones for communication and interaction (Motive 1), for entertainment (Motive 4), and for educational purposes (Motive 5) had higher perceptions in terms of mobile phone use in an academic environment than the others whose motivations were getting/searching information (Motive 2), and tools and productivity (Motive 3). Among these contributed motivations, Motive 5 was the highest Beta value ($\beta = .22$, $p < .05$), and Motive 1 was the lowest ($\beta = .07$, $p < .05$).

The model 5 with self-directed learning was statistically non-significant. This means that whether being a self-directed learner or not affect the use of mobile phone regarding the mobile phone use in an academic environment.

Lastly, the model 6 with mobile phone self-efficacy was significant F (1, 1834) = 199.97, $p < .05$, where the variation of the model reached 32% from 24%. Self-efficacy beliefs were a significant predictor of the model, (t (1834) = 14.14, $p < .05$). This indicates that students with high self-efficacy beliefs used their mobile phones in an academic environment more than the others with low self-efficacy beliefs.

Table 4. 26

Regression Analysis Summary for the Total MPUAE Score

Variable	*B*	*SE B*	*β*	sr^2	*R*	R^2	ΔF
Model I					.24	.06	8.96*
Gender	.24	.03	.18	.032*			
23-26+vs.<19-19	.12	.07	.05	.003			
23-26+vs.20-22	.15	.04	.11	.012*			
0.00-2.0vs.3.01-4.00	.01	.05	.01	.000			
2.01-3.0vs.3.01-4.00	.08	.03	.06	.004*			
EDUvs.ARCH	.00	.08	.00	.000			
EDUvs.ART&SCI	-.15	.05	-.08	.007*			
EDUvs.ECON	.01	.06	.01	.000			
EDUvs.ENG	.02	.05	.01	.000			
Seniorvs.Fresh	-.02	.06	-.01	.000			
Seniorvs.Soph	.06	.06	.04	.002			
Seniorvs.Junior	-.04	.05	-.03	.001			
Model II					.32	.11	17.02*
SmartPhoneYear(0-3)vs.(4-6)	.08	.04	.06	.004*			
SmartPhoneYear(4-6)vs.(>6)	.20	.04	.13	.017*			
TabletOwner	.09	.03	.06	.004*			
LaptopOwner	.01	.05	.00	.000			
(<10)vs.(10-30)	.23	.03	.17	.029*			
(<10)vs.(>30)	.26	.05	.13	.016*			
Model III					.49	.24	67.38*
MOTIV1	.03	.01	.07	.005*			
MOTIV2	.02	.01	.04	.002			
MOTIV3	.01	.01	.04	.002			
MOTIV4	.05	.01	.17	.028*			
MOTIV5	.07	.01	.22	.050*			
Model IV					.49	.24	1.27
SDL	-.02	.02	-.02	.001			
Model V					.56	.32	199.97*
SEF	.28	.02	.29	.081*			

*N = 1860, *p* < .05, Motive 1 "*Communication & Interaction*", Motive 2 "*Getting/Searching Information*", Motive 3 "*Tools & Productivity*", Motive 4 "*Entertainment*", Motive 5 "*Educational Purposes*"

4.4 Summary of the Results

The purpose of the study was to investigate undergraduate students' mobile phone usage in an academic environment. Moreover, the study aimed to examine the effect and contribution of certain demographics, certain technology-use related characteristics, motives for mobile phone use, self-directed learning, and mobile phone self-efficacy on mobile phone use in an academic environment in terms of facilitator, distractor, and connectedness sub-dimensions. A correlational research design was employed with 1867 undergraduate students from all departments of Middle East Technical University in Ankara. A stratified random sampling method was used for the selection of the sample. The following data collection tools were employed in the study: (1) Educational Use of Mobile Phone divided into three sections as educational mobile activities, a list of mobile applications/services, and motives for mobile phone use which were partially developed by the researcher, (2) Mobile Phone Use in Academic Environment Scale (MPUAES) was developed by the researcher. For this scale, the item pools of the Mobile Phone Affinity Scale (MPAS) (Bock et al., 2016), was used, (3) Self-Directed Learning Scale (SDL) (McVay, 2000; 2001), and (4) Mobile Phone Self-Efficacy Scale (MPSEF) (Compeau & Higgins, 1995).

Data was collected during the fall semester of 2015-2016 and the spring semester of 2016-2017. Firstly, for the development of Mobile Phone Use in Academic Environment Scale (MPUAES), exploratory and confirmatory factor analyses were performed through SPSS and AMOS, respectively. For validation and confirmation of the factor structure, a pilot study was carried out with 240 undergraduate students. Then, cross-validation analysis was performed for the validation of the scale with the sample of the main study. The Mobile Phone Use in Academic Environment Scale (MPUAES) proposed a three-factor structure with 18-item: facilitator (9-item), distractor (5-item), and connectedness (4-item). Cronbach alpha coefficients were examined for each factor, which was found as .92 for *facilitator* factor (9 items), .82 for *distractor* factor (5 items) and .73 (4 items) for *connectedness* factor. Being greater than .70, these values were acceptable (Nunally, 1978). The results of the study showed that the scores the developed scale MPUAES are valid and reliable in assessing undergraduate students' mobile phone use in an academic environment.

Moreover, confirmatory factor analyses were conducted for Self-Directed Learning (SDL) scale and Mobile Phone Self-Efficacy (MPSEF) scales with 87 undergraduate students. The reliability coefficients for SDL and MPSEF were calculated, which were found .84 and .77, respectively.

Both two research questions were analyzed quantitatively. In the first research question, undergraduate students' educational mobile phone use in regard to frequency and usefulness of mobile activities, mobile applications/services, and motives for mobile phone use were explored through descriptive statistical analyses. In the second research question, inferential statistical analyses were performed to examine the factors affecting undergraduate student' mobile phone use in an academic environment in terms of facilitator, distractor, and connectedness sub-dimensions.

The first research question was how undergraduate students use their mobile phones for educational purposes, which had four sub-research questions. In the first sub-research question, undergraduate students' educational mobile activities usage frequency was asked. The educational mobile activities with a 29-item scale were developed based on based on literature (Clough, Jones, & Scanlon, 2007; Son, 2007; Bomhold, 2013; Pollara, 2011, Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013; Ng et al., 2017) and the results of informal interviews with undergraduate students. Then, the researcher categorized these 29 items under six main titles as the follows: (a) communication and interaction, (b) accessing academic materials, (c) self-learning, (d) getting/searching information, (e) using tools and applications, and (f) generating content/artifacts. This categorization was made by means of analysis of the reference studies. According to the results, out of 29 educational mobile activities, the students reported these five activities as most frequently used: instant messaging with classmates (e.g. WhatsApp, Facebook, or other messengers); accessing Moodle (ODTUCLASS) or course website to find lecturers' notes, references readings, videos, announcements etc.; looking up words in dictionaries; checking social media related to university/academic life; and lastly browsing the web for academic purposes. On the other, those five activities were reported as least frequently used: participating in a video call/chat for academic purposes; playing educational games; using reference tools such as Mendeley, EverNote; sharing academic information on social media; and lastly instant messaging with instructors. The second sub-research question concerned the extent of the usefulness of these 29-item educational mobile activities. The five most useful activities were including the same items as in the usage frequency result, which were reported as follows: looking up words in dictionaries; instant messaging with classmates (e.g. WhatsApp, Facebook, or other messengers); accessing Moodle (ODTUCLASS) or course website to find lecturers' notes; references readings, videos, announcements etc.; checking and/or sending e-mails for academic work, and lastly two items had the same score, which were looking up something that students did not understand during the lecture and joining WhatsApp or Facebook groups for academic purposes. The five least useful educational mobile activities were also showed some similarities to the usage frequency results, which were as follows: playing educational games, using reference tools, participating in a video call/chat for academic purposes, sharing academic information on social media, and lastly interacting with –like/comment- and academic post on social media. In the third sub-research question, undergraduate students listed mobile applications that they used for their academic work. The results showed that the following applications were used by more than half of the students: WhatsApp, YouTube, Google Search, Wikipedia, and Google Drive. On the other hand, out of 36, the following ten applications were used by the less than five percent of the undergraduate students: Yahoo, Podcasts, WordPress, Edmodo, Bologger, Udemy, iTunes University, Mendeley, Be Focused, and LibAnywhere. In the fourth-sub research question, the motives for mobile phone use were asked. The students reported that they used their mobile phones firstly for communication and interaction, secondly for getting and searching information, thirdly for tools and productivity such as calendar, notes, flashlight, and alarm, fourthly for entertainment, and lastly for educational purposes which were indicated as 29 items in educational mobile phone activities part in the instrument. Thus, it was seen that the highest motivation of undergraduate students for mobile phone use was for communication and interaction whereas the educational purposes were the lowest motivation. As the results of descriptive statistics analyses, undergraduate students' mobile phone use in an academic environment was at a moderate level. Among the three sub-dimensions, they mostly used their mobile phones for connectedness. Then, they evaluated their mobile phones as a facilitator and distractor in an academic environment, respectively. Moreover, the students had moderate self-directed learning level and mobile phone self-efficacy beliefs. In order to see apparently the relationship among the total Mobile Phone Use in Academic Environment (MPUAE) score, self-directed learning (SDL), mobile phone self-efficacy beliefs (MPSEF), and the motives for mobile phone use, correlational analyses were performed. When examined the relationship between the total MPUAE score and SDL, the results showed that there was a significant relationship between SDL and three sub-dimensions of MPUAES. While the relationship was positive with facilitator and connectedness, it was negatively associated with the distractor dimension. Students' mobile phone self-efficacy beliefs were associated with the total MPUAE score and its three sub-dimensions in the following order: the total MPUAE score, facilitator, connectedness, and distractor sub-dimensions. Lastly, a significant relationship between the sub-dimensions of MPUAES and the motives for mobile phone use was observed. The results showed that all three sub-dimensions significantly correlated with the all motives. More specifically, while facilitator and distractor sub-dimensions were highly associated with the motive "educational purposes", the connectedness dimension was highly correlated with the motive "entertainment". To sum up, the results of the study regarding the first research question showed that students used their mobile phones in the academic environment for the following categories, respectively: (1) Communication and Interaction, (2) Getting/searching information, (3) Self-learning, (4) Accessing materials, and lastly (5) Using tools and generating artifacts. The summary of the first research question of the study was presented in Figure 4.21.

Figure 4.21 Summary of the results regarding undergraduate students' educational mobile phone use

The second research question aimed to answer how five groups of variables (demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs) predicted the undergraduate students' total MPUAE scores and its three sub-dimensions, namely, the facilitator, distractor, and connectedness. For this purpose, four separate hierarchical regression analyses were performed. Firstly, the results showed that all five groups of variables explained 27 % of the variance of facilitator dimension, 21 % of the variance of the distractor dimension, 28 % of the variance of connectedness dimension; and different from the others, four groups of variables accounted for 32 % of the variance of students' mobile phone use in the whole aspect. It was the self-directed learning which did not have any relationship with the total MPUAE score. Accordingly, apart from the aforementioned exceptional issue, each group of variables had significant contributions to the total MPUAE score and its three sub-dimensions. Among these five group variables, the motives for mobile phone use together and self-efficacy explained much of the variability in the four analyses. Considering the unique contribution of each variable, self-efficacy and the motive 5 "Educational Purposes" were the best predictors for the total MPUAE, the facilitator, and the connectedness sub-dimensions. The results showed some differences for the distractor dimension; the motive 4 "Entertainment" was the first strongest predictor, then self-efficacy was the second strong predictor. Moreover, the contribution of the self-directed learning on the distractor dimension was higher than the other sub-dimensions; and its relationship with the distractor dimension was found negative. The summary of the results for each sub-dimension – *facilitator, distractor*, and *connectedness* – and the *total MPUAE score* was presented in Figure 4.22, Figure 4.23, Figure 4.24, and Figure 4.25, respectively.

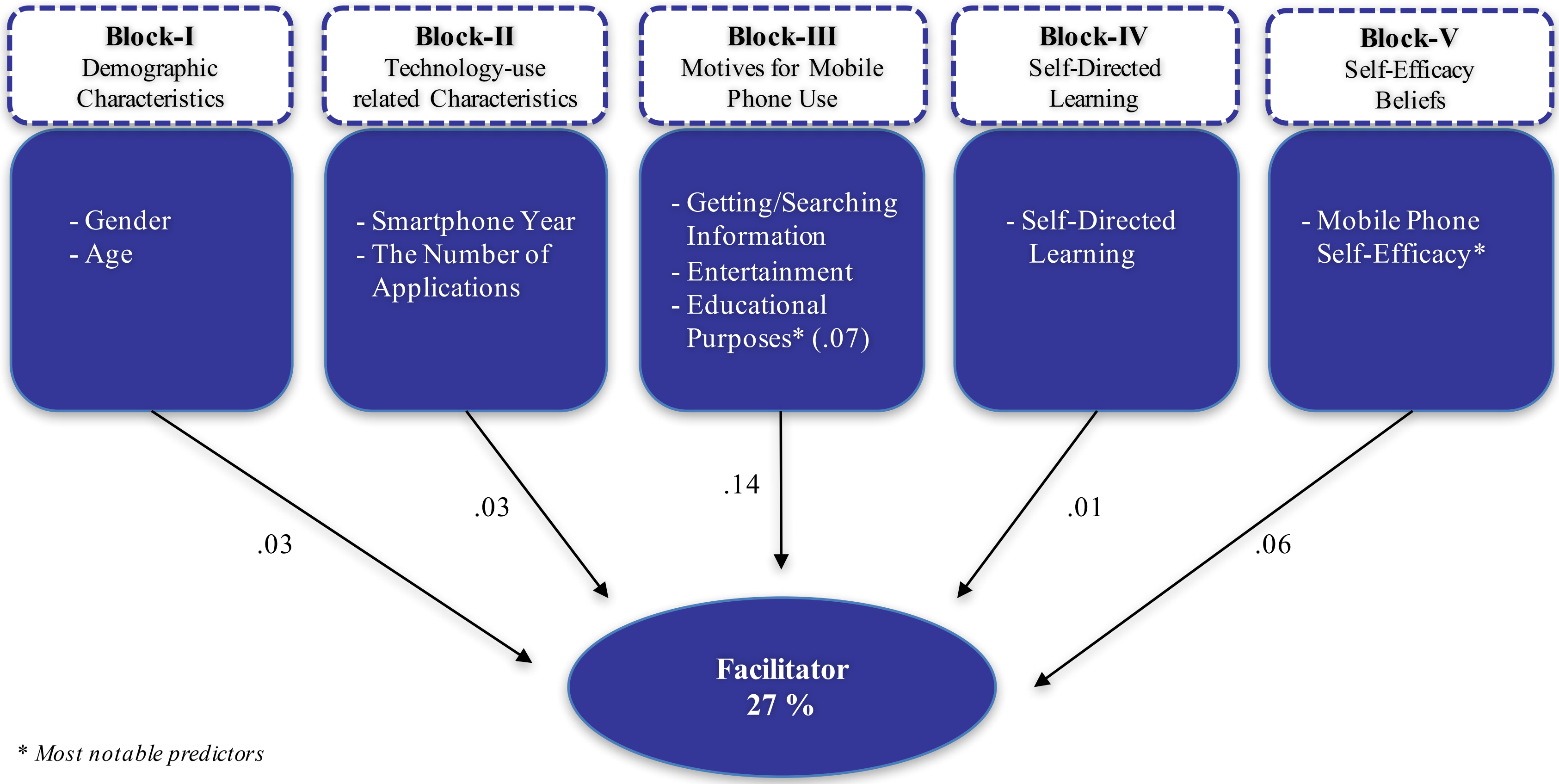

Figure 4.22 Summary of the results regarding the predictions of the facilitator sub-dimension

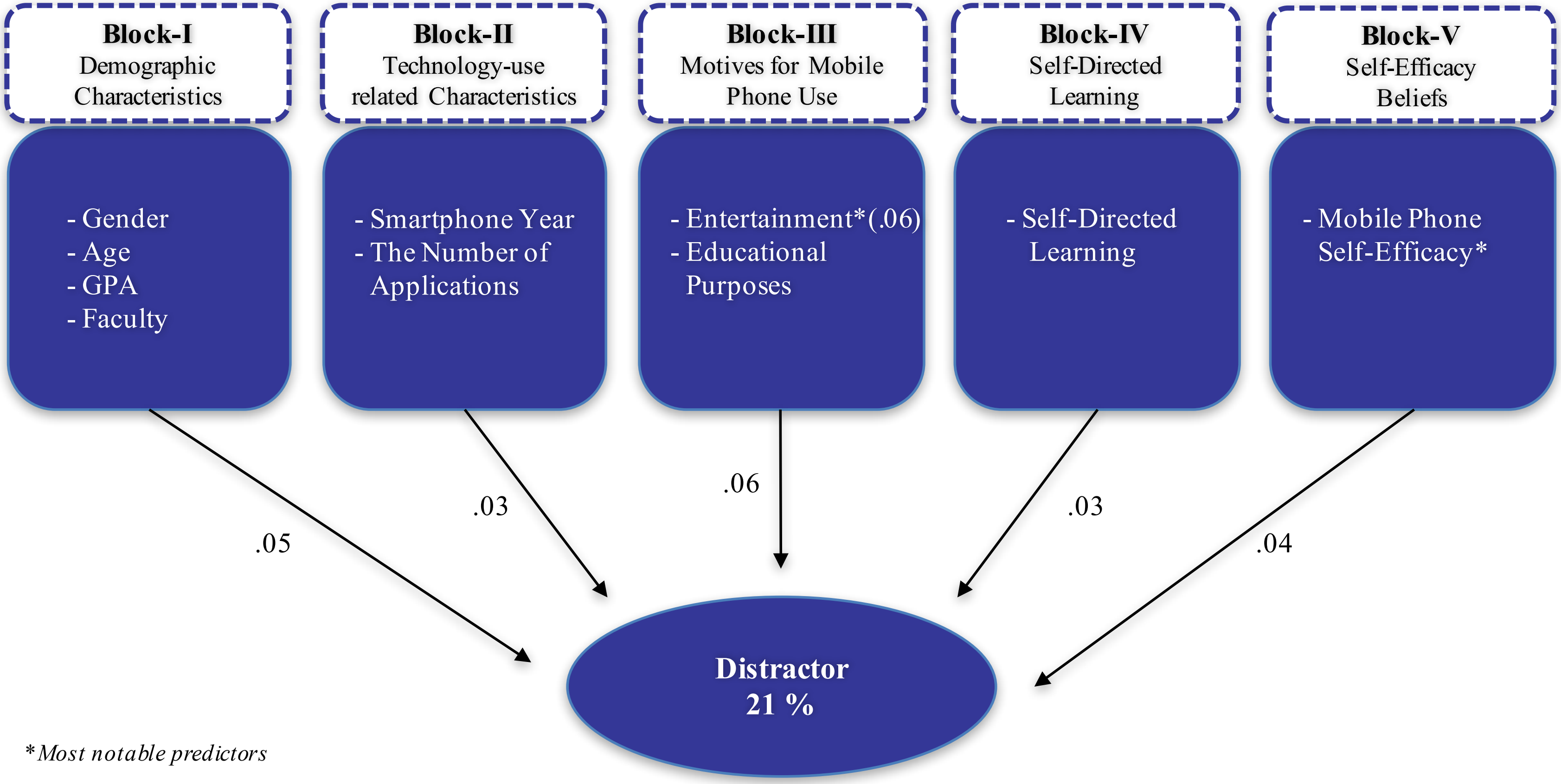

Figure 4.23 Summary of the results regarding the predictions of the facilitator sub-dimension

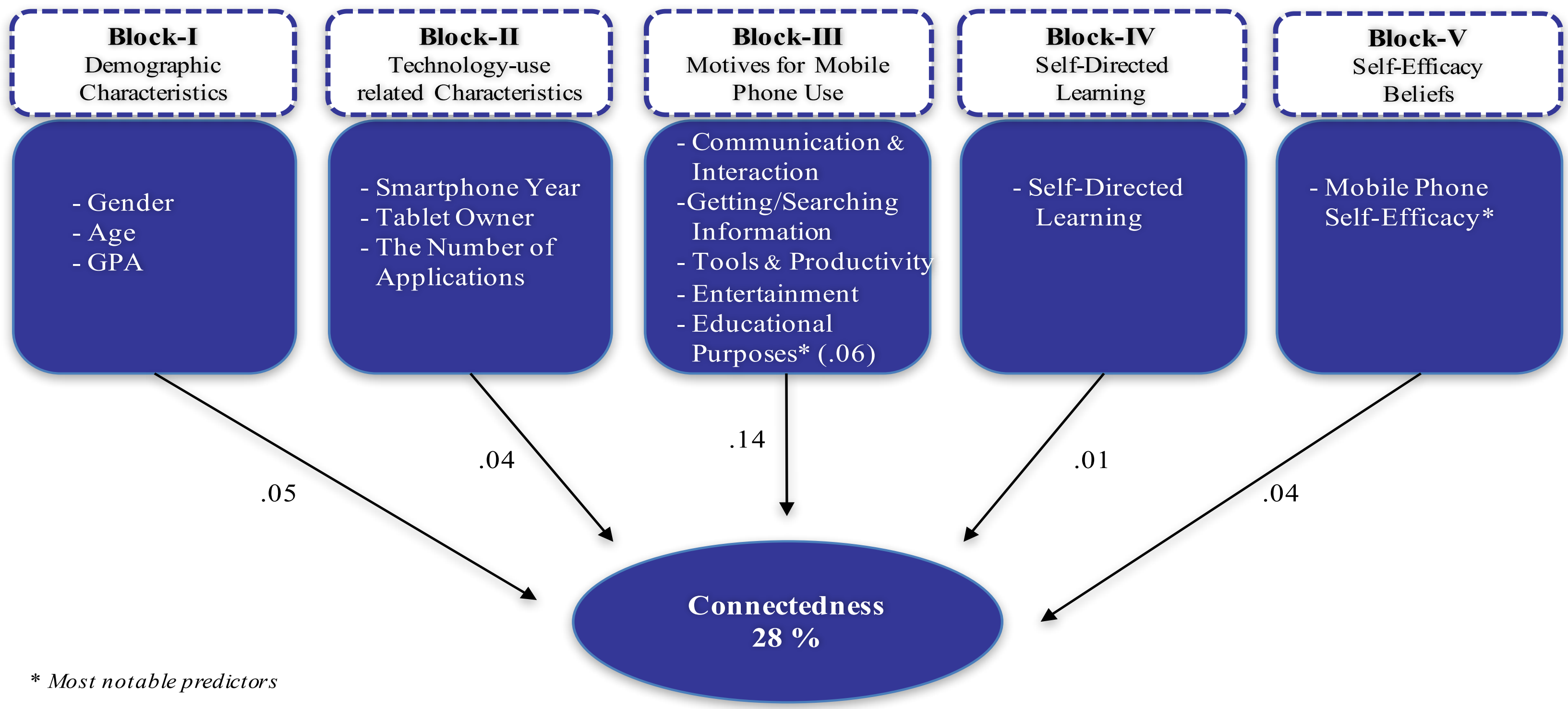

Figure 4.24 Summary of the results regarding the predictions of the facilitator sub-dimension

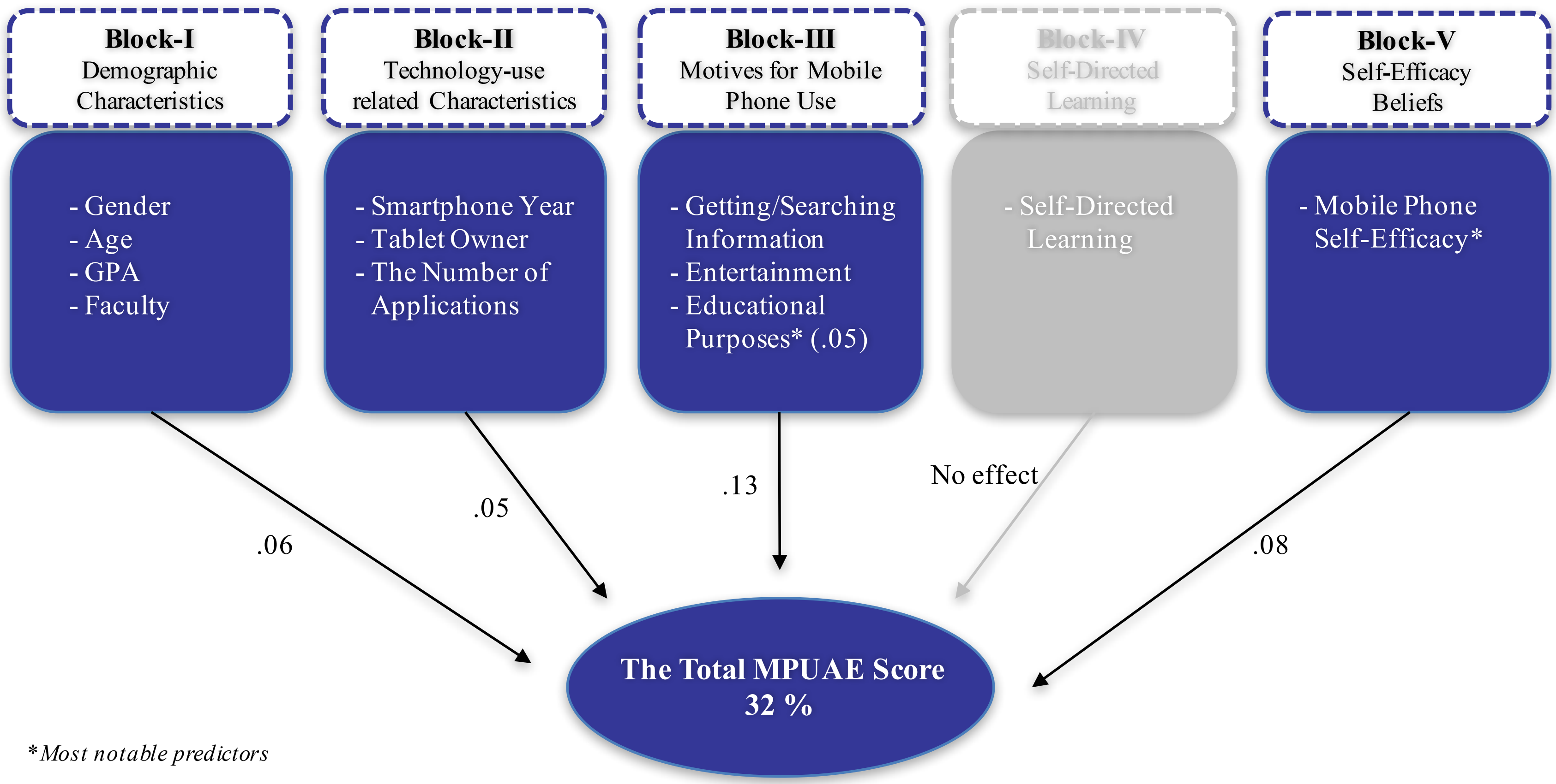

Figure 4.25 Summary of the results regarding the predictions of the total Mobile Phone Use in Academic Environment (MPUAE) score

CHAPTER V

DISCUSSION AND CONCLUSION

In this section, firstly, the major findings of each research question were discussed, respectively. The first research question was explained based on three sub-titles as follows: (1) frequency and usefulness educational mobile activities, (2) applications that students used for educational purposes, and (3) students' motives for mobile phone use. In the second research questions, the factors of mobile phone use in an academic environment were investigated in regard to three aspects, namely, facilitator, distractor, and connectedness. Lastly, the implications and further research directions were given.

5.1 Discussion of the Results

This part was divided into two sub-titles. The first title corresponded to the first research question "how do undergraduate students use their mobile phones for educational purposes?". Under this sub-title, students' educational mobile activities in terms of the frequency and usefulness, applications for educational purposes, and motives for mobile phone use were discussed, respectively. The second sub-title was for the second research question answering "how five groups of variables (demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and self-efficacy beliefs) predict the undergraduate students' mobile phone use in regard to facilitator, distractor, and connectedness sub-dimensions", where each dimension was discussed in detail.

5.1.1 Educational Use of Mobile Phone

Unlike cell phones, smartphones offer the users many functions; that is why they have a highly personalized nature. This means that the users can achieve a variety of goals with their smartphones, and they can decide “what a smartphone is for themselves”. In the first question of the study, how undergraduate students used their mobile phones for educational purposes was answered. By this question, students evaluated their mobile phones whether they use their mobile phones for educational purposes and consider them as an educational tool or not. For this question, the results were presented especially through synthesizing of these following three parts of the instruments: (1) educational mobile activities, (2) mobile applications for educational purposes, and (3) motives for mobile phone use.

The results of the study showed that undergraduate students used their mobile phones mostly for communication and interaction in an academic environment. Firstly, in the present study, when examined the frequency and usefulness of the educational mobile activities, it was seen that the majority of most frequently used activities were under the *Communication and Interaction* category, and in the same way, which were evaluated as most useful educational mobile activities by the students. More specifically, the results presented that students mostly communicate through instant messenger tools, social media, and e-mail, respectively. When examined each item under the Communication and Interaction category, some points were needed to be highlighted. First of all, instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers) was one of the five most frequently used activities, but instant messaging with instructors was among the least frequently used activities. However, students evaluated both of these activities as the most useful activities. Similarly, the study of Lauricella and Kay (2013) investigated how university students used text and instant messaging for academic purposes. The results were parallel to the present study, in which it was found that students rarely used instant messaging with instructors, but weekly with their classmates. Related to this difference, more research, which are especially in the form of in-depth interviews, may be conducted to find potential barriers of using instant messaging with instructors. In the present study, students were also asked to indicate the applications that they perform on their mobile phones for academic purposes. Among 36 applications, WhatsApp was the most frequently used application with a percentage 73.1 of the students, which supported the previous findings that students used their mobile phone mostly for instant messaging. Similarly, according to the report by Digital in 2006, WhatsApp was the most preferred instant messenger application with a 24 percentage in Turkey (Kemp, 2016). Again, in the recent study of Bilü (2017), it was found that WhatsApp was the most popular application among undergraduate students. The main reasons of instant messenger use are a convenience, preventing waste of time, and ease of use (Lauricella & Kay, 2013). In addition, students used these instant messenger tools for creating groups related to their academic work. A penetration rate of about 64 percent, students indicated that they join WhatsApp or Facebook groups (or other messengers) for academic purposes such course project, assignments, etc., and 77% of students found this activity very useful. In the informal pre-interviews of the study, students explained the functions of these groups and indicated that the groups were very beneficial for their academic works since they could take information related to courses, projects, assignments, instantly. These groups did not consist of only their classmates, but also seniors to be informed about academic-related issues before they start the new semester. Thus, it can be said that WhatsApp or other messengers allow students to study as a team and co-operate with their peers, which is indispensable skill in the information age (Bouhnik & Deshen, 2014). Another highlighted point about the educational mobile activities is related to social media usage. Students indicated that they check social media related to university/academic life very frequently, and found them very useful. Furthermore, this activity was found among the five most frequently used and five most useful activities. The studies in the literature also supported this finding, in which accessing social network sites was ranked among the top five activities (Salehan & Negahban, 2013; ComScore, 2012). Consequently, the study showed that undergraduate students used their mobile phones for instant messaging and social network sites for their academic work, and it was seen that the results of the study were consistent with the literature. This is because instant messaging and social networks had many contributions to the learning process in terms of supporting collaborative learning environment, individualized learning in anywhere at any time, active participation, and informal communication (Bouhnik & Deshen, 2014). On the other hand, they rarely interact with an academic post or share academic information on social media, and found them slightly useful. This finding initially might be explained because of the terms used in the items. The meaning of "university/academic life" is more comprehensive, and includes all aspect of academic life. However, "academic post" or "academic information" might concern only course or project issues rather than other aspects of academic life. Furthermore, students might use these platforms as a kind of course websites to check the news related to their courses. In other words, instructors post some announcement, assignments, materials related to their courses and they do not require students to share any post or interact with any post. This finding was consistent with the literature. In the study of Moran, Seaman, and Tinti-Kane (2011), it was observed that over 40 percentage of faculty required students to check or read social media as part of course assignments while only 20 % of them assigned students to share any post or comment to social media use. Moreover, in terms of the use of social media, the results of the present study showed that Facebook was the most used social media with a penetration rate of 37.4% while it was 15.7% for Twitter. Researchers has long paid attention to Facebook as an educational tool (Aydin, 2012), which provides several opportunities to the learning environments. For instance, students can communicate with their instructors and each other in a rapid and convenience way (Sturges, 2011), and they can engage with the course concepts in a more efficient way because of high familiarity level with Facebook (Nemec, Holb, Burkeljca, & Welzer, 2011). Similarly, in the experimental study of Ha and Kim (2014), the effectiveness of smart tools, such as Twitter, microblogging services on the educational environment, was examined; and the results showed that smart tools had a positive effect on the educational environment. Then, the motives for mobile phone use of the students were examined, which were under five categories as follows: (1) for communication and interaction, (2) for getting/searching information, (3) for tools and productivity, (4) for entertainment, and (5) for educational purposes corresponding educational activities with 29-item in the previous part of the instrument. Students marked *between 1(lowest) - 10 (highest)* by considering their priority in mobile phone use. The results affirmed the previous findings of the study, in which communication and interaction had the highest mean value with 9.06. In other words, 93.8 % of the students marked this motive between 7 and 10. Lastly, the descriptive results of Mobile Phone Use in Academic Environment scale were examined in terms of its three subscales, namely, facilitator, distractor, and connectedness. The results were not surprised, and showed that connectedness had the highest mean value with 3.75 while other two sub-dimensions, facilitator and distractor, had 3.08 and 3.02 mean values, respectively. More specifically, each item was checked in this scale, and it was also seen that the Item 2 "*I use my phone to connect with my classmates or instructors*" had the highest mean score (M = 4.16). The results of each scale in the present study obviously showed that the students used their mobile phones mostly for communication and interaction in an academic environment. In parallel with the results of the present study, many studies also affirmed that mobile technologies provided a collaborative learning environment to the students, and improved communication and interaction with peers and instructors (e.g., Carini, Kuh, & Klein, 2006; Kuh, Cruce, Shoup, Kinsie, & Gonyea, 2008; Gosper, Malfory, McKenzie, & Rankine, 2011; Pike, Kuh, & McCormick, 2011; Bomhold, 2013; Laurcicella and Kay, 2013; Moreira, Ferreira, Santos, & Durao, 2016). This situation is explained by Jung (2014) as "improve communication is the most significant means in that it leads to several of the highly centralized goals such as socialization, productive daily life and acquire information" (p. 310). Accordingly, communication does not improve only social relations, but also afford their daily academic activities, and provide acquisition of information.

Secondly, it was seen that students used their mobile phones for getting and searching information in the academic environment. In the present study, firstly, the results of educational mobile activities were examined, in which the activities under the category *Getting/Searching Information* were most frequently used by the students. Moreover, more than half of the students found all these activities very useful for their academic work. Especially, browsing the web for academic purposes was ranked among the five-top used and useful activities. The results of motives for mobile phone use also

supported this finding, in which Getting/Searching Information was in the second place with an 8.36 mean value. Moreover, among the most used application for academic purposes, the inclusion of application such as Google Search, Wikipedia, and YouTube also proved these results. The results of the study supported that "seeking information and gaining concrete knowledge" were one of the main motivation of mobile phone usage in learning environment (Wai et al., 2018; Sawaya; 2015; Quinn, 2013; Clough et al., 2007). Related to educational mobile activities under the category of *Getting/Searching Information*, there are some points to be highlighted. Firstly, the result showed that although students read "other content" such as newspaper, blogs, more frequently than "academic content", they found both activities almost equally beneficial. In the study of Reese Bomhold (2013), it was reported that 41.3 % of students used their mobile phones for casual reading, which was consistent with the present study. On the other hand, in a recent study of Wai et. al. (2018), it was found that college students mostly read "academic content" rather than "other content" with their mobile phones. Another point, despite searching literature via library' electronic database, students found this activity very useful for their academic work. There were plenty of research on the use of library mobile services (Farkas, 2010; Krishnan, 2011; Thomas, 2012), which focused the role of smart phones as a potential and important tool for libraries. The study of Dresselhausa and Shroda (2012) showed consistency with the present study, in which it was reported that 4.3 percent of the college students used their mobile devices for libraries while 60 percent of them used for search engines. On the other hand, in a recent study, Selwyn and Gorard (2016) surveyed 1658 undergraduate students on information technologies usage for academic purposes. The study reported that majority of the students used library websites or library online database. Thus, the results of the present study might be explained by the inadequacy of the existing library mobile service system. LibAnywhere was one of the mobile learning system was used in the previous years, but the system was not effective and not upgraded recently.

Thirdly, the results revealed that most used activities were observed under the self-learning category, which might be thought a similar category to getting/searching information. Especially these two activities under the self-learning category were most frequently used by the students: (1) looking up words in dictionaries (73.5%), and (2) looking up something that they did not understand during the lecture. They also found both of them very useful. As Sawaya (2015) stated that "In the age of immediate and instant access to resources, it makes sense that participants consider learning as similarly immediate, occurring instantly" (p. 72). The present study also affirms that students use their mobile phones in just-in-time situations to solve the problems they face in their daily academic life as observed in the literature (e.g., Looi et al. 2008; Ciompa, 2013; Sawaya, 2015; Wait et al., 2018). Furthermore, Song and Fox (2008) also found that Song and Fox found that undergraduate students used their mobile devices for vocabulary learning, which was also consistent with the results of the present study. Under the self-learning category, listening to/watching videos related to academic learning such as lectures in YouTube or podcast took place as the most frequently used and most useful activity. Likewise, YouTube, Google Search, Wikipedia, and Dictionary were seen among the most commonly used applications by more than half of the students. Particularly, it was seen that YouTube was used by 70% of the students. There are also some studies in the literature, which investigates the effect of YouTube as a teaching and learning tool. For instance, the study of Clifton and Mann aimed to explore whether YouTube could enhance students' learning or not. They found that YouTube can be used for teaching and learning despite its some constraints such as authorship. In the present study, despite of the popularity of YouTube among undergraduate students, podcasts were in the least used applications list. Actually, podcasts, in the literature, are asserted as an innovative learning tool in higher education (e.g., Bongey, Cizaldo, & Kalnbach, 2006; Lakhal, Khechine, & Pascot, 2007; Evan, 2008). However, parallel to the results of the present study, students are not willingly or ready to use for educational purposes (O'Bannon et al., 2011). On the other hand, the results showed that students did not download any specific applications related to their study area that help them learn something new or they did not study the language via specific applications. However, as observed in most of the activities, they found these activities useful. Learning through games has been subjected to the literature of education (e.g., Facer, Joiner, Stanton, Reid, Hull, & Kirk, 2004; Klopfer, 2008; Hoffmann, 2009; Squire, 2011; Clark, Tanner-Smith, & Killingsworth, 2016). In the present study, it was seen that playing educational games were among the five least frequently used and the five least useful educational mobile activities. Parallel to this finding, when considered motives for mobile phone use, the Entertainment category was ranked as fourth with a 7.56 mean value. Similarly, in the study of Ford (2016), 86 percent of the students used their mobile phones firstly for communication, social media, and lastly for entertainment. On the other hand, in some studies, entertainment was found as one of the important motivation in mobile phone use (Kang & Jung, 2014, Junco, 2013).

In the fourth place, the results showed that students used their mobile phones for accessing academic materials in the academic environment. More specifically, after instant messaging with classmates (88.6%), students access Moodle (ODTUCLASS) or course websites to find lecturers' notes, reference readings, videos, announcements etc." as the most frequently used second activity (77.2%). This activity was also among the most five useful activities. Furthermore, it was seen that more than half of the students visit the university websites for daily updates, e-mail, or getting information etc., which was found useful by students with a penetration rate of about 70%. It was obviously understood students used ODTUCLASS very actively through their mobile phones. In the informal pre-interviews, students were also asked whether the university should have its own mobile application or not. Out of 25 students, the majority thought that these kinds of applications bring more advantages rather than Web 2.0 tools in terms of being convenience. In the literature, there is consistency with the present study. For instance, Dahlstrom et al. (2013) investigated undergraduate students' mobile phone use for academic purposes. The study was employed with 112.000 students in USA from 2011 to 2013. According to the results, the main activities were as follows: "accessing a course management system for reading course materials, viewing academic performance information like grades, accessing library resources and doing course registration" (p.98). Although students used ODTUCLASS frequently, they rarely used other learning platforms such as iTunes, Khan Academy or Coursera. But again, they found these platforms useful. When examined the most used applications, it was seen that Khan Academy was used mostly among others (n = 559).

Lastly, using tools/applications and generating content/artifacts were reported at the fifth and sixth (last) ranks in terms of undergraduate students' mobile phone usage in an academic environment, respectively. First of all, under using tools/applications category, it was seen that about 60 percent of students use a calendar or set up reminders for their academic works. Then, using cloud storage for academic purposes had importance for 47 percent of the students. Both of these activities were also found very useful. Similarly, when examined the most used applications list, it was seen that students mostly used Google Drive (55.3%) and Dropbox (41.3%). Moreover, the Using Tools & Productivity category was found as the forth motive for mobile phone use among undergraduate students. The results were consistent with the previous studies that students generate content such as audio or video recording, taking photos through their mobile phones (Sharples et al. 2007; Pierroux, 2008).

To sum up, the first research questions was how undergraduate students use their mobile phones for academic purposes. The results of the study showed that students used their mobile phones firstly for communication and interaction, secondly for getting/searching information, thirdly for self-learning, fourthly for accessing materials, and lastly for using tools and generating artifacts. Apart from these main categories, students were also asked to rate their motives for Educational Purposes, which indicated with 29-item in the Educational Mobile Activities part. The results of the present study showed that students used their mobile phones for several educational activities, and found those activities useful for their academic life. The study is consistent with the literature. The result of The Educause Center for Applied Research [ECAR] (2012) surveyed college students on the use of Mobile Information Technology for academic purposes. Accordingly, 67 percent of the students indicated that they used their mobile devices, such as smartphones, cell phones, tablets, for academic activities, and indicated that these devices had an important place for their academic achievement. In another study, Dresselhaus and Shrode (2012) also found that 54 percent of undergraduate students used their mobile devices for academic purposes. Thus, considering the findings of the present study together with the literature, it can be concluded that students used their mobile devices as an educational tool in the academic environment.

5.1.2 Predictors of Undergraduate Students' Mobile Phone Use in an Academic Environment

As Koole (2009) stated in the FRAME model, learning though smartphones is personalized nature since it differentiates according to each learner's needs, prior knowledge, motivation, and context. Thus, in the second research question, the factors affecting mobile phone usage in an academic environment were investigated in terms of the learner aspect. For this purpose, the Mobile Phone Use in Academic Environment scale was administrated, which had three subscales labeled *facilitator*, *distractor*, and *connectedness*. Four separated hierarchical regression analyses were carried out in order to answer the second research question. The predictor variables entered in five blocks as follows: (1) demographic characteristics, (2) technology use-related characteristics, (3) motives for mobile phone use, (4) self-directed learning, and (5) phone mobile self-efficacy beliefs. Each block was based on the learner aspect, and include several predictors in it as seen in Table 4.20.

As the first sub-research question, the present study examined how well five groups of variables predict undergraduate students' mobile phone use in an academic environment (MPUAE) with regards to the facilitator dimension. The results showed that five groups of variables were significantly associated with the facilitator dimension, and indicated that 27 percent of the variability in the facilitator dimension was explained by these five groups, namely demographic characteristics, technology-use related characteristics, the motives for mobile phone use, self-directed learning, and mobile phone self-efficacy. Among these five groups, it was identified that the motives for mobile phone usage together explained much of the variability in the facilitator dimension compared to other groups. Nonetheless, considering the unique contribution of each variable, both the motive 5 “Educational Purposes” and self-efficacy beliefs were found the same and as the strongest predictors. Furthermore, the contribution of demographic characteristics and technology-use related characteristics to the facilitator dimension were found the same as well. With regards to each contribution of the variables, the results of the study indicated that gender, faculty, smartphone use year, tablet owner, the number of applications, the motive 1 “Communication & Interaction”, the motive 4 “Entertainment” and self-directed learning also had certain contribution to the facilitator dimension whereas age, GPA, study year, laptop owner, the motive 2 “Getting/Searching Information”, and the motive 3 “Tools & Productivity" did not have any contributions. Consequently, the results can be interpreted as that although some of the variables belong to other three groups had a significant relationship with the facilitator dimension; the main predictors of the facilitator dimension were the motive 5 “Educational Purposes” and mobile phone self-efficacy beliefs.

Secondly, the result of the hierarchical regression analysis revealed that five models explained 21 percent of the variability in the distractor dimension of mobile phone use in the academic environment. It was identified that each model had a significant effect on the distractor dimension. Among all variables, the entertainment motive had the most notable contribution on the distractor dimension. The other two notable contributors were self-efficacy and self-directed learning; but it was a negative relationship between self-directed learning and the distractor dimension. Considering each variable of the groups, it was observed that gender, age, GPA, faculty, smartphone use year, the number of applications and the motive 5 “Educational Purposes” had certain contributions whereas study year, tablet owner, the motive 1 “Communication & Interaction, the motive 2 “Getting/Searching Information” and the motive 3 “Tools & Productivity" did not have any contributions on the distractor dimension. Accordingly, the results can be interpreted as that the main predictors accounting for the distractor dimension were the motive 4 “Entertainment”, self-efficacy, and self-directed learning despite of the contributions of the other groups of the variables.

Thirdly, five groups of variables were investigated to reveal how they predicted undergraduate students’ mobile phone use in terms of connectedness dimension. The results showed that the connectedness dimension was explained with a 28 percent of variation by the five models. It was observed that the motives for mobile phone use together accounted for much of the variance in the connectedness dimension. However, considering the unique contribution of each variable, the motive 5 “Educational Purposes” and self-efficacy were found as the same and best predictors. The other notable predictors were gender and the motive 1 “Communication & Interaction”. Moreover, age, GPA, smartphone use year, tablet owner, the number of applications, and self-directed learning had certain contributions while faculty, study year, laptop owner, the motive 2 “Getting/Searching Information”, the motive 3 “Tools & Productivity", and the motive 4 “Entertainment” did not have any contribution. Consequently, the results can be interpreted as that even though other groups of the variables showed a significant association with the connectedness dimension; the main contributors explaining undergraduate students’ mobile phone use in terms of connectedness dimension were the motive 5 “Educational Purposes”, self-efficacy, gender, and the motive 1 “Communication & Interaction”.

Lastly, in the present study, five groups of variables were examined to see what extent they predicted undergraduate students’ mobile phone use in an academic environment in the whole aspect. The results of the study revealed a significant positive association of four groups with the total MPUAE score and indicated that 32 percent of the variability in the total MPUAE score was accounted for by these four groups predictors. More specifically, while demographic characteristics, technology-use related characteristics, the motives for mobile phone use, and mobile phone self-efficacy were significant factors, self-directed learning did not predict undergraduate students' mobile phone use in an academic environment. It was identified that the motives for mobile phone use together explained much of the variance in the undergraduate students' mobile phone usage in an academic environment. However, considering the unique contribution of each variable, self-efficacy beliefs were found as the strongest predictor, then the motive 5 "Educational Purposes" was the second notable predictor. Furthermore, the contribution of demographic characteristics and technology-use related characteristics to the total MPUAE score were found similar. Another result of the analysis indicated that gender, age, GPA, faculty, smartphone use year, tablet owner, the number of applications, the motive 1 "Communication & Interaction, and the motive 4 "Entertainment" also had certain contribution to the total MPUAE score while study year, laptop owner, the motive 2 "Getting/Searching Information", and the motive 3 "Tools & Productivity" did not have any contribution. Accordingly, the findings can be interpreted as that although some of the variables belong to demographics and technology-use related characteristics had a significant relationship with the total MPUAE score; the main variables predicting the educational mobile phone use were the total motives for mobile phone use and self-efficacy beliefs.

To sum up, the results of the study showed that each model had a significant contribution to three sub-dimensions of the MPUAE namely, facilitator, distractor, and connectedness. Except for self-directed learning, the other four models also significantly predicted undergraduate students' total MPUAE scores. Among the five models, the *motives of mobile phone use* and *mobile phone self-efficacy beliefs* were the most significant predictor for each dependent variable. Similarly, related studies investigated self-efficacy as one of the potential factors that could affect educational mobile phone use, mobile phone acceptance, or readiness of mobile learning (e.g, Aypay, Çelik, Aypay & Sever, 2012; Moran, Hawkes, & Gayar, 2010; Venkatesh & Bala, 2008; Teo, 2009; Wong,Teo & Russo, 2012; Vankatesh, Morris, Davis, & Davis, 2003; Yi & Hwang, 2003; LaRose, 2003; Venkatesh & Davis, 1996). In many studies, it was found that self-efficacy was a strong predictor of mobile phone use (e.g., Moran et al., 2010; Liaw, Huang, & Chen, 2007; Meng-Jung & Chin-Chung, 2003; Wang, Ertmer, & Newby, 2004), which was consistent with the present study. This means that, students with high mobile self-efficacy beliefs can mostly achieve any task with their mobile phones. Thus, to be able to use mobile phones in the academic environment in terms of facilitator, distractor, or connectedness, students should have high self-efficacy beliefs. Furthermore, in the present study, the motives for mobile phone use was the other most notable factor. Inclusion of the motives to the model was the novelty of this study. For facilitator and connectedness dimension, the motive *educational purposes* was the strongest predictor for facilitator, connectedness, and the total MPUAE score while the motive *entertainment* was for distractor sub-dimension. This showed that the main motivation of mobile phone use in the academic environment was communication, which is consistent with prior research (Wai et al., 2018; Ford, 2016). The relationship between entertainment motives and distractor sub-dimension were also understandable. The students who see their mobile phones as an entertainment tool rather than learning tool was affected negatively more than the other students. In the present study, demographic characteristics and technology-use related characteristics had certain contributions to the total MPUAE score, and its three sub-dimensions. The study is consistent with some studies (Pauley, 2015; Bryant, 2016; Moreira et al., 2016; Wang et al., 2007). The more the learner controls their own activities, the more successful learning will occur (Ravenscroft, 2003; Sharples, 2003). However, in the current study, except distractor sub-dimension, self-directed learning was significant but the least notable predictor among the five models. This result showed inconsistency with the literature, which indicated self-directed learning as a strong predictor of technology use in many studies (e.g., Wang et al, 2007; Lowenthal, 2010; Huang et al., 2011; Almatari, 2013; Ahn, 2018). Overall, this study indicate that motive and self-efficacy can have an important role in mobile phone use in academic environment.

5.2 Implications of the Study

The study has some significant implications which should be considered by researchers interested in mobile technologies usage in higher education, educators, administrators, policy makers, and m-learning system developers.

- The present study provided a comprehensive perspective on undergraduate students' educational mobile phone use by considering both positive and negative aspects. This study can help educators and mobile learning scholars to devote more effort to adapting mobile technologies in existing teaching and learning methods.
- Apart from the technology acceptance models, this study offered a new measurement approach for the assessment of educational mobile phone use.
- This study gave insight to better understand undergraduate students' current educational mobile phone use, and to unravel what motivates them to use their mobile phones for educational purposes. Thus, the university or policy makers will be able to see mobile phones from an academic standpoint, which may help develop a vision and plan in terms of using of mobile technology tools to support students in the academic environment.
- Lastly, this study will be helpful for the sectors interested in educational technologies while designing or updating strategy and policy in terms of mobile phones and mobile learning. The results of the study may also be useful for the developers of mobile learning systems or applications while designing their products or systems.

5.3 Recommendations for Further Studies

The present study was about exploring undergraduate students' mobile phone usage in an academic environment, and investigating the contribution of certain variables related to the learner aspect on mobile phone use in terms of facilitator, distractor, and connectedness sub-dimensions. The results contributed to drawing a whole picture of undergraduate students' educational mobile phone use by elucidating relationships among variables. The further studies might be needed in the following areas:

- One of the purposes of this study was to find the contribution of five groups of variables (demographic characteristics, technology-use related characteristics, motives for mobile phone use, self-directed learning, and mobile phone self-efficacy beliefs) on mobile phone use in terms of facilitator, distractor, and connectedness sub-dimensions. For each dimension, the hierarchical regression analyses were run, separately. However, the variables predicted a small variance of the total MPUAE score and its three sub-dimensions, the big percentage of mobile phone use was still unexplained. Thus, for the further studies, the regression analyses might be performed by adding new variables to enhance the predictions percentages of the total MPUAE score and its three sub-dimensions.
- This study focused on the learner aspect. Further research might be conducted with faculty and administration in order to see the use of mobile technologies in higher education from different aspects.
- A quantitative research design methodology was applied in the present study. Based on the results of the study, deep interviews might be done with students in order to evaluate students' conceptions of mobile phone use in an academic environment in terms of facilitator, distractor, and connectedness sub-dimensions. Furthermore, educational mobile activities or the use of applications for learning can be investigated deeply. For example, the study showed that WhatsApp and YouTube were the first two most frequently used applications among undergraduate students. Their roles in teaching and learning might be considered for the further research.
- This study utilized a correlation correlational research design, which examines only relationships; to investigate causality, experimental designs, especially pre- and post-experimental design might be considered.
- The inclusion of only one university was one of the limitations of this study. Thus, in order to enhance generalizability and external validity (Merriam,

2009), the study might further be conducted with different universities from different regions of Turkey.

- According to Tabachnick and Fidell (2013), “if you have a hypothetical causal sequence of three (or more) variables, the middle variable is considered a mediator (indirect effect) that represents at least part of the chain of events leading to changes in the dependent variable” (p. 196). For further studies, the analyses may be performed by considering mediator effects. Especially, as stated in the study of Huang (2014), since self-management of learning (or self-directed learning) plays a significant role in individuals’ lifelong learning, the moderating effect of this variable should be considered for the further studies.

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APPENDIX A

Pre-Intervıew Questıons

1. Akıllı telefonunuzun hangi özelliklerini eğitsel amaçlı kullanıyorsunuz?

	Video/Fotoğraf		Alarm
	Mesajlaşma,		Hesap makinesi
	Web-browser		Not alma
	Sözlük/ansiklopedi		Sözlük/ansiklopedi
	E-mail		Uygulamalar

2. Eğitsel amaçlı kullandığınız mobil uygulamalar nelerdir?

	WhatsApp/ Viber		TED
	SesliSozluk/ Tureng/ Dictionary		Google Driver
	Wikipedia		Facebook
	Pinterest		Twitter
	Dropbox		YouTube

3. Bu uygulamalardan hangilerini daha çok sınıf içinde kullanıyorsunuz? Ve nasıl kullanıyorsunuz?

4. Ve yine bu uygulamaları sınıf dışında nasıl kullanıyorsunuz?

5. Eğitsel amaçlı olarak kullandığınız mobil uygulamaları genel olarak hangi yönlerden faydalı buluyorsunuz?

6. Sosyal medyayı eğitsel amaçlı nasıl kullanıyorsunuz?

7. Akıllı telefon ders çalışırken dikkatinizi dağıtıyor mu (Sınıf içi/Sınıf dışı)? Açıklar mısınız?

8. Öğrenme Yönetim Sistemlerinden olan ODTU-Class'ı akıllı telefon üzerinden kullanabiliyor musunuz? Faydalı buluyor musunuz?

9. Web-browser yeterli oluyor mu? Uygulama şeklinde olsa daha çok kullanır mıydınız?

APPENDIX B

The Permission Letter for Adaptation of the Mobile Phone Affinity Scale (MPAS)

Gmail – Requesting Permission for Adaptation of The Mobile Phone Affinity Scale 29.03.2018 17*58

Gmail Nehir YASAN <nehir.yasan@gmail.com>

Requesting Permission for Adaptation of The Mobile Phone Affinity Scale

Bock, Beth C <BBock@lifespan.org> 27 December 2016 at 20:23
To: Nehir YASAN <nehir.yasan@gmail.com>

Thank you for the explanation. That makes sense. I'd be really interested to see how well (or how badly) it holds up. I haven't yet had the chance to use it in any intervention studies. I'm hoping to get the chance to see if it predicts anything, like how well someone responds to an intervention that is delivered through a mobile phone.

Good luck with your work.

Beth Bock, PhD

Professor of Psychiatry & Human Behavior

Centers for Behavioral and Preventive Medicine

Brown Medical School and The Miriam Hospital

401-793-8020

BBock@Lifespan.org

APPENDIX C

The Ethics Approval

UYGULAMALI ETİK ARAŞTIRMA MERKEZİ
APPLIED ETHICS RESEARCH CENTER

ORTA DOĞU TEKNİK ÜNİVERSİTESİ
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Sayı: 28620816 / 167

08 MART 2017

Konu: Değerlendirme Sonucu

Gönderen: ODTÜ İnsan Araştırmaları Etik Kurulu (İAEK)

İlgi: İnsan Araştırmaları Etik Kurulu Başvurusu

Sayın Prof. Dr. Soner YILDIRIM;

Danışmanlığını yaptığınız doktora öğrencisi Nehir YASAN'ın "***Mobile Telefonların Üniversite Öğrencilerinin Akademik Hayatına olan Etkisinin İncelenmesi***" başlıklı araştırması İnsan Araştırmaları Etik Kurulu tarafından uygun görülerek gerekli onay **2017-FEN-003** protokol numarası ile **08.03.2017 – 31.12.2017** tarihleri arasında geçerli olmak üzere verilmiştir.

Bilgilerinize saygılarımla sunarım.

Prof. Dr. Canan SÜMER

İnsan Araştırmaları Etik Kurulu Başkanı

Prof. Dr. Mehmet UTKU
İAEK Üyesi

Prof. Dr. Ayhan SOL
İAEK Üyesi

Prof. Dr. Ayhan Gürbüz DEMİR
İAEK Üyesi

Doç. Dr. Yaşar KONDAKÇI (4.)
İAEK Üyesi

Yrd. Doç. Dr. Pınar KAYGAN
İAEK Üyesi

Yrd. Doç. Dr. Emre SELÇUK
İAEK Üyesi

APPENDIX D

The Original Version of the Mobile Phone Affinity Scale (MPAS)

Factor	Item
CONNECTEDNESS	- My phone helps me keep track of my social life. - When it comes to my health or social life, my phone is my personal assistant. - My phone helps me stay close to my friends and family. - My phone makes it easy to cancel plans with others.
PRODUCTIVITY	- I use my phone to connect with my co-workers or other students. - My mobile phone helps me to stay up-to-date with work/school activities. - My phone is necessary for work/school. - My phone helps me to be more organized at work/school
EMPOWERMENT	- I feel safe when I have my phone with me - Having my phone with me makes it easier to leave a risky situation. - I feel in control when I have my phone with me. - My phone gives me a sense of security.
ANXIOUS ATTACHMNET	- I feel dependent on my phone. - I feel anxious if I don't have my phone with me. - I feel isolated without my phone. - Without my mobile phone, I feel out of touch with the world.
ADDICTION	- I would get more work done if I spent less time on my phone. - I find myself occupied with my phone when I should be doing other things. - I find myself occupied on my phone even when I'm with other people. - I find myself engaged with my mobile phone for longer period of time than I intended.
CONTINUOUS USE	- I read/send text messages when I am at work or in class that are not related to what I am doing. - I rely on my phone 24/7. - I am never bored if I have my phone with me. - I use my phone all day.

APPENDIX E

The Adapted Version of MPAS - The Mobile Phone Use in Academic Environment Scale (MPUAES)

Factor	Item
CONNECTEDNESS	- My phone helps me keep track of -follow- my academic life. - When it comes to the academic life, my phone is my personal assistant. - My phone helps me stay close to my classmates and instructors. - My phone makes it easy to cancel the arranged plans with classmates or instructors.
PRODUCTIVITY	- I use my phone to connect with my classmates or instructors. - My mobile phone helps me stay up-to-date with school activities. - My phone is necessary for my academic life. - My phone helps me be more organized for my academic life.
EMPOWERMENT	- I feel more comfortable in doing my school work when I have my phone with me. - Having my phone with me makes it easier to sort out *–resolve, handle-* the critical situations related to my academic life. - I feel in control of my academic life when I have my phone with me. - In my academic life, my phone gives me a sense of comfort.
ANXIOUS ATTACHMNET	- For my academic life, I feel dependent on my phone. - I feel anxious in school or doing school work when I don't have my phone with me. - In my academic life, I feel isolated without my phone. - Without my mobile phone, I feel detached -*out of touch, isolated*- to my academic life.
ADDICTION	- I would get more school work done if I spent less time on my phone. - When I should be doing the school work, I find myself occupied with my phone. - I find myself occupied on my phone even when I'm with my classmates or instructors (during the class or studying). - I find myself engaged with my mobile phone for longer than I intended.
CONTINUOUS USE	- In class or whenever I study, I read/send text messages that are not related to what I am doing. - I rely on my phone 24/7 for academic purposes. - When I study, I am never bored if I have my phone with me. - I use my phone all day for academic purposes.

APPENDIX F

Pattern Matrixes of MPUAES in the Pilot Test: The First Run of EFA

	Factor				
	1	2	3	4	5
Item17	.75	.02	-.06	-.06	.00
Item14	.72	.13	.07	-.08	.01
Item15	.60	-.02	.01	-.03	-.32
Item17	.59	.06	-.09	.28	-.02
Item16	.58	-.14	-.10	.19	-.22
Item8	.42	.21	-.01	-.02	-.15
Item12	**.28**	**.13**	**.09**	**.28**	**-.27**
Item13	**.24**	**-.01**	**-.23**	**.20**	**-.22**
Item5	.07	.83	.05	.11	.05
Item3	-.11	.70	.08	.05	-.04
Item9	.14	.66	-.13	.01	.09
Item510	.13	.65	-.12	-.11	.00
Item24	.05	.52	-.19	-.11	-.10
Item19	.10	-.02	-.88	-.17	-.01
Item20	.00	.08	-.65	-.02	-.20
Item2	-.12	.12	-.58	.29	.06
Item1	-.03	.10	-.38	.40	-.14
Item11	.26	-.04	-.12	.39	-.36
Item4	.33	-.04	-.22	.37	-.16
Item23	-.05	.04	-.11	.13	-.80
Item22	.10	-.08	-.04	.07	-.76
Item21	.13	.00	-.03	-.08	-.41
Item18	.02	.29	-.05	-.20	-.39
Item6	.24	.07	-.17	.12	-.32

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. The items which were removed from the scale signed with bold.

APPENDIX G

Pattern Matrixes of MPUAES in the Pilot Test: The Second Run of EFA

	Factor			Communality
	1	2	3	
Item15	.86	.02	-.12	.68
Item16	.83	-.14	.07	.68
Item22	.76	-.11	.16	.66
Item17	.74	.10	-.15	.55
Item7	.68	.05	.09	.59
Item14	**.68**	**.20**	**-.28**	**.51**
Item11	.66	-.12	.29	.65
Item23	.65	-.01	.28	.67
Item4	.58	-.09	.32	.59
Item6	.56	.06	.19	.50
Item8	**.54**	**.25**	**-.07**	**.44**
Item21	**.45**	**.01**	**.03**	**.32**
Item5	.00	.78	.01	.57
Item10	.06	.73	.04	.57
Item3	.02	.71	.09	.43
Item24	-.12	.66	.02	.46
Item18	**.08**	**.59**	**.13**	**.31**
Item2	.29	.33	.01	.48
Item1	-.08	.13	.71	.54
Item19	.18	.05	.61	.59
Item20	.16	.19	.57	.60

Extraction Method: Principal Axis Factoring. Rotation Method: Oblimin with Kaiser Normalization. The items which were removed from the scale signed with bold.

APPENDIX H

Linearity – Homoscedasticity Assumptions (Scatterplots)

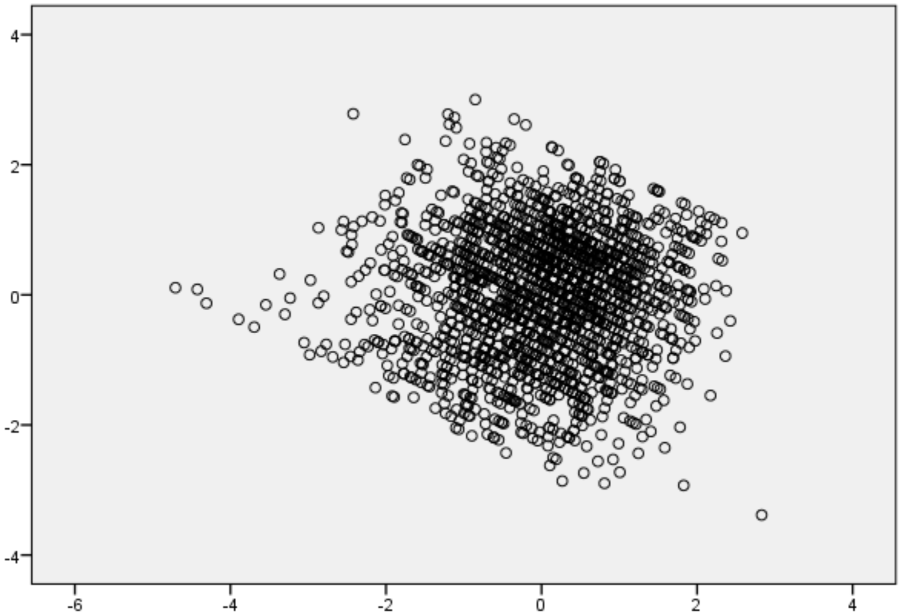

Figure 4. 9 Scatterplot of facilitator

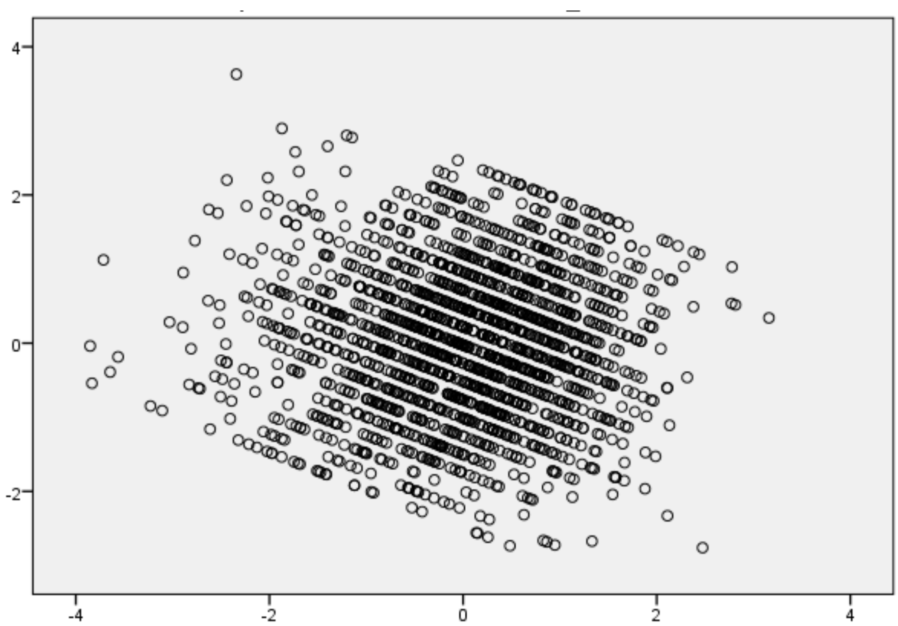

Figure 4. 10 Scatterplot of distractor

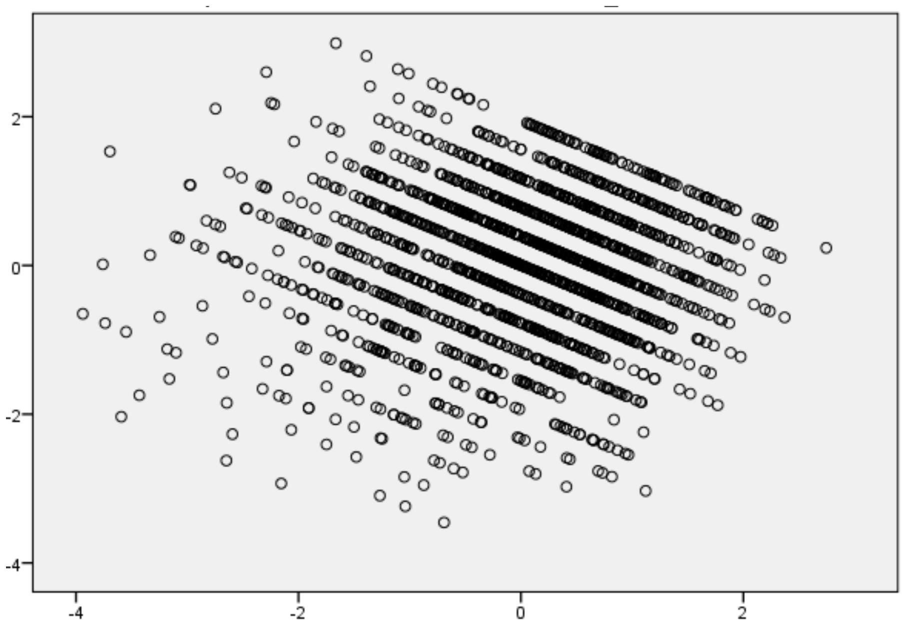

Figure 4. 11 Scatterplot of connectednes

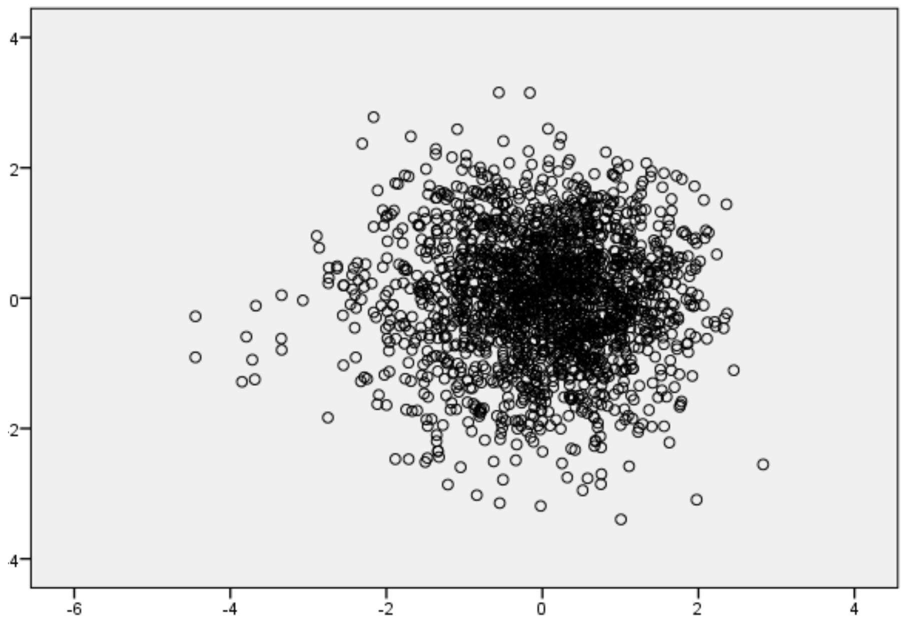

Figure 4. 12 Scatterplot of the MP

APPENDIX I

Multicollinearity Assumption (Correlational Matrices for the total MPUAE score and its three sub-dimensions)

Table 4. 27

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
FACILITATOR	-																									
MOTIV1	.13	-																								
MOTIV2	.30	.38	-																							
MOTIV3	.24	.30	.46	-																						
MOTIV4	.23	.24	.26	.32	-																					
MOTIV5	.37	.17	.54	.38	.26	-																				
SEF	.35	.11	.19	.18	.18	.20	-																			
SDL	.12	.09	.14	.11	.00	.21	.12	-																		
Gender	.12	.13	.12	.16	.13	.17	.02	-.02	-																	
EDUvs.ARCH	.02	.03	.03	.01	.00	-.01	-.01	-.02	.13	-																
EDUvs.ART&SCI	-.04	-.02	.04	.04	-.01	.09	-.05	.00	.13	-.12	-															
EDUvs.ECON	-.01	.03	.02	-.04	.04	.00	-.03	-.01	.05	-.10	-.20	-														
EDUvs.ENG	-.02	-.01	-.06	-.05	-.07	-.10	.05	.01	-.39	-.23	-.45	-.38	-													
TabletOwner	.10	.01	.05	.05	.08	.07	.04	.04	.06	-.05	.00	.01	-.01	-												
LaptopOwner	.01	-.02	-.01	.01	.00	.01	.04	-.02	.00	-.06	-.02	.00	.06	.12	-											
Seniorvs.Fresh	-.02	-.01	.03	-.04	.07	-.01	.00	-.03	.09	.04	.05	.17	-.27	.02	-.04	-										
Seniorvs.Soph	.06	-.01	.00	.00	.00	.01	.03	-.03	-.04	-.15	-.09	-.06	.13	-.01	.03	-.40	-									
Seniorvs.Junior	-.02	-.03	.01	.03	-.04	.03	-.02	.02	-.03	.14	-.02	-.10	.10	-.01	-.03	-.36	-.36	-								
23-26+vs.<19-19	.00	.02	.02	-.02	.05	.01	.00	-.02	.06	.00	.01	.06	-.09	.00	-.02	.40	-.10	-.18	-							
23-26+vs.20-22	.06	-.01	.08	.03	.06	.05	.04	.01	.03	.00	-.08	.02	.00	-.02	.01	.07	.30	-.02	-.42	-						
.0-2.0vs.2.01-3.0	-.01	-.08	-.04	-.01	-.01	-.02	-.04	-.17	.05	-.06	.04	.09	-.14	.03	.01	.25	-.06	-.11	-.03	.06	-					
.0-2.0vs.3.01-4.0	.04	.01	.00	.02	.02	.02	.01	-.06	.01	.10	-.05	-.08	.06	.03	-.01	-.18	-.03	.13	-.09	-.12	-.41	-				
(<10)vs.(10-30)	.11	.04	.06	.09	.09	.03	.03	.04	.02	.01	-.05	.04	-.01	.07	.06	.01	.00	.00	-.01	-.01	-.01	.05	-			
(<10)vs.(>30)	.04	.01	.02	.02	.06	.00	.03	-.09	-.10	-.01	-.03	.00	.08	.01	.04	.01	.02	.00	.02	.03	-.03	.00	-.42	-		
(0-3)vs.(4-6)	.00	.05	.00	-.01	.02	.00	-.02	.00	.03	-.01	.03	.00	-.01	.00	-.03	-.01	.03	.00	.01	.02	.00	.00	-.01	.03	-	
(4-6)vs.(>6)	.10	.03	.08	.07	.08	.01	.03	.02	.02	.04	-.05	.00	.03	.12	.08	-.02	-.08	.07	-.03	-.03	-.01	.06	.08	.01	-.57	-

Table 4. 28

Correlational Table for Distractor

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
DISTRACTOR	-																									
MOTIV1	0.08	-																								
MOTIV2	0.09	0.38	-																							
MOTIV3	0.13	0.30	0.46	-																						
MOTIV4	0.30	0.24	0.26	0.32	-																					
MOTIV5	0.11	0.17	0.54	0.37	0.26	-																				
SDL	-0.16	0.09	0.14	0.11	0.00	0.21	-																			
SEFF	0.25	0.11	0.19	0.18	0.18	0.20	0.12	-																		
Gender	0.13	0.13	0.12	0.16	0.13	0.17	-0.02	0.02	-																	
EDUvs.ARCH	0.00	0.03	0.03	0.01	0.00	-0.01	-0.02	-0.01	0.13	-																
EDUvs.ART&SCI	-0.09	-0.02	0.04	0.04	-0.01	0.09	0.00	-0.05	0.13	-0.12	-															
EDUvs.ECON	0.07	0.03	0.02	-0.04	0.04	0.00	-0.01	-0.03	0.05	-0.10	-0.20	-														
EDUvs.ENG	-0.02	-0.01	-0.06	-0.05	-0.07	-0.10	0.01	0.05	-0.39	-0.23	-0.45	-0.38	-													
TabletOwner	0.07	0.01	0.05	0.05	0.08	0.07	0.04	0.04	0.06	-0.05	0.00	0.01	-0.01	-												
LaptopOwner	0.06	-0.02	-0.01	0.01	0.00	0.01	-0.02	0.04	0.00	-0.06	-0.02	0.00	0.06	0.12	-											
Seniorvs.Fresh	0.04	-0.01	0.03	-0.04	0.07	0.00	-0.03	0.00	0.09	0.04	0.04	0.17	-0.27	0.02	-0.04	-										
Seniorvs.Soph	0.07	-0.01	0.00	0.00	0.00	0.01	-0.03	0.03	-0.04	-0.15	-0.09	-0.06	0.13	-0.01	0.03	-0.40	-									
Seniorvs.Junior	-0.05	-0.03	0.01	0.03	-0.04	0.03	0.02	-0.02	-0.03	0.13	-0.02	-0.10	0.10	-0.01	-0.03	-0.36	-0.36	-								
23-26+vs.<19-19	0.00	0.02	0.02	-0.02	0.05	0.00	-0.02	0.00	0.06	0.00	0.01	0.06	-0.09	0.00	-0.02	0.40	-0.10	-0.18	-							
23-26+vs.20-22	0.10	-0.01	0.08	0.03	0.06	0.05	0.01	0.04	0.03	0.00	-0.08	0.02	0.00	-0.02	0.01	0.07	0.30	-0.02	-0.42	-						
.0-2.0vs.2.01-3.0	0.06	-0.08	-0.04	-0.01	-0.01	-0.02	-0.17	-0.04	0.05	-0.06	0.04	0.09	-0.14	0.03	0.01	0.25	-0.06	-0.10	-0.03	0.06	-					
.0-2.0vs.3.01-4.0	0.04	0.01	0.00	0.02	0.02	0.02	-0.06	0.01	0.01	0.10	-0.05	-0.08	0.06	0.03	-0.01	-0.18	-0.03	0.13	-0.09	-0.12	-0.41	-				
(<10)vs.(10-30)	0.10	0.04	0.06	0.09	0.09	0.03	0.04	0.03	0.02	0.01	-0.05	0.04	-0.01	0.07	0.06	0.01	0.00	0.00	-0.01	-0.01	-0.01	0.05	-			
(<10)vs.(>30)	0.04	0.01	0.02	0.02	0.06	0.00	-0.09	0.03	-0.10	0.00	-0.03	0.00	0.08	0.01	0.04	0.01	0.02	0.00	0.02	0.03	-0.03	0.00	-0.42	-		
(0-3)vs.(4-6)	-0.02	0.05	0.00	-0.01	0.02	0.00	0.00	-0.02	0.03	-0.01	0.03	0.00	-0.01	0.00	-0.03	-0.01	0.03	0.00	0.01	0.02	0.00	0.00	-0.01	0.03	-	
(4-6)vs.(>6)	0.10	0.03	0.07	0.07	0.08	0.01	0.02	0.03	0.02	0.04	-0.05	0.00	0.03	0.12	0.08	-0.02	-0.08	0.07	-0.03	-0.03	-0.01	0.06	0.08	0.01	-0.57	-

Table 4. 29

Correlational Table for Connectedness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
CONNECTEDNESS	-																									
MOTIV1	.29	-																								
MOTIV2	.32	.38	-																							
MOTIV3	.26	.30	.46	-																						
MOTIV4	.22	.24	.26	.32	-																					
MOTIV5	.34	.17	.54	.37	.26	-																				
SDL	.15	.09	.14	.11	.00	.21	-																			
SEFF	.32	.11	.19	.18	.18	.20	.12	-																		
Gender	.16	.13	.12	.16	.13	.17	-.02	.02	-																	
EDUvs.ARCH	.04	.03	.03	.01	.00	-.01	-.02	-.01	.13	-																
EDUvs.ART&SCI	-.06	-.02	.04	.04	-.01	.09	.00	-.05	.13	-.12	-															
EDUvs.ECON	.00	.03	.02	-.04	.04	.00	-.01	-.03	.05	-.10	-.20	-														
EDUvs.ENG	.01	-.01	-.06	-.05	-.07	-.10	.01	.05	-.39	-.23	-.45	-.38	-													
TabletOwner	.08	.01	.05	.05	.08	.07	.04	.04	.06	-.05	.00	.01	-.01	-												
LaptopOwner	.03	-.02	-.01	.01	.00	.01	-.02	.04	.00	-.06	-.02	.00	.06	.12	-											
Seniorvs.Fresh	.01	-.01	.03	-.04	.07	.00	-.03	.00	.09	.04	.04	.17	-.27	.02	-.04	-										
Seniorvs.Soph	.06	-.01	.00	.00	.00	.01	-.03	.03	-.04	-.15	-.09	-.06	.13	-.01	.03	-.40	-									
Seniorvs.Junior	-.04	-.03	.01	.03	-.04	.03	.02	-.02	-.03	.13	-.02	-.10	.10	-.01	-.03	-.36	-.36	-								
23-26+vs.<19-19	.02	.02	.02	-.02	.05	.00	-.02	.00	.06	.00	.01	.06	-.09	.00	-.02	.40	-.10	-.18	-							
23-26+vs.20-22	.09	-.01	.08	.03	.06	.05	.01	.04	.03	.00	-.08	.02	.00	-.02	.01	.07	.30	-.02	-.42	-						
.0-2.0vs.2.01-3.0	-.09	-.08	-.04	-.01	-.01	-.02	-.17	-.04	.05	-.06	.04	.09	-.14	.03	.01	.25	-.06	-.10	-.03	.06	-					
.0-2.0vs.3.01-4.0	.03	.01	.00	.02	.02	.02	-.06	.01	.01	.10	-.05	-.08	.06	.03	-.01	-.18	-.03	.13	-.09	-.12	-.41	-				
(<10)vs.(10-30)	.12	.04	.06	.09	.09	.03	.04	.03	.02	.01	-.05	.04	-.01	.07	.06	.01	.00	.00	-.01	-.01	-.01	.05	-			
(<10)vs.(>30)	.04	.01	.02	.02	.06	.00	-.09	.03	-.10	.00	-.03	.00	.08	.01	.04	.01	.02	.00	.02	.03	-.03	.00	-.42	-		
(0-3)vs.(4-6)	.02	.05	.00	-.01	.02	.00	.00	-.02	.03	-.01	.03	.00	-.01	.00	-.03	-.01	.03	.00	.01	.02	.00	.00	-.01	.03	-	
(4-6)vs.(>6)	.08	.03	.07	.07	.08	.01	.02	.03	.02	.04	-.05	.00	.03	.12	.08	-.02	-.08	.07	-.03	-.03	-.01	.06	.08	.01	-.57	-

Table 4. 30

Correlational Table for MPUAE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)
MPUAE	-																									
MOTIV1	.20	-																								
MOTIV2	.29	.38	-																							
MOTIV3	.26	.30	.46	-																						
MOTIV4	.32	.24	.26	.32	-																					
MOTIV5	.34	.17	.54	.37	.26	-																				
SDL	.03	.09	.14	.11	.00	.21	-																			
SEFF	.38	.11	.19	.18	.18	.20	.12	-																		
Gender	.17	.13	.12	.16	.13	.17	-.02	.02	-																	
EDUvs.ARCH	.02	.03	.03	.01	.00	-.01	-.02	-.01	.13	-																
EDUvs.ART&SCI	-.08	-.02	.04	.04	-.01	.09	.00	-.05	.13	-.12	-															
EDUvs.ECON	.02	.03	.02	-.04	.04	.00	-.01	-.03	.05	-.10	-.20	-														
EDUvs.ENG	-.02	-.01	-.06	-.05	-.07	-.10	.01	.05	-.39	-.23	-.45	-.38	-													
TabletOwner	.10	.01	.05	.05	.08	.07	.04	.04	.06	-.05	.00	.01	-.01	-												
LaptopOwner	.04	-.02	-.01	.01	.00	.01	-.02	.04	.00	-.06	-.02	.00	.06	.12	-											
Seniorvs.Fresh	.01	-.01	.03	-.04	.07	.00	-.03	.00	.09	.04	.04	.17	-.27	.02	-.04	-										
Seniorvs.Soph	.08	-.01	.00	.00	.00	.01	-.03	.03	-.04	-.15	-.09	-.06	.13	-.01	.03	-.40	-									
Seniorvs.Junior	-.04	-.03	.01	.03	-.04	.03	.02	-.02	-.03	.13	-.02	-.10	.10	-.01	-.03	-.36	-.36	-								
23-26+vs.<19-19	.01	.02	.02	-.02	.05	.00	-.02	.00	.06	.00	.01	.06	-.09	.00	-.02	.40	-.10	-.18	-							
23-26+vs.20-22	.10	-.01	.08	.03	.06	.05	.01	.04	.03	.00	-.08	.02	.00	-.02	.01	.07	.30	-.02	-.42	-						
.0-2.0vs.2.01-3.0	-.01	-.08	-.04	-.01	-.01	-.02	-.17	-.04	.05	-.06	.04	.09	-.14	.03	.01	.25	-.06	-.10	-.03	.06	-					
.0-2.0vs.3.01-4.0	.04	.01	.00	.02	.02	.02	-.06	.01	.01	.10	-.05	-.08	.06	.03	-.01	-.18	-.03	.13	-.09	-.12	-.41	-				
(<10)vs.(10-30)	.14	.04	.06	.09	.09	.03	.04	.03	.02	.01	-.05	.04	-.01	.07	.06	.01	.00	.00	-.01	-.01	-.01	.05	-			
(<10)vs.(>30)	.05	.01	.02	.02	.06	.00	-.09	.03	-.10	.00	-.03	.00	.08	.01	.04	.01	.02	.00	.02	.03	-.03	.00	-.42	-		
(0-3)vs.(4-6)	.00	.05	.00	-.01	.02	.00	.00	-.02	.03	-.01	.03	.00	-.01	.00	-.03	-.01	.03	.00	.01	.02	.00	.00	-.01	.03	-	
(4-6)vs.(>6)	.12	.03	.07	.07	.08	.01	.02	.03	.02	.04	-.05	.00	.03	.12	.08	-.02	-.08	.07	-.03	-.03	-.01	.06	.08	.01	-.57	-

APPENDIX J

Normality of Residuals Assumptions (Histograms)

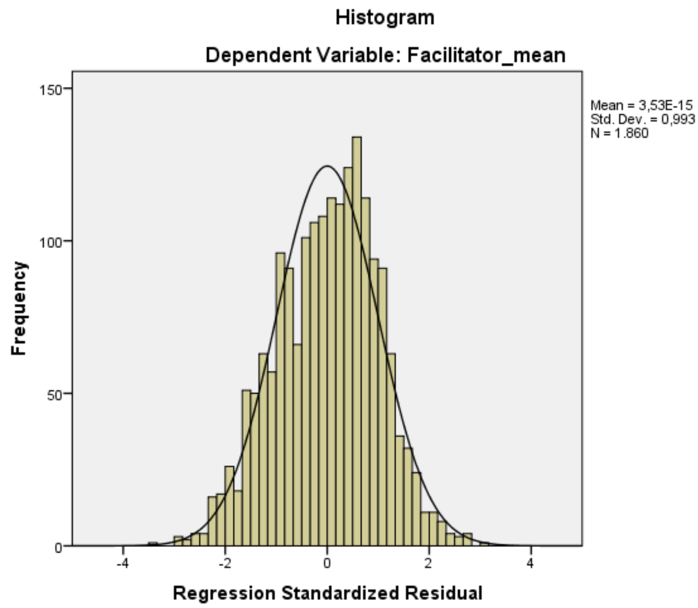

Figure 4. 13 Histogram of residuals of the facilitator

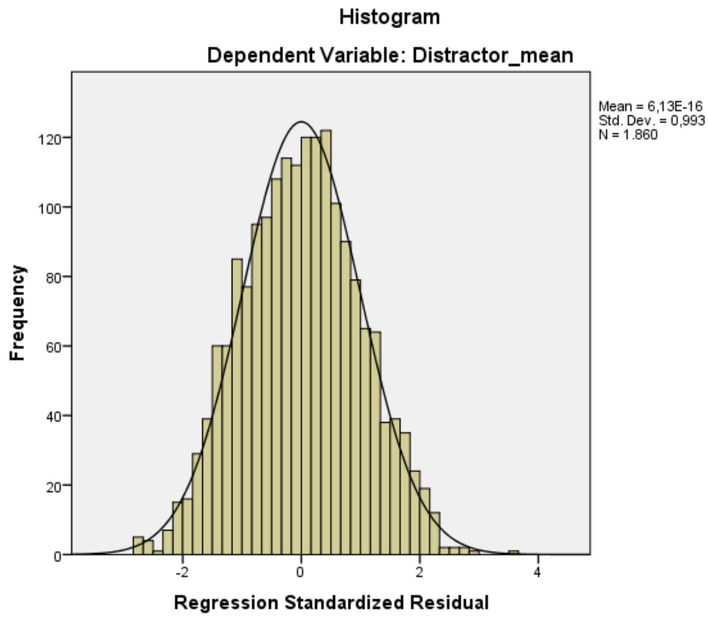

Figure 4. 14 Histogram of residuals of the distractor

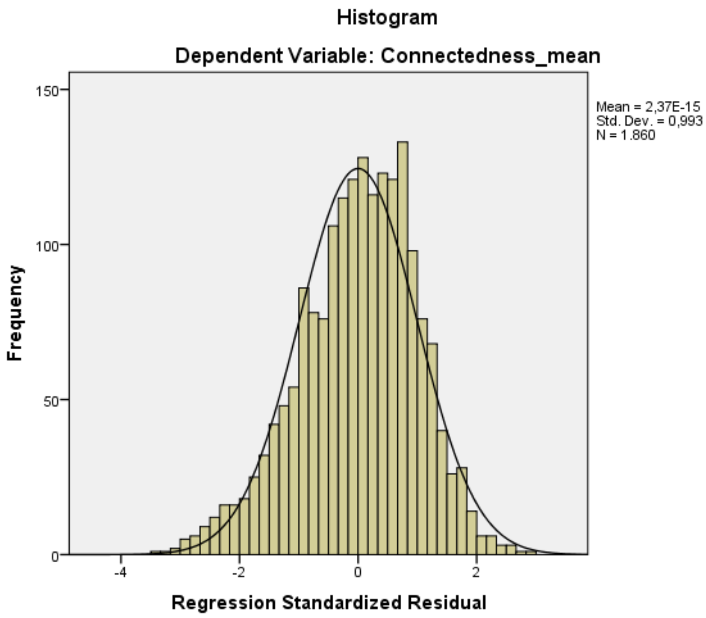

Figure 4. 15 Histogram of residuals of the connectedness

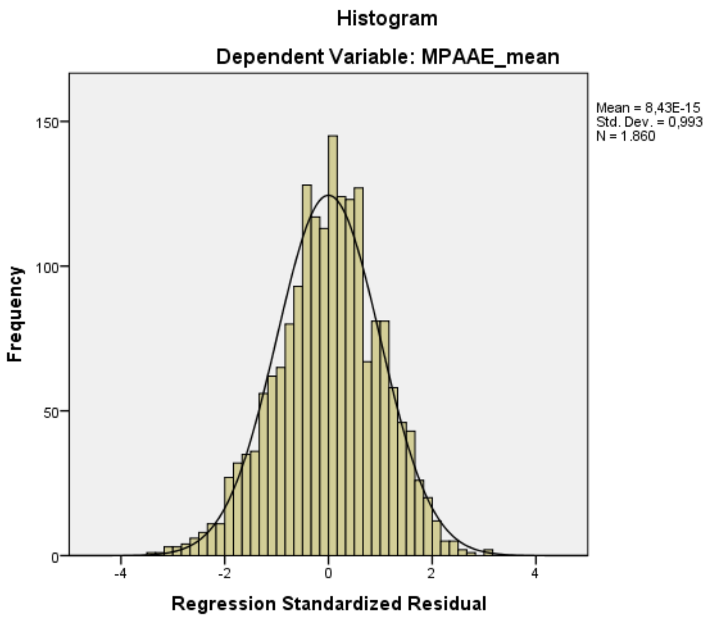

Figure 4. 16 Histogram of residuals of the total MPUAE Score

APPENDIX K

Normality of Residuals Assumptions (P-P plots)

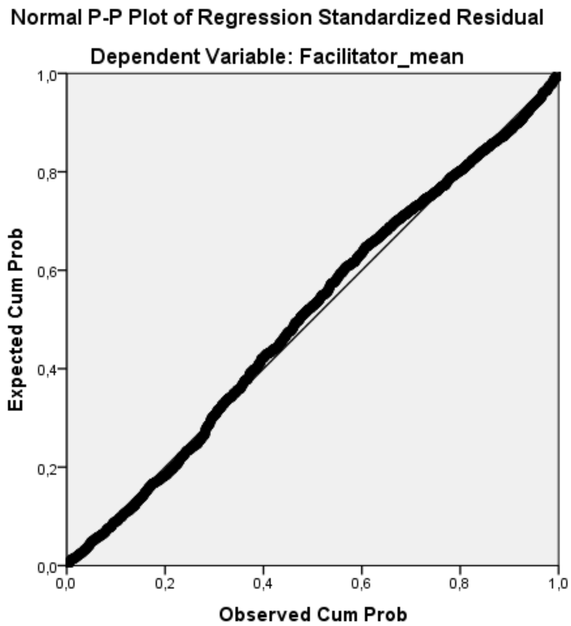

Figure 4. 17 P-P Plot of Residuals of the facilitator

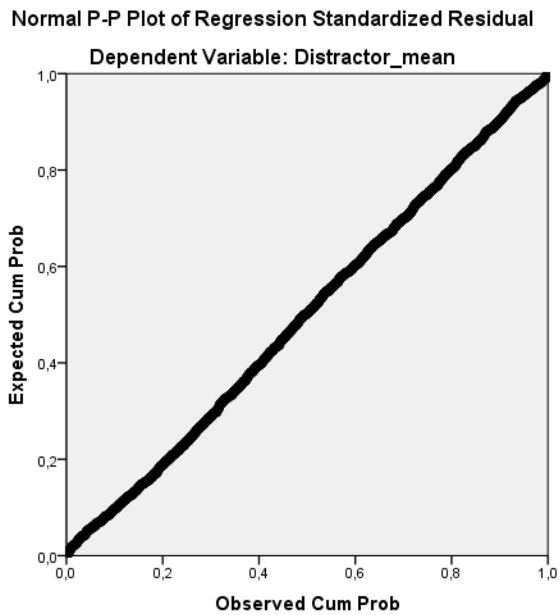

Figure 4. 18 P-P Plot of Residuals of the distractor

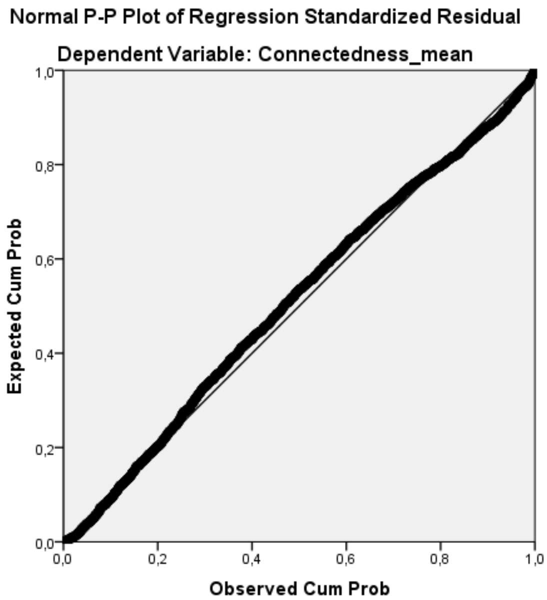

Figure 4. 19 P-P Plot of residuals of the connectedness

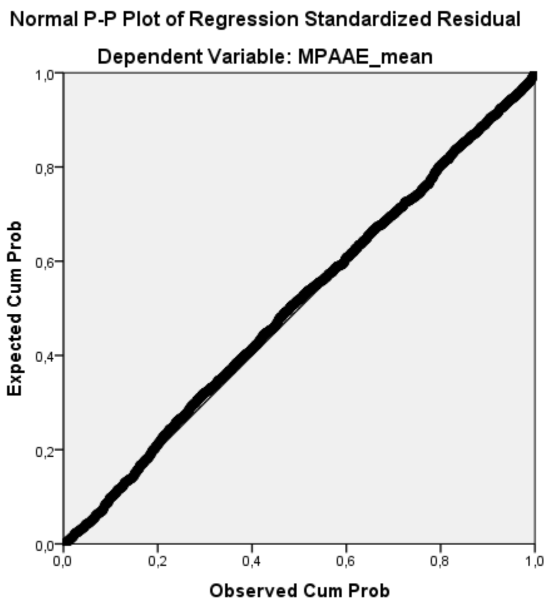

Figure 4. 20 P-P Plot of residuals of the total MPUAE score

APPENDIX L

Dear participants,

The questionnaire that you are going to reply is about undergraduate students' acceptance and use of mobile phone phones in the academic environment. Please respond to each statement which represents your idea. This will take approximately 15 minutes. I would like to thank you for participating in this study.
Please complete all the questions in this questionnaire.

Nehir Yasan & Prof. Dr. Soner Yıldırım
METU/CEIT/ nyasan@metu.edu.tr

Name (not required) : ....
Surname (not required): ....
E-mail(required) :** ....

** Your responses will be held in strict confidence and your identity will not be revealed to anyone other than the researcher in the project. You will be informed of the research results and if needed you will be requested to participate in the following step of the research.

PART – I DEMOGRAPHIC INFORMATION

1. What is your gender? : ◯ Female ◯ Male ◯ Other

1. What is your age? : ◯ <19 ◯ 19 ◯ 20 ◯ 21 ◯ 22 ◯ 23 ◯ 24 ◯ 25 ◯ 26+

3. What is your current GPA? ◯ 0.00-1.00 ◯ 1.01-1.50 ◯ 1.51-2.00 ◯ 2.01-2.50 ◯ 2.51-3.00 ◯ 3.01-3.50 ◯ 3.51-4.00

4. What is your faculty? ◯ Architecture ◯ Arts and Science ◯ ECON&ADM ◯ Education ◯ Engineering

Your department : ....

5. Year of study? ◯ Freshmen (1.year) ◯ Sophomore (2.year) ◯ Junior (3.year) ◯ Senior (4.year) ◯ Senior (+4) ◯ Graduate

6. What kind of mobile device do you have and for how long ?

	I do not have...	0 - 3 years	4 - 6 years	7 - .... years
Cell phone (basically only for calls and texts) IF YES DO NOT CONTINUE TO FILL OUT THE FORM!	◯	◯	◯	◯
Mobile (smart) phone (advanced computing ability and connectivity)	◯	◯	◯	◯
Tablet PC	◯	◯	◯	◯
Laptop	◯	◯	◯	◯
Other devices, please specify (e.g. smart watch, kindle)...	◯	◯	◯	◯

7. Number of total applications that you used in your mobile phone.
◯ < 10 ◯ 10 - 20 ◯ 21 - 30 ◯ 31 - 40 ◯ 41 - 50 ◯ > 51

8. Which operating systems do you use in your mobile phone?
◯ iOS ◯ Windows ◯ Android ◯ I don't know ◯ Other

9.How frequently do you use the Internet through…

	Never	Rarely	Monthly	Every week	Everyday	I do not have Internet access
…your mobile service package?	1	2	3	4	5	0
…the WiFi at school (including dormitory)?	1	2	3	4	5	0
…the WiFi at home (DSL, CableNet, etc.)?	1	2	3	4	5	0

PART – II EDUCATIONAL USE OF MOBILE PHONE

1. Overall, how often do you perform the following educational activities with your mobile phone? And how much do you find them useful for your academic work?

1= Never 2= Rarely (2-3 times a month) 3= Occasionally (1-2 times a week) 4= Frequently (1-2 times a day) 5= Very frequently (more than 2 times a day)	1= Not at all useful 2= Slightly useful 3= Moderately useful 4= Very useful 5= Extremely useful	**FREQUENCY**	**USEFULNESS**
1. Browsing the web for academic purposes.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
2. Searching literature via library's electronic databases.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
3. Reading academic content (e.g. article, e-book, e-journals, course materials).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
4. Reading other content (e.g. newspaper, blogs).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
5. Accessing Moodle (ODTU Class) or course websites to find lectures notes, reference readings, videos, announcements etc.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
6. Performing mathematical calculations.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
7. Checking social media related to your university/academic life (e.g. Facebook, Twitter, Instagram, LinkedIn).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
8. Looking up words in dictionaries.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
9. Instant messaging with classmates (e.g. WhatsApp, Facebook or other messengers).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
10. Instant messaging with instructors.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
11. Checking and/or sending e-mails for your academic work.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
12. Playing educational games.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
13. Recording audio/video for academic purposes.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
14. Taking photos for academic purposes.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
15. Downloading applications –specific to your study area- that help you learn something new.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
16. Note taking for academic purposes.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
17. Using the calendar or setting up reminders (alert/alarm) for your academic work.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
18. Using cloud storage for academic purposes (e.g. Dropbox, iCloud, Google Drive, Yandex.Disk).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
19. Online sharing and concurrent editing (e.g. Google Docs).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
20. Joining WhatsApp or Facebook (or other messengers) groups for academic purposes (e.g. course projects, assignments, etc.).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
21. Looking up something that you didn't understand during lectures.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
22. Visiting the university website (e.g. for daily updates, e-mail, getting information).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
23. Listening to/watching videos related to academic learning (e.g. lectures in YouTube/podcasts, etc.).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
24. Joining courses and educational content from outside of your university (e.g. iTunes-U, Khan Academy, Coursera, Udemy, edX, etc.).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
25. Interacting with –like/comment- an academic post (e.g. status/link/picture/video) social media.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
26. Sharing academic information on social media.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
27. Studying language via specific apps (e.g. Duolingo).		① ② ③ ④ ⑤	① ② ③ ④ ⑤
28. Participating in a video call/chat for academic purposes.		① ② ③ ④ ⑤	① ② ③ ④ ⑤
29. Using reference tools (e.g. Mendeley, EverNote).		① ② ③ ④ ⑤	① ② ③ ④ ⑤

2. Below is list of types of applications/services for mobile phones. Please indicate the one(s) that you use for academic purposes. You can choose more than one.

◯ Dropbox	◯ Yandex	◯ GoogleSearch	◯ TEDConference	◯ KhanAcademy	◯ Edmodo
◯ Google Drive	◯ WhatsApp	◯ Safari	◯ Youtube	◯ Udemy	◯ Dictionary
◯ iCloud	◯ FacebookMsngr	◯ Yahoo	◯ iTunesUniversity	◯ Coursera	◯ Facebook
◯ Twitter	◯ MS Office Apps	◯ Pinterest	◯ Mendeley	◯ LinkedIn	◯ Duolingo
◯ Wikipedia	◯ Quora	◯ WordPress	◯ Evernote	◯ LibAnywhere	◯ Podcasts
◯ PDFreader	◯ E-book reader	◯ Blogger	◯ GoogleDocs	◯ edX	◯ Be Focused

Write the other application(s) that you used ____________________

3. The motives of general mobile phone use are categorized as below. Please mark your motivation level for each category between 1 (lowest) - 10 (highest) considering your priority in general mobile phone use.

THE MOTIVES OF MOBILE PHONE USE

For Communication & Interaction	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
For Getting/Searching Information	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
For Tools & Productivity (calendar, notes, flashlight, alarms)	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
For Entertainment	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩
For Educational (academic) Purposes (for activities between 1-29. items in Part II /1.)	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩

PART – III Mobile Phone Affinity in Academic Environment Scale (MPAAES)

Please use the 1-5 scale provided ("Not at all true" to "Extremely true") to rate how TRUE for YOU the following statements are.

****ACADEMIC LIFE corresponds to your school life. It includes all school works, which is about your professional life at university (i.e. courses, seminars, workshops, career days, university clubs, all university activities).**	**Not at all true**	**A little true**	**Somewhat true**	**Very true**	**Extremely true**
1. My phone helps me keep track of -follow- my academic life**.	1	2	3	4	5
2. I use my phone to connect with my classmates or instructors.	1	2	3	4	5
3. I would get more school work done if I spent less time on my phone.	1	2	3	4	5
4. When it comes to the academic life, my phone is my personal assistant.	1	2	3	4	5
5. When I should be doing the school work, I find myself occupied with my phone.	1	2	3	4	5
6. I feel more comfortable in doing my school work when I have my phone with me.	1	2	3	4	5
7. For my academic life, I feel dependent on my phone.	1	2	3	4	5
8. In class or whenever I study, I read/send text messages that are not related to what I am doing.	1	2	3	4	5
9. I find myself occupied on my phone even when I'm with my classmates or instructors (during the class or studying).	1	2	3	4	5
10. Having my phone with me makes it easier to sort out –resolve, handle- the critical situations related to my academic life.	1	2	3	4	5
11. I feel in control of my academic life when I have my phone with me.	1	2	3	4	5
12. My phone is necessary for my academic life.	1	2	3	4	5
13. Without my mobile phone, I feel detached -out of touch, isolated- to my academic life.	1	2	3	4	5
14. My phone helps me stay close to my classmates and instructors.	1	2	3	4	5
15. My phone makes it easy to cancel the arranged plans with classmates or instructors.	1	2	3	4	5
16. In my academic life, my phone gives me a sense of comfort.	1	2	3	4	5
17. My phone helps me be more organized for my academic life.	1	2	3	4	5
18. I find myself engaged with my mobile phone for longer than I intended.	1	2	3	4	5

PART – IV SELF-DIRECTED LEARNING

Please indicate how much you agree or disagree with each statement in relation to your autonomous learning.

****Self-directed person: The person who has the ability to manage his/her own learning process.**	**Strongly disagree**	**Disagree**	**Neither agree nor disagree**	**Agree**	**Strongly agree**
1. When it comes to learning and studying, I am a self-directed person**.	1	2	3	4	5
2. In my studies, I am self-disciplined and find it easy to set aside -to assign -reading and homework time.	1	2	3	4	5
3. I am able to manage my study time effectively and easily complete assignments on time.	1	2	3	4	5
4. In my studies, I set goals and have a high degree of initiative - have high motivation to start -.	1	2	3	4	5
MOBILE PHONE SELF-EFFICACY					
I could complete a task using the mobile phone…					
1. If there was no one around to tell me what to do as I go.	1	2	3	4	5
2. If I had seen someone else demonstrate how it could be used.	1	2	3	4	5
3. If I could call someone to help if I got stuck	1	2	3	4	5
4. If I had a lot of time to complete the job.	1	2	3	4	5
5. If I had just the built in help facility for assistance.	1	2	3	4	5

THANK YOU !

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Yasan Ak, Nehir
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EDUCATION

Degree	Institution	Year of Graduation
MS	METU/ Science and Technology Policy Studies	2008 – 2011
BS	Süleyman Demirel University/ Computer Engineering	2018 – 2019 (*expected)*
BS	Anadolu Open University/ Sociology	2014 – 2019 (*expected)*
BS	Fırat University/ Computer and Electronic Education	2012 – 2006
High School	Mehmet Akif Ersoy Super High School, Elazig	1997 – 2001

WORK EXPERIENCE

Year	Place	Enrollment
2012-Present	METU department of Computer Education and Instructional Technology	Research Assistant
2008 - 2011	METU department of Science and Technology Policies Studies	Research Assistant
2006 - 2008	Gaziosmanpaşa Elementary Shool/ Pertek - Tunceli	Government Information Technology Teacher

FOREIGN LANGUAGES

Advanced English

ACADEMIC STUDIES

THESIS

1. Yasan, N. (2011). Exploring the Research Assistants' Opinions regarding the Effects of Graduate Course on Their Research Skills and Science Perception. Unpublished Master Thesis.

PUBLICATIONS

Articles

1. **Yasan Ak, N.** & Yıldırım, S. (2018). Nomophobia among Undergraduate Students: The Case of A Turkish State University. *International Journal on New Trends in Education and Their Implications*, Vol *9*(4) ISSN: 1309-6249, pp. 11-20 (**in press**).

2. **Yasan, N.,** & Medeni, T, & Yıldırım, S (2012). Exploring the Research Assistants' Opinions to Improve Science Perception at Graduate Programs. *International Journal of e-Business and e-Government Studies* Vol 4, No 22012 ISSN: 2146-0744.

Full papers

1. **Yasan Ak, N.** & Yıldırım, S. (2018) Nomophobia among Undergraduate Students and Its Link to Mobile Learning, *EDULEARN18 Proceedings Full Paper*, pp. 3018-3025. ISSSN: 2340-1117

2. **Yasan, N.**, & Yıldırım, S, & Medeni, T (2014). Research Assistants' Suggestions on the Improvement of Graduate Programs regarding Science Perception. *Procedia – Social and Behavioural Sciences 116*(2014) 3370-3374.

Proceedings

1. **Yasan Ak, N.** & Yıldırım, S. (2018), An Exploration of Educational Mobile Phone Usage among Undergraduate Students, *ITTES'18 Abstract Proceedings*.

2. **Yasan Ak, N.** & Yıldırım, S. (2018), Adaptation of Mobile Phone Affinity Scale (MPAS) into Academic Environment, *ITTES'18 Abstract Proceedings*.

3. **Yasan Ak, N. & Yılmaz Yendi, B.** (2018), An Investigation of Pre-Service Teachers' Attitudes towards Teaching Profession in Regard to Some Variables, *ITTES'18 Abstract Proceedings*.

4. **Yasan Ak, N.**, & Yıldırım, S. (2018), Nomophobia among Undergraduate Students: Case of a Turkish State, *EJER Congress 2018 Bildiri Kitabı*, Anı Yayıncılık, pp. 1556-1558

5. **Yasan Ak, N.** (2018), Development and Validation of Internet Literacy Self-Efficacy Scale for Pre-Service Teachers, *EJER Congress 2018 Bildiri Kitabı*, Anı Yayıncılık, pp. 1541-1543

6. **Yasan Ak, N.** & Yılmaz Yendi, B. (2018) The Relationship between Personality and Attitudes towards Teaching Profession of Pre-Service Teachers, *EDULEARN18 Proceedings*, p. 3887. ISSSN: 2340-1117

7. Yurdagül, C., Kamali Arslantas, T., **Yasan Ak, N.**, Gül, A., & Yıldırım, Z. (2017), Improving English Vocabulary Knowledge of Visually Impaired People: A Design-based Research Approach., *ITTES'17 Abstract Proceedings*.

8. **Yasan, N** (2015). Is ICT Enough in order to Provide Equal Opportunity in Education?: FATIH Project. *12th ESA Conference-Abstract book*, p.442. ISBN 978-80-7330-272-6

Web-Based Publications

1. **Yasan, N. (2013).** Teacher Education Simultaneous Renewal with TPACK. Baran, E. (Ed.), The Many Faces of TPACK: Perspectives and Approaches. Wikibooks/ Textbook, available at: *https://en.wikibooks.org/w/index.php?title=The_Many_Faces_of_TPACK/Teacher_Education_Simultaneous_Renewal_with_TPACK_with_TPACK&oldid=3117773.*

CONFERENCES AND PRESENTATIONS

1. "An Exploration of Educational Mobile Phone Use among Undergraduate Students", paper presented in 6th International Instructional Technologies & Teacher Education Symposium, Edirne/ Turkey, 12 – 14 September 2018

2. "Adaptation of Mobile Phone Affinity Scale (MPAS) into Academic Environment, paper presented in 6th International Instructional Technologies & Teacher Education Symposium, Edirne/ Turkey, 12 – 14 September 2018

3. "An Investigation of Pre-Service Teachers' Attitudes towards Teaching Profession in Regard to Some Variables", paper presented in 6th International Instructional Technologies & Teacher Education Symposium, Edirne/ Turkey, 12 – 14 September 2018

4. "Nomophobia among Undergraduate Students: Case of a Turkish State University", paper presented in 5th International Eurasian Educational Research Congress, Antalya/Turkey, 2-5 May 201

5. "Development and Validation of Internet Literacy Self-Efficacy Scale for Pre-Service Teachers", paper presented in 5th International Eurasian Educational Research Congress, Antalya/Turkey, 2-5 May 2018

6. "Nomophobia among Undergraduate Students and Its Link to Mobile Learning", paper presented in 10th annual International Conference on Education and New Learning Technologies, Palma De Mallorca, Spain, 2-4 July, 2018

7. "The Relationship between Personality and Attitudes towards Teaching Profession of Pre-service Teachers", presented in 10th annual International Conference on Education and New Learning Technologies, Palma De Mallorca, Spain, 2-4 July, 2018

8. "How should science perception be improved? Suggestions by Research Assistants", paper presented in Philosophy, Education and History of Science Symposium, Muğla/Turkey, 12-14 Nov 2015

9. "Is ICT Enough in order to Provide Equal Opportunity in Education?: FATIH Project", poster presented in 12th Conference of the European Sociological Association – Differences, Inequalities and Sociological Imagination, Prague/Czech Republic, 25-28 August 2015

10. "Research Assistants' Suggestions on the Improvement of Graduate Programs regarding Science Perception", paper presented in 5th World Conference on Educational Sciences, Rome/Italy, 5-8 Feb 2013

11. "Exploring the Research Assistants' Opinions to Improve Science Perception at Graduate Programs", paper presented in International Conference on e-Business and e-Government: Social Sciences Research Society, İzmir/Turkey, 28-29 April 2012

12. Attendant in 11th International Globelics Conference: Entrepreneurship, Innovation, and Economic Development in an Era of Increased Globalization, held by METU-TEKPOL, Ankara/Turkey, 11-13 Sept 2013 – also worked as a member of organization.
13. Attendant in 14th Annual International Conference on Economics and Security, held by EKOLIDER, İzmir University of Economics, METU-TEKPOL, İzmir/Turkey, June 2010 - also worked as a member of organization.

14. Attendant in 4th International Conference on Innovation, Technology and Knowledge Economics, held by EKOLIDER, İzmir University of Economics, METU-TEKPOL, İzmir/Turkey, May 2010 - also worked as a member of organization.
15. Attendant in 3rd International Conference on Innovation, Technology, and Knowledge Economics, held by METU-TEKPOL, Ankara/Turkey, June 2009 - also worked as a member of organization.

16. Attendant in 12th Annual International Conference on Economics and Security, held by METU- TEKPOL, Ankara/Turkey, June 2008 - also worked as a member of organization.

PROJECTS

1. 2011-Ankara Development Agency Project: The Strategic Analysis of Innovation Capacity in Ankara ICT Sector

   I worked as a researcher in the project.
   Project Team: Prof. Dr. Erkan Erdil, Pof. Dr. M. Teoman Pamukçu, Cansu Durukan, Asli Ertan, Gülsevim Evsel, Derya Fındık, Anıl Tay, Yelda Erden

2. 2015-Tubitak 1001 Project: Improving Vocabulary Knowledge of Blind or Visually Impaired People: A Design-Based Research Approach

   I worked as a researcher in the project.
   Project Team: Prof. Dr. Zahide Yıldırım, Tuğba Kamalı Arslantaş, A. Menaf Gül, Cemil Yurdagül

TEACHING ASSISTANTSHIPS

- CEIT 100: Computer Applications in Education
- CEIT 111: Information Technology in Education – I
- CEIT 112: Information Technology in Education – II
- CEIT 216: Principles and Methods of Instruction
- CEIT 319: Instructional Technology and Material Development
- CEIT 382: Computer Education and Teaching Methods
- CEIT 341: Measurement and Evaluation
- CEIT 411: School Experience
- CEIT 652: Theories of Learning and Instruction

OTHER PROFESSIONAL ACTIVITIES

1. Participation to 10 Weeks Intensive Course Program on "MAXQDA Workshop Series" organized by METU –Faculty of Education, Ankara/Turkey, October 2016 - January 2017.

2. Participation to One Week Intensive Course Program on "The Design and Evaluation of Innovation Policy (DEIP) in An Emerging Country Context" organized jointly by UNU-MERIT Maastricht, TUBITAK and METU TEKPOL, Gebze/ Turkey, 6-10 December 2010 (Trip is financed by METU TEKPOL and TUBITAK)

VOLUNTEER EXPERIENCE

1. Worked as a Volunteer for Five Years in *OkulaYuzVerin* Company: A volunteer group including METU graduated students worked to build an elementary school in a rural area of Ankara. Supported by METU Alumni Association.
   The school - *ODTÜ Mezunları İlköğretim Okulu*- has started to serve a diverse student population of 700 students since 2013.