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E-Learning: Students Input for Using Mobile Devices in Science Instructional Settings

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Abstract

A variety of e-learning theories, models, and strategy have been developed to support educational settings. There are many factors for designing good instructional settings. This study set out to determine functionality of mobile devices, students who already have, and the student needs and views in relation to e-learning settings. The study participants are undergraduate students who are enrolled department of science education in faculty of education and electrical and electronics engineering department in faculty of engineering. Prepared questionnaire form is used to collect data. This form consists of three parts. First part of questionnaire related to mobile devices, second part related to user preferences and third part contains open ended question to get students ideas about usage of self-phones in science educational settings. Countable data are analyzed with descriptive techniques. And content analysis technique is used for written data. Findings show that mobile phones should be selected as required equipment for usage of mobile devices in e-learning setting. Other important findings that students suggest that mobile phone can be used face to face educational setting in classroom and outside of classroom without and face to face interaction to teacher or students.

Keywords: e-learning, learning needs, science instruction

1. Introduction

In 1800's years had been beginning a revolution in communications by inventing the telephone. In 1940's years, after first phone calls, people had met new concept "mobile phone". There was no physical cable for connecting one phone to others. There were limited city which were have own mobile phone technology infrastructure, and providing service with low capacity (AT & T, 2016). Good sound transmission was much more important topic in those years. These are called first generation mobile phones (1G). After first generation mobile phones, developed second generations (2G) which has new feature; added fax, data, and messaging services. Later, third generation (3G) has multimedia facilities. Today, we have fourth generation (4G) mobile phones which have high-speed connectivity and provide better-than-TV quality images and video-links (Ashiho, 2003). Today, Over 1 billion users have mobile broadband subscriptions in the 34-country OECD (OECD, 2016).

Mobile phones are useful devices in our daily life. They are a kind of personal assistant which is powered by internet. We use it for listening music (download and upload any time), watching various documentaries, educational video, TV, etc., socializing and communication (twitter, Facebook, what's up…), surfing internet for research or what we want to get information about any question in our mind. Also, we use this technology for individual learning.

The most functionality of mobile phones is providing social interaction among the peoples. In education, mobile phones the best supporter of e-learning environment which is based on individual and social learning (Ally & Tsinakos, 2014). There are many educational technology applications provide individual learning in e-learning environment.

In education, e-learning environment is designed with models. Those models have developed on quantity and quality specification of all applications, and suitable for all of disciplines. These are adjunct mode, blended mode, and online mode (Harasim, 2006).

Adjunct mode: Using online networking for adjunction to traditional face to face educational setting.

Blended mode: Using online networking with integrating level of course and curriculum.

Online mode: Online networking platform using as a main learning environment.

The other important factor for e-learning is pedagogy (educational approach). Harasim (2006) was point out that three educational approach for e-learning. (1) *Online collaborative learning* point up the use of collaborative dis-course and group projects. (2) *Online distance education* refers to the use of e-mail rather than postal mail. (3) *Online computer-based training* refers to the use of the internet for individualized learning modules.

In literature, many of studies have researched e-learning environment models and educational approach in higher educations. Wang (2014) used web-based dynamic assessment to develop an assessment centered e-learning system. Study pointed out that e-learning models with personalized dynamic assessment are remarkable effective in student learning, especially for students with low-level prior knowledge. Zlatovic, Balaban, and Kermek (2015) used a sample of 351 students from higher education institutions to explore the influence of certain type of online assessment has on students' learning strategies. Results show that students' learning strategies can be influenced by various types of online assessments and it has positive impact on both formal and perceived levels of success in achieving. Tabuenca, Kalz, Drachsler, and Specht (2015) investigated the effects of tracking and monitoring time devoted to learn with a mobile tool, on self-regulated learning. Findings showed that positive effects of tracking time on time management skills. Chen (2010) used mobile technology to develop a Mobile Assessment Participation System. Implemented model enhanced teaching and learning through active engagement in idea-sharing, feedback-giving, and self-reflection. They used didactic content was recorded and posted online for student viewing outside of the classroom. They used a blended and flipped format in one semester. Findings showed that students achieved learning outcomes that were at least as good, and in one comparison importantly better than traditional classroom.

All of these studies have focused on e-learning educational setting. And, findings show that it's effective on instruction and learning. But, all implementation needs specific devices which have special technology. As is known, all technological devices should be replaced with a new one by the time. This replacement is financial burden for schools. The fact remains that every next generation university students have modern technological opportunities such as notebook, tables, mobile phones, etc. These technological opportunities can be used in instructional setting. Today, almost whole college students have self-phones but sometimes they may prefer not to use in educational setting. The reasons can be various but the main reasons collected in two categories.

1.1 Technological Barriers

Battery life and connectivity: A good battery performance should be able to keep the mobile phone standby a complete day. The mid-end mobile phones provide around half of day time of talk time. When user play games, chat on social platforms, surf on internet, record videos, take pictures, etc., battery drains much faster (Permi, 2016). Also, connectivity is another problem for battery life. Communication protocol with mobile phone and GMS services can be establishing different band channel. For instance, when phone connects to GSM base station over 4G band widths, battery life drains much faster (Bartlett, 2012).

Screen size: Comparing mobile phone screen with desktop, or notebook screen, big screen display much more information than small screen. Visual appearance of interface effects user's understandability of the learning (Ashour, 2012).

Limited memory: Mobile phones have limited information storage capacity, comparing with PC. Especially RAM, type of internal memory, doesn't upgrade in phones (Elias, 2011).

Multiple standards and format support: There are many firm producing mobile phones with their own combining of hardware and software, and also user interface. Its need to consider these variety of platforms when designing an application or learning activity.

1.2 Educational Challenges

Educators should focus on the worldwide accessible design of materials using tools, and it doesn't mean just content transfer (Elias, 2011). Technology should use as a tool, not as aim. Principle of instructional design should be based on interactive learning strategy (Sung et al., 2005). All learning environments need to a pedagogical model which application is based on (Harasim, 2006). Pedagogical potential of the various types of model and integration their usage of effectively in learning and teaching limited in science because of nature of science curriculum (Webb, 2008).

There are many factors for the implementation of e-learning application. User preference is one of important factors for well-designed e-learning environment, especially m-learning applications (Yılmaz & Sanalan, 2011).

At that point, users' personal preference in learning, opinion about the educational setting, specifications of users' mobile phones need to take in consideration.

This study is aimed to reveal;

Are students' mobile phones features suitable for e-learning?

What are the ideas of preservice science teachers about using mobile phone as an e-learning tool?

What kind of opinion's and expectation they are already having about the usage mobile phones as a learning tool?

2. Method

In this study, students who enrolled faculty of education and faculty of engineering are asked to provide information on type of mobile devices they own, usage preference, and views about e-learning implementations.

2.1 Participants

The study participants were 43 (27.6%) undergraduate students who are enrolled in a Misconception in Science Course (It's an elective course) in the faculty of education and 113 (72.4%) undergraduate students who are enrolled Physic I Course in the faculty of engineering. All students are selected from a small town university which is located in northeastern part of Turkey.

2.2 Instruments

The student questionnaire used in this study was created by Yılmaz and Sanalan (2011). The questionnaire consists of three parts. In first part, questions are to get information about users' type and number of mobile devices already they have, family income, and specifications of users' mobile phones. This part gives information about suitability of hardware and software capabilities of devices that may be used for e-learning. In second part, questions about users preferences and major purpose of using mobile phones, and bring forward a proposal for implementing in learning. This part is used to get information from students for usage of mobile phones as a learning tool in educational settings. Third part contains an open ended question to get students' new ideas, about usage of self-phones in science educational settings.

2.3 Data Collection

It takes about 20 minutes to complete questionnaire. Four group of college students are sampled in this study. Data collection is completed within two weeks and four separate sessions, and implemented two different faculties in the same university.

2.4 Data Analysis

Firs two part of questionnaire contain countable data. These data are analyzed with descriptive techniques, and are showed with tables. Last part of questionnaire contains written data based on open ended question. These data are analyzed with content analysis in Nvivo PC software, and illustrated with diagrams.

3. Results

This part shows that data collected by questionnaire about the specifications of hardware need to be used in e-learning and students' views about usage of mobile phones as a learning tool in educational purpose.

Table 1. Portable mobile devices used regularly

Measure	Number (N)	Percent (%)
Type of Device		
Mobile Phones	149	95.5
Notebook	2	1.3
Missing System	3	1.9
Total	156	100
Number of Device		
One	122	78.2
Two	14	9.0

Three or more	4	2.5
Missing System	16	10.3
Total	156	100

As can be seen from the table above 95.5% of students have mobile phones, and someone have also second or more. That's mean mobile phone is the most popular portable device in using from students.

Table 2. Students' family income

Revenue	Number (N)	Percent (%)
Under MW	39	25.0
MWx1	49	31.4
MWx2	30	19.2
MWx3	17	10.9
MWx4	10	6.4

MW: Minimum Wage

Numbers vary due to missing answers

It can be seen from the data in Table 2 that the 25% of students' family income have under the minimum wage income and 67.9% of family income are above the minimum wage. Family income is effective on purchasing power. As can be seen families' income not much more but, it's adequate to buy mobile devices.

Table 3. Wireless connectivity protocol of mobile phones

	Number (N)	Percent (%)
Wi-Fi		
Yes	122	78.2
No	11	7.1
No Idea	1	.6
Missing System	22	14.1
Bluetooth		
Yes	140	89.7
No	5	3.2
No Idea	1	.6
Missing System	10	6.4
Total	156	100.0

From the Table 3 above we can see that the majority of mobile phones have connectivity protocols. Mobile phones having support of Wi-Fi protocols are 78.2% and Bluetooth 89.7%. Connectivity is an important factor for designing e-learning environments. Percentages values show that hardware properties of mobile phones are appropriate.

Table 4. Mobile operation systems and specifications of self-phones

	Number (N)	Percent (%)
Mobile Phone OS		
Symbian	9	5.8
MWM(Microsoft Windows Mobile)	7	4.5
IOS	20	12.8
Android	102	65.4
Other	1	.6
No idea	11	7.1
Missing System	6	3.8
Total	156	100
Software Installation Feature		
Yes	134	85.9
No	15	9.6
No idea	2	1.3
Missing System	5	3.2
Total	156	100.0

From the Table 4 above we can see that the majority of students have android operation software based mobile phone (65.4%). In total, above two-thirds of the students have smart mobile phones and that phones have software installation feature (85.9%). These features are important for designing different platforms in e-learning activities. After hardware, as can be seen that majority of students' phones software suitable for e-learning platforms.

Table 5. Communication ways and internet packet

	Number (N)	Percent (%)
Communication way with mobile phones		
Text Message	50	32.1
On Internet Based	40	25.6
Call Up	55	35.3
Missing System	11	7.1
Mobile Internet Packet		
No	36	23.1
1-1000Mb	4	2.6
100-200Mb	4	2.6
200-300Mb	3	1.9
500Mb	65	41.7
1Gb limitless	1	.6
2Gb	17	10.9
1.5Gb	1	.6
3Gb	1	.6

4Gb	3	1.9
5Gb	1	.6
Other	1	.6
Missing System	19	12.2
Total	156	100.0

The Table 5 above illustrates some of the main characteristics of the students' communication way with mobile phones and usage of mobile internet packet. As can be seen from the table, students' prefers first way to call up, second way to text message and the last way use internet for communication. And, the majority of students have around 500 Mb data packed for using internet in a month. After hardware and software features of mobile phones, the most important factor is probably internet connectivity. Students have mid-size internet data packed. If they have much more data packed, probably they will prefer internet as a first way of communication. Developing technology in GSM services can be offer cheaper data packed opportunity to users over the time. Table 5 show that students' internet data packed enough to use in simple e-learning activity (simple e-learning activity: no need much more data on internet).

Table 6. Students views about using mobile phones in educational setting

	Number (N)	Percent (%)
Needs		
Very necessary	37	23.7
Necessary but has difficulties	33	21.2
Not sure	12	7.7
Makes life easier but unnecessary	37	23.7
Totally unnecessary	23	14.7
Missing System	14	9.0
Learning Environment		
Theoretical courses	61	39.1
Applied courses	24	15.4
Field trips	23	14.7
Distance learning	4	2.5
Other	3	1.9
Missing System	41	26.3

This table is quite revealing in two ways. First, what is interesting in this data is that students' views are not clear about using mobile phone in education. Almost one-fourth of the students (23.7%) said that "very necessary" and "makes life easier but unnecessary" with on an equal basis. This values show that students have hesitation about using mobile phones in educational setting. However, they prefer to use mobile phone based educational applications in the "theoretical courses" (39.1%).

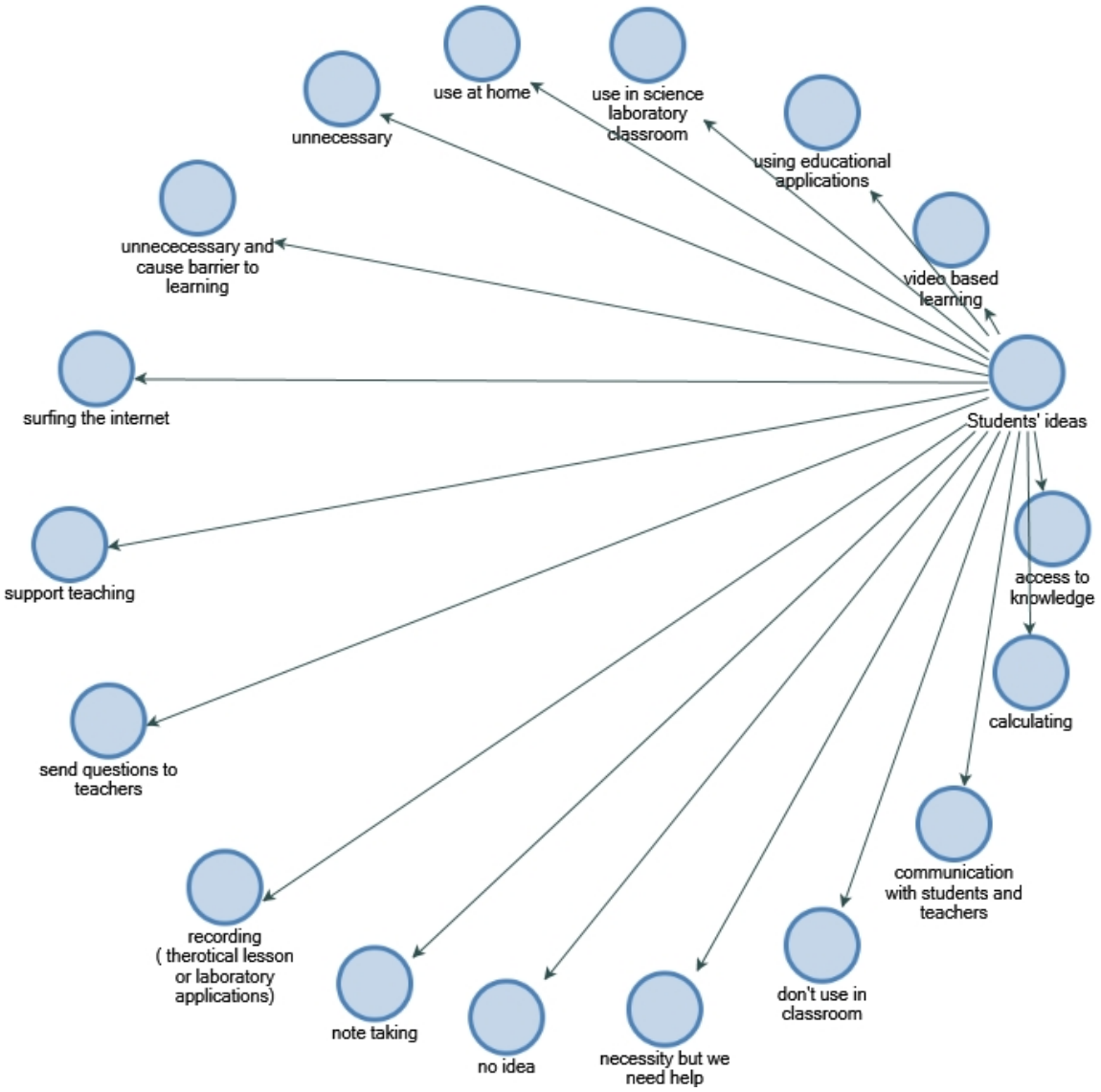

Figure 1. Students' views about using mobile phones in educational setting

As can be seen on Figure 1 students' views about using mobile phones in educational setting grouped seventeen nodes. Every node has different number of referenced by student. These references show that which idea has much more important in all ideas as a descriptive way. These nodes have importance for designing e-learning models in science instructional setting. Some of comments are given below.

- Video based learning (4 references): "We can watch videos which are recorded in the lessons." (R4)
- Using educational applications (3 references): "We can download special educational application such as simulations, animations…etc. and use it for support to theoretical course." (R3)
- Use in science laboratory classroom (2 references): "We can reach to knowledge when making experiments." (R2)
- Use at home (1 reference): "It's much more productive when use at home special time schedule instead of use in classroom." (R1)
- Unnecessary (11 references): "It's absolutely unproductive. No!" (R8)
- Unnecessary and cause barrier to learning (2 references): "In my opinion, it's unproductive and cause negative influence on instructions."(R2)
- Surfing the internet (2 references): "It helps to surfing the internet and research." (R1)

• Support teaching (2 references): "When teacher need information during the teaching, he/she can look for visuals materials." (R1)

• Send questions to teachers (2 references): "We can send questions, we couldn't solve, to teacher with mobile phones and teacher can give to us feedback in same way." (R2)

• Recording (theoretical lesson or laboratory applications) (4 references): "It can be useful recording laboratory experiment application or during lecture for students." (R1)

• Note taking (2 references): "[for] lectures notes." (R1)

• No idea (3 references): "I don't know." (R1)

• Necessity but we need help (2 references): "We don't know all features of mobile phones. First of all we need to know all to have idea how we can use it." (R2)

• Don't use in classroom (1 reference): "In my opinion, don't use mobile phones in the classroom." (R1)

• Communication with students and teacher (1 reference): "Teacher and students can use [mobile phone] for point of common coupling and application." (R1)

• Calculating (3 references): "Use for calculating after installed specific application [to mobile phones]." (R1)

• Access to knowledge (1 reference): " Students can research when teacher ask any questions, so that student can easily access to knowledge… it's a reinforces…" (R1)

4. Discussion

In this study, two important factors are researched which is based on usage of mobile devices on e-learning activity. Therefore, discussions are made by hardware and software (OS) of mobile phones that students have and findings about students' ideas for e-learning application which is based on mobile phone technology.

First of all, it need to adequate number of appropriate equipment for designing e-learning environment. Findings show that students have mobile phones by 95.5%. Also, some of them have second and many more mobile phones or mobile devices. Family income is effective on purchasing power. So that, students can buys many more mobile devices which are have much more specifications. Findings show that more than half of students' family income are above the minimum wage. Of course, the high number of mobile phones doesn't mean that they can be used for e-learning activities. These mobile phones must have an adequate Operating System (OS), capability of program installation and connection protocol. Very high rates of mobile phones have proper OS (88.5%) and connection support rate is high-leveled as 78.2% Wi-Fi and 89.7% Bluetooth. Another important fact, program installation feature is also very high rates leveled by 85.9%. These findings show that students have high-level featured mobile phones.

Students' preferring ways of communication are almost identical. They use text message, internet, and call up for communicating others. Only 23.1% of users have no internet packet. Around half of students have 500Mb data packet. Besides that some of them have very high data packet. It is apparent from these findings there is no critical barrier for establishing e-learning environment if taking considering distance connectivity with mobile phones.

Students' ideas are another important factor for establishing e-learning environment. What is surprising is that students have positive and negative ideas same rates level (23.7%) about using mobile phones in educational setting. Some of them said that "very necessary" some of them said "make life easier but unnecessary". However, around half of students (39.1%) want that learning environment in theoretical courses. This findings show that probably students have no experience with any kind of mobile device based educational setting. But, they want to use in theoretical course. The level of controlled information is associated experience of effort (Bruya, 2010). Students have no experience with using mobile phones in educational setting. Probably, their ideas would be changed, if they get special experience.

The third question in this research was what kind of opinions and expectation students were already have about the usage mobile phones as a learning tool. As can be seen on Figure 1, students' ideas about that question are varied throughout the seventeen nodes. In high rates (11 ref.), students thought that it is "unnecessary". On the other hand, they suggest various way of using mobile phone in educational setting. Their ideas basically collect in two areas.

One of them is face to face educational setting in classroom for accessing to knowledge, communication with other students and teacher, using mobile phone program installation feature to use calculating, simulating, animation etc. Students' preferences for computing devices changed from desktop to laptops. It's changed

computing concept to mobile computing (Boettcher, 2009). As can be seen on students' ideas and literature, mobile phones would be new mobile devices for mobile computing. The last decades, different mobile devices used to support instruction and learning. For instance, used handheld computer to support improved classroom assessment in science (Yarnall, Shechtman, & Penuel, 2006), handheld tools that "informate" assessment of student learning in science (Roschelle, Penuel, Yarnall, Shechtman, & Tatar, 2005), teaching with student response system in elementary and secondary education settings (Penuel, Boscardin, Masyn, & Crawford, 2007). Todays, mobile phone features are advanced phone to smart phone. So, there is no need to use special devices for educational setting. The other area is outside of classroom and school setting. It's based on recording lesson and watching of these video later. There are two online interactional models in educational setting based on e-learning approach. These are asynchronous interaction and synchronous interaction. There are various tools that can be utilized in asynchronous interaction. For example, pre-recorded presentation and lectures are using for asynchronous learning (Kung-Ming & Khoon-Seng, 2009).

The present student ideas seem to be consistent with other research which found using mobile phones as a "clickers" and using for distance education. Dunn, Richardson, Oprescua, and McDonald (2013) have been studied about usage mobile phone as a Classroom Response System (CRS) in undergraduate course level in Mathematics Education. The result indicated that it has no new marginal challenges for students and also, has pedagogical advantages. Students reported that it has effective on "enhanced their learning", help them understand concepts" and "think more deeply". Maier (2009), Used in his research mobile phone as "keypads and the internet as the receiver and processor of signals". He used that application in university level in environmental engineering course. Study showed that application positive effective on student interaction in classroom. Tremblay (2010), used mobile phone as an Audience Response System in science classes (Medical Laboratory Science program, Veterinary Technology program). The Study was revealed that majority of science students were positive aspects about that application.

5. Conclusion

This study set out to determine functionality of mobile devices, students who already have, and the student needs and views in relation to e-learning settings. Almost whole mobile phones support at least one wireless connection protocol type. It's get an opportunity students for freedom of movement in learning activity. Also, students have internet packet in own mobile phones. The research has shown that students have good mobile phone feature and internet for e-learning. That means mobile phones should be selected as required equipment for usage of mobile devices in e-learning setting.

Students input, like in other educational study, have a significant factor to create an appropriate educational setting. This study has found that students suggest that mobile phone can be used face to face educational setting in classroom and outside of classroom without and face to face interaction to teacher or students.

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