Journal of Computer and Education Research
March 2023 Volume 11 Issue 21
http://dergipark.org.tr/jcer
(ISSN:2148-2896)

Research Article

Developing and Reviewing a Mobile Application for a 7th Grade Mathematics Course

Sevinç TAŞ *[1] Ayşe YAVUZ [2]

[1] *Ministry of Education, Karaman, Turkey, sevinc.tas9@gmail.com*

[2] *Necmettin Erbakan University, Ahmet Keleşoğlu Faculty of Education, Konya, Turkey, ayasar@erbakan.edu.tr*

* *Corresponding Author: sevinc.tas9@gmail.com*

Article Info

Received: *28 October 2022*
Accepted: *07 January 2023*

Keywords: ADDIE design methodology, mathematics education, mobile learning, usability of mobile applications

10.18009/jcer. 1194818

Publication Language: English

Abstract

The Covid-19 epidemic that occurred in 2019 prevented education from continuing face to face. Various searches were conducted as part of this procedure that can be used effectively in online education. As a result, the GeoHepta mobile application was created to help students study the 7th grade mathematics course subjects using the ADDIE design methodology. Activities using dynamic mathematics software that students may use interactively were created as part of the content of the built mobile application. Students were also given the opportunity to complete online evaluation using Web 2.0 tools after learning the lesson's topics. The research was performed by 7th-grade students in a secondary school in the Central Anatolia Region in the second term of the 2020-2021 academic year, utilizing a mobile application in the distance education process. A quasi-experimental design was used to conduct the study. The "Mobile Application Usability Scale" was involved in the analysis to assess the usability of the mobile application after the experimental group had been educated. As a result of the research, it was established that the GeoHepta mobile application is "usable" by the students, and their attitudes about the mobile application are good. Participants' opinions on the mobile application's style, colour, control, typeface and hierarchy are also "useful". The "control" function of the mobile application received the greatest score, while the "aesthetic" aspect of the mobile application received the lowest grade.

To cite this article: Taş, S., & Yavuz, A. (2023). Developing and reviewing a mobile application for a 7th grade mathematics course. *Journal of Computer and Education Research, 11* (21), 1-19. https://doi.org/10.18009/jcer.1194818

Introduction

It is crucial to use instructional strategies and procedures that are suitable for the unique characteristics of the students' learning environments when teaching mathematics and geometry to the students of the future. The primary goal of education is to provide quality instruction to children, adolescents and adults. Successful teaching to individuals at all levels of school is dependent on careful preparation and organization (Dede & Dursun, 2004). While teaching environments are carefully structured, it should be assured that students access concepts and learn by making sense under the supervision of the instructor in a learning environment based on a constructivist approach in accordance with the curriculum's educational philosophy (Altun, 2016; Göksu & Köksal, 2016; Kutluca, 2013). Depending on current developments, it should be established what sort of method will be used in teaching to meet the requirements of people. In this scenario, instructional design becomes more important. In order to increase the quality of teaching, instructional designs are defined as systematically improving instruction through the use of learning and instructional theories (Brown & Green, 2016).

Instructional design models are used in accordance with the steps outlined by producing an actual reality to provide concreteness to conceptual links and procedures. Each instructional scenario is completely finished by following processes without skipping any of the stages of creating the conceptual relations that instructional design models want to convey. However, depending on the model's peculiarities, it may be feasible to omit certain processes while focusing more on others. Instructional design models may differ in this regard. Depending on current developments, it should be established what sort of method will be used in teaching to meet the requirements of people. In this scenario, instructional design becomes more important.

According on the comparison of instructional design models, the models utilized may be characterized as linear or cyclic. While linear models are made up of sequential stages, circular models do not have a beginning or finishing point. While ASSURE and the Instructional Development Institute model are instances of linear models, the Kemp model and the American Air Force model are examples of circular models (Ocak, 2015). Although instructional designs differ in several areas, they share some elements (Richey, 1986). The same components determine how all teaching approaches will proceed overall. Determine the requirements of the learners, determine the aims and objectives, determine the assessment techniques, create the presenting styles, test the system generated, and review the system are all similar components in all teaching models (Richey, 1986). Instructional design models may be used with visual models to represent the entire process in detail at a look based on comparable components and various process aspects. Looking at these models can provide information about how the model's design process is progressing. Designers and instructors can collaborate to develop the best appropriate teaching environment in accordance with an instructional design model. The teaching environment in mathematics may be developed using several instructional design models so that students can achieve the intended goals in teaching the courses. When looking at studies in the literature on instructional design models that can be used in mathematics teaching, Özdemir and Uyangör's (2011) study aimed to present an instructional design model among the existing instructional design models that is thought to be suitable for the nature of mathematics education, and to reveal the steps and lower levels of the instructional design model envisaged for mathematics education. According to his research, they developed an instructional design model for mathematics education based on the ASSURE model and backed by the Dick and Carey model, which is regarded to be most appropriate for the nature of mathematical education. They proposed that the model they created be applied in several areas of mathematical education. Karakış, Karamete, and Okçu (2016) investigate the impact of computer-assisted education on students' attitudes toward mathematics classes and computer-assisted instruction on mathematics learning. Based on the ASSURE methodology and the ARCS motivation model, they created computer software to teach fractions to fourth graders. These students' ability levels were assessed before and after they took the computer-aided mathematics course. Instructional design models are models that allow for the determination of the impacts of education during and after the process. As a result, the research was carried out by utilizing the ADDIE instructional design model to determine the teaching methods and techniques in accordance with the design model in order to create the best teaching environment in the teaching of subjects related to geometry and measurement learning field of 7th grade students. Within the framework of the project, a mobile application named GeoHepta was built in order to demonstrate to students that mobile tools may also be utilized for education. It is intended to supplement mobile device functionality such as communication, gaming, and information gathering. Instructional design models are models that enable the determination of the impacts of education during and after the process. As a result, the research was carried out using the ADDIE instructional design model to determine the teaching methods and techniques in accordance with the design model to create the best teaching environment in the teaching of subjects related to geometry and measurement learning field of 7th grade students. The ADDIE design approach offers the chance to construct the ideal learning environment for students' learning. It is important to set up the learning environment using the ADDIE model in accordance with the needs analysis that was completed during the analysis step. The design process is initiated based on the findings of the analysis step. The decision to create an environment that would encourage the use of technology in the mathematics teaching process was made as a result of the interviews with students and teachers that were done during the analytical stage of this study. Because students are able to use technical tools like computers, tablets, and cellphones in their daily lives, a design for the planned use of these resources in the learning environment has been created. A mobile application named GeoHepta was developed as part of the project, and it was hoped that it would demonstrate to students that mobile tools can also be utilized for education. In addition to the capabilities of mobile devices such as communication, gaming, and information acquisition, it is hoped that students would see mobile devices in a new light by discovering that they may give ease in studying subjects both inside and outside of the classroom. The GeoHepta mobile application was created following the phases of the design model, and the impacts of its use in the learning process were explored. There are few studies in the literature that use a mobile application designed according to a learning model inside the context of a design model to conduct research in mathematics instruction. The fact that the GeoHepta mobile application was built within the framework of the ADDIE instructional design paradigm and that the teaching outcomes contributed to the literature in this regard demonstrates the value of the research. In accordance with the research's goal, the following research problems were developed and investigated within the scope of the study:

1. According to the ADDIE instructional design model, what are the stages of the development of the GeoHepta mobile application for teaching the 7th grade Geometry and Measurement learning field?

2. What is the measurement results based on the 'Mobile Application Usability Scale (MAUS)' post-application scores for the mobile application of the experimental group of students studying in the learning environment designed using the ADDIE instructional design model in teaching courses associated to the 7th grade Geometry and Measurement learning?

When the studies in the literature were evaluated, no similar research could be discovered in the field of Geometry and Measurement learning in the seventh grade on the subjects of lines and angles, polygons, circle and circular region, and unit cube constructions from different sides. In this regard, the study is expected to add to the discipline.

Literature

Model of Instructional Design ADDIE

Individual learning is targeted via instructional design, which comprises of lengthy or short phases. The steps of instructional design are identifying performance goals, deciding instructional tactics, selecting or developing a setting and content, and assessing (Branch, 2016). The process of employing instructional design to generate useful learning lessons is defined as the phases of these five processes. Today, it is known that there are over 100 versions of the General ADDIE model (Ocak, 2015). The figures below depict some of the model's versions that have been produced. Figure 1 depicts the progressions between the phases of the Molenda (2003) model and Figure 1 created by Texas A & M University (2001).

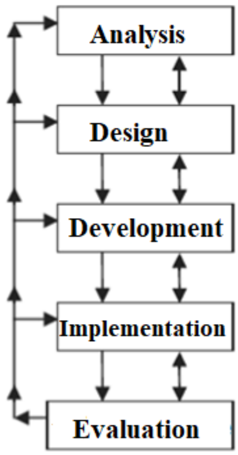

Figure 1. Shows the molenda ADDIE model (2003)

When the many forms of the ADDIE model are reviewed, it is clear that the core components are the same, with the only difference being the procedures between the phases. When developing using the ADDIE paradigm, the outcome of each step influences the following stage, and the next stage is passed. The ADDIE design model's phases are incremental, and a link is built with the previous step based on the work done after each step. The ADDIE technique, which is now one of the most effective product creation methods, is an appropriate model for educational goods and other learning materials (Branch, 2016). In line with the applicability of the ADDIE design model, research has been carried out at different levels of education (Albalawi, 2018; Cihan & Akkoç, 2020; Çoban 2020).

Method

Research Design

The application was prepared based on the ADDIE design model, which is one of the instructional design models (Molenda, 2003). The ADDIE design model is an instructional design model that evaluates every step of the process from the planning of educational material to obtaining its final form. The ADDIE instructional design model gets its name from the initials of the English equivalents of its steps (Analysis, Design, Development, Implementation, Evaluation). The participants of the study are 7th grade students who continue their education in a state secondary school in the Central Anatolia region in the 2020-2021 academic year. The teaching of the subjects belonging to the sub-learning areas in the 7th-grade Geometry and Measurement learning field will be carried out by the analysis, design, development, application, and evaluation steps of the ADDIE instructional design model. Within the scope of this research, the course design that was carried out through the ADDIE instructional design model which was implemented with 7th grade students, was included. In this section, the development steps of the learning material that can be used for both tablets and mobile devices are given respectively.

Application of ADDIE Design Model in 7th Grade Mathematics Lesson Geometry and Measurement Learning Field Subjects

Analysis

Studies to realize the analysis step, which is the first step of the ADDIE instructional design model, were planned and provided. First of all, a needs analysis was carried out in the analysis step. For this purpose, data were collected by asking interview questions with a semi-structured interview form for teachers and students to reach answers that include the problems encountered in learning and teaching the subjects in the field of Geometry and Measurement learning in the 7th grade, and expectations for the learning environment. In line with the findings obtained as a result of the needs analysis, it was aimed to design teaching based on the use of technology. The following sub-headings include the analysis of the findings obtained as a result of the needs analysis.

Analysis of the Interview with the Teachers

In the study, research questions were asked to 50 mathematics teachers working at different seniority in public secondary schools. The needs analysis step was created with the data obtained from the research questions directed. In the interviews, questions were asked to the teachers about the methods they use in teaching the subjects of Lines and Angles, Polygons, Circle and Circular Region, Views of Objects from Different Sides, which subjects the students misunderstood the most and how they developed the learning environment to make the teaching effective. The names of all the teachers interviewed were coded as O1, O2, ..., O50. The demographic characteristics of the teachers whose opinions were taken are given in the table below.

Table 1. Frequency table of the demographic characteristics of the teachers

Graduated faculty	Seniority	Postgraduate education, if any	Gender (1:Female, 0:Male)	Teachers
Faculty of Education	1-5	-	1	15
Faculty of Education	1-5	-	0	7
Faculty of Education	1-5	Master	1	2
Faculty of Education	1-5	Master	0	2
Faculty of Education	6-10	-	1	11
Faculty of Education	6-10	-	0	1
Faculty of Education	6-10	Master	1	3
Faculty of Education	6-10	Master	0	3
Faculty of Education	11-15	-	0	1
Faculty of Education	over 15 years	Master	0	1
Faculty of Education	over 15 years	-	0	1
Faculty of Arts and Sciences	6-10	-	0	1
Faculty of Arts and Sciences	11-15	Master	0	1
Faculty of Arts and Sciences	over 15 years	-	1	1

In Table 1, frequency information is given according to the seniority, postgraduate education status and gender of the teachers interviewed according to the faculties they graduated from. In the second stage of the interview with the teachers, questions were asked about the teaching of the 7th grade geometry and measurement sub-learning areas. First of all, it was asked how they taught the four subjects. When the teachers were asked about the methods they used in teaching the subject of "Lines and Angles", the teachers mostly used the teaching method by presentation (f=28), the teaching method by the discovery (f=17), the question-answer method (f=17), the narrative method (f=17). Statements stating that they used it were given as answers. It is stated in the statements that teachers use the methods of learning by doing (f=2), problem-based teaching (f=3), and realistic mathematics education (f=3) at least. When the teachers were asked about the methods they use in teaching the subject of "Polygons", the most presentation learning strategy (f=20); is stated in the statements that they use the least discussion method (f=2), group work (f=2), and teaching with games (f=2). When the teachers were asked about the methods they use in teaching the subject of "Circle and Circular Region", the teachers' most telling method was (f=15); Statements indicating that they use at least daily life (f=3) methods are stated. When the teachers were asked about the methods they used in teaching the subject "View of structures with unit cubes from different angles", the most computer-assisted instruction (f=15) and lecture method (f=15); It is stated in the statements that they use the least problem-based teaching (f=3) methods.

In the second question of the interview, the teachers were asked about the points that students had the most difficulty with while teaching these subjects. Some teachers stated that while the subjects were well understood by some students, they remained abstract to others and had difficulties. When the teachers' views on teaching the subject of lines and angles were examined, they stated that they were generally good and that the most difficult points were the appearance of the angles and the abstract points. It was stated that teachers have difficulties in distinguishing opposite and congruent angles (f=10), not separating subjects from each other in complex shapes (f=9), and not being able to see angles (f=9). It was found that the teachers stated that the most difficult points for the students in teaching polygons were learning the hierarchy between polygons (f=13) and making sense of the rules while learning the formulas (f=12). The teachers said that the children considered it difficult to calculate the circle's area and radius (f=13). The teachers stated that the most difficult points for the students regarding the view of unit cube structures from different sides are the views of objects from different directions (f=16), the shapes stated that they could not imagine their appearance (f=14).

In the third question of the interview form, "What kind of differences can help to teach in the classroom environment or outside the classroom in mathematics teaching according to the sub-learning areas in the field of Geometry and Measurement learning would be better learning?" has been asked. The answers given by the teachers depending on the sub-topics were examined respectively. It is seen that the teachers mostly stated that technology-assisted teaching could be improved on the subject of lines and angles (f=18). It has been reached that they stated that technology-assisted teaching could be developed most (f=14) about how the teaching of polygons should be. When the opinions of the teachers about how the teaching of the circle and the circular region subject should be examined, it is seen that the teachers mostly stated that technology-assisted teaching could be improved (f=20) and the use of concrete materials (f=15). It is seen that the teachers mostly stated that the use of concrete materials (f=11) and technology-assisted teaching could be improved (f=15) for teaching about the view of structures with unit cubes from different aspects.

As a result of the interviews with the teachers, it was concluded that the use of concrete materials and technology support should be used in the teaching of the sub-topics.

- While expressing different suggestions for teaching the subject of Lines and Angles, Polygons and Views of Objects from Different Sides, they stated that technology-supported applications should be used mostly in the teaching of these subjects.
- Circle and Circular Region stated that the use of concrete materials and dynamic mathematics software should be used in the teaching of their subjects. In the fourth question of the interview form, the teachers were asked: "Do you think there are situations where changes should be made in the achievements of the 7th grade Geometry and Measurement learning curriculum? What changes should be made?" has been asked. Although there are different opinions from the teachers, it is stated that the achievements are in place and there is enough simplicity in the curriculum. As a result of the interviews with the teachers, it was found that teaching could be done by using technology. As a result of the analysis of the interviews with the teachers, the analysis of the interviews with the students was also carried out.

Analysis of Interview Questions with Students

In the research, 46 students studying in the 8th grade of the state secondary school were reached and interview questions were asked. The students' names were coded as C1, C2, …, C46 and their views were analyzed. In the first question to the students: "How do you learn the subjects in the sub-learning area of Lines and Angles, Polygons, Circle and Circular Region, Unit Cubes from different angles in the field of Geometry and Measurement? Can you explain how your teacher teaches?" has been asked. As a result of the interviews with the students, the students have statements about what they have learned in the lessons based on the narrative method-presentational teaching strategy of the subjects of lines and angles (f=13), polygons (f=26), and circle and circular region (f=26). They stated that teaching is based on models (f=21) and presentation strategy (f=8) about the appearance of objects from different aspects.

In the second question of the interview: "Which are the subjects that you have the most difficulty in understanding regarding the learning of the sub-learning domains?" question has been asked. It was seen that the students stated that they had more difficulties in learning some subjects and that these subjects were circle and circular region, views of objects from different directions, and learning the formulas of polygons.

In the third question of the interview form: "Which subjects do you think you understand better in the teaching of these sub-learning areas?" has been asked. The students stated that they mostly understood the circumference of the circle, the problems where the area calculation of the circular region is required (f=9), and the lines and angles (f=8).

In the fourth question of the interview form: “How do you think you would learn effectively if there was a difference in the learning environment in the sub-learning areas?” a question was asked. Some of the students stated that there is no need for a difference and stated that the presence of technological tools and digital learning environments in the teaching environment would enable them to learn better. Apart from these, some students stated that it would be positive to include more examples with activities.

In the fifth question of the interview, “Have you ever learned geometry subjects outside of these learning areas by using different tools in the classroom?” has been asked. Students stated that they mostly use models (f=17) while learning geometry subjects. The opinions of the students stating that no tool was used (f=14) were also high. As a result of the needs analysis from the interviews with the teachers and students, it was stated that if a technology-oriented, concretization-oriented course environment is created, the intelligibility of the subjects would be better and the learning on the subject would progress in a positive direction. As a result of the needs analysis, the studies carried out in the 7th grade Geometry and Measurement learning field were examined in the literature. Studies in the literature have looked at how they integrate technology into teaching. In this research, it is researched how technology can be included in the lesson environment can increase the success of students in their thoughts and learning about mathematics. In this direction, it was decided to design a mobile application-supported course. Mobile learning is based on carrying out any education and training activity at the desired place and time, via portable mobile devices. In the current Covid-19 pandemic period, the importance of learning with portable devices has increased in the realization of the distance education process. The importance of mobile learning-supported teaching in the creation of instructional design can be seen here. In the analysis step, it was decided to develop a mobile application based on the instructional objectives and needs analysis, and to design a mobile application-supported instructional design.

Design

What kind of teaching environment should be in the research process was planned at the design stage. In this step, it was determined that mobile application-based teaching should be done in line with the needs analysis. The design of the mobile application for the learning environment to be created based on the mobile application was made in this step. The content of the mobile application was designed according to the 5E learning model of the topics in the 7th grade Geometry and Measurement learning field.

Development

The preparation of the designed mobile application was provided at the development stage. During the preparation of the mobile application, help was received from an information technology teacher, who is an expert in the field of educational technologies. First of all, in the development phase, a pilot application was carried out with 24 7th grade students in the 2nd term of the 2019-2020 academic year. After the pilot application, the students were interviewed about the application. The mobile application was tried to be organized according to the results of these interviews and the opinions of field experts. After the pilot application, questions for the deepening step were added to the mobile application by the 5E learning model, as a result of the interviews with the students and in line with the expert opinions. In the 2020-2021 academic year, the mobile application named GeoHepta was rearranged before the actual application and presented as both a mobile application and a web page. For the mobile application to be used with the experimental group of students to be used as a web page, it was rearranged as a web page with the name GeoHepta.com. The web page organized in this way was converted into a mobile application. User names and passwords were given to the students by the teacher on the web page, and each student was allowed to enter the web page in this way. With the mobile application, the final form of which was created in the development stage, the implementation stage of the ADDIE design model was started.

Web Page and Mobile Application Developed Based on the 5E Learning Model

In the development stage of the ADDIE instructional design model, the content of the web page named GeoHepta (http://geohepta.com/login) was tried to be created according to the 5E learning model. While creating the content, it is aimed to teach the subjects according to the steps of the 5E learning model.

- According to this; In the introductory step on pre-subject pictures or videos.

- At the discovery stage; It is expected that the students will discover the achievements by giving access to the activities prepared on GeoGebra 6.0 related to the desired objectives to be learned.
- In the explanation step; Explanations of the subjects were given to the students who discovered the subjects in the activity.
- In the deepening step; It is aimed to construct students' minds by giving new examples to ensure the active participation of students on the topics explained.
- At the evaluation stage; Students were asked questions to find out what they had learned about each subject. Using the programs Kahoot! and Socrative, the researcher's queries were presented to the students.

The web page and mobile application were created according to the 5E learning model steps described above. During the development of the application called GeoHepta, the help of an expert in the field of Educational Technologies was obtained, and the development of the web page and mobile application was ensured. The programs used during the creation of the GeoHepta website, which was developed as a website, are explained below.

- Php, Css, and Javascript are used in page coding. The pictures of the subjects were taken from the internet and rearranged with Photoshop. The images in the slider section were used for representational purposes.
- Plugins used; Bootstrap is used to make the site both mobile and desktop compatible. In the figures below, some images from the development process of the GeoHepta mobile application are given.

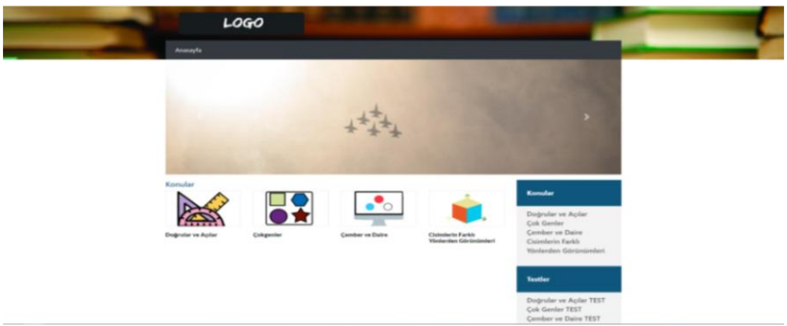

Figure 2. Desktop view under development

Figure 2 shows the image of the GeoHepta application during the development phase.

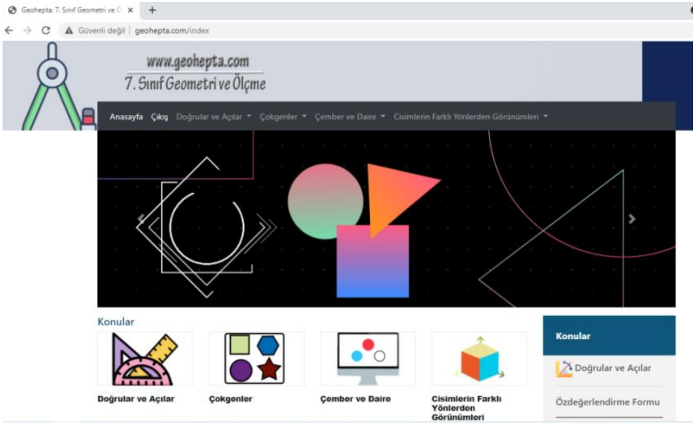

Figure 3. Desktop view of the developed website

In Figure 3, the desktop view of the website for the GeoHepta application, which was developed by giving its final shape during the development phase, is given.

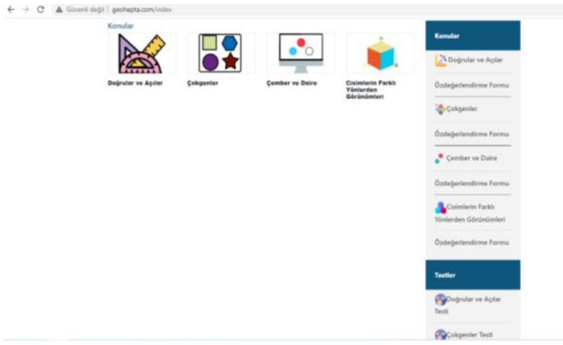

Figure 4. View of the application from a mobile device during development

In Figure 4 above, the view from the mobile device of the GeoHepta mobile application, which was developed by giving its final shape in the development stage, is given.

- Font Awesome is used for icons.

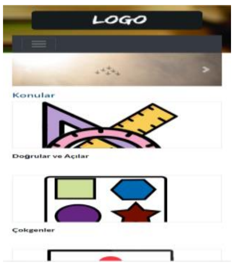

Figure 5. Icons in the development process of the application

In Figure 5 above, the icons in the development phase of the GeoHepta mobile application are given.

- Summernote was used as the editor for the content part in the page insertion section.
- The theme used in the Admin section is AdminLTE 3.

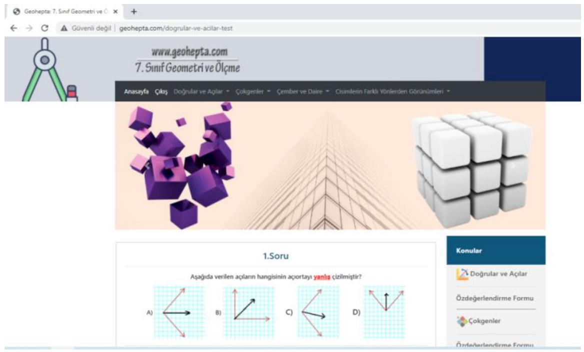

Figure 6. Images from the problem solving page from the desktop

Figure 6 is a screenshot from the desktop question-solving page of the GeoHepta application's website, which was completed during the development period. MobiRoller, a web platform that offers premium and free choices and enables mobile application development, was used to convert the website www.geohepta.com into a mobile application.

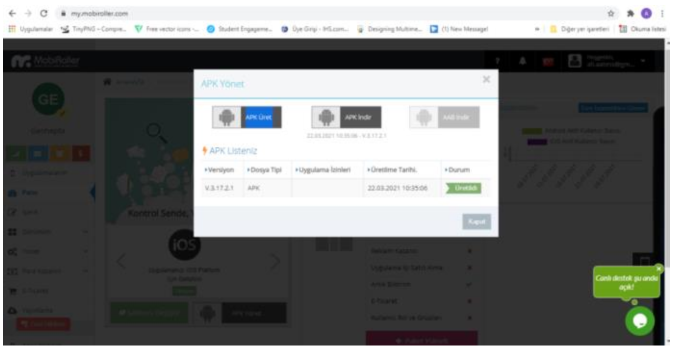

Figure 7. The screen that appears while converting the GeoHepta website into a mobile application

Figure 7 shows how MobiRoller is used to convert the picture of the GeoHepta application's website, which was completed during the development stage, into a mobile application.

Application

Teaching was carried out in the application stage using the GeoHepta mobile application built with the determined students. This stage was completed with one of the branches where there was no significant difference based on the achievement test scores of the 7th grade student groups. This research, which is expected to be conducted, will be conducted in classrooms if the schools are face to face according to the Covid-19 pandemic protocol. Because of the distant education in schools, the classes were carried out through the live lessons specified on EBA, based on the conditions of the epidemic. The GeoHepta mobile application was used to offer instruction to the determined 26 pupils.

Evaluation

The success of the teaching was studied in the evaluation stage using an interview form to investigate the impacts of the GeoHepta mobile application produced using the ADDIE design paradigm and the post-teaching application carried out based on the web page.

Scale of Usability for Mobile Applications

The "Mobile Application Usability Scale", converted into Turkish by Güler (2019), was utilized in the research with permission to assess the usability of the mobile application among the experimental group students. Güler (2019) converted the scale to Turkish and assessed the scale's nomological network inside a structural measurement model in his study. These four factors were added in the model after considering the link between usability perceptions, willingness to continue using, brand loyalty, and users' actual usage of mobile applications in the scale investigated based on the technology acceptance model. Data was gathered from 476 individuals. Translation of the scales, confirmatory factor analysis, and reliability tests were done to verify the scale's validity and reliability. The original structure of the three scales was intact for Turkish, according to confirmatory factor analysis. For all structures, Cronbach's Alpha coefficients were acceptable. The reliability coefficient (Cronbach Alpha) for all elements of the "Mobile Application Usability Scale" was found to be high, ranging between 0.74 and 0.94. There are 40 entries on the 7-likert scale. The scale is rated from 1 to 7; 7 (Totally Agree), 6 (Agree), 5 (Slightly Agree), 4 (Undecided), 3 (Somewhat Disagree), 2 (Disagree), 1 (Strongly Disagree).

Findings

In the study, "What are the measurement results based on the "Mobile Application Usability Scale (MAUS)" post-application scores for the mobile application of the experimental group of students studying in the learning environment designed using the ADDIE instructional design model in teaching courses connected to the 7th grade Geometry and Measurement learning?". The students' post-application data for the scale were evaluated to arrive at the conclusions for the question. Following their examination of the mobile application, the participants were asked to rate it based on several factors such as aesthetics, colour, and control. Table 2 displays the findings of mobile application usability scores. The MAUS results suggest that users' attitudes regarding the mobile application are "useful" in general ($\bar{X}$=5,49). The participants' mobile application is "useful" in terms of aesthetics ($\bar{X}$=4,52), colour ($\bar{X}$=5,71), control ($\bar{X}$=5,86), font (font) ($\bar{X}$=5,57), and hierarchy ($\bar{X}$=5,80). The "control" element of the mobile application receives the greatest grade, while the "aesthetic" feature receives the lowest. Table 2 shows the descriptive analysis findings based on the final measurement scores below.

Table 2. Shows the descriptive analysis findings for the mobile application usability scale

MAUS	Aesthetic	Colour	Control	Font	Hierarcy	MAUS
Average	4,52	5,71	5,86	5,57	5,80	5,49
Total Number of Participants	26	26	26	26	26	26
Standard Deviation	1,31	1,14	0,95	0,94	1,19	0,55
Minumum	1,50	2,50	2,75	2,75	2,25	4,52
Maksimum	6,25	7,00	7,00	7,00	7,00	5,86
Standard Error of the Mean	0,25	0,22	0,18	0,18	0,23	0,24

Discussion and Conclusion

Following the experimental process, the GeoHepta mobile application was designed based on the experimental group students' ADDIE design model, depending on the instructional process supported by the mobile application. The "Mobile Application Usability Scale (MAUS)" was used to collect feedback on the app's usability. According to the MAUS results, the GeoHepta mobile application was considered to be "useful" by the students, and their attitudes regarding the mobile application were good. The GeoHepta mobile application and web page that was created offer resources that students may use both during and after the session. As a result, students may access material at any time and from any location. As a result, mobile learning may be perceived as aiding learning by pupils. Lin (2013) claims that learners may access their learning environments more flexibly, quickly, and efficiently from anywhere using smart phones and mobile devices such as tablet PCs. The majority of students reported that the mobile application's information is intelligible easy content. According to the MAUS results, the GeoHepta mobile application was considered to be "useful" by the students, and their attitudes regarding the mobile application were good. The content of the prepared mobile application, as well as the topic menus, are easily accessible, and the layout has been designed with the goal of making them quickly discovered. Mobile gadgets that have been developed have a substantial impact on learner interaction, resource access, and resource transfer (Chen, Chang, & Wang, 2008).

After the experimental process, data were collected from the experimental group of students using the "Mobile Application Usability Scale" to evaluate the usability of the GeoHepta mobile application. Students were asked to evaluate the mobile application according to different criteria such as aesthetics, colour, and control. The mobile application's usability ratings indicate that participants' thoughts about the mobile application in general are "usable". Participants' opinions on the mobile application's style, colour, control, typeface (font), and hierarchy are also "useful". The "control" element of the mobile application receives the greatest grade, while the "aesthetic" feature receives the lowest. The fact that GeoHepta is a student-friendly program is regarded to be due to the following features: process. Students were asked to rate the mobile application based on factors such as aesthetics, colour, and control. The mobile application's usability ratings indicate that participants' thoughts about the mobile application in general are "usable". Participants' opinions on the mobile application's style, colour, control, typeface (font), and hierarchy are also "useful". The "control" element of the mobile application receives the greatest grade, while the "aesthetic" feature receives the lowest. The fact that GeoHepta is a student-friendly program is regarded to be due to the following features:

- The GeoHepta mobile application is available on smartphones and tablets, both on the mobile app and the online page, which may have made it beneficial. Students who were unable to use the mobile application might check in via the online website and resume their studies from where they left off.
- In GeoHepta, the headers are organized according to the sub-learning areas. GeoGebra 6.0 software, Socrative, and Kahoot! activities are all available separately and easily accessible inside each sub-learning area. This may have helped to make the application useable.
- Using dynamic math software activities on the mobile app and assessments using Web 2.0 technologies, the students were able to achieve the desired outcomes by examining the opportunities supplied by the software while answering questions in the process of learning the ideas. This may have resulted in the application's high "control" feature.

Suggestions

Some suggestions for further study were made based on the teaching outcomes from the GeoHepta mobile application, which was built based on the ADDIE instructional design approach for the grade mathematics course Geometry and Measurement learning field subjects:

- During the study, it was established that the mobile application produced using the GeoHepta mobile application was useful. Based on the findings, it is recommended that instructors create and deploy such mobile applications, which are resources that improve the learning environment, at all grade levels, in general in mathematics sessions, particularly in geometry and measurement learning.
- In this study, the GeoHepta mobile app was created exclusively for the 7th grade Geometry and Measurement learning field subjects in accordance with the ADDIE instructional design approach. Future mobile applications may also be created within the parameters of mathematical theories in accordance with the requirements of students in mathematics-related sub-learning areas, improving student learning.
- Using the ADDIE design model and other design models, various education levels may plan designs and analyze their impact on student learning.

Acknowledgement

This research was produced from the doctoral thesis of the first author, supervised by the second author.

Ethical Committee Permission Information

Name of the board that carries out ethical assessment: Necmettin Erbakan University Social and Humanities Scientific Research Ethics Board

The date and number of the ethical assessment decision: 19.02.2021-2021/50

Author Contribution Statement

Sevinç TAŞ: *Conceptualization, literature review, methodology, implementation, data analysis, translation, and writing.*

Ayşe YAVUZ: *Conceptualization, literature review, methodology, data analysis, translation, and writing.*

References

Albalawi, A. S. (2018). The effect of using flipped classroom in teaching calculus on students' achievement at University of Tabuk. *International Journal of Research in Education and Science, 4* (1), 198-207.

Branch, R. M. (2016). *Instructional design: ADDIE approach.* (İ. Varank, Trans. Ed.). Education Publisher: Konya.

Brown, A. H., & Green, T. D. (2016). *The essentials of instructional design: Connecting fundamental principles with process and practice (3rd ed.)*. Routledge.

Cihan, F., & Akkoç, H. (2020). Improving pre-service mathematics teachers' views on proof: A design study. *Turkish Journal of Computer and Mathematics Education. 11 (1)*, 280-311.

Chen, G. D., Chang, C. K., & Wang, C. Y. (2008). Ubiquitous learning website: Scaffold learners by mobile devices with information-aware techniques. *Computers & Education, 50* (1), 77-90.

Çoban, M. (2020). The experiences of the prospective information technology teachers taking the multimedia design and production course with project-based learning method: A case study. *Journal of Computer and Education Research, 8* (16), 720-737. http://doi.org/10.18009/758956

Dede, Y., & Dursun, Ş. (2004). The factors affecting students' success in mathematics: mathematics teachers' perspectives. *Gazi University Journal of Gazi Education Faculty, 24* (2), 217–233.

Göksu, F. C., & Köksal, N. (2016). Teaching the lines, angles and polygons according to constructivisim supported by concept cartoons. *Journal of Qualitative Research in Education, 4* (3), 68-91.

Güler, Ç. (2019). A structural equation model to examine mobile application usability and use. *International Journal of Informatics Technologies, 12* (3), 169-181.

Karakış, H., Karamete, A., & Okçu, A. (2016). The effects of a computer-assisted teaching material, designed according to the ASSURE instructional design and the ARCS model of motivation, on students' achievement levels in a mathematics lesson and their resulting attitudes. *European Journal of Contemporary Education, 15* (1), 105-113.

Kutluca, T. (2013). Yapılandırmacı öğrenme-öğretme yaklaşımı. In G. Ekici ve M. Güven (Eds.), Yeni öğrenme-öğretme yaklaşımları ve uygulama örnekleri (ss. 620-653). Ankara: Pegem Akademi.

Lin, H. F. (2013). The effect of absorptive capacity perceptions on the context-aware ubiquitous learning acceptance. *Campus-Wide Information Systems, 30* (4), 249-265.

Molenda, M. (2003). In search of the elusive ADDIE model. *Performance Improvement, 42*, 34-36.

Ocak, M. A. (2015). *Öğretim tasarımı kuramlar, modeller ve uygulamalar (2. Baskı)*. Ankara: Anı Yayıncılık.

Özdemir, E. & Uyangör, M. S. (2011). The instructional design model for mathematics education. *e-Journal of New World Sciences Academy, 6* (2), 1786-1796.

Richey, R. (1986). *The theoretical and conceptual bases of instructional design.* NY: Nicols Publishing.