Facilitating Self-regulated Learning Using Mobile Learning Games

Alla' Junia Nurdin*, Triana Rejekiningsih, and Sri Sumaryati

***Abstract*—Facilitating Self-regulated learning for students has become a concern recently. This is important for students because this mental activity increases a sense of control and confidence in fulfilling learning tasks, thus increasing self-efficacy, motivation, and autonomy in learning. Self-Regulated Learning (SRL) helps students progress and develop personally and socially. It is known that educators usually train self-regulated using learning media such as Massive Open Online Courses (MOOCs), games, augmented reality, virtual reality, and others. However, games are the most easiest and enjoyable learning media because games can promote independent learning in a constructivist, social problem-solving context. Some games would be better if they were developed with learning in mind. Therefore, the research objective of this paper is to develop games that can enhance self-regulatory learning. The type of study used was a 4D modeling application development study with the participation of 120 vocational high school students. The results showed that students who used game-based mobile learning improved in three aspects of self-regulated learning: metacognition, motivation, and behavior.**

***Index Terms*—Self-regulated learning, mobile learning game, student learning**

I. Introduction

Educational technology is one of the relevant answers for realizing 21st-century education, which puts forward various dynamic and practical life demands through technology. Educational technology is essential in creating and developing media to increase learning effectiveness. Through educational technology, technology will be produced that fits the needs of students and the progress of science in education. Educational technology will become a forum for disseminating knowledge in technology-based education. Educational technology is ethical research or practice that promotes learning and improves performance through developing, using, and managing technology according to resources [1]. Efforts to solve problems in education and learning are the role of educational technology. Educational technology's role in improving education quality includes needs-based development and media use. Therefore, the role of media in teaching and learning activities is essential. It is necessary to consider several things regarding the advantages of the characteristics of the media to be developed and the need to connect various learning components [2]. According to Gee [3], learning new literacy through play is very important. It is no secret that game computers and console games have bound today's youth. The motivational factor inherent in the game attracts the attention of Teenagers forced to play the same game for hours.

For this reason, it is possible to apply Game-Based Learning (GBL). Mobile game-based learning has the potential to provide learners with an ideal environment to "learn how to learn". Game-based learning offers a promising context for self-regulated learning (SRL) because of its complex but autonomous setting. Recently, educational psychologists have recognized the potential of digital games as platforms for engaging in self-directed learning.

According to the conceptualization of Schraw [4], facilitating self-regulated learning for students has become a concern in recent years. Students must actively create Self-Regulated Learning (SRL). Its interpretation of the knowledge formed makes sense because it is based on the student's analysis and practical knowledge. Self-Regulated Learning (SRL) is a term used to describe learner behavior that actively directs learning [5]. Constructivism is a concept that helps students increase their knowledge and understand what they are experiencing [6]. There needs to be a motivational boost from the teacher in building student SRL. This is caused by the behavior of students who demonstrate SRL [7]. SRL is a systematic process of activating and sustaining student perceptions, behaviors, and influences to achieve a goal and generally includes a motivational component that is metacognitive and strategic [8]. More specifically, SRL models generally consist of strategic, metacognitive and motivational components manifest in the form of a person's ability to effectively evaluate and control cognitive and motor processes in the learning process in specific domains [9–11]. Empirical evidence was found in research by Barry and Wenjuan [12], who identified the positive effects of students' self-study strategies. Mental activity increases students' autonomy, self-efficacy, desire to learn, confidence in completing learning tasks, and a sense of control over learning. Digital platforms are learning solutions that educational institutions currently use to implement distance learning [13].

Recently, increased interest has been observed in games intended for education. According to Dabbagh *et al*. [14], the term 'GBL' is related to us a game not for entertainment but for educational purposes. The meta-analysis by Clark *et al*. [15] shows that digital games greatly enhance student learning Compared to out-of-game states. Similar results were obtained in a meta-analysis conducted by Wouters and Van Oostendorp [16]. In the same way, Sailer *et al*. [17] emphasized how different psychological needs can be addressed through game elements with different mechanics. Several studies have investigated mobile game-based learning. Troussas *et al*. [18] advocate for

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creating unique learning experiences for students, as they can manage engagement and participation in learning settings that include play. Prasetya *et al*. [19] reported that game-based learning can support the learner-centered process. With the support of constructivism, the mobile play has developed into a successful student-centered learning method that builds on self-awareness and reflects that experience. In addition, according to research by Samaniego [20], several SRL strategies increase when students use games in educational practice. There have been many studies that examine SRL. However, only a few have discussed the use of mobile-based learning games using Zimmerman's three SRL aspects, namely metacognitive, motivational, and behavioral, simultaneously. This article aims to investigate the impact of play on mobile learning using three aspects of Zimmerman's self-regulating learning process.

II. Research Question

Therefore, the questions of this study are as follows:

1) How is the effectiveness of mobile learning games in improving student self-regulated learning?
2) What is the effectiveness of each self-regulated learning component after using mobile learning games?

III. Research Method

This examination makes use of a studies and improvement approach. This study adopted Thiagarajan's 4D model (defined, designed, developed, and disseminated) [21]. The essential consideration for selecting the 4D model is that each stage of the development procedure is explained in detail, what the researcher will do when developing a product in the form of teaching materials, books, or other teaching materials. This research examines SRL by implementing mobile learning games in class 12 vocational high school students. Participants in this study totaled 120 students from two vocational high schools in Indonesia. This study used a control and experimental class design. Each class group consists of 60 students who are randomly selected. The instruments used in this study were interviews and questionnaires. Interviews and questionnaires were conducted with teachers and students before and after using the game. The interview contents are related to the process, learning methods, and Student's self-regulated learning ability. Question corner, at the same time given, was based on self-regulated learning indicators from Zimmerman on a scale of 1 to 5. Each number of statement items validated 19 points on the pre-test and 20 points on the post-test.

Effectiveness data retrieval is carried out during the dissemination process in 4D. To test the effectiveness of teachers providing learning using mobile learning games to experimental lessons in traditional learning-controlled lessons using module books. The researcher served as an observer at the time of learning. Data from interviews were analyzed using source triangulation. Source triangulation is done by comparing the results of interviews between students and teachers to produce a conclusion of some information. Statistical tests processed data from the questionnaire results due to the use of t-test formulas for self-regulated learning samples, and there was a difference between experimental and control classes. After testing the product on the implementation of the learning process has been carried out, the next step is to test the level of effectiveness of mobile game products to increase students' self-regulated learning. This effectiveness test is carried out with a questionnaire distributed to students. The analysis used to determine the level of product effectiveness is the Gain score analysis (N-Gain).

IV. Result and Discussion

A. Result

Product development mobile learning game using 4D design includes four development steps: definition, planning, development, and dissemination. The product definition and planning are prepared Based on an analysis of student needs. Before testing the effectiveness of the product mobile learning game, validation is first carried out by several experts and practitioners and trial tests on students. The following is an explanation of the research results according to 4D syntax:

1) Define stage (needs analysis)

Based on observations with teachers, learning is carried out with two systems, including online and face-to-face systems, learning process using modules, Youtube, WhatsApp, and google classroom. Teachers use modules and videos from YouTube during online learning. In a learning environment, students must self-regulate and monitor their learning process, but their awareness of independent learning has not yet been awakened. During this time, students work on assignments even though it exceeds the allotted time. Some students are not maximal in learning independently, and teachers still have difficulty knowing students' understanding during online learning. There needs to be a motivational boost from parents and teachers in building self-regulated learning in students. The independence of student learning in accounting subjects is essential. Students' self-regulated learning before using games is included in the low category. Learning independence is the key when online learning. Therefore, efforts should be made to apply learning media to students so that it becomes a means of independent learning.

Every teacher who teaches at school hopes output graduates are of good quality. The teacher's competence also influences students with good quality or competence in their fields in the learning process. Teachers must continue to develop their competence. These various skills developed can be applied to learning in schools. One of the factors supporting learning in schools is using compelling, innovative media to increase students' enthusiasm for learning and, in the end, improve their abilities as Self-regulated learning learners.

Learning with simulations or games can be self-regulated learning [22]. Self-regulating learning is closely related to the self-regulation process. Self-regulation in learning can be beneficial if students are challenged and motivated [23] but may not be effective if students cannot manage their learning activities [24]. This is where additional guidance or support is

needed. One of her ways of supporting self-learning in students is by encouraging the use of cognitive meta-strategies through direct or indirect guidance during learning. This research provides an approach for fostering metacognitive processes, motivations, and attitudes that aid learning, especially in complex learning environments.

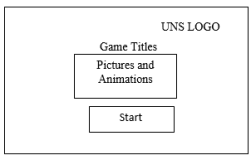
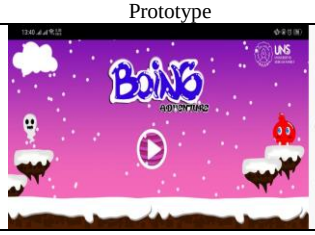
Based on interviews with several students in accounting subjects, it was considered quite challenging, mainly if the learning process was carried out remotely. The obstacles faced in the learning process are that sometimes the teacher explains the material too quickly, students have difficulty, and they do not understand how to work on the questions because the teacher often gives assignments and material. There are no examples of discussion of questions, so to understand the material, some students often discuss the lesson. Some students were late in submitting assignments. Students considered the use of learning media essential because it made understanding and exploring the material being conveyed easier. Besides that, learning became more exciting, and students became interested in learning the material presented.

Observation results during learning in class show that educators have used and utilized instructional media but still tend to use less mixed media, such as books or package modules provided by the government. They sometimes use smartphones to find references related to the topic being discussed. A needs analysis is performed to determine media usage used during the learning process so that, based on the identification results, an innovative learning media can be created that follows the characteristics of students. Through a needs identification questionnaire circulated to students, limitations were found related to the use of studying media throughout the studying process.

2) Design

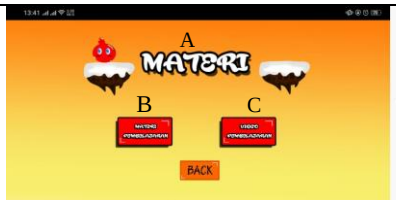
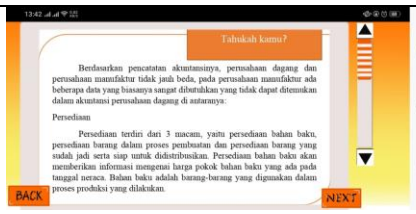
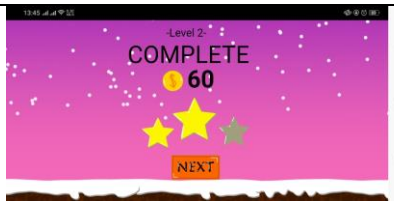
This stage is done to create mobile learning game following the framework of the results of curriculum analysis, analysis of students, and the preparation of an outline of media content and description of the material as well as incorporating a learning framework to develop students' independent learning. Several activities are carried out during the design or product design phase, including defining capabilities and metrics and creating learning materials, flowcharts, storyboards, and media prototypes. A mobile learning game was developed using the software Construct 2 and adapted to the development design. A comparison of the results of the story board and prototype design can be seen in Table I.

TABLE I. STORYBOARD AND PROTOTYPE MOBILE LEARNING GAMES

Storyboard	Prototype
Initial Design 	

Usage Game is considered challenging, fun, and easy to understand because the mobile learning feature game is equipped with questions, videos, materials, and game learning. Game material and features are played by students repeatedly, and students compete to get high scores in answering questions. Students also do not forget to work on structured questions in the material section. The display of mobile learning games can be seen in Table II.

TABLE II: MOBILE LEARNING GAME

Page	Visual Display
Main course a. User Guide b. Developer Profile c. Material d. Game	
Material a. Material b. Learning Materials c. Tutorial Video	
Material Discussion	
Video Tutorial	
Game	
Question	
Layout lose	
Layout win	

Total score	

3) Develop

The level of functional development produces mobile learning game, which has been revised based on criticism and suggestions from experts and trials on students. There are two steps at this stage: expert validation and student trials. The results of the expert validation and student trials can be seen in Table III and Table IV.

TABLE III: EXPERT VALIDATION

No	Validator	Mean	Category
1	Media	4.58	Very good
2	Material	4.54	Very good
3	Learning expert	4.1	Very good
4	Self-regulated learning experts	4.45	Very good

TABLE IV: TRIAL TO STUDENTS

No	Trials	Mean	Category
1	One-on-one trial	4.2	Very good
2	Small test	4.2	Very good
3	Extensive Test	4.3	Very good

This has been revised according to the input of media experts, materials, and trials of 25 students. So that the game is feasible and according to the student's learning needs. The features in the game are easy to use so that students can follow the guidelines coherently and finish the game well. Even though at the beginning of its use, some students needed adjustments.

The results of expert validation and student trials show that mobile learning game is feasible to be applied in learning because it is an alternative for educators in facilitating accounting learning with the media. This media has been tested, and the results have met the quality: valid, and can be implemented in learning.

4) Disseminate

Product effectiveness testing refers to the 4D model research and development procedures: Disseminate. The data presented in product testing is in the distribution frequency tables of the resulting pre-test and post-test students from each class. The teacher acts as a facilitator who directs students to use mobile-based games while researchers participate in observing students' learning activities. In this study, two questionnaires were used, namely the pre-test and post-test, so there were two Cronbach's alpha tests.

TABLE V: RELIABILITY CRONBACH'S ALPHA ON PRE-TEST AND POST-TEST

Result Reliability Cronbach's Alpha	Cronbach's Alpha	N of Items
Pre-test	0.873	19
Post-test	0.881	20

Based on Table V, the r-count (r is used as a valid limit or not an item). Based on the Table V the r-count pre-test score is 0.873 with N of reliable items as many as 19. While the r-table for 25 students is 0.396 (N = 25), the instrument used in this study will be valid if r-count > r-table, so 0.873 > 0.396. This indicates that the self-regulated learning distributed to students is stated as reliable as a data collection tool.

The r-count post-test score is 0.881 with N of reliable items as many as 20. While the r-table for 25 students is 0.396 (N=25), the instrument used in this study will be valid if r-count > r-table, so 0.881 > 0.396. This indicates that the self-regulated learning distributed to students is stated as reliable as a data collection tool.

Prerequisite test results from independent sample t-tests equalize the use of samples in a study.

TABLE VI: STATISTICAL RESULTS OF INDEPENDENT T-TEST (PRE-TEST AND POST-TEST)

Result Independent T-test	F	Say.	Sig. (2-tailed)	Mean Difference
Pre-test	1.823	0.180	0.000	2.717
Post-test	0.813	0.369	0.000	11.667

Based on the statistical testing independent t-test on getting a score pre-test for each class, information was obtained that the 120 data scattered. It was comparable or homogenous between experimental and control classes. Also, the value of Sig. (2-tailed is known to be 0.00 to refer to the decision criterion of the test, which is 0.00. For testing the hypothesis, there are several terms. Among others, hypothesis (H) is a statement that is still weak in truth and still requires proof or temporary conjecture about a matter. The null hypothesis (H0) is a statement that there is no difference in parameters or characteristics in the population. While the Alternative Hypothesis (H1), is a statement that contradicts H0. If the value of Sig. (2-tailed) < 0.05, then H0 is rejected and H1 is accepted. This means there are no differences in mean pre-self-regulated learning test questionnaire scores between control and experimental classes. So based on these statistical tests, the use of the sample in this study has equality in terms of self-regulated learning ability.

While the post-t test (independent t-test) is used to determine the effectiveness of the product's mobile learning game by processing data using the SPSS 20 application.

The post-test result of the decision-independent t-test when the value of Sig. (2-tailed) < 0.05. Based on the known table 0.000 <0.05, reject H0, accept H1, then conclude to test the hypothesis that rejects H0, accept H1, then the experimental class uses mobile learning game showed better independent learning than the control class.

Product effectiveness rate mobile learning game carried out through further tests using calculations that refer to the N-Gain score. The following are statistical gain score test results using competence questionnaire data from self-regulated learning students in experimental and control classes, processed with the help of the SPSS 20 application.

TABLE VII: N-GAIN TEST RESULTS (PERCENTAGE)

Class	Mean	Variance	S.D.
Experiment	56.19	166.727	12.912
Control	17.22	179.353	13.392

Based on the results of the N-Gain test calculations shown in Table VII, the average value of self-regulated learning, which has been analyzed using N-Gain for the experimental class with learning using the product mobile learning game is

56.19, when referring to the N-Gain category table, it is included in the Quite Effective category. At the same time, the results obtained in the control class (not using mobile learning game) of 17.22, which is included in the inefficient category. So based on the result statement of hypothesis testing and testing the level of effectiveness using N-Gain, the product uses a mobile learning game on learning to account, included in the category of being quite effective as a deep tool for self-regulated learning students of SMK N 3 Surakarta and SMK N 6 Surakarta.

B. Discussion

The development of mobile learning game products based on observation results is a solution to solve a learning problem. Product mobile learning game This has been validated theoretically and practically before being used in a learning activity so that the process is carried out theoretically and practically to improve product quality, and mobile-based have obtained appropriate feasibility assessments as game products.

Product development mobile learning game using 4D design includes four development steps: definition, planning, development, and dissemination. The product definition and planning were prepared based on an analysis of student needs. Before testing the effectiveness of the product mobile learning game, validation is first carried out by several experts and practitioners, namely media experts, experts in self-regulated learning, material experts, learning experts, and trial tests on students.

This has been revised according to the input of media experts, materials, and trials of 25 students. So that the game is feasible and according to the student's learning needs. The features in the game are easy to use so that students can follow the guidelines coherently and finish the game well. Even though at the beginning of its use, some students needed adjustments. However, this is similar to the results of Nikou and Economides [25] in the environment of the mobile learning game. This study suggests that the effect of cognitive competence on cognitive motivation or learning engagement in this study was insignificant. One potential explanation is that students with self-directed learning are more likely to be self-disciplined than others and may consider mobile-only learning as one of the most crucial learning methods necessary for self-study. Based on expert validation tests and student trials of mobile learning game products, they are included in the category that is feasible to be applied in learning because it is an alternative for educators to facilitate accounting learning with the media. This media has been tested, and the results have met the quality: valid and can be implemented in class 12 accounting lessons at Vocational Schools in Surakarta.

1) Product effectiveness mobile learning game to improve students' independent learning

Product effectiveness test calculation data mobile learning game obtained from a questionnaire distributed online to the experimental and control classes because the teaching and learning process is still taking place online. The effect test results using an independent sample t-test showed that the product mobile learning game for learning the practice of trade and manufacturing accounting services is said to be capable of being a means of self-regulated learning for student Class XII Vocational High School in Surakarta.

Based on the N-Gain test calculation results in Table VII, the mean of the self-regulated learning experimental class using the product mobile learning game is 56.19, when referring to the table. The N-Gain category is included in the Effective Enough category. This matter Follows

Research conducted by Samaniego [20] found that using games can increase SRL. The frequency of independent learning increases when using games in educational practice. Barzilai and Blau [26] also stated that scaffolding has an effect when playing games. Mobile games can enhance students' independent learning toward a learning goal [27–29]. Based on research by Troussas *et al*. [18], mobile learning game can help students by advancing their knowledge level of students and encouraging their learning. This follows this research in which the category of self-regulated learning in students increases after using mobile learning games. Of the eleven indicators, ten are in the excellent category and one in the good category. As for testing using N-Gain, it states that mobile learning games are quite effective as suggestions for students' self-regulated learning. This follows Sailer and Homner [30] regarding games that can support students in recognizing that learning can be fun and entertaining, stimulating students to perform better. So that students feel facilitated to achieve the learning objectives set. On the other hand, among the functions of learning media are supplements for classroom learning practices that can complement and support the learning process. Nor independent learning.

Usage Game is considered challenging, fun, and easy to understand because the mobile learning feature game is equipped with questions, videos, materials, and game learning. Game material and features are played by students repeatedly, and students compete to get high scores in answering questions. Students also do not forget to work on structured questions in the material section. Characteristics attached to non-educational games are not enough to make them teach [31, 32] suggest that guaranteeing that a game education is effective in facilitating learners in achieving learning goals, given how learning content is embedded in a game, is very important. Mobile games can enhance students' self-regulated learning toward a learning goal [27–29]. This follows research in which the category of self-regulated learning in students increases after using mobile learning games. Of the eleven indicators, ten are in the excellent category and one in the good category. As for testing using N-Gain, it states that mobile learning games are quite effective as suggestions for students' self-regulated learning.

Based on the results of the interviews, it can be concluded that the development of mobile learning games can encourage SRL when online learning. Both teachers and students positively assess the use of mobile learning games. Game media is considered relevant in a distance learning environment, where students must organize and transform their learning. Many students assess by using the game can easily repeat the subject matter, summarizing the material obtained. Games also provide a different atmosphere in learning so that students are motivated and enthusiastic when

participating in learning with games.

2) Effectiveness of self-regulated learning

After using mobile learning game, self-regulated learning students can be seen in Table VIII.

TABLE VIII: SELF-REGULATED LEARNING STUDENT

Aspect	Indicator	Mean	SD	Category
Metacognitive	Goal setting and planning	4.42	0.69	Very Good
	Rehearsing and memorizing	4.36	0.64	Very Good
	Organizing and transforming	4.43	0.73	Very Good
	Self-evaluating	4.39	0.69	Very Good
Motivation	Self-consequence	4.27	0.77	Very Good
	Seeking social assistance	4.32	0.62	Very Good
	Environmental structuring	4.43	0.56	Very Good
	Keeping records and monitoring	4.42	0.60	Very Good
Behavior	Seeking information	4.18	0.77	Good
	Reviewing records	4.43	0.59	Very Good
	Other/help-seeking	4.33	0.79	Very Good

The description of each indicator will be discussed below:

a) Goal setting and planning

Based on Table VIII, students using the game-based learning mobile app had a high level of planning and goal setting, averaging 4.42. The process of forming self-regulating learning begins with goal setting. Learners' ability to self-regulate in setting goals and learning plans is an essential initial skill. The most dominant aspect of the metric is the time it takes to complete the homework. For example, a maximum limit is set when a teacher asks students to submit assignments in a game-based learning mobile app. This suggests the role of others, namely the teacher, as an external influence on self-regulating learning.

b) Rehearsing and memorizing

Rehearsing and memorization are individual initiatives of students trying to memorize the material by practicing or studying it repeatedly until the student can remember it or memorize it with friends or self-learning. As shown in Table VIII, students using a game-based learning mobile application that can repeat and memorize achieved an average score of 4.36. The most dominant aspect of practice and memorization in this index is memorizing the material on a self-study basis as Get learning materials with our mobile learning game app. Some students prefer to study material by mobile phone for convenience and convenience.

c) Organizing and transforming

Organizing and transforming is the attempt to rearrange received and rewritten material in a way that is easy to understand. Based on Table VIII, students using a mobile learning game app can sort and convert with an average score of 4.43. This metric is one of the most prominent that emerges to students after using a mobile learning game app, with a prominent aspect being the rearrangement of material obtained from learning-based learning. Mobile learning game with self-regulated learning can be observed from actions that lead to the achievement of learning goals. In addition to periodically rearranging the material obtained from the mobile learning game app, this metric has another dimension of organizational and transformability, the ability to rewrite the material.

d) Self-evaluating

During the learning process, a self-regulated learner can set learning goals. Students strive to monitor, regulate, and control perceptions, behaviors, and motivations to achieve goals. Based on Table VIII shows that students who learn through mobile games have high self-esteem, with an average score of 4.39. The most dominant aspect is assessing the quality or progress of the student's work. The most fundamental aspect of self-regulating learning is goal focus, so assessment is the best way to achieve goals.

e) Self-consequence

Self-consequence is the student's ability to organize and predict rewards or punishments for success or failure encountered in learning activities. Consequences are necessary because they enable students to be more active and motivated to learn and achieve their learning goals. In any case, the reward or pleasure will pay off. Table VIII shows that students who used mobile games had high self-consequence, an average score of 4.39. The most dominant aspect is aggregating and predicting the benefits of mobile learning game. This aspect shows consequences in the form of prizes that students think about. If a student scores well in a mobile learning game app, the student will get added value from the teacher. However, this aspect scores not too high on average because it turns out that this self-restraint brings consequences by imagining rewards or pleasures that will be brought about by oneself and not by others. In this respect, the benefits or rewards that students will receive come from other parties, namely teachers, which means that these benefits or rewards do not come from the students themselves.

f) Seeking social assistance

The ability to ask for help is an individual student's initiative to seek help from friends, teachers or others when learning difficulties may affect the functioning of the learning process. Table VIII shows that students using mobile learning game were able to request help with an average score of 4.32, with the most dominant aspect of ability being the discussion of material and questions obtained from mobile learning game with classmates.

g) Environmental structuring

Structuring the environment is an attempt to adjust the learning environment to make learning easier and more comfortable. Based on Table VIII shows that students who use mobile learning game can organize the environment with an average score of 4.43. The most dominant aspect is the organization and selection of a comfortable environment or location for mobile learning game. Students frequently use apps for mobile learning game while at home.

h) Keeping records and monitoring

Keeping records and monitoring Recording and monitoring is the individual initiative of students attempting to record or

document a learning outcome. Based on Table VIII shows that students who learn through mobile games have good recording and tracking abilities. The average score is 4.42.

i) Seeking information

Seeking Information is also a student's initiative to seek additional necessary or valuable information from social sources while completing assignments. From Table VIII, students using the mobile learning game had an average score of 4.18, with an appropriate category as an indicator or ability for improvement. This is because some students study the material that the teacher has given. Students do not seek additional information from other sources because, according to students in mobile learning game, the material presented is comprehensive, including material in modules and videos.

j) Reviewing records

Reviewing notes is a student's initiative to re-read notes, questions and textbooks in preparation for exams. Based on Table VIII, we can see that students using mobile learning game have an average score of 4.43. Assessment in the learning process is an activity or phase of learning aimed at viewing, assessing, and evaluating the skills and outcomes of the learning process. To achieve maximum results, students are sure to adopt strategies and efforts to achieve those maximum results. Reviewing these notes will help students feel more prepared and confident when mastering the exam. This leads to the idea that optimal results are very likely and that deep learning could achieve the goal of self-regulated learning.

k) Other/help-seeking

A friend, teacher, parent, or someone else initiates help-seeking help. For example, students voluntarily complete assignments to emulate learning methods used by others, following teacher guidance and other examples. Although this strategy is input from others, it is up to the student to decide whether to follow instructions. Table VIII shows that students using mobile learning game asking for help is 4.33. Learning behavior is the most dominant aspect of the help-seeking indicator.

V. Conclusion

This research showed a positive impact of mobile learning games on self-regulated learning. Mobile learning game products were effective in increasing students' self-regulated learning. This was shown by mobile learning games that can encourage students' self-regulated learning from metacognitive, motivational, and behavioral aspects. Using game was challenging, fun, and easy to understand because the mobile learning feature game was equipped with questions, videos, materials, and game learning. Game material and features were played by students repeatedly, and students compete to get high scores in answering questions. Mobile learning games were practical and easy to use anywhere and anytime. The use of mobile learning games was not only used during online learning but can be used as an additional tool in ordinary learning.

Of the 11 indicators of Self-regulated learning, Seeking information gets a good category, and 10 other indicators get a very good category. This is because some students only study the material that has been given by the teacher. Students do not seek additional information from other sources because according to students in the mobile game the material presented is complete, which includes material in modules and videos. Meanwhile, there are three indicators of Self-regulated learning with the highest scores, namely Organizing and transforming, Environmental structuring, Reviewing records.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Alla' Junia Nurdin director of the project, created the questionnaire and did the literature review and parts of the statistical analysis and wrote the final paper. Triana Rejekiningsih worked analysis and conclusion. Sri Sumaryati reviewed and finalized the paper as to the required format. All authors had approved the final version.

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