JISE 11 (1) 2022 : 38–47

Journal of Innovative Science Education

http://journal.unnes.ac.id/sju/index.php/jise

Development of Mobile learning (My Repro) Based on Contextual Teaching Learning to Improve Cognitive Understanding Senior High School Student

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Article Info

Article History :
Received
September 2021
Accepted
November 2021
Published
April 2022

Keywords:
Cognitive Understanding, Contextual Teaching Learning, Mobile learning

Abstract

During the current pandemic, the utilization of technology is needed in teaching and learning activities. It supports the emergence of Android-based learning innovations. Likewise, biology learning is accompanied by contextual learning related to everyday life. This study aimed to develop learning materials based on contextual teaching-learning and analyze the validity of learning media and cognitive understanding. This research used the 4-D model development method by Thiagarajan (Define, Design, Develop, Disseminate). The subjects were media experts and material experts, while the product's effectiveness was tested on 56 students of class XI MIPA at SMAN 1 Semaka. The results showed that the validation scores of material experts and media experts were 92.39% and 92.61%, respectively, with very valid criteria. Analysis of students' cognitive understanding showed high criteria with an average N-gain value of 0.70 (high criterion). Based on the research analysis results, it can be concluded that learning media mobile learning based on contextual teaching-learning have been valid and effectively used as a learning resource for high school students.

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p-ISSN 2252-6412
e-ISSN 2502-4523

INTRODUCTION

The Covid-19 pandemic impacts various fields, one of them is education (Aji, 2020). Changes in learning methods must also be made online (Wilson, 2020). Online learning connects students with learning resources (databases, experts, libraries) who are physically far apart but communicate with each other (Sadikin & Hamidah, 2020). Teachers and students must carry out the teaching and learning process through distance methods. Mobile media learning is expected to provide effective learning, increase student learning activities, and provide learning experiences so that learning is more meaningful than before. Mobile learning focuses on new skills, knowledge, and experiences (Demir & Akpinar, 2018).

The rapid development of technology supports the emergence of android-based learning media innovations to support flexible learning in teaching and learning activities (Martono & Nurhayati, 2014) and can be studied anywhere and anytime (Ariyanto et al., 2020). Mobile learning virtually can be accessed anywhere, with access to the entire learning materials that are different. Furthermore, a mobile learning-based open-source nature makes it easy for everyone to develop and use it according to learning wants and needs (Belina & Batubara, 2013).

Biological concepts to be conveyed optimally, namely by contextual learning that links the material with everyday life (Nur, 2014). Contextual learning helps students relate the material being studied to real-world situations and encourages them to connect their knowledge with its application in everyday life (Widarti et al*.,* 2013). Learning by linking something learned with real-life is suitable for learning biology because biology learning must be environmental. Furthermore, physiological learning in biology is challenging to understand. Therefore a medium that is capable of physiological understanding is needed.

Based on preliminary studies made by SMA Negeri 1 Semaka, Lampung Province, many students have smartphones, especially smartphones based on Android. However, smartphones have not been optimally utilized by students. Students primarily use smartphones only for playing games and social media. The school has complete and excellent multimedia facilities. Further, teachers and students also have good skills in operating existing multimedia. Multimedia should create innovative, creative, and fun learning. The learning media used in SMA Negeri 1 Semaka are natural/environmental media, textbooks, laptops, cellphones, and LCDs. In addition, students use the distance learning method using the messaging application (Whatsapp) during a pandemic.

Based on interviews with students, it was found that some students felt they were still experiencing difficulties with the reproductive system material. Learning media are less practical and cannot be carried anywhere, and students expect fun learning and fun learning media. Some students argue that contextual learning can help them understand the concept of human reproduction. The mobile learning being developed is called My Repro because the mobile learning being developed includes material on the reproductive system.

Based on this background, innovation in learning is needed to support the optimal learning process. Learning media have an essential role to play in achieving a learning goal. Contextual-based mobile learning media on reproductive system material in high school is used to become alternative learning during the pandemic to improve students' cognitive understanding. The media is expected to make a positive contribution to learning biology, especially for physiological materials. This study aimed to analyze the validity of the development of mobile learning and students' cognitive understanding of the reproductive system material.

METHODS

This research was developmental research based on Thiagarajan et al. (1974) model, encompassing four stages: defining, designing, developing, and disseminating. The defining stage included facts and a series of needs in learning Biology at SMA N 1 Semaka. The second stage was the designing stage, which included developing learning materials and making product flowcharts and storyboards. The third stage was the developing stage, which included developing *mobile* learning (My Repro) with text, graphics, video, and the formative evaluation stage. Finally, the last stage was disseminating; *mobile learning* validated and tested was then disseminated on the *Playstore*

platform. At this stage also, the access to the product had known. This research was conducted at SMA N 1 Semaka in classes XII MIPA 3 and MIPA 4. The research was conducted in the academic year 2020/2021 in August - September 2020. Products were Mobile learning used in learning at SMA N 1 Semaka with a total of 57 students. This research was conducted online due to a pandemic using WhatsApp and mobile learning (My Repro).

The research data included the validation data of learning media mobile learning obtained through media and material validation questionnaires given to materials and media expert lecturers. The validity data collection was carried out online via email by attaching a questionnaire and an application mobile learning that has been developed. Student and teacher responses were obtained through questionnaires and mobile learning that have been developed. The data were collected pre-test with multiple choice questions as many as 30 questions were carried out simultaneously using google form with a predefined time. Post-test data retrieval was carried out using a mobile learning application, each student who took part in the test was given access to use his NIK (Student Identification Number) to log in. Assessment data post-test with multiple choice questions as many as 30 questions to measure students' cognitive understanding. The data from the material and media validator, student and teacher responses were then analyzed using a Likert scale. The research data pre-test and post-test were analyzed using the *N-gain* test.

RESULTS AND DISCUSSION

Validity of Mobile Learning (My repro)

The validity of learning media includes two components, namely the material and media components. Material experts and media experts carry out validity. Learning media are declared valid if the assessment of material experts and media experts reaches an average percentage score of> 62%, or the criteria are valid and very valid. A total of the material expert's assessment of learning media mobile learning (My Repro) is presented in Table 1.

Table 1. Validation mobile learning (My repro) Reproductive System by Expert Matterial

No	Indicator	Validator 1		Validator 2		Criteria
		Score	Validity Value	Score	Validity Value	
1	Aspects of content validity	22	91.66	22	91.66	Very valid
2	Organizing aspects of the material	21	87.50	21	87.50	Very valid
3	Aspects of evaluation	27	96.42	27	96.42	Very valid
4	Aspects of language	7	87.50	7	87.50	Very valid
5	Aspects of the validity of the effect on learning strategies	8	100	8	100	Very valid
Average		85	92.39	85	92.39	Very valid
Total					92.39	Very valid

Table 2. Validation results of mobile learning (*My repro*)Reproduction System by Media Expert

No	Indicator	Validator 1		Validator 2		Criteria
		Score	Validity Value	Score	Validity Value	
1	Aspects of language validity	12	100	9	75	Very valid
2	Aspects of the validity of the effect on learning strategies	19	95	18	90	Very valid
3	Aspects of engineering software	22	91.6	22	9.6	Very valid
4	Aspects of visual appearance	32	100	29	90	Very valid
Average		85	96.59	78	88.63	Very valid
Total					92.61	Very valid

Based on Table 1, the validity of *mobile learning* (*My Repro*) media by material experts from the five aspects scores is 92.39%, with very valid criteria. Table 1 and Table 2 show that each aspect of the assessment obtains a score above 70%. It means that each component gets a good assessment from material and media experts. The material expert's assessment shows that the presentation component and content feasibility are sufficient as expected. The conformity includes 1) The contents of the components are appropriate; 2) The presented technique is good; 3) Completeness of the presentation is good; 4) The material description is following the basic competencies: and 5) The accuracy of the material is good. In line with Wahyuningsih et al. (2014), the validation of the feasibility aspect of the content will be good if the material presented is good and follows basic competencies. The media expert's assessment shows that the components of the feasibility of language, graphics, and the usefulness of mobile learning are as expected. It includes 1) mobile learning compatibility is following the rules of Indonesian: 2) images are presented in real terms: 3) the fonts presented are very suitable for each component: 4) the layout is presented attractively: 5) Ease of operation of learning media. Therefore, the validity category of mobile learning (My Repro) according to material and media experts is very valid, which means it is very valid to use.

Material testing conducted by material experts validates aims to obtain data on the validity of the content of the reproductive system material in *mobile learning* (My Repro). Material experts gave comments and suggestions that there were some mistakes in typing and suggested to be more careful. For example, in the description of the previous image, there was no source of the image, and the image of the female reproductive organ was very vulgar, and it should be replaced. Based on the material expert's advice, it was revised by correcting the typing according to the correct spelling.

There was no image source in the previous image, so it should add an image source. Providing image sources is part of writing ethics and respecting copyright. Based on the advice given by material experts, mobile learning was revised by adding an image source to the material. It is in line with Murfianti's (2020) opinion that the use of copyright works must provide a description or source of copyright information in the header of digital data. Previously, the image of the female reproductive organs looked very vulgar, and then it was revised with an appropriate image. It is in line with Hanifah's (2014) opinion that teaching materials must contain images that attract students and age-appropriate layouts. Image display needs to be considered in teaching materials because it can affect student motivation and interest in learning (Hersandi et al., 2017).

In the previous view, videos on *mobile learning* cannot be accessed, so it needs to be replaced by accessing videos on YouTube with the link provided. Furthermore, videos cannot be accessed due to copyright, so they cannot be opened. Ulinnuha (2017) explains that copyright is a special right given to the creator or copyright holder. Therefore, copyright can only be used except with the permission of the creator or copyright holder concerned (Susanti & Junaedi, 2013).

Media revision in the form of suggestions for improvement obtained by media experts said that the application should be made to be more compatible for all devices so that students find it easier to use. Material experts suggest that it should be made more interesting and varied to be repeated or not boring. The display of mobile learning before being revised is using the format *apk. After being revised, mobile learning is uploaded to the plaster to be accessed from all devices. Mobile learning uploaded to the plaster can be accessed by anyone, anywhere, and anytime (Matlubah et al., 2016).

The media expert's assessment of the visual appearance of mobile learning falls into very valid criteria. Based on expert comments, the visual display media for mobile learning that has been developed are packaged using illustrations and appropriate color combinations and age-appropriate layouts to attract students to learn. An attractive visual appearance is an initial requirement so that the media can attract readers' interest. It is in line with Labib & Yolida's (2019) opinion that the appearance of media mobile learning must attract readers who use it by including attractive illustrations and layouts that can positively respond to mobile learning. Visual appearance needs to be considered because it can affect student motivation and interest in learning (Hersandi et al., 2017). Data from expert assessment media and material experts are used as a basis for revising mobile learning (My

Repro), which was developed to improve the component of mobile learning (My Repro) before being tested on students.

Responses from users (students and teachers) are also used to revise efforts to improve mobile learning (My Repro). Mobile learning that has been declared valid by experts and has gone through the revision stage was then tried out in schools to find out the responses of teachers and students. The trial was conducted at SMA Negeri 1 Semaka with a total number of respondents of 20 students and a teacher.

Student response to mobile learning (My Repro) as a learning medium was made by filling out a questionnaire. A positive response to mobile learning developed with an average percentage of 86.66%, and it is included in the very good category. It indicates that mobile learning is suitable for use as a learning medium.

The student response questionnaire analysis shows that mobile learning has an attractive and fun presentation; thus, it is not boring. The use of contextual learning also provides examples of events to relate to the learning material. Mobile learning with an attractive appearance can increase interest in learning, where the higher the student's interest in learning will affect students' cognitive understanding. It is in line with the research of Sulistyawati et al. (2019) that media developed based on daily events can provide contextual insights, improve cognitive abilities, authentic experiences for students, and motivation in the learning material. The use of mobile learning that can be accessed anywhere makes it easier for students to learn, makes it easier for students to understand the material, and increase student knowledge.

Table 3. Response to the use of Mobile learning by teachers

No	Indicator	Score
1.	Clarity	51
2.	Compliance with curriculum	22
3.	Integrity of Understanding / Acceptance	11
4.	Influence / Impact	18
5.	Punctuality	6
6.	Effect of Learning Strategies	15
Total scores		113
% validity of mobile learning (My Repro)		83.08
Criteria		Very Good

The results of the teacher response assessment obtained a score of 83.08%, which is classified as a very good criterion. Mobile learning has an attractive presentation so that mobile learning can increase student interest and motivation and is helpful as a learning medium that can make it easier to learn the material. The qualitative data obtained is in the form of teacher comments directly after learning; namely, mobile learning has an attractive appearance to make students want to read each mobile learning page. In addition, it is very good for student understanding because it relates to problems and events that occur in the environment.

The teacher provides comments regarding the material in mobile learning, which uses many terms that students do not understand, some of the questions presented have too difficult levels, but these questions can add to students' insight. Finally, the teacher adds that the language used should use language that students easily understand. Mobile learning as a learning medium is considered very valid for learning, where mobile learning can be used as a companion to existing books because the information presented does not overlap but is complementary. Textbooks in schools emphasize the concept of material, but minimal contextual learning and image quality are not good and interesting, so mobile learning is a valid alternative to use as a learning medium. It is in line with Kuswanto & Radiansah's (2018) opinion, which states that learning media with an attractive appearance greatly affects the learning process, the more attractive the appearance of the media, the more motivated students are to learn so that it affects student learning outcomes.

The Use of *Mobile Learning* based on Students' Cognitive Understanding

Cognitive comprehension is measured using pre-test and post-test questions. After the pre-test and post-test results were obtained, the data obtained were analyzed using the test N-gain. The test N-gain is used to measure the difference between the values pre-test and post-test. Based on the pre-test and post-test results, it was found that the average cognitive understanding of students had increased. The results of the analysis of the test data N-gain are presented in Table 4.

Table 4. Score Understanding Cognitive Students

No	Data	Value	N-gain	Criteria
1.	XI MIPA 3	29 students	0.64	Moderate
	Pretest lowest	23.3		
	Pretest highest	76.6		
	Post-test lowest	70.0		
	Post-test highest	93.3		
	Average Pretest	41		
	Average Post-test	79.48		
2.	XI MIPA 4	28 students	0.77	High
	Pretest lowest	20		
	Pretest highest	86.6		
	Post-test lowest	70		
	Post-test highest	96.6		
	Average Pretest	40		
	Average Post-test	81.01		
Average Pretest		40.5		
Average Post-test		80.24		
Average N-gain			0.70	High

Students' cognitive understanding determines the effectiveness of the developed mobile learning (My Repro). The learning outcome data were taken through the scores of pre-test and post-test students, which were then analyzed using N-gain. The test N-gain shows the difference in values between before and after learning using mobile learning (My Repro) so that it can be seen how the increase in students' cognitive understanding. The average test N-gain in the MIPA 3 and MIPA 4 classes falls into the high category. The total number of students completed after participating in learning using mobile learning (My Repro) is 57 students or 100%. The minimum completeness criteria set in schools for biology subjects are 70.

Pre-test carried out in class before participating in learning using mobile learning (My Repro). The questions presented in the pre-test were presented with more emphasis on applicable or applied questions so that students can relate their knowledge contextually. It happens because the material presented is contextual material that is commonly found in the surrounding environment. In addition, application problems have difficulties to solve. The positive thing that can be taken from this event is that mobile learning (My Repro) contextual-based provides new experiences for students whose surroundings are not limited to classroom and textbooks. Insights into the environment are essential so that there is no mistake in human behavior towards the environment (Prasetyo & Perwiraningtyas, 2016).

Based on Table 3, the average student activity in the post-test showed higher activity compared to the pre-test. Thus, student activities during learning with mobile learning improve cognitive understanding, which is carried out systematically with contextual learning linkages. The linkages of contextual learning are made in writing and accompanied by a brief explanation. Table 3 shows the average acquisition of students' pre-test and post-test scores of cognitive comprehension abilities. The mean pre-test and post-test scores showed a difference. From the data above, it can be said that the average pre-test and post-test scores have increased. The average n-gain score falls into the

high category. The difference in pre-test and post-test scores is because they have been treated in mobile learning using online learning using mobile applications. It shows that mobile learning (My Repro) is effectively used as a learning medium for system material reproduction. The same results on the criteria being in Afifah's (2018) research regarding E-module material kingdom Plantae development. Media can be effective if it increases activity and learning outcomes (Sari & Susanti, 2016).

The results of N-gain with high criteria means that learning materials using mobile learning can help students understand learning material effectively. A good student response indicates it during the learning process. Student learning activities will increase if motivated to learn; one that motivates students is that they quickly understand the learning material. Therefore the learning material should be close to everyday life. Gaol & Simarmata (2019) learning materials that link contextual learning, where students have seen, heard, and observed their environment, can increase student learning motivation.

Learning online using whatsapp and mobile learning applications. Learning begins with the teacher reminding students that learning will begin, students respond well. Furthermore, the teacher gives an explanation of the material and asks students' difficulties in learning the material. Students ask about reproductive system problems experienced in real life and other students answer about these problems. During class students can see pictures and learning videos contained in mobile learning. Student responses show that students can understand the material more optimally by watching the video because it is more real and clear. This means that students will better understand the material using videos on reproductive system material that is physiological in nature. Sari & Susanti (2016) students can learn the material in mobile learning because the material in the media contains clearer and more interesting images and videos.

The definition of the effectiveness of teaching materials is very diverse, depending on what indicators you want to achieve from the development of the product. Teaching materials can be effective if they are able to improve critical thinking skills (Yuliati, 2013). Contextual-based mobile learning is effective for improving critical thinking skills (Liliarti & Kuswanto, 2018). Mobile learning in this case, can be effective because it increases cognitive understanding between students before and after learning.

Contextual material can increase motivation, interest and encourage students to apply their knowledge (Zulfah & Aznam, 2018). Along with increasing motivation, interest and application will have an impact on increasing students' cognitive understanding. The development of contextual-based materials tends to increase students' understanding of the subject matter of biology (Lepiyanto & Pratiwi, 2015; Sulistyawati et al., 2019; Wulandari et al., 2017). Contextual learning can increase student activity individually or in groups (Shofiah et al., 2014). Mobile learning Media tends to increase cognitive understanding in terms of values before and after learning (Ibrahim, N & Ishartiwi, 2017; Muyaroah & Fajartia, 2017). Mobile learning based on contextual learning effectively improves cognitive understanding because it presents examples of problems experienced in the surrounding environment and connects the material studied students' daily lives, thus providing contextual insights.

Contextual-based learning in this study involves students linking learning material with students' daily lives to learn the knowledge around them to provide authentic experiences. As many as 91.66% of students answered strongly agree that contextual learning can improve students' cognitive understanding. Student involvement in contextual learning positively impacts students' cognitive understanding and is expected to be one of the lessons applied in other materials. Teaching materials developed based on the potential of the surrounding environment can provide contextual insights and authentic experiences for students (Rahmatih et al., 2017; Tiffany et al., 2018). Contextual learning connects the material with the conditions around students to encourage students to apply knowledge (Widarti et al., 2013; Erlianti et al., 2017) so that contextual learning can improve students' analytical thinking (Intany et al., 2016). Mobile learning increases student motivation and satisfaction, facilitates the learning process, and positively affects student performance (Ozan, 2013).

Mobile learning media positively influences learning reproductive system material seen from the

increase in students' cognitive understanding. It is in line with the opinion of Karo-Karo & Rohani (2018) that learning media can help the process. Mobile learning has three advantages: facilitating technological mobility, increasing mobility in the learning and evaluation process, and increasing students' desire to learn (Osman & Johannes, 2010). In addition, media is interactive, attracting students to learn (Wulandari et al., 2019). Mobile devices can be used as effective learning media because of their mobility and ease of use (Criollo et al., 2018), the presentation of material in products mobile learning is very easy to operate (Ibrahim & Ishartiwi, 2017) able to access information quickly (Gikas & Grant, 2013). Furthermore, the cost of mobile devices is relatively cheap compared to PCs and laptops (Musahrin, 2016). Then, mobile learning provides a comprehensive learning environment, promotes content understanding, and facilitates teacher-student interactions (Zhao et al., 2016). Mobile learning is a suitable medium for distance learning during a pandemic (Makuni, 2020).

The weakness of mobile learning being developed is the lack of stability in the internet network, considering that evaluations are carried out online to find it challenging to access evaluations in mobile learning. The weakness of mobile learning requires an internet network connection (data package) (Rahmat et al., 2019); mobile learning requires the internet because it is online (Singh et al., 2017). In addition, mobile learning requires students to familiarize themselves with the characteristics of new devices in learning mobile-based learning for new skills, knowledge, and experiences (Demir & Akpinar, 2018).

CONCLUSION

Based on the research that has been done, it can be concluded that mobile learning (My Repro) as learning media are valid based on material and media experts and are effective for use based on the N-gain obtained. There is a significant difference in increasing cognitive understanding ability between the students who use mobile learning, and the students who do not use it, with an average N-gain obtained is 0.705.

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