# The effect of mobile learning applications on students' academic achievement and attitudes toward mobile learning

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## ABSTRACT

This study examines the effect of mobile learning applications on undergraduate students' academic achievement, attitudes toward mobile learning and animation development levels. Quasi-experimental design was used in the study. Participants of the study were students of the Buca Faculty of Education at Dokuz Eylul University in Turkey. The experiment was conducted during the first semester of 2013-2014 academic year. A mobile learning-based strategy was used in experimental group (n = 15), while the control group participated in a lecture-based classroom (n = 26). An attitude scale was used to measure the students' attitudes toward mobile learning, and achievement test was used to examine the effect of mobile learning applications on the students' achievement. In order to evaluate the animations developed by students, a rubric was used. For exploratory analysis, interviews were conducted with students. The findings suggest that mobile learning may promote students' academic achievement. Both groups had significantly high attitude scores toward mobile learning. Furthermore, the students appreciated mobile learning as an approach that may significantly increase their motivation. Researchers and practitioners should take into consideration that mobile learning can create positive impact on academic achievement and performance and increase the motivation of students.

**Keywords:** *mobile learning; tablet computer; graphic; animation; academic achievement; attitude*

## INTRODUCTION

The number of mobile cellular network subscribers is expected to be seven billion in 2016. Also, the number of Internet users is known to reach 3.2 billion (ICT Facts and Figures, 2015). Mobile technologies transform our daily lives in ways such as connectivity, communication and cooperation (McQuiggan, McQuiggan, Sabourin & Kosturko, 2015). Mobile devices (specifically smartphones and tablet computers) aim to change the way of learning and teaching methods innovatively (Kuzu, 2014; Middleton, 2015). However, it is indicated that mobile learning cannot replace with formal education but offers methods to support learning outside of the classroom and brings advantages for different interactions (Sharples, Taylor & Vavoula, 2010).

In conjunction with the use of mobile devices in learning and teaching activities, the term "Mobile learning" has emerged. There are different definitions of mobile learning in the literature (Crompton, 2013). According the Quinn (2000), mobile learning is e-learning which is performed through mobile devices. The definition of mobile learning varies over time and affected by emerging technologies. McQuiggan, McQuiggan, Sabourin and Kosturko (2015) defined mobile learning as instant and optionally accessible, anywhere and anytime learning, which helps us create our knowledge, satisfy our curiosity, collaborate with others and enrich our experiences.

People in virtual environments and those in real world can connect with each other via mobile learning (Traxler & Koole, 2014). Moreover, learning communities can be created among people on the move. Considering these specialities, mobile learning is at the forefront as a supportive element of lifelong learning and in-service learning. The interaction opportunities of mobile learning provide sustainability of education outside of the classroom (Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009). In this way, mobile devices affect the socio-cultural and cognitive aspects of learning (Pachler, 2009).

Studies on mobile learning focus on how learners on the move gain new knowledge, skills and experiences (Sharples et al., 2009). Rapid development of mobile technologies brings some disadvantages to researchers and learners as well. Learners devote time to get used to the characteristics of the new device. Researchers face challenges carrying out longitudinal studies. People, who have mobile devices, desire to use these devices in mobile learning settings for their personal needs, which poses challenges to researchers on having control over variables (Pachler, 2009).

While hardware was at the forefront in the past, the design and content of mobile learning are becoming prominent recently in mobile learning research (Odabasi et al., 2009; Traxler, 2007; Wang, Shen, Novak, & Pan, 2009; Wu et al., 2012). Mobile learning is not just e-learning which ends up with the adoption of e-learning objects to mobile devices. Mobile learning objects should be created on the basis of mobile design principles. Mobile learning contents should be presented in small chunks instead of presenting the entire material. These small chunks in the form of mobile learning content are called as "nuggets" or "bite-sized" (Parsons, Ryu & Cranshaw, 2007). Naismith and Corlett (2006) points out the design of mobile learning as following:

- Create quick and simple interactions,

- Prepare flexible materials that can change according to the needs of learner,

- Design access of device and interaction by considering the different devices and standards,

- Contribute to the learning experience using the characteristics and constraints of mobile devices,

- Use mobile technologies as a learning facilitator not a tool for only distributes learning contents,

- Design materials with learner-centered approach.

Mobile devices are widely used in the digital age. Social network sites, which are becoming indispensable with Web 2.0 technologies, facilitate acceptance of mobile devices by teachers and students. The educational use of mobile devices in and outside of the classroom helps students develop positive attitudes towards courses (Özdamar Keskin, 2011). Students' interest and motivation are enhanced by mobile learning (Ozan, 2013). Moreover, the use of mobile devices in the learning environments encourages students to participate in learning activities. Therefore, it can be said that mobile devices may become a necessity for students and educators (Yılmaz and Akpinar, 2011).

One of the advantages of mobile learning is the ability to provide access to learning contents out of the course time. Mobile learning management systems might be used to provide this. Additionally, mobile learning contents are produced based on design principles for qualified interactions. Researchers suggest that the duration of access time should be increased (Çelik, 2012). Moreover, determining and reporting duration and number of the visit session in the mobile learning system are important (Sayın, 2010; Martin & Ertzberger, 2013). At the same time, various technical regulations are proposed for effective learning through mobile learning such as rapid and wireless internet network infrastructure, big screen size and mobile applications in the native language of students, so that students will not be exposed to extraneous cognitive load (Anderson, Franklin, Yinger, Sun, & Geist, 2013; Ozan, 2013; Royle, Stager & Traxler, 2014; Sur, 2011). Being distractive, challenges in use and technical issues are seen as problems that have to be solved in mobile learning (Gikas & Grant, 2013). There are implications and recommendations for implementation in mobile

learning research. There are various researches that mobile learning increased academic achievement (Çelik, 2012; Köse, Koç & Yücesoy, 2013; Oberer & Erkollar, 2013). Ozan (2013) came with a conclusion that mobile learning is more permanent for learning. In addition, using social networks and mobile technologies positively affect students' performance toward courses. Evans (2008) emphasized that mobile learning is more effective and instructive than books, and more supportive in learning. Mobile learning offers benefits such as quick access to information for students, diverse ways of learning, contextual learning, control over own learning, supporting and encouraging learning, increased participation in the course, will to use in the course and positive meaningful differences of academic achievement, considering the results of the researches.

This research was designed in accordance with the recommendations expressed above. In this research, bite-sized and interactive course content was created and used. The use of native applications on mobile devices is provided to support learning. Also, students could personalize mobile devices because the students kept mobile devices during the research. Introducing mobile learning environments to pre-service teachers is considered to be crucial. This research is expected to contribute to the empirical and theoretical researches.

### The Research Aim and Scope

The aim of this research is to investigate the effects of mobile learning applications on undergraduate students' academic achievement, attitudes toward mobile learning and animation development levels. In this context, the research problem is "Do mobile learning applications affect the academic achievement, attitudes of undergraduate students towards mobile learning and animation development levels?". The research questions are identified below:

Are there any meaningful differences between the academic achievement of the experimental and control groups?

Are there any meaningful differences between the attitudes toward mobile learning of the experimental and control groups?

Are there any meaningful differences between the animation development levels of the experimental and control groups?

What are the students' views about mobile learning in the experimental group?

### Limitations

(1)This research is limited to 41 second-grade pre-service teachers (experiment: 15, control: 26) who study in Computer Education and Instructional Technology Department in Dokuz Eylul University.

(2)This research is limited to 15 tablet computers.

(3) This research is limited with "Graphic and Animation in Education" course.

(4)In this research, Blackboard learning management system (Blackboard, n.d.) is used.

### Research methodology

#### *Participants*

The study group of this research consisted of 41 second-grade pre-service teachers who voluntarily participated in the research and study in Computer Education and Instructional Technology Department in Dokuz Eylul University, Turkey. 15 tablet computers were given to students in the experimental group for this research supported by Dokuz Eylul University as a scientific research project (Project Id: 2013.KB.EGT.004). The students were assigned to control and experimental groups using random sampling (Creswell, 2013), which is ended up with 15 participants in experimental group and 21 participants in control group.

The experimental group voluntarily signed "Usage Agreement for Mobile Devices" (Burden, Hopkins, Male, Martin, & Trala, 2012). This agreement consisted of mobile devices' being kept by the students for 12 weeks and ethical use of these devices.

Both groups' demographic and mobile awareness information were collected through a questionnaire. 73% of experiment group and 65% of control group have a smart phone, which shows that most students were familiar with mobile phones and applications. However, only 20% of experimental group and 8% of control group have a tablet computer, which may mean that students could face difficulties using tablet computers. Students stated that they listen to podcasts the least (experiment: 0%, control: 12%) with their mobile devices; and listen to music (experiment: 100%, control: 96%) and communicate (experiment: 100%, control: 92%) the most with mobile devices. Almost half of the students (experiment: 47%, control: 42%) stated that they carried out e-learning activities via mobile devices. Additionally, 47% of experimental group and 62% of control group indicated that they want to use mobile learning applications in both theoretical and practical courses.

### Research design

In this study, quasi-experimental design was used as research method (Cohen, Manion & Morrison, 2013). Both groups have recieved 50% theoretical and 50% practical courses by lecturer. Learning contents (blog, presentation, sample, video, podcast, homework, test, forum) were accessible for both groups through a learning management system. The dependent variables of research are academic achievement, attitude toward mobile learning and animation development level. The independent variables of the research are mobile learning and traditional learning conditions.

Mobile learning group (15 pre-service teachers): This group were taught through mobile learning approach. Tablet computers were distributed to this group, and learning management system and learning contents were available on mobile devices.

Traditional learning group (26 pre-service teachers): This group were taught in a traditional learning environment. Learning management system and learning contents were also available for this group but this time, on the Internet. The details of research design can be seen Figure 1.

**Figure 1. Research design.**

|  | Traditional learning | Mobile learning |
|---|---|---|
| Before research | Academic Achievement Test<br>Attitude Scale Toward Mobile Learning | |
| During Research | Attend conventional lectures | |
| | Access learning management system via PC | Access learning management system via mobile devices |
| | Access course blog | |
| | Access learning contents via PC | Access learning contents via mobile devices |
| After research | Academic Achievement Test<br><br>Attitude Scale Toward Mobile Learning<br><br>Animation Development Levels Rubric | |
| | Interview | |
| Six months after research | Academic Achievement Test<br><br>Attitude Scale Toward Mobile Learning | |

### Data collection

*Academic Achievement Test*

The test was developed by researchers in order to measure academic achievement based on the acquisition through the course. The scope of the subject, objectives and content were created before the test was developed. 36 questions were prepared based on feedbacks received from the experts of the field. The table of specification chart was created during the development phase. 150 undergraduate students took part in the test for item analysis. Statistical analyses were performed with the TAP (Test Analysis Program) software. 13 items were removed from the test because of low item distinctiveness power. The KR-20 reliability coefficient of test consisting of 23 items was found 0.83, which is close to 1 and means the test is reliable (Perry & Nichols, 2014). The distinctiveness index of test items was found very good (0.49) and item difficulty of test was found average (0.64).

*Attitude Scale Towards Mobile Learning*

"Attitude Scale Toward Mobile Learning" scale was developed by the researchers in order to measure attitudes of participants toward mobile learning (Demir & Akpınar, 2016). Data was collected from 78 undergraduate students in order to create pool of draft items. Data collected from students were analysed and a draft consisting of 57 items was created. Following experts' opinions from several universities, inappropriate and similar items were excluded from the draft. After revisions, the draft comprised of 52 items (41 positive, 11 negative). The 5-point Likert-type scale was graded in five categories: totally agree (5), agree (4), partially agree (3), disagree (2), totally disagree (1).

Kaiser Meyer-Olkin (KMO) and Bartlett sphericity tests were required for factor analysis (Fraenkel & Wallen, 2006). KMO value found as 0,94, which is considered to be very good and Bartlett test was found meaningful, which is considered that data is suitable for factor analysis ($\chi 2=8530,19$; $p<,000$). In the light of this data, it was decided that scale is statistically appropriate for factor analysis (Coolican, 2014). The final decision was given after the third factor analysis.

The final version of scale consists 45 items. The Cronbach's alpha internal consistency coefficient of the scale was found .950, which is accepted as highly reliable. KMO value found as 0,93 and considered to be very good. Bartlett test was found meaningful ($\chi 2=7820,10$; $p<,000$). The scale has four factors and explains the %50,34 of the total variance. Internal consistency of factors were high (satisfaction ,942; effect to learning ,877; motivation ,886; usability ,776).

*Interview*

The semi-structured interviews were conducted to reveal participants' views about the process of the implementation. Five students who are chosen randomly from mobile learning group were interviewed. The semi-structured interview form, which consists of 11 open-ended questions related with application process, was used as data collection tool.

*Animation Development Level Rubric*

All of the students who participated the research were asked to develop animations. These animations should include all techniques that students were thought during research. The students were given 90 minutes to develop an animation properly. The animations were collected and reviewed using "Animation Development Level Rubric".

### Data Analysis

A combination of parametric and non-parametric tests was used in this research taking into consideration of normal distribution and homogeneity (Fraenkel & Wallen, 2006). The data collected from participants were analysed using the SPSS 20.0 software. Animations developed by participants were graded

separately by field experts and researchers using "Animation Development Level Rubric".

## RESULTS

### *The impact of mobile learning on academic achievement*

Mann-Whitney U test was performed to compare academic achievement scores of both groups (see Table 1). There was no significant difference between academic achievements of both groups before research (p>.05) while significant difference was found in favour of experiment group after research (p<.05). In accordance with these results, it can be said that mobile learning poses better effect in terms of academic achievement.

**Table 1. The effect of mobile learning on academic achievement.**

| Group | Test | N | Mean rank | Sum of ranks | Mann-Whitney U | Z | Sig. |
|-------|------|---|-----------|--------------|----------------|---|------|
| Experiment | Pre test | 15 | 25.20 | 378.00 | 132.000 | -1.716 | .086 |
| Control |  | 26 | 18.58 | 483.00 |  |  |  |
| Experiment | Post test | 15 | 31.13 | 467.00 | 43.000 | -4.150 | .000 |
| Control |  | 26 | 15.15 | 394.00 |  |  |  |
| Experiment | Follow up test | 15 | 28.67 | 430.00 | 80.000 | -3.130 | .002 |
| Control |  | 26 | 16.58 | 431.00 |  |  |  |

For persistence control, follow up tests were performed six months after the end of the research. Data collected from follow up tests compared with post-tests. It is seen that there was still significant difference in favour of experiment group according to follow up tests (U=80.000, p<0,005). It can be said that mobile learning has persistent effect on academic achievement.

There were no significant differences between pre-test – post-test attitude scores of both groups. In this case, high results of pre-test and post-test was due to the fact. The high attitude scores can be explained as participants' being digitally literate and studying in Computer Education and Instructional Technology department. It is seen that both groups had significantly high attitude scores towards mobile learning (p>.05).

### *The impact of mobile learning on attitudes toward mobile learning*

There were no significant differences between pre-test – post-test attitude scores of both groups. In this case, high results of pre-test and post-test was due to the fact. The high attitude scores were explained because of participants, who were digitally literate, were studying in Computer Education and Instructional Technology department. It is seen that both groups had significantly high attitude scores towards mobile learning (p>.05).

**Table 2. The effect of mobile learning on attitudes toward mobile learning.**

| Factor | Group | Test | N | X | SS | t | Sig. |
|--------|-------|------|---|---|----|----|------|
|  | Experiment | Pre test | 15 | 74.13 | 9.72 | .754 | .528 |
|  | Control |  | 26 | 76.38 | 11.52 |  |  |
| Satisfaction | Experiment | Post test | 15 | 70.80 | 12.42 | -.841 | .405 |
|  | Control |  | 26 | 74.00 | 11.33 |  |  |
|  | Experiment | Follow up | 15 | 76.53 | 13.84 | .944 | .351 |

| | | | N | Mean rank | SD | Z | Sig. |
|---|---|---|---|---|---|---|---|
| | Control | test | 26 | 72.00 | 15.33 | | |
| Effect to learning | Experiment | Pre test | 15 | 42.40 | 8.08 | -.079 | .206 |
| | Control | | 26 | 45.38 | 6.60 | | |
| | Experiment | Post test | 15 | 42.60 | 5.84 | -1.153 | .256 |
| | Control | | 26 | 44.77 | 5.78 | | |
| | Experiment | Follow up test | 15 | 45.53 | 6.02 | .485 | .631 |
| | Control | | 26 | 44.53 | 6.49 | | |
| Motivation | Experiment | Pre test | 15 | 26.00 | 3.93 | -.868 | -.722 |
| | Control | | 26 | 26.46 | 3.99 | | |
| | Experiment | Post test | 15 | 24.67 | 5.27 | -1.204 | .236 |
| | Control | | 26 | 26.50 | 4.34 | | |
| | Experiment | Follow up test | 15 | 26.73 | 5.03 | 1.023 | .313 |
| | Control | | 26 | 24.88 | 5.85 | | |
| Usability | Experiment | Pre test | 15 | 24.40 | 3.16 | -1.369 | .091 |
| | Control | | 26 | 22.04 | 5.56 | | |
| | Experiment | Post test | 15 | 22.47 | 4.45 | .838 | .407 |
| | Control | | 26 | 21.08 | 5.45 | | |
| | Experiment | Follow up test | 15 | 19.40 | 3.94 | -.694 | .492 |
| | Control | | 26 | 20.42 | 4.85 | | |

### The effect of mobile learning on animation development levels

The animations that were developed by students were analysed. Significance differences found in favour of experiment group (p<.05) which is similar to the post-test and follow up test results of academic achievement tests.

**Table 3. The effect of mobile learning on animation development levels.**

| Group | N | Mean rank | Sum of ranks | Mann-Whitney U | Z | Sig. |
|---|---|---|---|---|---|---|
| Experiment | 15 | 30.97 | 464.50 | 45.500 | -4.096 | .000 |
| Control | 26 | 15.25 | 396.50 | | | |

### The views of students towards mobile learning

The students indicated that they felt excitement, joy, happiness and valuable when they learned that mobile learning and tablet computers would be used in this course. Also, two students expressed that they

hesitated because they never experienced this before. However, it was observed that motivation of students increased:

Student 1: "I was glad when I first heard. I hesitate a little bit. We were faced with things we didn't know how to do them."

Student 3: "I felt nice things. I was excited and happy. I felt valuable in this department."

Student 4: "Access to the resources and samples any time kept me motivated."

Student 5: "It was very nice to me. I walked around constantly mobile. I continuously was mobile."

The students stated that mobile learning had positive impacts on their learning and supported them:

Student 2: "The information was persistent which I got through my mobile device. In addition, my mobile device provided me extra time because of rapid access to the information. I rapidly learned an incorrect or incomplete information that caught my mind thanks to mobile learning. I fixed my wrong and deficit knowledge."

Student 3: "Instantly access to information about our course with mobile devices gave us extra time and made learning easier for us."

Student 4: "I reinforced parts with resources when I didn't understand during course study and I tried to figure out the issues."

The students had some technical problems during the research about Internet connection, tablet computers, application notifications and other technical issues. In addition, they expressed that if technical issues were solved, they would want to use mobile learning in other courses as well. Also, students advised about mobile learning in the course:

Student 2: "The information, which I encountered relevant and irrelevant, caused confusion. I think the persistence will be increased if it is used in practical courses."

Student 3: "I want to reach the course notes at the end of the course."

## DISCUSSION AND CONCLUSION

This research examined the effects of mobile learning applications on undergraduate students' academic achievement, attitudes toward mobile learning and animation development levels. Mobile learning has significantly positive effect on academic achievement compared to traditional learning in this research. Results were similar to those of Oberer and Erkollar (2013) and Hwang and Chang (2011). Similarly, Hwang and Chang (2011) indicate that mobile learning not only catches students' interaction but also increases their success. Chu (2014), on the other hand, emphasize that mobile learning has negative effect on academic achievement because of cognitive overload and inappropriate design of learning.

Chu, Hwang, Tsai and Tseng (2010) have found that students have positive attitudes toward mobile learning. It was found in this study that both of the groups had positive attitudes toward mobile learning in line with the results of previous research (Evans, 2008; Gikas and Grant, 2013; Kutluk and Gülmez, 2014; Oberer and Erkollar, 2013). This situation was seen reasonable by researchers because both groups are at an age called "digital native" (Wishart & Thomas, 2015). The students who participated in this research were studying in department related ICT and were considered to be digitally literates.

Ozan (2013) have found that mobile technologies positively affect performance of students. Animations, which were developed by mobile learning group, were found more qualified in this research. This result supports the results of other research (Ozan, 2013; Huang, Liao, Huang & Chen, 2014; Oberer & Erkollar, 2013).

Quick access to information, anywhere and anytime learning, interacting with friends and facilitating learning are observed as important key points of mobile learning according to the interviews with students. Mobile learning applications increase the effect of learning and enhance the process of learning (Huang et al., 2014; Wishart, 2015). Students emphasized that they would want further mobile learning experiences such as doing homeworks using mobile devices, more activities on tablet computers and developing animations on tablet computers. However, some technical issues were faced in terms of software and hardware. These issues were slow Internet connection and notification restrictions of mobile learning management system.

## RECOMMENDATIONS

Suggestions are proposed in the light of the findings and results obtained through the research. Researchers should provide Internet and Wi-Fi during mobile learning studies. Limited number of mobile devices were used in this research. It is suggested that future research should be implemented with more mobile devices with larger samples. Tablet computers with Android operating system were used in this research. In order to develop positive attitude, mobile learning can be used in courses that students do not like or do not have interest. Students should develop animations via mobile devices and this is suggested to be examined in future research.

### Statements on open data, ethics and conflict of interest

Please contact the first author in order to access data and documents, which are collected during the research. This article produced from first author' master thesis with the second author as advisor. This thesis was supported by Scientific Research Projects Unit of Dokuz Eylul University (Project Id: 2013.KB.EGT.004). The necessary permissions to develop data collections tools and implement the research were taken from the Ethics Committee in Institute of Educational Sciences, Dokuz Eylul University, Turkey. Participants attended to the research on a voluntary basis and had the right to leave the research whenever they wanted.

### Compliance with ethical standards

#### *Conflict of interest*

The authors declare that they have no conflict of interest.

#### *Ethical approval*

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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## REFERENCES

Anderson, J., Franklin, T., Yinger, N., Sun, Y., & Geist, E. (2013). Going mobile: Lessons learned from introducing tablet PCs into the business classroom. *The Clute Institute International Academic Conference (pp. n.d).* Las Vegas, NV: The Clute Institute.

Blackboard (n.d.). Get the most powerful tools for your classroom. Retrieved March 23, 2016 from https://www.coursesites.com/webapps/Bb-sites-course-creation-BBLEARN/pages/learn.html.

Burden, K., Hopkins, P., Male, T., Martin, S., & Trala, C. (2012). *iPad Scotland evaluation final report*. Faculty of Education, University of Hull.

Chu, H. C. (2014). Potential negative effects of mobile learning on students' learning achievement and cognitive load-a format assessment perspective. *Educational Technology & Society*, *17*(1), 332-344.

Chu, H. C., Hwang, G. J., Tsai, C. C., & Tseng, J. C. (2010). A two-tier test approach to developing location-aware mobile learning systems for natural science courses. *Computers & Education*, *55*(4), 1618-1627.

Cohen, L., Manion, L., & Morrison, K. (2013). *Research methods in education*. Routledge.

Coolican, H. (2014). *Research methods and statistics in psychology*. Psychology Press.

Creswell, J. W. (2013). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.

Crompton, H.: A historical overview of mobile learning: toward learner-centered education. In: Berge, Z.L., Muilenburg, L.Y. (eds.) Handbook of Mobile Learning, pp. 3–14. Routledge, Florence (2013)

Çelik, A. (2012) *Yabancı dil öğreniminde karekod destekli mobil öğrenme ortamının aktif sözcük öğrenimine etkisi ve öğrenci görüşleri: Mobil sözlük örneği [The effect of QR code assisted mobile learning environment on productive vocabulary learning in foreign language studies and student reviews: The example of Mobile Dictionary]* (Unpublished Master's thesis, Graduate Schoold of Educational Sciences). Gazi University, Ankara.

Demir, K., & Akpınar, E. (2016). Mobil Öğrenmeye Yönelik Tutum Ölçeği Geliştirme Çalışması. Eğitim Teknolojisi Kuram ve Uygulama, 6(1).

Evans, C. (2008). The effectiveness of m-learning in the form of podcast revision lectures in higher education. *Computers & education*, *50*(2), 491-498.

Fraenkel J. R, & Wallen, N. E. (2006). *How to design and evaluate research in education*. McGraw-Hill.

Gikas, J., & Grant, M. M. (2013). Mobile computing devices in higher education: Student perspectives on learning with cellphones, smartphones & social media. *The Internet and Higher Education, 19*, 18-26.

Huang, Y. M., Liao, Y. W., Huang, S. H., & Chen, H. C. (2014). A Jigsaw-based cooperative learning approach to ımprove learning outcomes for mobile situated learning. *Educational Technology & Society*, *17*(1), 128-140.

Hwang, G. J., & Chang, H. F. (2011). A formative assessment-based mobile learning approach to improving the learning attitudes and achievements of students. *Computers & Education*, *56*(4), 1023-1031.

Köse, U., Koç, D., & Yücesoy, S. A. (2013). An augmented reality based mobile software to support learning experiences in computer science courses. *Procedia Computer Science*, *25*, 370-374.

Kutluk, F. A., & Gülmez, M. (2014). A research about mobile learning perspectives of university students who have accounting lessons. *Procedia-Social and Behavioral Sciences, 116*, 291-297.

Kuzu, E. B. (2014). *Use of social networks for educational purposes among pre-service IT teachers*. (Unpublished doctoral dissertation, Graduate School of Educational Sciences). Anadolu University, Eskişehir, Turkey.

Martin, F., & Ertzberger, J. (2013). Here and now mobile learning: An experimental study on the use of mobile technology. *Computers & Education*, *68*, 76-85.

McQuiggan, S., McQuiggan, J., Sabourin, J., & Kosturko, L. (2015). Mobile Learning: A Handbook for Developers, Educators, and Learners. John Wiley & Sons.

Naismith, L., & Corlett, D. (2006). Reflections on success: A retrospective of the mLearn conference series 2002-2005. In Proceedings of *mLearn 2006: Across generations and cultures*. Banff, Canada. Retrieved March 17, 2016 from https://hal.archives-ouvertes.fr/hal-00197366/document.

Oberer, B., & Erkollar, A. (2013). Mobile learning in higher education: A marketing course design project in Austria. *Procedia-Social and Behavioral Sciences*, *93*, 2125-2129.

Odabasi, H. F., Kuzu, A., Girgin, C., Çuhadar, C., Kiyici, M., & Tanyeri, T. (2009). Reflections of Hearing Impaired Students on Daily and Instructional PDA Use. *International Journal of Special Education, 24*(1), 8-19.

Ozan, O. (2013) *Directive support in connectivist mobile learning environments.* (Unpublished Master's thesis, Graduate School of Social Sciences). Anadolu Üniversitesi, Eskişehir.

Özdamar Keskin, N., (2011). *Developing and assessing a mobile learning system for academicians.* (Unpublished Master's thesis, Graduate School of Education). Anadolu Üniversitesi, Eskişehir.

Pachler, N.: Research Methods in Mobile and Informal Learning: Some Issues. In: Vavoula, G., Pachler, N., Kukulska-Hulme, A. (eds.) Researching Mobile Learning: Frameworks, Tools and Research Designs, Peter Lang, Bern, Switzerland, pp. 1–15 (2009)

Parsons, D., Ryu, H., & Cranshaw, M. (2007). A study of design requirements for mobile learning environments. *Journal of Computers, 2*(4), 1-8. doi: 10.4304/jcp.2.4.1-8

Perry Jr, F. L., & Nichols, J. D. (2014). *Understanding Research in Education: Becoming a Discerning Consumer*. Routledge.

Royle, K., S. Stager, and J. Traxler. 2014. "Teacher Development with Mobiles: Comparative Critical Factors." *Prospects* 44: 29–42.

Sayın, Z. (2010) *A research and an example practice on mobile learning through mobile phones.* (Unpublished Master's thesis, Graduate School of Sciences). Selçuk University, Konya.

Sharples, M., Arnedillo-Sánchez, I., Milrad, M., & Vavoula, G. (2009). Mobile learning. In N. Balacheff, S. Ludvigsen, T. Jong, A. Lazonder, S. Barnes (Eds.) *Technology-enhanced learning* (pp. 233-249). Netherlands: Springer Netherlands. doi: 10.1007/978-1-4020-9827-7_14.

Sharples, M., Taylor, J., & Vavoula, G. (2010). A theory of learning for the mobile age. In Medienbildung in neuen Kulturräumen (pp. 87-99). VS Verlag für Sozialwissenschaften.

Sur, E. (2011) *Comparing mobile learning with web-supported learning sysytems (A practice in Sinop University, Gerze Vocational School.* (Unpublished Master's thesis, Institute of Education). Gazi University, Ankara.

Traxler, J. (2007). Defining, Discussing and Evaluating Mobile Learning: The moving finger writes and having writ.... The *International Review of Research in Open and Distributed Learning, 8*(2).

Traxler, J., & Koole, M. 2014. The Theory Paper: What is the Future of Mobile Learning?, In I.A. Sánches and P. Isaías (Eds.), 10th International Conference on Mobile Learning, IADIS Press, 289–293.

Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom. *British Journal of Educational Technology, 40*(4), 673-695.

Wishart, J. (2015). Assimilate or Accommodate? The Need to Rethink Current Use of the Term 'Mobile Learning'. In *The Mobile Learning Voyage-From Small Ripples to Massive Open Waters* (pp. 229-238). Springer International Publishing.

Wishart, J., & Thomas, M. (2015). Introducing e-research in educational contexts, digital methods and issues arising. *International Journal of Research & Method in Education*, *38*(3), 223-229.

Wu, W. H., Wu, Y. C. J., Chen, C. Y., Kao, H. Y., Lin, C. H., & Huang, S. H. (2012). Review of trends from mobile learning studies: A meta-analysis. *Computers & Education, 59*(2), 817-827.

Yılmaz, Y., & Akpınar, E. (2011). Mobile technologies and mobile activities used by prospective teachers. In I. A. Sanchez, & P. Isaisas (Eds.), *Proceedings of IADIS International Conference Mobile Learning 2011* (pp. 144-150). Avila, Spain.