Edubiotik: Jurnal Pendidikan, Biologi dan Terapan
ISSN 2528-679X (print), ISSN 2597-9833 (online)
Vol. 8, No. 02, September 2023, pp. 118 – 128

Available online at:
http://ejurnal.budiutomomalang.ac.id/index.php/edubiotik

Research Article

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Development of android media in invertebrate learning

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Article Information
Submitted: 2023-02-28
Accepted: 2023-12-15
Published: 2023-12-31

ABSTRACT

The development of android media for invertebrate material in biology lessons has not been carried out and needs to be optimized. The research aims to develop android media for invertebrate learning. This type of research is research and development using the Plomp and Nieveen development model, which is limited to the prototyping phase, and formative evaluation based on Tessmer which consists of self-evaluation, expert opinion, individual testing, small group testing, and field testing. The research subjects consisted of 3 experts and 30 students who had programmed the Invertebrates course for individual tests, small group tests, and field tests. The research instruments include validation sheets and essay-based tests. The acquired data was subjected to descriptive analysis. The validation of Android media shows that the media is suitable for use with an average of 72, practicality testing shows the ease of the learning process with an average of 94, effectiveness testing before using Android media is 32 and after using Android media is 87. The conclusion is that the Android media developed is valid, practical, and effective and can be used for the learning process. Furthermore, tests can be carried out on a wider scale to obtain more homogeneous data.

Keywords: Android; development, invertebrate

Publisher
Biology Education Department
IKIP Budi Utomo, Malang, Indonesia

How to Cite
Nugroho, B. A., Soendjoto, M. A., & Zaini, M. (2023). Development of android media in invertebrate learning. *Edubiotik : Jurnal Pendidikan, Biologi Dan Terapan, 8*(02), 118-128. https://doi.org/10.33503/ebio.v8i02.2698

INTRODUCTION

Advances in technology in the digital era are something that cannot be denied, one of which is the world of education. Technology promises potential in one's learning, and obtaining information (Deadara et al., 2017). Learning media innovations are currently required to be more creative and able to adapt to developments in science and technology (Surahman & Surjono, 2017). Learning media has a contribution in the form of delivering material that is more controlled, more interesting, and

interactive, time can be shortened, but quality can be improved.

The choice of instructional media is a crucial issue in the disciplines of education (Lee et al., 2022). One of the media which may be created to improve how students learn is mobile learning. M-learning is characterized by students' accessibility to learning resources using mobile devices at any time and in any location (Kankam, 2020). The results showed that the learning efficacy of the mobile learning (M-learning) app and students' motivation and autonomous learning as well as the simplicity and convenience of using the mobile app were positively correlated (Wang et al., 2019).

Information and communication technology (ICT) use has increased significantly over the past few years across several industries, and education is no exception (Ojeda et al., 2020). The Information and Communication Technologies (ICT) learning process must be able to be placed as an initial plan that is used as enrichment, or as remedial material, this is important because it will adapt to the content being created. Mobile learning's role in the education process, particularly in biology education study programs, can make it easier because every lecturer and student has a smartphone running the Android operating system. Mobile learning is placed as a supplement in this study, and students who use it undoubtedly have additional knowledge or insight. Android is a program used on smartphones to make using applications simpler (Purwantoro et al., 2013).

Android is usable as an alternative due to its flexibility and ability to be used anytime and anyplace when learning, alternative learning supplements can give children the chance to learn independently. Mobile learning is used in the learning process and has a very good impact, Biology mobile learning on Android is effective at improving learning (Wang et al., 2019). The growth of science during the 21st century is accelerating and requires students to be able to improvise by developing skills and knowledge (Chaka & Govender, 2020). There are so many skills that students must have, one of which is critical thinking skills. Today, the importance of critical thinking abilities in society and curricula is emphasized (Nygren et al., 2019).

The goal of education must be to support the growth of critical thinking skills (Turkmen & Sertkahya, 2015). Hence, critical thinking might be regarded as a reaction to novelty or, alternatively, surprise (Wang et al., 2019). One of the things that influences success is the ability to think critically and the effectiveness of developing learning tools (Zaini, 2019). The low critical thinking skills of students because learning in class generally only trains verbal thinking processes. Students lack critical thinking skills because classroom learning generally only trains verbal thinking processes, without student involvement. This research focuses on implementing learning that involves students using learning media, especially Android. The goal to be achieved is to improve students' cognitive skills, not just verbal abilities. The core principle of the intended learning outcomes concept is that teaching must be designed according to the competencies students are expected to obtain, not according to the subject matter the teacher wants to teach (Erikson & Erikson, 2019).

Halpern (2013) Knowledge, cognitive abilities, and affective traits all go into critical thinking. Apart from that, critical thinking must be conveyed to other people to be useful, especially when being evaluated (Kleemola et al., 2022). Critical thinking skills can change student learning patterns from initially conceptual to contextual (Mahmuzah, 2015; Noprianda et al., 2016). The basis of this research is to use critical thinking, environmental learning patterns also affect students' motivation and way of thinking. Invertebrates are one of the subjects in biology education, this course discusses the sub-concept of gastropods. The learning process is carried out by delivering theory accompanied by practicum.

Looking at several studies that have been carried out, there is a gap, in that the learning media

used is not yet digital, in this case Android, and many of the media developed are still conventional, such as print media. The use of models in this research tries to be different from other research for time efficiency. The research location is also a point in this research because very few people have researched it and the object in this research is gastropods, and no one has researched it at that location. The instrument used is a questionnaire to measure the level of validity, practicality, and effectiveness of each stage. Therefore, this research aims to develop Android-based learning media that focuses on gastropod material.

RESEARCH METHODS

To analyze how the impact of developing learning media is made, this research uses research and development (research development). With a development research theory approach, we want to analyze how the impact of media is made to improve students' critical thinking skills. The qualitative method provides an interpretation of the data on how students develop after using the media. This research was conducted for 3 months at Lambung Mangkurat University. The research flow is in Figure 1 below.

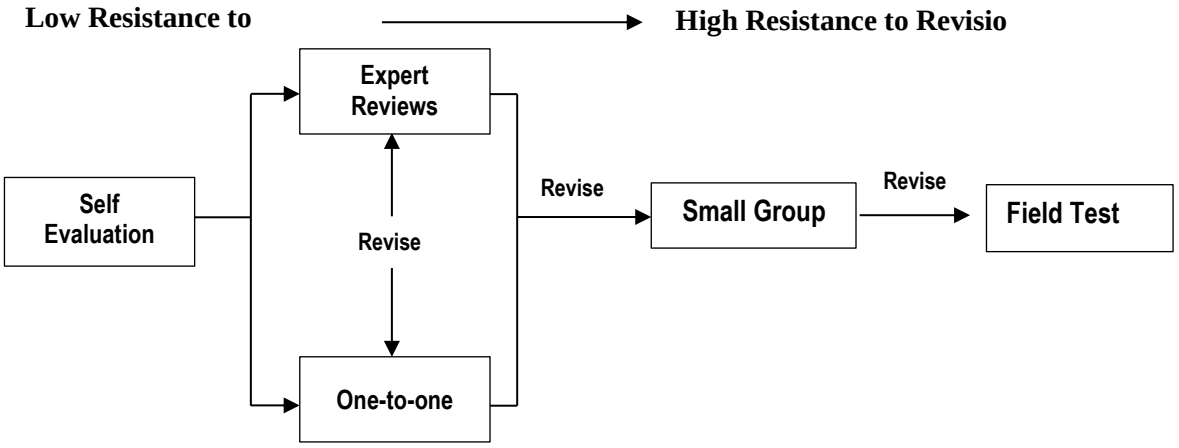

Figure 1. Formative evaluation design flow

Thirty students took the essay-based test employed in this study. The creation of the questions takes the pupils' capacity for critical thought into account. The identical format of the questions is used both before and after the use of media. The acquired data was subjected to descriptive analysis. The total subjects in this study were 35 participants when the expert validation test was carried out with 3 expert lecturers who focused on material, discussion and media. The one-to-one test to see the readability of the media involved 5 students with the condition that they had taken invertebrate courses with a minimum grade of B. The next test that was carried out after making revisions based on the input results was the small group test whose aim was to see the skills of students. the small group test involved 7 students with the condition that they had taken invertebrate courses with a minimum grade of B. The last test carried out was in the form of a Field Test involving 25 students.

Retrieval of data using a questionnaire filled out by all respondents involved in each stage. Expert reviews use language, material, and media validation instruments, one-to-one tests use readability questionnaires, and the small group test uses practical instruments. The test results were analyzed descriptively according to the categories that had been determined according to each stage of the

research. The following formula is used to calculate and descriptively examine the outcome data for each validator. The criteria shown in Table 1 match the proportion of known validity outcomes.

$$Pi = \frac{Xi}{Yi}\ x\ 100$$

Information:
P: Percentage of assessment
Xi: Total number of validators' validation scores
Yi: The highest possible anticipated score

Table 1: Standards of Validity

Range of Values	Declaration of Validity	Details
80.1 < PV ≤ 100	Very valid	No need for revision
60.1 < PV ≤ 80	Valid	Minor Revisions
40.1 < PV ≤ 60	Fairly valid	Minor Revisions
20.1 < PV ≤ 40	Not valid	Major revision
0 < PV ≤ 20	invalid	Total Revision

Data on practicality is descriptively examined using the following formula and standards in Table 2.

$$X = \frac{\Sigma X}{n}$$

Information:
X: Average score
∑X : Total score
n : Number of aspects

Table 2. Practical Value Range

Range of Values	Statement/ Level of practicality
80.01 < PK ≤ 100	Very practical
60.01 < PK ≤ 80.00	Practical
40.01 < PK ≤ 60.00	Less practical
20.01 < PK ≤ 40.00	Not practical

Descriptive analysis was used to analyze the effectiveness data (Table 3). The normalized Gain value formula (N-Gain or g) is used to determine the four markers of improving students' critical thinking skills such as: interpretation, assumptions, deduction, and inference.

$$g = \frac{\text{S postest} - \text{S pretest}}{\text{S maksimum} - \text{S pretest}}$$

Information:
g : gain value
S postest : Critical Thinking Skills Score After
S pretest : Critical Thinking Skills Score Before

Table 3. N-gain classification

Nilai g	Details
G > 0.7	Tall
0.7 > g > 0.3	Currently
g≤ 0.3	Low

FINDING AND DISCUSSION

Three experts evaluated the learning media's content, presentation, and language because of their validation work. Complete data is presented in Figure 2.

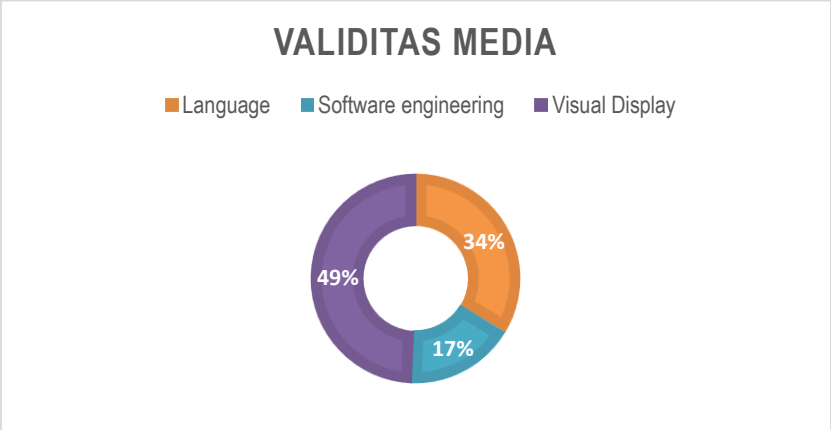

Figure 2. Results of Validation Research

This media satisfies the presentational, linguistic, and content feasibility requirements. Thus, theoretically learning media can be used well in learning. Rahman et al. (2017) explained that linguistic aspects are a combination of one discourse structure and another. In line with Wilson and Bolliger, (2013), in theory, mobile learning attempts to make it simpler for students to learn whenever they want, wherever they are. The researchers explain this finding by pointing out that students in the twenty-first century are extremely enthusiastic about technology, own cell phones, and frequently use mobile applications in various spheres of life in general and the classroom in particular (Saleh & Jalambo, 2022). Since mobile technology has advanced, learning on the go is becoming a rapidly expanding trend in educational settings (Han & Shin, 2016).

An interesting finding in this study, especially in the validation, is the high yield of the visual display. This is important because good media must show attractive data for students, in this case as users. Other research shows that interactive displays will attract students during the learning process (Panjaitan et al., 2020). Learning media is useful for helping convey material, besides that, it can facilitate understanding of the material (Kusmayadi et al., 2017). Because of this, it's crucial for M-learning developers to create applications with strong interaction patterns, a user-friendly interface, and appealing visuals (Chaka & Govender, 2020).

The display of images on the Android media is also made as real as possible so that students will be helped when using it later. Students will be happier and more engaged in learning activities if they select high-quality images (Surahman & Surjono, 2017). Apart from that, with attractive visuals, students will easily understand abstract material, this is reinforced by Nurbaiti et al. (2017) with visualization, the material can be easier for students to understand. Bradley et al., (2023) According to interviews with educators who use the internet to prepare their students for learning, using the internet is very beneficial since it will be simpler for educators to handle, especially when learning to hunt for supplemental information and visuals to assist learning material. It contains practical features like social networking, mobile search, and image capture with cameras (Kankam, 2020).

No less significant is the application's menu, which will facilitate students' utilization of learning media. It's important to pay attention to where text and animation are placed on each page (Anggraeni & Kustijono, 2013). What is no less important is the placement of components and harmonious so that the

media becomes more beautiful. Supported by the application of shapes, colours, characters, text, images, animations, and backgrounds can form a harmonious and attractive presentation to look at (Bradley et al., 2023). The results of the validity indicate that the developed media is feasible based on the assessment of experts. In line with Putra (2021) this shows that the media according to the material-based criteria is appropriate, and systematically arranged. Other research conducted by (Branchais & Achmadi, 2019; Nurbaiti et al., 2017; Putra, 2021; Sari et al., 2017).

The usefulness of learning media can be broken down into two categories: that of expectations based on the results of the small group test, and that of actual usefulness based on the findings of the field test. Figure 3 presents the practicality research results.

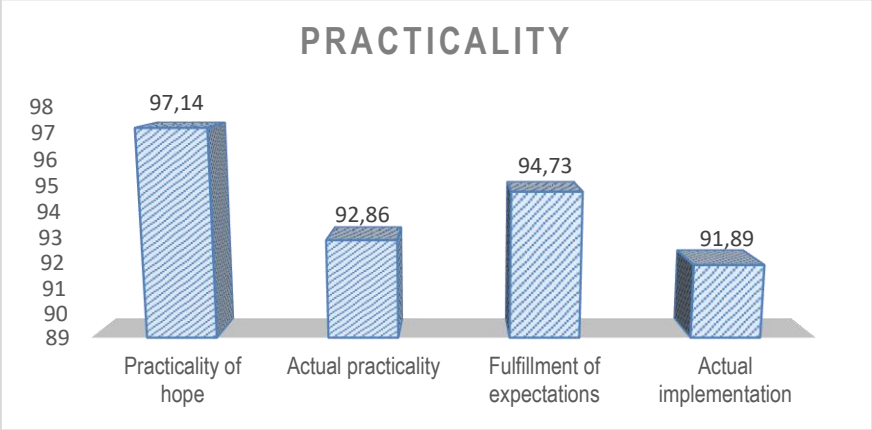

Figure 3. Practicality research results

The practicality of the learning media seen from the implementation observed by the observer and the practicality of the content assessed by students is practical, based on this it means that the ongoing learning process has been accepted by students. This is supported by Bradley et al. (2023) stating that the media can influence the concept of learning Biology so that students are more motivated to learn. Putra (2021) explain if a piece of learning media is simple and helpful for students to utilize, it is considered practical. To put it another way, the developed media is useful.

Media is said to be practical if the teacher and students consider the learning device easy to use in the field (the material can be understood) and according to the researcher's design plan Chaka & Govender (2020). An interesting finding in this study was that there was a decrease in actual practicality and implementation, this was thought to have occurred due to the difference in the number of students taking the test. The scores of the students who were the subjects of this study supported the differences in the scores obtained. That media can be used to accelerate learning material (Astuti et al., 2017).

In addition, another view, Jusniar et al. (2014) and Pramita (2016), if a piece of learning media is simple and helpful for students to utilize, it is considered practical. To put it another way, the developed media is useful. The advantage of developed media is in disrupting the limitations of space and time, this is also what Purnama et al. (2017) stated states that the practical benefits of learning media can overcome the limitations of the senses, time, and space.

Information about the effectiveness of learning medium in the form of expectations effectiveness was gleaned from the small group test results and actual effectiveness was gleaned from the Field Test findings. Based on the data collected from the evaluation of student worksheets before and after learning media were provided, students' critical thinking skills learning outcomes were summarized, the findings from the small group test on students' critical thinking abilities are depicted in Figure 4.

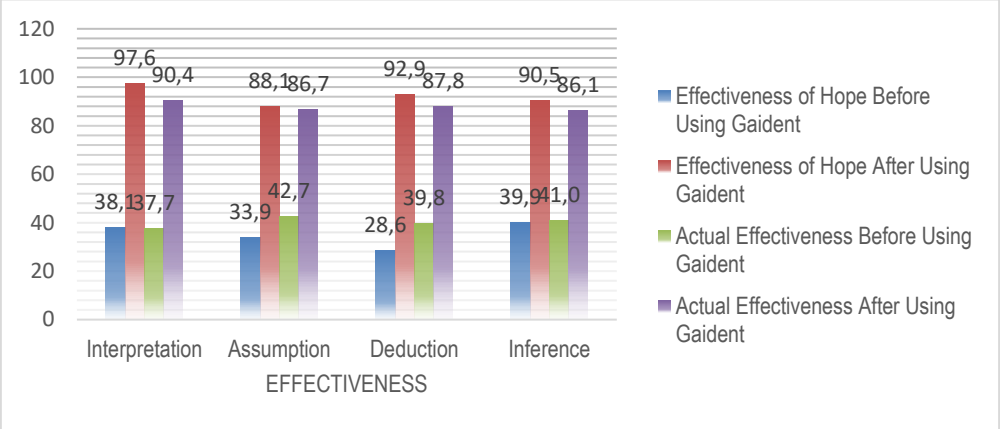

Figure 4. Results of effectiveness research

Results have increased, according to both expected and actual data on practicality. This demonstrates how learning media can enhance students' capacity for critical thought. Like research Firmansyah & Ambarwati (2018) and Fransisca (2017), the effectiveness of E-Learning Media is stated to be effective in improving student learning outcomes in terms of achievement indicators of student learning outcomes. Before and after giving out learning materials, students' critical thinking abilities were evaluated by having them complete worksheets and respond to assessment questions.

The interpretation skills that students use when working on LKM can be seen when reading the discourse in the LKM. Students can study a problem from discourse and then be able to formulate the problem correctly. Android media here helps in the process of searching for material and phenomena because the media already provides material. Active discussion can improve critical thinking skills such as interpretation (Halpern, 2013). Interpretation can collect and organize information and be able to test conclusions drawn based on the information that has been collected (Fisher, 2014).

Judging from the students' interpretation skills before using them, they are constrained when working on interpretation skills because there is no media used. After using the learning media, the effectiveness of the expectation has changed, this shows that this learning media has an impact on students' interpretation skills. This is reinforced by Fransisca (2017), android media has succeeded in increasing student learning outcomes. Agree with May et al. (2022), who explain that critical thinking skills can be started from interpretation by using the thoughts or knowledge you must understand a problem.

Because they are taught to express their perspectives on the interpretations produced during the learning process, pupils receive great marks for their assumption skills. Reinforced by Halpern (2013) critical thinking skills are skills in drawing conclusions, assumptions, deductions, interpreting information, and analyzing arguments. Improving abilities in assuming a high score because students are trained to express their opinions on the interpretations produced during the learning process. Students can engage in active learning (Muyaroah & Fajartia, 2017).

Learning that is arranged in group work effectively increases learning motivation and encourages students to discuss every assumption they have (Ojeda et al., 2020). Students' ability to evaluate given or provisional assumptions through their use of assumption skills. To obtain an answer, this assumption must be demonstrated through the process. Unfortunately, some pupils are still unable to accomplish it, making it impossible for them to know if the presumptions made are genuine or untrue. This is not in accordance with Fisher (2014) It claims that being able to recognize and assess assumptions is one of the tasks that demonstrates critical thinking abilities.

Because they use the created Android media to examine their observation data during the learning process, students can improve their deduction skills. This is supported by Sari et al. (2017), the most effective method for honing critical thinking abilities is the deductive hypothesis cycle. This is supported by Dewy et al. (2016) To make learning activities easier for students to understand and give them actual experiences, it is preferable to employ teaching media.

Because the student must identify concepts that are appropriate for the problem to be solved, a student's deductive analysis of a problem promotes greater conceptual knowledge. Students must therefore use critical thinking. Other studies that like interactive media such as applications influence learning outcomes, Khuzaini and Sulistyo (2020) claim that the created Android-based learning media satisfies successful aspects based on the results of the evaluation test (Handoyono & Mahmud, 2020) the findings indicate that using Android mobile learning can speed up learning.

CONCLUSION

The research results can be concluded that the learning media is valid with an average value of 72, practical with an average value of 94, and effective before using Android media is 87. This illustrates that the development of learning media can now be used on a large scale. Further research can be carried out to test on a larger scale from several universities to obtain more homogeneous data. Apart from that, it is necessary to add species to the Android media being developed.

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