Online-Journals.org

iJIM International Journal of Interactive Mobile Technologies

iJIM | eISSN: 1865-7923 | Vol. 17 No. 23 (2023) | OPEN ACCESS

https://doi.org/10.3991/ijim.v17i23.43877

PAPER

"Let's *Go*," A Mobile Learning Application for Social Studies Subjects: Prototype of Application Development

Bekti Aprilia(✉), Maria Paristiowati, Muhammad Japar

Universitas Negeri Jakarta, Jakarta, Indonesia

Bektiaprilia_9902921013@mhs.unj.ac.id

ABSTRACT

The value of social studies learning for junior high school students in several schools still needs to be higher. One of the factors of low student scores is the need for more variety in learning methods used by teachers, low student motivation, and the use of learning media that could be more optimal. One way to do this is to develop a learning model with engaging learning media. This research aims to develop mobile understanding by integrating artificial intelligence at the evaluation stage. The methodology used in this research is the waterfall approach method with requirements analysis, design, implementation, testing, operation, and maintenance. The mobile learning prototype was tested on media experts and junior high school student respondents. The dimensions of expert assessment are reviewed from media appearance, quality and use of media, navigation, product strength, media interface, product attractiveness, and material delivery in the media. The dimensions of questions for students consist of 4 points: content, interface, feedback and assessment, and personalization. The research results show a mobile application's results, including a brain gym menu, problem identification, materials, discussion forums, assignment results, and quizzes. The menus presented make it easier for students to learn. The questionnaire results from experts show that the highest average is 5.00, with a standard deviation of 0.00. The questionnaire results from student respondents had the highest average of 49.714, with a standard deviation of 0.169. The results of the scores obtained in the expert and student respondent questionnaires show that mobile learning is acceptable.

KEYWORDS

prototype, mobile learning, social studies

1 INTRODUCTION

Technological advances in the twentieth century have led to changes in all aspects of life. These changes are increasing with increasingly advanced technologies such

Aprilia, B., Paristiowati, M., Japar, M. (2023). "Let's *Go*," A Mobile Learning Application for Social Studies Subjects: Prototype of Application Development. *International Journal of Interactive Mobile Technologies (iJIM)*, 17(23), pp. 105–124. https://doi.org/10.3991/ijim.v17i23.43877

Article submitted 2023-08-09. Revision uploaded 2023-10-02. Final acceptance 2023-10-02.

as computers, smartphones, and the Internet that are increasingly accessible and used everywhere. According to data from Stock Apps, 67% of the world's population, or about 5.3 billion people, has used mobile phones. Data was recorded in July 2021.

Education today has shifted to using innovative technologies due to highly rapid scientific and technological developments [1]–[3]. Learning has gone from conventional to distance learning, one of the significant educational impacts of the pandemic a few years earlier [4], [5]. The Internet and adequate electronic devices support distance learning [6].

The use of mobile devices as a learning medium is becoming increasingly popular in various countries [7]–[9]. Mobile learning (m-learning) has become very popular in today's educational environment due to advances in information and communication technologies. M-learning refers to using everywhere communication capabilities and the user-friendly interface offered by handheld mobile devices and wireless technology in the formal learning process. M-learning is profitable in many ways, facilitating learning anytime and anywhere and enabling personalization for students and instructors. It also helps students advance their technological and conversation skills and promotes knowledge sharing by creating a sense of collaboration among students, consequently improving their learning outcomes [10]–[13].

In addition, the smartphone also uses an operating system that provides a platform for application development. Smartphones significantly impact every student who uses them, both positively and negatively. Among students, using smartphones with internet access can help their learning process, especially finding reference materials. Through the smartphone, students can browse their learning materials using internet access. Later, students will be able to conduct their research and complete the projects given by their tutors. Thus, students can use the Internet to obtain material using their devices comprehensively [14]–[17].

Mobile media has been used in various fields of learning. One of them is social studies. Social studies is a compulsory subject in primary to secondary school. Social studies education includes History, Geography, Citizenship and Government Education, Psychology, and Sociology. The learning objectives of social studies are to develop basic knowledge of social sciences, problem-finding and problem-solving skills, social skills, awareness of human values, and the ability to cooperate within a complex society. Social studies learning activities are designed to enable students to study, explore, and analyze social sciences related to social symptoms and problems in the community. To the social studies learning objectives, educators must package learning so students can easily understand it. Some issues in social studies lessons are that social studies are marginal learning and teaching focuses only on memorizing from textbooks, less on stimulating student thinking skills about social problems [18], [19].

Therefore, in presenting the phenomena of social problems in learning, social studies need media that can accommodate the achievement of learning goals. This study aims to develop a dedicated mobile application for social studies lessons that match the characteristics of social studies classes and the needs of high school students. Learning that uses mobile learning in social studies allows students to access learning material via mobile devices such as smartphones and tablets or any device connected to the internet. Students can access learning wherever they are without knowing time and space. Mobile learning in classroom learning activities can help students and teachers, including giving

assignments and taking quizzes. Mobile learning positively impacts learning because, through mobile learning, students can connect with teachers and other students by relying on an internet connection. The technology offered by mobile learning does not limit learning to face-to-face schedules. Therefore, the use of transferable knowledge in learning offers extraordinary progress in the future. This research produces a mobile learning product, which will then be installed on each student's smartphone. It is hoped that the results of this research can increase the effectiveness and accessibility of learning activities and make it easier for students to complete assignments and understand lesson material via their smartphones.

Based on a preliminary study conducted in several junior high schools on social studies subjects, student scores in social studies topics were found to be below the minimum average for completeness, so learning objectives still need to be achieved. Data shows that 52% of students must pass the minimum standard mark limit. The results of interviews with 104 junior high school students revealed that learning did not use learning media that supported independent learning. Teachers still teach using textbooks and the lecture method. The analysis of student activities shows that all students carry a smartphone when they go to school. However, the use of smartphones could be utilized more optimally in learning.

There has been research into the development of mobile learning. Existing mobile learning development research is still limited to providing mobile information and assessment evaluations with scores. However, only some have researched integrating artificial intelligence into mobile learning. In this research, apart from the presentation of material and assessment, mobile learning development is also done by integrating artificial intelligence into mobile learning, especially in the assessment menu. Apart from seeing scores on assignments completed on mobile learning, students can also receive suggestions regarding what learning material needs to be restudied to get maximum marks. Automatic offers will appear after students complete their work on mobile learning. This research aims to develop Android-based mobile learning media to make it easier for students to learn digital simulation subjects using visual simulation material. Mobile learning can turn smartphones, usually used for communication or the internet, into learning tools that contain teaching plans, learning materials, and practice questions. They are equipped with various features such as images, videos, and animations, making it easier for students to understand the material.

2 REVIEW OF LITERATURE

Several studies correlate with the research to be developed. Here are some studies related to social studies and mobile learning.

The authors [20] say their research succeeded in developing MeL (mobile e-learning) integrated into augmented reality by utilizing 2D/3D visuals and interactive media for university technical learning. It was found that visual reproduction combined with joint efforts and collaboration provides many conveniences in innovation-based education. This paper introduces a MeApplication Ling named "MeApplication L" that will work in THE. Mel upgrade procedures framework and Mobile OS form of MeL Applications have contributed to MeL support blended and cooperative learning with various capacities that benefit learners to collaborate.

The author [21] examines one of the advanced technologies emerging in 2022. The GPT chat technology currently being widely used has both positive and negative impacts. Based on the findings, GPT chat has several advantages in education, including helping provide a summary of a piece of writing, being used as a literature review, producing literature, being used for translation and paraphrasing, producing complex and in-depth answers, a personalized learning experience, useful in assessment and data analysis, helps with learning, as well as creating material content for learning. Authors [22] research an empirical study on applying four coding applications to support children's Computational Thinking (CT) and Computational Fluency (CF) learning. The main conclusion is that all applications positively affect the development of children's CT skills. Neither application can ultimately support CF development, although ScratchJr, with its "sandbox" approach, can help students express themselves better. The authors suggest that there are challenging decisions that researchers and designers must make in creating software products to facilitate CT and CF for children. Researchers should also work in this area and try innovative approaches that utilize helpful ideas.

According to the authors [23], the selected APP content includes listening, speaking, reading, and writing lessons based on their textbooks and leveled according to the student's level. Teachers and English language teaching experts select and align vocabulary. This APP, named "ABC Detective," is a series of mission-oriented puzzle-solving game stories designed with different content levels. Through stories, players are given authentic situations. The primary presentation method uses colorful pictures with Chinese and English characters so students can select the units they want to challenge, increasing their attention. Overall, students' vocabulary test scores improved. The APP helps students listen, read, and write English vocabulary but has less effect on speaking. At the affective level, most students had positive attitudes. They reported that learning English with the APP was more exciting and provided a sense of collaboration compared with learning through their English textbooks.

The authors [16] gave information comparing four mobile apps for teaching English: Duolingo, EWA, Mondly, and Lingos. Of the four apps selected, only Duolingo does not limit users' educational content. Compared to others, Duolingo is the best in terms of clarity. Although the screens include a relatively large amount of information that is not always relevant to the content and may seem overwhelming, it is still a relatively easy app to navigate. The EWA: English app, which has rather large controls, is also good. Overall, the Duolingo app seems best suited for seniors. The application has very pleasant processing, all content is reachable, and the orientation in the application is straightforward. Applications can have more economical content on the screen to not confuse their users. App content continues to improve and is more relevant and usable in everyday life situations.

The authors [8] say m-learning attracts student attention and actively involves students in learning. Most case studies produce positive feedback and positive effects on the learning process of chemical engineering subjects using the m-learning methodology with evidence of increased student participation and collaboration and improved academic performance. Tools often used in e-mobile methods: video, quick response code, mobile games, and non-commercial and task-specific applications. This study suggests that further research is needed to assess the benefits and use of mobile devices in other studies.

The author [24] researched to measure the effectiveness of mobile use in learning. This study developed a mobile application for computer learning and measure the effectiveness of transferable knowledge on computer programming subjects with the result that a mobile application called "CCN2042 C" is designed for iOS and Android devices. This mobile app is designed to help students learn about Computer Programming subjects. In mobile, it consists of illustrations and explanations of basic programming techniques, simple programming exercises for student revision and practice, and a small quiz to test their level of understanding. This dedicated mobile application follows the instructional sequence of subjects throughout the semester. Mobile application content is also adopted from lecture notes and subject tutorials so students can refer to them quickly. The mobile application quiz is divided into more than 150 levels. Students must complete the quiz correctly to open the quiz at the next level. Competition among students to reach higher levels can increase their motivation and engagement. With the development of mobile applications, precisely (with different environmental settings on mobile learning) can be effectively applied in education accompanied by appropriate pedagogical strategies.

The authors [25] designed a video that combined the available questions and answers. The author used artificial intelligence to ask for a solution. The main features in videos called DL videos are the Question Generation Platform (QG-P) and the Learning Assessment Platform (LA-P). The questions presented are not only multiple choice questions, but there are also questions in the form of short entries and descriptions. There are four types of questions generated. Authors [26] are developing mobile learning that combines augmented and virtual reality under enhanced reality (e-real). This e-real development utilizes technology to transform student learning through this program, hoping that students will be better prepared to choose jobs in the health sector.

The authors [27] report that mobile game-based development can improve academic performance. In this study, an intelligent game-based application was produced for programming students. The mobile app developed is focused on assessment. The author [28] analyzes the games used in learning, especially at the elementary level, to help teachers choose suitable games according to the curriculum. The criteria used are based on game content, motivation, game methods, students' active participation in the game, graphic design, game objectives, playing time, and game model.

The author [29] identifies the contribution of online mobile applications that can help autistic children in their daily lives. Web applications are used as assistive technology. It was determined that there were 13 applications used. Each application has benefits; these applications are Proloquy4 Text, Assistive Express, Proloquo2 Go, Keeble, Avaz Free Speech, Children with Autism, Choiceworks, Miracle Mode, Flummox Vision, Injini, Pictello, Emergency Chat, Autism Apps.

Sophonhiranrak [7] conducted systematic literature review research by analyzing mobile learning features, barriers, and factors that affect the use of mobile devices in learning. The result of this study is that mobile learning can be used as a learning tool for tasks such as submitting assignments, reflecting on learning experiences, and sharing ideas. Factors to be considered in cellular learning consist of three main components: the readiness of students and teachers, learning management, and support systems. This study advises that teachers should pay attention to detail in developing these mobile learning designs, such as student analysis, design and development of learning materials, and learning evaluation. This research serves

as a reference for research that will be developed with attention to the components that become inhibitors.

The authors [30] in the paper present *BlockCode*, a web application developed to create board games that support learning computer programming logic. The goal of the games made with *BlockCode* is to move a bunny around a board using block-based programming to collect all the carrots placed on the board. In every game, the bunny has to deal with obstacles, represented by rocks and holes, which must be avoided using the available commands. *BlockCode* was designed for teachers and students: teachers can create games, specifying the arrangement of the boards, and students play the games, identifying the sequence of commands to collect all the carrots. The technology and tools used to develop block code are Java server pages (JSP), javascript, greensock, cascading style sheets (CSS), Netbeans, Apache Tomcat, MySQL, and balsamic mockups.

The author [31], in his research, systematic literature review, explains trends in the use of mobile learning in social studies. There are 32 articles analyzed. Results from the analysis of reports showed that of the 32 articles that discussed social studies and mobile, the most used mobile learning are history and geography. All the analyzed articles show that mobile learning supports the learning process in social studies. However, further research is needed on how mobile devices can enhance social activity and connectivity on all social study content.

In the study, the authors [32] analyzed the impact of digital learning materials on student social skills in social studies learning. This study shows that students can build social skills through online collaborative learning. Using materials digitally has a more significant impact on improving student social skills through experimental research. If digital learning materials provide benefits in learning skills, then it should be considered to develop digitalized learning in social studies learning.

The authors [33] researched the impact of online learning on historical education; from the results of such research, the use of online media learning can increase students' motivation for historical knowledge. The author [34] developed a Social Science learning model based on e-learning using two systems, the Content Management System (CMS) and the Learning Management System (LMS), as well as using the ADDIE development model in its development process. The researchers [35] created a group investigation learning model that was assisted by visual and audio media and assessed whether it influenced the learning outcomes of social studies. Teachers can use this model to create a pleasant learning atmosphere to contribute excellently to learning activities.

The author [36] developed a learning model using the media game of snake and ladder to improve student learning outcomes on social science subjects. The author examines the role of teachers in learning that uses adaptive games in science education. Although students are considered the center of teaching, teachers play a crucial role. Teachers must understand each student's needs, provide appropriate learning materials, and evaluate the learning process. The research [37] explores how active and pre-service teachers design and integrate adaptive gamification environments into science education teaching. Adaptive gamification environments and other assistive technologies, such as mobile learning, have great potential, but they must be combined with appropriate pedagogical strategies to maximize their potential. Otherwise, we risk hindering student learning rather than improving it. The authors [38] investigated the impact of multimedia use and student learning styles on student learning performance in social studies topics, and the study's results mentioned that multimedia effectively improves students'

learning performance. Research [39] studied the use of YouTube media as a means of learning, and research [40] on the use of virtual reality in learning geography. VR helps the desired quality of educational products and opens up new opportunities for mastering practical skills. In experimental studies, implementing VR technology improves understanding of complex concepts and contributes to gaining experience in the chosen professional field. The use of VR in learning can improve student learning outcomes. This study recommends technology integration to enhance learning in today's era. The research that will be conducted is one of the answers from the analysis above.

The author [41], in his research, developed e-learning for Civic Courses with the result that e-learning provides flexibility and ease for students in learning, in addition to also allowing students to think critically, creatively, and innovatively. This research shows that e-learning technology can help students improve their critical thinking ability.

After analyzing relevant research, it concluded that mobile learning helps students learn, grows motivation and interest, and improves academics. Although there has been a lot of research on the benefits and uses of mobile learning, it still needs to be determined how it is widely used in learning from the beginning to the end. The assessment carried out on mobile learning is only a limit of the information value obtained, not up to the recommendation to students about the test that has been done. Therefore, this study is expected to suggest any material that needs to be further studied based on the results of each student's test.

3 METHODOLOGY

The type of research used in this research is development research or Research and Development (R&D). Research and development is a method used to produce specific products and test the effectiveness of these products. Research in the form of needs analysis needs to be carried out to ensure products and to test the efficacy of these products so that they can function in the broader community. So, research is required to test the effectiveness of these products.

3.1 Development of mobile learning

Developing mobile learning uses the waterfall method. The waterfall method is a model for developing systematic and sequential information systems. The waterfall method has the following stages [42] (see Figure 1):

1. Requirements analysis: At this stage, the researchers dig all the information about the user's needs through interviews and observations.
2. Design: This stage provides an overview of what to do and how to look for a desired system based on previous requirement results.
3. Implementation: This stage is a programming phase that performs a check of functionality, whether it is already following the requirement and design or not.
4. Testing: At this stage, the system is inspected and tested as a whole, whether it is running well or there are still errors.
5. Operation and maintenance: At this stage, the system will be run or operated by the user and maintenance such as correction of errors, repair of implementation of system units, and improvement of the system as needed, carried out.

Here is the waterfall approach.

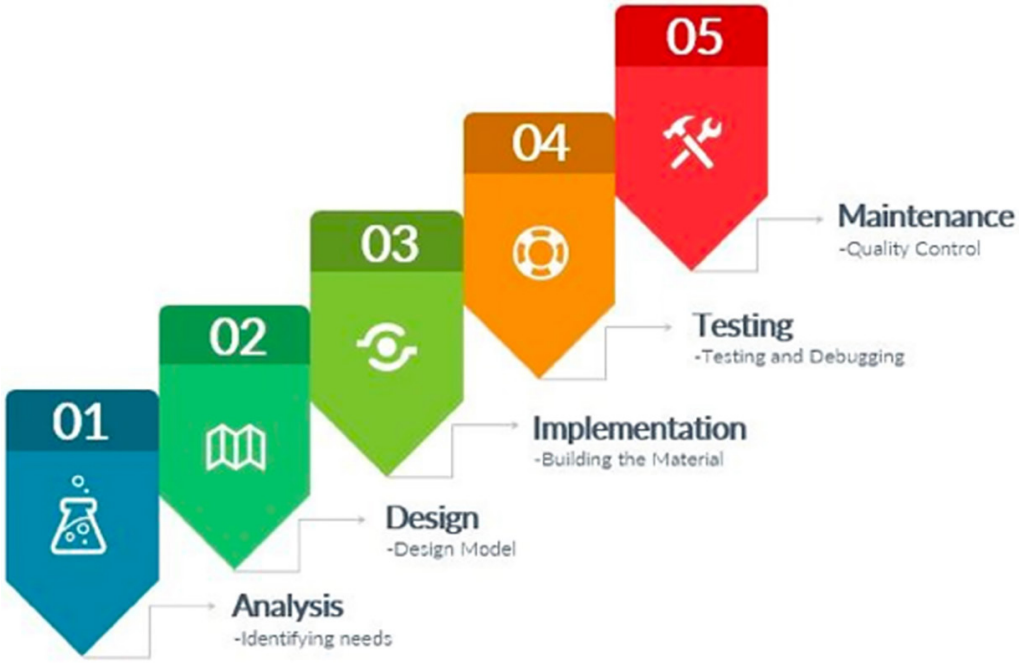

Fig. 1. The waterfall model

The tool design in this study uses the software Balsamiq. Balsamic enables the creation of interactive prototypes to describe the workflow of system development. The tool allows you to work in collaboration with others to get feedback. Balsamiq allows real-time collaboration so team members can provide input and make immediate changes to the design.

In this study, using UML as the software uses the classic and semantic model notation associated with the Unified Modelling Language (UML), which allows the identification of use cases.

According to the method mentioned above, the researchers developed applications based on the phases of the above methodology. The steps to be taken are as follows:

a) Analysis: At this stage, researchers need to use the "let's go" application later. The needs collection is done through questionnaires, observations, interviews, and focus group discussions. This stage will produce system needs, both functional and non-functional needs. The Table 1 below describes system requirements related to operational needs.

Table 1. Functional needs

No	Necessity
1	Registration of Users
2	Login or User
3	Access to Materials
4	Access to Tasks and Evaluation
5	Virtual class access

The following Table 2 describes system needs related to non-functional needs.

Table 2. Non-functional needs

No	Necessity
1	Security: The prototype developed must be safe in the morning of the user
2	Functionality: All modules can run well
4	Quality: The input or output data must be of good quality.
5	Accessibility: Ease and speed in accessing
6	Efficiency: To be efficient at every stage

b) Design at the design stage is determined based on the analysis of the needs that have already been obtained, both functional and non-functional needs, and the design process at this stage is not only the appearance of the software but the existing model of the software the "let's go" design. This phase begins with creating a use case diagram describing the interaction between the actor and the system.

c) At the stage of program code making, it becomes essential that the software process will operate properly if the program code creation follows the programming structure.

d) Software that has passed the program encoding or code-making phase must be tested first to ensure that the software is free from bugs. In the testing phase, the software can be tested with Blackbox or white testing according to the requirements of the desired testing process.

e) Treatment of software. The software is always evaluated at this stage, and the system maintenance activities routine should be done.

3.2 Design of model

Model design can define the features contained in the system. This feature is the result of analyzing user needs (function requirements). In this research, use cases are used to design a model. The use case diagram also represents interactions between actors with other use cases. An actor is a human or machine entity interacting with a system that aims to perform a job. The use case is a particular job that an actor can do. Here is a picture of the use case used in this research (see Figure 2).

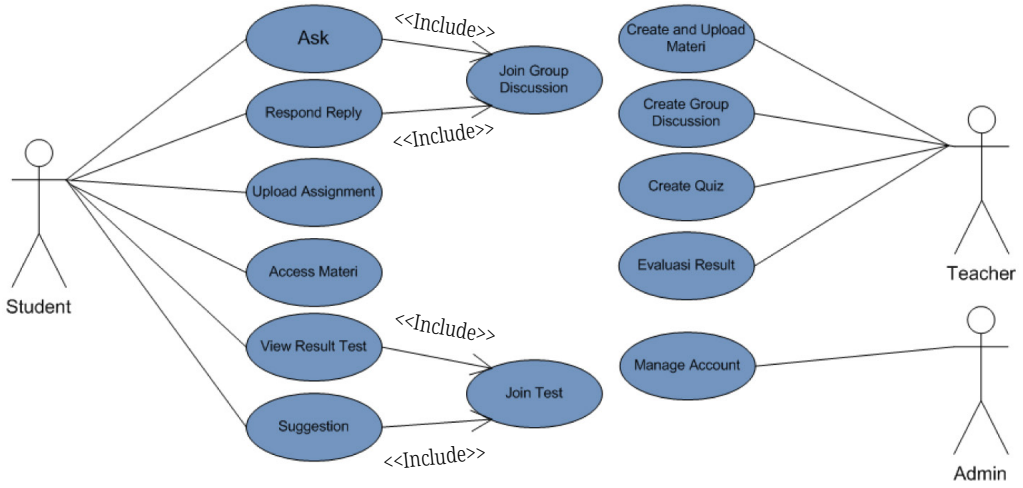

Fig. 2. Use case diagrams

3.3 Participants

The results of this mobile learning development will be validated by five learning media experts and 35 junior high school students as student respondents. Respondents were selected from class 7 randomly. The instrument used was a questionnaire. The questionnaire used for learning media experts consists of 7 assessment dimensions with 20 indicators. Meanwhile, the questionnaire for students has several questions of 4 sizes with 24 queries.

3.4 Data analysis

The development of mobile learning is assessed from the evaluation of media experts. A survey was conducted to determine whether this mobile learning prototype was feasible and acceptable. The survey tool uses a questionnaire with a Likert scale. Question items are grouped into seven dimensions: the appearance of learning media, quality and usability of media, navigation, product strength, media interface, product attractiveness, and method of delivering material in the media. Experts assess by giving a score between 1 and 5. The highest score indicates the quality of the learning media. The expert scores are averaged, and then the results are obtained. The highest scale score indicates good results and vice versa. The questionnaire results were analyzed using descriptive statistics by calculating the mean and standard deviation. The data is good and accepted if the standard deviation is smaller than the mean.

Student perceptions about the mobile learning prototype were analyzed from a student assessment questionnaire consisting of 24 questions grouped into four dimensions: content, interface, feedback and assessment, and personalization. The assessment questionnaire scores are available from 1 to 5 using a Likert scale. The results of the questionnaire answers were analyzed using descriptive analysis by looking for the mean and standard deviation.

4 RESULTS

4.1 Mobile learning application

The mobile application developed is named Let's Go. This application contains several menus used for learning social studies. Mobile learning was designed using visual code software. On the first page, a brain gym will be displayed as a video in which there are movements that students must follow. The brain gym feature is placed at the beginning before students log in to mobile learning. Brain gym is carried out to prepare the brain for education. Brain gym movements balance the right and left brains in receiving lesson information. The brain gym features are shown in Figure 3.

Fig. 3. Brain gym menu display

After students complete the brain gym, they are directed to log in with the user and password given by their teacher. After logging in, students will be presented with menus that will help students in learning. There are several menus on the main page. The first is problem identification, in which videos are presented about problems in everyday life related to learning material. The second menu is learning materials. The learning materials menu summarizes the material in videos or writing. The following menu is a discussion forum that facilitates students to discuss with teachers and other friends. The following menu is the assignment results, which is the menu used by students to save answers to the effects of discussions in their groups. There is a glossary menu that contains terms contained in the material. This menu allows students to add term references. The following menu is a quiz. In this menu, there will be a quiz in the form of multiple-choice questions, which students will answer based on the specified time. In this quiz menu, artificial intelligence will be integrated. When students have finished answering the quiz, scores and suggestions will appear that will help students regarding which material students should restudy. The main page display is shown in Figure 4.

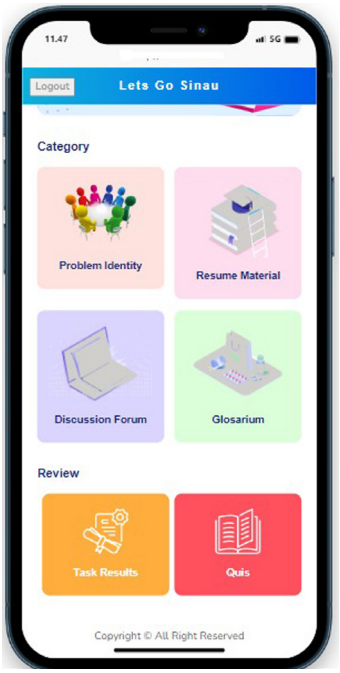

Fig. 4. Main menu lets go SINAU application display

4.2 Expert and response evaluation

Five experts then validated the design of the mobile learning prototype. This survey was conducted to determine whether this mobile learning prototype is valid and acceptable. It consists of several dimensions of assessment of media learning [43]. Statements in surveys are developed from a defined measurement. The assessment dimensions display media, quality, media use, navigation, product strength, media interface, output product, and material delivery in the media. Questions are listed in 20 items distributed through Google Forms to experts. Dimensions and a list of questions are presented in Table 3.

Table 3. Expert instruments

Criteria	No	Details of Statement
Display of media	1	Improve the appearance in general
	2	An early look at mobile learning
	3	Incorporate color combinations in learning media
Quality and Use of Media	4	Compatibility in the choice of type and size of letters
	5	Images displayed in the media can strengthen the material
	6	Images/video in learning media are clear and recognizable
	7	Audio in the media reinforces the learning material
Navigated	8	Navigation on an accessible interface
	9	The navigation button works well
Strength of product	10	Stability of defense media when used/no error
	11	Program speed in responding to user commands
Learning Media Interface	12	The regular layout of the media element indicates the unity of information
	13	Balance of media
	14	Regular layout of media elements vertically and horizontally
	15	Continuity of Learning Media Interface
Output products	16	The media developed can attract the attention of students
	17	Aesthetic interfaces enhance an effective learning environment
Materials in Media	18	Developed media reinforces learning materials
	19	The delivery of material in the media makes it easier for students to understand the concept
	20	The delivery of material in the learning media makes it easier for learners to repeat material to help them remember it

Table 4 is the result of the reviews of experts; the average results of expert assessments range from 3.20 to 5.00. Most queries have a large scale, with the highest average of 5.00 with a standard deviation of 0.00 on the learning media interface criteria. A statement on the regular layout of the media element indicates the unity of information. The lowest average scored 3.20 with a standard deviation of 0.44 on quality criteria, and using learning media with displayed image statements can reinforce the material.

Table 4. Result of the expert review

Criteria	Question	Mean	Standard Deviation
Display of media	R1	4.2000	0.44721
	R2	4.2000	0.44721
	R3	4.8000	0.44721
Quality and use of media	R4	4.4000	0.89443
	R5	3.2000	0.44721
	R6	4.8000	0.44721
	R7	3.4000	0.89443
Navigated	R8	4.2000	0.44721
	R9	4.2000	0.44721
Strength of product	R10	4.4000	0.89443
	R11	4.8000	0.44721
Learning media interface	R12	5.0000	0.00000
	R13	3.8000	0.44721
	R14	3.8000	0.44721
	R15	3.8000	0.44721
Output products	R16	4.4000	0.54772
	R17	3.4000	0.54772
Materials in media	R18	4.8000	0.44721
	R19	4.4000	0.54772
	R20	4.2000	0.44721

Table 5 is a statement table assigned to respondents who originate from students as users of mobile learning media. Respondents consisted of 35 junior high school students, with a percentage of 40% male students and 60% female students. Students are given a Google form questionnaire after using mobile learning on a learning topic. The assessment dimension consists of content, interface, feedback, assessment, and personalization. The survey consists of 24 statements. This survey aims to look at the effectiveness of mobile learning developed.

Table 5. Student response instruments

Criteria	No	Details of Statement
Contain	1	The m-learning system provides content that is ideally suited to your needs
	2	The m-learning system provides applicable content
	3	The m-learning system provides comprehensive content
	4	M-learning provides up-to-date content
Interface	5	M-learning is easy to use
	6	The m-learning system makes it easy for me to find the materials I need
	7	The content provided by m-learning is easy to understand
	8	M-learning is user-friendly
	9	Stable and smooth learning system

(Continued)

Table 5. Student response instruments *(Continued)*

Criteria	No	Details of Statement
Return and assessment	10	Your application is responded to the m-learning system quickly
	11	The m-learning system makes it easy to evaluate learning demonstrations
	12	Testing methods such as tasks through m-learning systems are easy to understand
	13	Testing methods such as tasks through the m-learning system are fair/fair
	14	The m-learning system provides a secure testing environment
	15	The test methods tell the results quickly
Personalized	16	The m-learning system allows me to control my learning progress
	17	The m-learning system allows me to study the materials I need
	18	The m-learning system allows me to choose the materials I want to learn
	19	The m-learning system records my learning progress
	20	The m-learning system records my learning performance
	21	The m-learning system makes it easier for me to discuss with friends and teachers
	22	The m-learning system makes it easy for me to share what I've learned with the learning community
	23	Interactivity learning through m-learning system increases motivation/ learning spirit
	24	Interactive learning through the m-learning system provides pleasure/ satisfaction

Table 6 shows the survey results of 35 respondents consisting of junior high school students. The statement dimension consists of four dimensions: content, interface, feedback and assessment, and personalization. Each design has a high average range of 35.429 to 49.714. Of the 24 highest moderate statements obtained as 49.714 with a standard deviation of 0.169 on the content dimension of the statements, the m-learning system provides valuable content. The lowest average on the content dimension is 35.429, with a standard deviation of 0.885.

Table 6. The result of student's response

Criteria	Statements	Mean	Std. Deviation
Content	R1	41.143	0.75815
	R2	49.714	0.16903
	R3	49.429	0.23550
	R4	35.429	0.88593
Interface	R5	40.571	0.33806
	R6	40.571	0.33806
	R7	34.286	0.81478
	R8	41.714	0.51368
	R9	40.857	0.50709

(Continued)

Table 6. The result of student's response *(Continued)*

Criteria	Statements	Mean	Std. Deviation
Feedback and assessment	R10	45.714	0.69814
	R11	46.000	0.65079
	R12	40.571	0.48159
	R13	44.000	0.84714
	R14	42.857	0.89349
	R15	43.143	0.93215
Personalized	R16	39.429	0.41606
	R17	45.429	0.56061
	R18	46.571	0.59125
	R19	39.714	0.29563
	R20	39.714	0.29563
	R21	48.857	0.40376
	R22	40.286	0.16903
	R23	45.143	0.78108
	R24	46.286	0.49024

5 DISCUSSION

This article aims to develop a prototype of mobile learning that will be used in social studies subjects. This research uses the waterfall method, which has good documentation and clear workflow so that each machine team can run according to their respective skills and the process can run within the specified time. Stage waterfall starts from a) requirement, process requirement involves teachers and students in the school. This phase produces two needs: functional needs and non-functional needs. b) after the requirement phase is completed, design continues this study's design process using use case diagrams. The existence of this use case can describe the flow of the developed system. c) implementation, after the design has been completed, is the implementation process, in this study, using the programming language Java PHP. At this stage, a product is produced and ready to be tested; d) testing, at this stage, the system testing process is carried out. This study uses the Blackbox method, in which each process is tested. e) maintenance, the last stage of this waterfall method is to treat the system that has been completed, whether it is software, hardware, or network maintenance so that the product that has been developed can work as it should.

Based on the findings that the trial results of 5 experts and 35 student respondents showed, prototype mobile learning gained a significant acceptance for social studies learning in secondary school. Richey & Kelin state that a program/product to be disseminated must go through the testing phase [44]. Experts and users do testing. Formative evaluation of the product is required at every stage to be used without restrictions.

Students' findings show that mobile learning helps students in education, allowing them to record their education so they can re-learn it anywhere. Mobile learning

also helps students learn about their abilities. Mobile learning design can give recommendations to students after learning about materials that students have not mastered. Some research supports that mobile learning attracts student attention and actively involves students in learning. Students become actively engaged in learning. Learning in mobile education can also be packed into a game so that knowledge will be more exciting and student learning motivation will increase. Research [45] suggests that in developing mobile applications, developers can combine education with games in learning presented in mobile learning and provide comprehensive materials so that students can learn them quickly. Portable learning benefits in terms of flexibility and its ability to provide high-quality learning opportunities and accessibility, convenience, and balance between personal, professional, and academic life [46]. Mobile learning applications can shape a new, more modern, democratic, and educational learning culture [47]. M-learning technology facilitates a variety of learning modes based on student preferences. It allows personalization for students and educators, providing an interactive, exciting, and tailored environment to the needs of each student.

Mobile learning can make the learning process more attractive and grow student interest in learning highly effectively because it can be done anywhere with the help of Mobile and the Internet. But for areas far from the city, where the internet network still needs improvement, it will hinder when it wants to implement mobile learning in the process of learning.

6 CONCLUSION

Technological advances in education provide opportunities for education to create innovation in the use of technology. Mobile learning technology has taken shape in recent years. Mobile learning offers excellent advantages in implementing flexible learning that can be done anywhere and anytime. The study aims to develop a prototype of mobile learning for social studies subjects. The development method conducted using the waterfall method produces a prototype "let's go" mobile learning application for social studies learning. Based on the results of trials by experts and respondents, the "let's go" application is acceptable.

Some limitations of this research are that the material used does not use 3D technology because the better and more interesting the material presented, the more it will increase students' curiosity so that the learning process can be carried out optimally. For future research, it is recommended that AI (Artificial intelligence) technology be implemented in collaboration with mobile learning. It is hoped that by maximizing AI technology in mobile learning, the material can be in 3D form so that it can stimulate students' desire to learn. Assignments to students can be collaborated with AI so that students who get lessons get regular reminders until they complete the job that has been assigned. Quizzes can be teamed with AI so that after completing the quiz each student can immediately find out the results obtained and be given suggestions to learn what they don't understand automatically according to each student's profile.

7 ACKNOWLEGMENTS

The authors would like to thank DRTPM Kemendikbudristek Republic of Indonesia (Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi) that supporting

this research through Penelitian Disertasi Doktor (Doctoral Dissertation research) scheme in 2023, with contract number 138/E5/PG.02.00/PL/2023 and 3/UN39.14/PG.02.00.PL/VI/2023

8 REFERENCES

[1] A. Guraliuk, D. Zakatnov, S. Lapaenko, I. Ahalets, and N. Varaksina, "Integrative technology for creating electronic educational resources," *International Journal of Engineering Pedagogy*, vol. 13, no. 3, pp. 68–79, 2023. https://doi.org/10.3991/ijep.v13i3.36109

[2] G. Asiksoy, "Empirical studies on the metaverse-based education: A systematic review," *International Journal of Engineering Pedagogy*, vol. 13, no. 3, pp. 120–133, 2023. https://doi.org/10.3991/ijep.v13i3.36227

[3] G. Asiksoy, "Effects of virtual lab experiences on students' achievement and perceptions of learning Physics," *International Journal of Online and Biomedical Engineering*, vol. 19, no. 11, pp. 31–41, 2023. https://doi.org/10.3991/ijoe.v19i11.39049

[4] N. A. Balogun, F. A. Adeleke, M. D. Abdulrahaman, Y. I. Shehu, and A. Adedoyin, "Undergraduate students' perception on e-learning systems during COVID-19 pandemic in Nigeria," *Heliyon*, vol. 9, no. 3, p. e14549, 2023. https://doi.org/10.1016/j.heliyon.2023.e14549

[5] M. Javaid, A. Haleem, R. Vaishya, S. Bahl, R. Suman, and A. Vaish, "Industry 4.0 technologies and their applications in fighting COVID-19 pandemic," *Diabetes Metab. Syndr. Clin. Res. Rev.*, vol. 14, no. 4, pp. 419–422, 2020. https://doi.org/10.1016/j.dsx.2020.04.032

[6] L. Gusho, A. Muçaj, M. Petro, and M. Vampa, "The use of educational technology to improve the quality of learning and teaching: A systematic research review and new perspectives," *International Journal of Emerging Technologies in Learning*, vol. 18, no. 15, pp. 109–119, 2023. https://doi.org/10.3991/ijet.v18i15.39641

[7] S. Sophonhiranrak, "Features, barriers, and influencing factors of mobile learning in higher education: A systematic review," *Heliyon*, vol. 7, no. 4, p. e06696, 2021. https://doi.org/10.1016/j.heliyon.2021.e06696

[8] G. Díaz-Sainz, G. Perez, L. Gomez-Coma, V. M. Ortiz-Martinez, A. Dominguez-Ramos, R. Ibanez, and M. J. Rivero, "Mobile learning in chemical engineering: An outlook based on case studies," *Educ. Chem. Eng.*, vol. 35, pp. 132–145, 2021. https://doi.org/10.1016/j.ece.2021.01.013

[9] İ. Yildiz, E. Topçu, and S. Kaymakci, "The effect of gamification on motivation in the education of pre-service social studies teachers," *Think. Ski. Creat.*, 2021. [Online]. Available: https://doi.org/10.1016/j.tsc.2021.100907

[10] A. A. Alfalah, "Factors influencing students' adoption and use of mobile learning management systems (m-LMSs): A quantitative study of Saudi Arabia," *Int. J. Inf. Manag. Data Insights*, vol. 3, no. 1, p. 100143, 2023. https://doi.org/10.1016/j.jjimei.2022.100143

[11] E. D. Tetteh, P. Ghann, J. Parbey, and A.-S. Yussiff, "An analysis of educational portals' implementation for effective online learning," *Int. J. Adv. Corp. Learn.*, vol. 16, no. 1, pp. 4–18, 2023. https://doi.org/10.3991/ijac.v16i1.34703

[12] W. J. Alkasasbeh and A. T. Amawi, "The effectiveness of using mobile learning application on undergraduates' intrinsic motivation and their general nutrition knowledge," *International Journal of Interactive Mobile Technologies*, vol. 17, no. 17, pp. 19–37, 2023. https://doi.org/10.3991/ijim.v17i17.40959

[13] I. Stevanus and L. Parida, "The impact of gadget usage on the social and linguistic development of primary school students," *International Journal of Online and Biomedical Engineering*, vol. 19, no. 11, pp. 159–172, 2023. https://doi.org/10.3991/ijoe.v19i11.40903

[14] S. Loewen, D. R. Isbell, and Z. Sporn, "The effectiveness of app-based language instruction for developing receptive linguistic knowledge and oral communicative ability," *Foreign Lang. Ann.*, vol. 53, no. 2, pp. 209–233, 2020. https://doi.org/10.1111/flan.12454

[15] W. Wei, "Understanding and supporting the use of feedback from mobile applications in vocabulary learning among young adolescent learners," *Stud. Educ. Eval.*, vol. 78, p. 101264, 2023. https://doi.org/10.1016/j.stueduc.2023.101264

[16] L. Sanda and B. Klimova, "Educational mobile applications for learning English as a second language by Czech seniors," *Procedia Computer Sciences*, vol. 192, pp. 1848–1855, 2021. https://doi.org/10.1016/j.procs.2021.08.190

[17] B. Klimova, "Mobile application for foreign language learning by cognitively unimpaired seniors," *Procedia Computer Sciences*, vol. 218, no. 2022, pp. 750–756, 2023. https://doi.org/10.1016/j.procs.2023.01.055

[18] S. Schroeder, N. C. Murray-Everett, J. Gates, and S. B. Shear, "Informing, transforming, inquiring: Approaches to elementary social studies in methods course syllabi," *J. Soc. Stud. Res.*, vol. 45, no. 2, pp. 102–117, 2021. https://doi.org/10.1016/j.jssr.2020.07.001

[19] A. Komar and N. Winarsih, "Problematika Pembelajaran Ilmu Pengetahuan Sosial Di Tingkat Sekolah Dasar: Studi Kasus Sdn Kebonsari Kulon 3 Kota Probolinggo Tahun Ajaran 2020–2021," *J. Pendidik. dan Sains*, vol. 1, no. 2, pp. 237–248, 2020.

[20] O. Saidani Neffati, R. Setiawan, P. Jayanthi, S. Vanithamani, D. K. Sharma, R. Regin, D. Mani, and S. Sengan, "An educational tool for enhanced mobile e-learning for technical higher education using mobile devices for augmented reality," *Microprocess. Microsyst.*, vol. 83, no. 2020, p. 104030, 2021.

[21] Z. H. İpek, A. İ. C. Gözüm, S. Papadakis, and M. Kallogiannakis, "Educational applications of the ChatGPT AI system: A systematic review research," *Educ. Process Int. J.*, vol. 12, no. 3, pp. 26–55, 2023. https://doi.org/10.22521/edupij.2023.123.2

[22] S. Papadakis and M. Kalogiannakis, *Mobile Learning Applications in Early Childhood Education*. Hershey, PA: IGI Global, 2019. https://doi.org/10.4018/978-1-7998-1486-3

[23] Y. Hao, K. S. Lee, S. T. Chen, and S. C. Sim, "An evaluative study of a mobile application for middle school students struggling with English vocabulary learning," *Computers in Human Behavior*, vol. 95, pp. 208–216, 2019. https://doi.org/10.1016/j.chb.2018.10.013

[24] H. S. Chiu, "Dataset of mobile learning effectiveness on learning computer programming in community college," *Data Br.*, vol. 26, p. 104525, 2019. https://doi.org/10.1016/j.dib.2019.104525

[25] A. R. M. Forkan, Y. B. Kang, P. P. Jayaraman, H. Du, S. Thomson, E. Kollias, and N. Wieland, "VideoDL: Video-based digital learning framework using AI question generation and answer assessment," *Int. J. Adv. Corp. Learn.*, vol. 16, no. 1, pp. 19–27, 2023. https://doi.org/10.3991/ijac.v16i1.35207

[26] F. Salvetti, T. L. Capshaw, L. Zanin, K. C. O'Connor, Q. Zeng, and B. Bertagni, "The GW mobile learning center: Mixed-reality within an immersive and interactive learning setting," *Int. J. Adv. Corp. Learn.*, vol. 16, no. 2, pp. 93–108, 2023. https://doi.org/10.3991/ijac.v16i2.35737

[27] C. Troussas, A. Krouska, and C. Sgouropoulou, "Collaboration and fuzzy-modeled personalization for mobile game-based learning in higher education," *Comput. Educ.*, vol. 144, p. 103698, 2020. https://doi.org/10.1016/j.compedu.2019.103698

[28] M. Valentová and P. Brečka, "Assessment of digital games in technology education," *International Journal of Engineering Pedagogy*, vol. 13, no. 2, pp. 36–63, 2023. https://doi.org/10.3991/ijep.v13i2.35971

[29] I. Moraiti and A. Fotoglou, "Digital and mobile applications for Autism inclusion," *International Journal of Online and Biomedical Engineering*, vol. 19, no. 11, pp. 83–95, 2023. https://doi.org/10.3991/ijoe.v19i11.37895

[30] C. R. Jaimez-González, J. Erazo-Palacios, and B. García-Mendoza, "*BlockCode:* A web application to create games that support the learning of computer programming logic," *International Journal of Emerging Technologies in Learning,* vol. 18, no. 15, pp. 240–257, 2023. Available: https://doi.org/10.3991/ijet.v18i15.40901

[31] M. M. Diacopoulos and H. Crompton, "A systematic review of mobile learning in social studies," *Comput. Educ.*, vol. 154, p. 103911, 2020. https://doi.org/10.1016/j.compedu.2020.103911

[32] Sariyatun, N. Suryani, L. A. Sutimin, N. F. Abidin, and A. Akmal, "The effect of digital learning material on students' social skills in social studies learning," *Int. J. Instr.*, vol. 14, no. 3, pp. 417–432, 2021. https://doi.org/10.29333/iji.2021.14324a

[33] O. Malysheva, E. Tokareva, L. Orchakova, and Y. Smirnova, "The effect of online learning in modern history education," *Heliyon*, vol. 8, no. 7, pp. 1–11, 2022. https://doi.org/10.1016/j.heliyon.2022.e09965

[34] N. Parsazadeh, R. Ali, and M. Rezaei, "A framework for cooperative and interactive mobile learning to improve online information evaluation skills," *Comput. Educ.*, vol. 120, pp. 75–89, 2018. https://doi.org/10.1016/j.compedu.2018.01.010

[35] N. L. A. Octaviyantari, N. K. Suarni, and I. W. Widiana, "Improving social studies learning outcomes through group investigation learning model assisted with audio-visual media," *J. Educ. Technol.*, vol. 4, no. 3, p. 349, 2020. https://doi.org/10.23887/jet.v4i3.25245

[36] A. Syawaluddin, S. Afriani Rachman, and Khaerunnisa, "Developing snake ladder game learning media to increase students' interest and learning outcomes on social studies in elementary school," *Simul. Gaming*, vol. 51, no. 4, pp. 432–442, 2020. https://doi.org/10.1177/1046878120921902

[37] A. I. Zourmpakis, M. Kalogiannakis, and S. Papadakis, *A Review of the Literature for Designing and Developing a Framework for Adaptive Gamification in Physics Education,* 2023, pp. 5–1–5. https://doi.org/10.1063/9780735425712_005

[38] A. A. Gani and S. Saddam, "Pembelajaran Interaktif Pendidikan Kewarganegaraan Melalui Mobile Learning di Era Industri 4.0," *Civ. Pendidikan-Penelitian-Pengabdian Pendidik. Pancasila dan Kewarganegaraan*, vol. 8, no. 1, p. 36, 2020. https://doi.org/10.31764/civicus.v8i1.1849

[39] S. Karamina, T. Arsal, and Y. Sunarjan, "The role of social studies teacher in the use of YouTube Vlog-based learning media," in *International Conference on Science and Education and Technology (ISET),* 2020. https://doi.org/10.2991/assehr.k.200620.036

[40] N. Shakirova, N. Al Said, and S. Konyushenko, "The use of virtual reality in geo-education," *International Journal of Emerging Technologies in Learning*, vol. 15, no. 20, pp. 59–70, 2020. https://doi.org/10.3991/ijet.v15i20.15433

[41] M. Japar, Y. Kardiman, Raharjo, D. N. Fadhillah, and S. Syarifa, "Interactive mobile technologies on civic education learning in higher education," *International Journal of Interactive Mobile Technologies,* vol. 15, no. 3, pp. 84–96, 2021. https://doi.org/10.3991/ijim.v15i03.17509

[42] T. Koparan, H. Dinar, E. T. Koparan, and Z. S. Haldan, "Integrating augmented reality into mathematics teaching and learning and examining its effectiveness," *Think. Ski. Creat.*, vol. 47, p. 101245, 2023. https://doi.org/10.1016/j.tsc.2023.101245

[43] M. J. Hannafin and K. L. Peck, *The Design, Development, and Evaluation of Instructional Software*, New York: Macmillan Publishing Company, 1988.

[44] R. C. Richey, J. D. Klein, and M. W. Tracey, *The Instructional Design Knowledge Base: Theory, Research, and Practice*, vol. 9780203840, Taylor and Francis, 2011. https://doi.org/10.4324/9780203840986

[45] Y. Lu and T. Xiong, "The attitudes of high school students and teachers toward mobile apps for learning English: A Q methodology study," *Soc. Sci. Humanit. Open*, vol. 8, no. 1, p. 100555, 2023. https://doi.org/10.1016/j.ssaho.2023.100555

[46] L. Maketo, T. Issa, T. Issa, and S. Z. Nau, "M-Learning adoption in higher education towards SDG4," *Futur. Gener. Comput. Syst.*, vol. 147, pp. 304–315, 2023. https://doi.org/10.1016/j.future.2023.05.010

[47] L. Pebriantika, B. Wibawa, and M. Paristiowati, "Adoption of mobile learning: The influence and opportunities for learning during the Covid-19 pandemic," *International Journal of Interactive Mobile Technologies*, vol. 15, no. 5, pp. 222–230, 2021. https://doi.org/10.3991/ijim.v15i05.21067

9 AUTHORS

Bekti Aprilia is a student at the Doctoral Program of Educational Technology, Universitas Negeri Jakarta, Indonesia. Research interest: Mobile learning, Educational Technology, technology-based learning, and Primary education (E-mail: toiciiaprilia@gmail.com; Bektiaprilia_9902921013@mhs.unj.ac.id).

Maria Paristiowati is a lecturer at the Department of Chemistry Education, Universitas Negeri Jakarta, Indonesia. Research interest: Chemistry Education, Educational Technology, TPACK, Lesson Study, Science Education, STEM education. Course Taught: Thermodynamics, Kinetics, Polymer, Media of Teaching and Learning, Methodology of Teaching and Learning, Chemistry literature (E-mail: maria.paristiowati@unj.ac.id).

Muhammad Japar is a Professor at Universitas Negeri Jakarta, Indonesia. Research interest: Civic Education and Instructional Technology. Course Taught: Instructional Media, Research Methodology, Introduction to Political Science, Democracy and Human Rights, Civic, Pancasila, Theories of Learning, Character Education, and Theory and Constitutional Law (E-mail: mjapar@unj.ac.id).