Development of Android-Based Colloidal Learning Media to Improve Students' Science Literacy in Chemistry Learning

Meydia Afrina[1(✉)], Harry Firman[2], and Muhammad Kristiawan[3]

[1] SMA Negeri 9 Bengkulu Selatan, Jl. Raya Kelutum, Kabupaten, Bengkulu Selatan, Bengkulu 38572, Indonesia
afrinameydia@gmail.com
[2] Seaqis, Jl. Diponegoro 12, Kota Bandung 40115, Indonesia
[3] Universitas Bengkulu, Kota Bengkulu 38371, Indonesia

Abstract. The colloid system, which is taught in class XI, is a subject that is extremely closely related to phenomena that occur in everyday life. For that we need a media that is able to convey information accurately, clearly and pleasantly so that students are taught the content's notion so that they may comprehend the material on the colloid system. Mobile learning developed is an Android-based colloidal learning media that uses smart apps creator software. In this colloidal learning media there are several features, namely competencies, materials, videos, evaluations, libraries and developers that can be accessed with Android. This study aims to determine the characteristics of Android-based mobile learning that was developed, to determine the effect of Android-based mobile learning to student activity, and to determine the effectiveness of Android-based colloidal learning media to improve students' scientific literacy in chemistry learning. This is research and development that follows the development paradigm of analysis, design, development, implementation, and assessment (ADDIE). Data were collected by means of response questionnaires, validation questionnaires, and scientific literacy tests. The data were analyzed with the percentage that met the requirements, qualified categorization, and the N-gain test. Practitioner and student responses were highly qualified with 80.95% and 89.02%, respectively. The result of effectiveness experiment got 0.62 N-gain with medium category. It can be concluded that android-based mobile learning is effective for improving students' scientific literacy on colloidal system material.

Keywords: Android · Learning · Media · Science Literacy · Chemistry · Student

1 Introduction

Colloid is one of the subject matter that is very closely related to phenomena in everyday life. For that we need a media that is able to convey information accurately, clearly and pleasantly so that the concept of the material is conveyed to students. One strategy for making it easier for students to understand colloidal material is media development. The

M. L. Firdaus and A. Defianti (Eds.): MASEIS 2021, ASSEHR 718, pp. 178–185, 2023.
https://doi.org/10.2991/978-2-38476-012-1_24

use of media in the learning process is highly helpful in reaching the desired learning objectives; it also makes it easier for pupils to learn the content not only at school but also at home. Incorporating information and communication technology into the classroom can motivate pupils to maximize their learning potential. In learning, information and communication technology can take the shape of video media, interactive media, virtual laboratories, or others. Therefore, the development of various ICT-based learning aids is rife nowadays [1]. One of the most ideal media to use for learning that is android-based interactive learning media.

Android-based learning media can be accessed at any time and from any location, so students can learn independently so that scientific literacy can be achieved as expected. One of the media that we can use is android mobile technology which has been owned by many students, so that students not only use the android for communication, social media and playing games, but can also be turned into a positive innovation in terms of education to support a learning system that is effective and interactive.

According to the findings of the PISA examination of Indonesian students' scientific literacy abilities, Indonesian students' scientific literacy skills ranked 72 out of 78 participating nations in 2018, which is still concerning [2]. Students' inadequate scientific literacy ability demonstrates that they have trouble applying science to solve a variety of problems that arise in everyday life and necessitate a thorough understanding of science. For this, we require a learning medium that can develop students' conceptual comprehension as well as their scientific literacy skills.

The findings of the Indonesian scientific literacy team show the low quality of Indonesian education in the field of scientific literacy. These difficulties are caused by the boring and monotonous learning atmosphere, the less varied learning methods used and only sticking to the dictates or textbooks. As a result, chemistry lessons that are expected to build people who are capable of logic and understand their environment are not achieved. This is relevant to the results of research by Lubis and Ikhsan [3], Anderson in Chang [4], Hopstein [5] and Holbrook [6] on chemistry learning. According to the findings of their study, students believe that learning chemistry is not popular, irrelevant, and does not improve students' cognitive capacities. Furthermore, there is a learning gap between students' and teachers' expectations. Because teachers are afraid to make changes, neither attitudes nor learning results have changed. Using android-based media is one of the adjustments that may be made to pique students' interest in learning chemistry.

Android-based educational media can be viewed at any time and from any location, so students can learn independently so that scientific literacy can be achieved as expected. One of the media that we can use is android mobile technology which has been owned by many students, so that students not only use mobile for communication, social media and playing games, but can also be used as a learning resource in terms of education to support the learning system at home.

Based on the findings of preliminary observations at SMAN 9 Bengkulu Selatan, because they still stick to modules and textbooks, there are still teachers who employ traditional approaches and lack development of learning media in the classroom. Teachers frequently choose the lecture approach in order to avoid being able to assess how well students comprehend topics. The starting point of learning does not start from the initial

knowledge that students have (prior knowledge), which starts from presenting information, providing illustration examples of questions, practicing questions until finally feeling what is being taught has been understood by students, so this results in low scientific literacy of students.

Mulyani [7] suggests that students must learn scientific literacy in order to comprehend the environment, health, economy, and other issues confronting modern society, which is heavily reliant on technology and scientific advancement and development. As a result, one of the most essential pillars in boosting the quality of human resources is scientific literacy, especially the world of education so that students are expected to have higher competitiveness in being competent in the current era of globalization and modern times.

Suryati [8] suggests that scientific literacy recognizes scientific discourse in the competencies of: 1) describing scientific events (recognizing, providing and evaluating explanations for the field of natural phenomena and technology); 2) Assess and plan scientific investigations (describe and evaluate scientific investigations and propose ways of presenting scientific questions); and 3) interpretation of data and scientific evidence (recognize, provide, and evaluate explanations for the field of natural phenomena and technology) (analysis and evaluation of data, claims and arguments presented in various formats, as well as summaries of relevant scientific findings). The goals of this study are to 1) identify the characteristics of the developed android-based colloidal learning media; 2) assess the efficacy of colloidal learning medium based on Android in boosting students' scientific literacy in chemistry classes; and 3) evaluate the usefulness of android-based colloidal learning media in boosting students' scientific literacy in chemical study.

2 Method

Research and development is the type of research (R&D). Development research is a type of research that is used to conduct research in order to develop new products and then test them [9]. The ADDIE development model is used to conduct research and development for android-based colloidal learning media, which includes the [1] preliminary study analysis stage, [2] development stage through the design stage and development stage, [3] model testing stage through the design stage, implementation, and evaluation stage (Fig. 1).

Twelve students from class XI IPA 1 SMA Negeri 9 Bengkulu Selatan participated in this research. Participants in this development research were one media expert and one material expert teacher. Response and validation questionnaires, as well as scientific literacy tests, were used to collect data. The instruments used to collect the expected data are material and media expert validation sheets, teacher response questionnaires, student interview sheets, questionnaires and pretest and posttest question sheets.

The data analysis technique that used are quantitative and qualitative data analysis. Qualitative data in the form of ideas and responses for improving android-based colloidal learning media, derived from expert validation results, teacher responses, and interviews with android-based mobile learning users, mainly students in the small group test. While quantitative data in the form of scores acquired from questionnaire scores of teacher or peer reactions, learning motivation, and student learning outcomes were

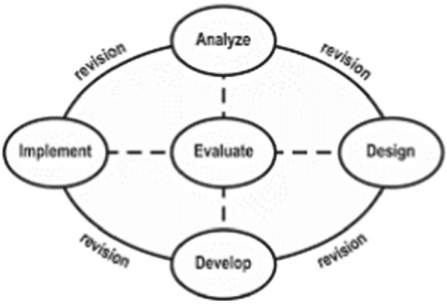

Fig. 1. ADDIE Development Model [10]

Table 1. Classification Based on the Average Teacher Answer Score [11].

No.	Total Answer Score	Classification Assessment Criteria
1	>4.2–5.0	Very Good
2	>3.4–4.2	Good
3	>2.6–3.4	Poor
4	>1,8–2.6	Not Good
5	1.0–1.8	Verry Not Good

studied numerically. The average answer score with reference to the following criteria is also used to determine the classification of media assessment by material experts and media experts (Table 1).

According to Riduwan in Widoyoko [11], the proportion of eligibility percentage is combined with the formula to establish the classification of student responses:

$$\mathrm{K} = \frac{\boldsymbol{F}}{\boldsymbol{N} \times \boldsymbol{I} \times \boldsymbol{R}} \times 100\% \tag{1}$$

Information:
K is the percentage of people who are eligible.
F denotes the total number of responses received.
N is the highest possible score on the questionnaire.
I is the number of questions in the survey
R is the number of people who responded.
With the interpretation of the score as in Table 2.

The N-gain test is used to measure the effectiveness of mobile learning based on Android. The N-gain test was used to measure how much scientific literacy improved after students were educated using a mobile learning android-based system developed by researchers. The N-gain test has the following formula:

$$\mathrm{g} = \frac{\boldsymbol{Spost} - \boldsymbol{Spre}}{\boldsymbol{Smaxs} - \boldsymbol{Spre}} \tag{2}$$

Table 2. Interpretation Criteria Score

No	Percentage	Criterion
1	0%–20%	Very Bad
2	21%–40%	Not Good
3	41%–60%	Poor
4	61%–80%	Good
5	81%–100%	Very Good

Table 3. N-gain Assessment Criteria [12]

Value	Criteria Value
g 0.7	High
0.3 g < 0.7	Medium
g < 0.3	Low

Description: g is *N-gain, Spost* is *post-test score, Spre* is *pre-test score, and Smaks* is *Maximum score question* Result of calculation N-gain are then categorized in the criteria as presented in Table 3.

3 Result and Discussion

The results of this development research are colloidal learning media based on Android that will help students increase their scientific literacy on colloidal material. The goal of developing android-based learning media is to create learning gadgets that are valid, practical, and effective in improving students' scientific literacy. The ADDIE stage that are Analysis, Design, Development, Implementation, and Evaluation process was used to create this android-based instructional media. The purpose of the Implementation phase is to see how effective it is to promote students' scientific literacy by using Android-based colloidal learning media.

3.1 Characteristics of Colloidal Learning Media

This android-based mobile learning development uses smart apps creator software. The main menu contained in this mobile learning is in the form of competencies, materials, videos, evaluations, libraries and developers. The characteristics of the android-based colloidal learning media that result from this development are in the form of colloidal learning media in the Application extension after going through the development stages which is installed and displayed on an android. This mobile learning does not require internet quota to run it. This android-based colloidal learning media has the characteristics of interactive learning media because of hyperlinks to several menus. Here are

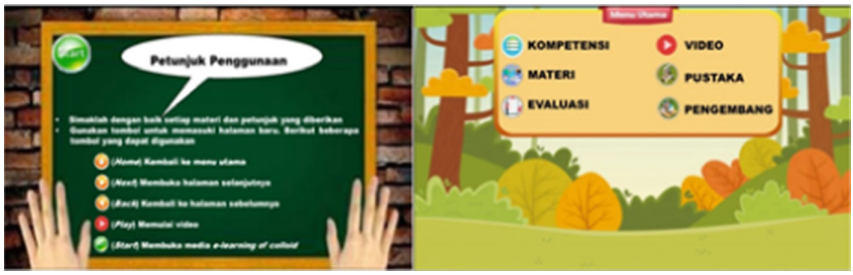

Fig. 2. Draft Media

some writing drafts *mobile learning of colloid* android-based that were developed as presented as seen in Fig. 2.

3.2 The Effect of Android-Based Colloidal Learning Media on the Activeness of Students

Based on the data analysis of the assessment results, the results of the assessment were obtained by material and media expert validators. The practicality of android-based learning media refers to the ease of use of the developed android-based colloidal learning media. Students can use Android-based colloidal learning media resources anywhere, at any time, and on several occasions. According to the study's findings, it was proven that android-based mobile learning had an effect on student activity in studying colloidal system material as indicated by student responses with a percentage of 89.50%.

3.3 The Effectiveness of Android-Based Colloidal Learning Media to Improve Students' Scientific Literacy

The N-gain test was used to analyze data in order to measure the success of android-based mobile learning. N-gain test to see if students' scientific literacy improves after being taught on the colloid system utilizing android-based learning media. Students' initial abilities were tested using pre-test questions in the form of reasoned multiple choice questions with up to 10 items, yielding an average score of 17.52, following which they were given a post evaluation after receiving learning utilizing android-based learning media. -Students received an average score of 69.53 on a test consisting of multiple choice questions with reasons for as many as 10 items. The N-gain test is used to analyze the data from the students' pre- and post-test results (Fig. 3).

Thus, it is said that android-based colloidal learning media to help students become more scientifically literate in colloidal system material can be used to support student learning activities, especially in the current pandemic. Students are given the opportunity to practice developing thinking skills, be scientific, and be able to make a connection between the knowledge possessed and its application in everyday life.

Fig. 3. Graph of Student Learning Outcomes

4 Conclusion

The characteristics of android-based learning of colloid media to improve students' scientific literacy on colloidal system materials using smart application creator software may be concluded based on the results and discussion. This media is in the Application extension, which is installed and displayed in an android. This mobile learning also affects the activeness of students in studying colloid system material which is indicated by the high student response. The effectiveness of the developed media is effective to use, this is based on the average N-gain score in the medium category.

Acknowledgment. Thanks to Seameo Qitep in Science who has funded the research and development of this android-based colloidal learning.

References

1. Khery, Y., Development of Virtual Laboratory on Electrolyte and Non-Electrolyte Solution Materials. Scientific Journal of IKIP Mataram, 3(2), 691–695, (2017).
2. PISA 2018, Draft Science Framework, (2019).
3. Lubis, I.R. & Ikhsan, J., Development of Android-Based Chemistry Learning Media to Improve Learning Motivation and Cognitive Achievement of High School Students. Journal of Science Education Innovation, Vol., No. 2, 191–201, (2015).
4. Chang, R., Basic Chemistry: Core Concepts (Volume 1, Edition 3), Transl. Moh. Abdulkadir. Jakarta: Erlangga, (2005).
5. Hofstein, A., Eilks, I. & Bybee, R., Societal Issues and Their Importance for Contemporary Science Education: A Pedagogical Justification and the State Of The Art in Israel, Germany and the USA. International Journal of Science and Mathematics Education, 9(6), 1438–1459, (2011).
6. Holbrook, J., Making Chemistry Teaching Relevant. Chemical Education International, 6(1), 1–12, (2005).
7. Mulyani, H.R.A., The Effect of Application of Contextual Learning on Increasing Mastery of Chemical Concepts in Daily Life and Critical Thinking Skills for Class VIII Students of SMP Negeri 4 Metro. Journal of Bioeducation, Vol. 4 No. 2. 114–121, (2013).
8. Suryati, Literature Review on Scientific Literacy. Proceedings of the 2016 National Seminar on Science and Mathematics Education Study Center "Assessment of Higher Order Thinking Skills", pp. 451–455, (2016).
9. Sugiyono, Quantitative, Qualitative and R&D Research Methods. Bandung: Alphabeta, (2010).

10. Asyhar, R. Creative Developing Learning Media. Jakarta: Reference, (2012).
11. Widyoko, E.P., Research Instruments Preparation Techniques. Yogyakarta: Learning Library, (2012).
12. Fitriah, E., Implementation of the Modified Free Inquiry Model in Invertebrate Zoology Learning to Grow Creative Characters and Scientific Work Skills for Biology Teacher Candidates. E-journal of IAIN Syeh Nurjati Cirebon, Holistic Vol. 1 Edition 2, (2016).