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DEVELOPMENT OF INTERACTIVE MULTIMEDIA ON NUMBER THEORY BASED ON METACOGNITIVE SKILLS

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Abstract

This research develops interactive multimedia based on metacognitive skills with the Lectora Inspire application. The multimedia presented is in the form of material, videos and quizzes that support the number theory course. This multimedia is also equipped with instructions and directions to improve metacognitive abilities in the form of planning, monitoring and evaluating at each stage of the learning process. The development model used in this research is DDD-E. The validity of interactive multimedia was carried out by 3 media experts and 3 material experts. The practicality test was carried out by 3 Tadris Mathematics lecturers and 30 Tadris Mathematics students at UIN Raden Mas Said Surakarta. The results of interactive multimedia validation by material experts were 3.66 (very good) and the results of interactive multimedia validation by media experts were 3.75 (good). The results of the usage test by Tadris Mathematics lecturers produced a score of 3.69 (very good) and by Tadris Mathematics students 3.58 (very good). This shows that the interactive multimedia developed is suitable for use.

Keywords: metacognitive abilities, interactive multimedia, multimedia development

Abstrak

Penelitian ini mengembangan multimedia interaktif berbasis keterampilan metakognitif dengan aplikasi *lectora inspire.* Multimedia yang disajikan berupa materi, video, dan kuis yang menunjang mata kuliah teori bilangan. Multimedia ini juga dilengkapi dengan petunjuk dan arahan untuk meningkatkan kemampuan metakognitif yang berupa *planning*, *monitoring*, dan *evaluating* pada setiap tahapan proses pembelajaran. Model pengembangan yang digunakan dalam penelitian ini adalah DDD-E. Validitas multimedia interaktif dilakukan oleh 3 orang ahli media dan 3 orang ahli materi. Uji kepraktisan dilakukan oleh 3 orang dosen tadris matematika dan 30 mahasiswa tadris matematika UIN Raden Mas Said Surakarta. Hasil validasi multimedia interaktif oleh ahli materi sebesar 3,66 (sangat baik) dan hasil validasi multimedia interaktif oleh ahli media sebesar 3,75 (baik). Hasil uji pemakaian oleh dosen tadris matematika menghasilkan skor 3,69 (sangat baik) dan oleh mahasiswa tadris matematika sebesar 3,58 (sangat baik). Hal tersebut menunjukkan bahwa multimedia interaktif yang dikembangkan layak digunakan.

Kata kunci: kemampuan metakognitif, multimedia interaktif, pengembangan multimedia

INTRODUCTION

Students are expected to have high-level thinking skills such as critical thinking, problem solving, metacognitive thinking, and others (Kozikoglu, 2019). One of the high-level thinking skills that students must have is metacognitive skills. Metacognitive skills are a crucial issue in today's education world (Pratama et al., 2019). Metacognition is defined by several experts in various ways. Metacognition is defined as students' concern and ability to monitor and organize their own cognition and cognitive processes (Kozikoglu, 2019). In ensuring that learning is achieved at a certain level, it is important for students to develop their metacognitive skills to control their own learning process. Metacognition plays an

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important role in improving the quality of student learning outcomes, because metacognition in the learning process becomes a controller and monitor of students' way of thinking (Tsai et al., 2018). These metacognitive skills are related to problem-solving skills based on experiments (Yusuf & Widyaningsih, 2020). In other words, metacognition can be used to monitor and organize cognitive processes such as understanding, asking, solving and analyzing problems. Therefore, it can be said that metacognition plays an important role in the learning process.

A good learning process cannot be separated from several factors that can produce holistic changes in cognitive, affective, and psychomotor aspects. One of the factors that influences the success of the learning process is the learning media used. Learning media is very much needed by students to facilitate the learning process (Rahmatika et al., 2021). Media can also make the learning process interesting and clear (Hanifah & Budiman, 2019; Putra & Sujana, 2020). Learning media can also attract students' attention during the learning process, making learning more meaningful (Prayitno & Mardianto, 2020; Rosmiati & Lestari, 2021). Students do not get bored easily and are motivated to learn. Learning media also has a positive influence on student learning outcomes and can increase learning activities and interest in learning (Qumillaila et al., 2017).

Often learning resources and media are used in the form of textbooks and Power Point slides that contain textual descriptions and core materials (Septiani & Rejekiningsih, 2020). Meanwhile, the industrial revolution 4.0 where the characteristics of the development of information technology depend on the integration of information and communication technology (ICT) in education (Shahroom & Hussin, 2018). Mastery of technology in education is shown in improving the quality of education and teaching (Al-Rabaani, 2018). One of the developments of ICT in the world of education is in the form of the development of ICT-based learning media (Syawaludin & Rintayati, 2019). One of the ICT learning media that can be used as learning resources and media is multimedia (Septiani & Rejekiningsih, 2020).

Multimedia is a form of development of science and technology that can support teaching and learning activities, can be in the form of text, images, graphics, sound, video animation combined into one product (Sandy & Murtiyasa, 2019). In its application, multimedia is a media that involves many of the senses of students and requires students to

be able to communicate interactively through computers (Saputri et al., 2018). The presence of multimedia in learning can improve the quality of education, especially in mathematics learning. The use of multimedia in mathematics learning activities can create motivation and interest in learning independently for students and achieve learning goals (Sandy & Murtiyasa, 2019). Many multimedia have been developed so far, one of which is interactive multimedia.

In Indonesia, interactive multimedia is created for mathematics, physics, biology, chemistry, and engineering subjects. Interactive multimedia is a computer-based learning media that is integrated with various elements such as text, images, photos, audio, music, narration, video, animation in one learning application product (Komalasari, 2019; Terentyeva et al., 2019). The use of elements depends on the needs and materials to be developed. The second principle of interactive multimedia learning is direction and interaction. Interactive multimedia must contain interactions between users and media, including directions that facilitate users to directly operate learning directions and can provide feedback to users (Septiani & Rejekiningsih, 2020).

Based on the results of observations conducted on students of the Mathematics Education Study Program at UIN Raden Mas Said Surakarta, students' problem-solving abilities still need to be improved. This can be seen from the students' study result cards which still rarely get an "A" in mathematics expertise courses. Research (Muchtar & Nasrah, 2021) states that elementary school students' critical thinking skills can be improved using interactive multimedia based on I-Spring Presenter. Research (Safarati & Zuhra, 2021) states that high school students' critical thinking skills can be improved using the quantum teaching learning model assisted by interactive multimedia. Research (Wahyuni & Yolanda, 2021) states that the use of interactive multimedia-assisted teaching materials has an effect on mathematical communication skills in educational statistics courses on students' mathematical communication skills. There has not been much research on the development of interactive multimedia to improve students' metacognitive skills, especially in the Mathematics Education study program. Therefore, researchers are interested in developing interactive multimedia to improve the metacognitive skills of students of the Mathematics Education Study Program at UIN Raden Mas Said Surakarta. The purpose of this study was to

determine the development of interactive multimedia to improve valid metacognitive skills of students of the Mathematics Education Study Program at UIN Raden Mas Said Surakarta.

METHODS

This study uses the DDD-E model development method which includes four stages, namely the decide, design, develop, and evaluate stages. The development of this interactive multimedia is in the form of an application that can be operated via a PC or laptop. The assessment of the initial multimedia development results was carried out by several experts in their fields. A total of three IT or Learning Media experts evaluated the technological aspects in the use of multimedia. Then to validate the content of the material in the multimedia was carried out by Mathematics Education experts. The trial use was carried out on a limited basis with 13 student participants and 3 lecturers of mathematics education at UIN Raden Maden Mas Said Surakarta.

The data collection instruments are in the form of interview guidelines in the preliminary study, expert validation sheets, user responses, and documentation guidelines. The expert validation sheet and user response instruments are in the form of a questionnaire where the questionnaire contains 4 alternative answer choices, namely very good, good, sufficient, and lacking. The type of questionnaire is in the form of a checklist in the form of a list of assessment or validation items, where experts and users can give a mark (check list) in the appropriate column. The score given to each answer choice contained in the questionnaire is adjusted to the following criteria. Score 4 for the alternative answer strongly agree, score 3 for the alternative answer agree, score 2 for the alternative answer less agree, and score 1 for the alternative answer disagree.

The results of validation by experts and the results of the user trial stage evaluation were analyzed descriptively qualitatively using a rating scale (Likert scale) according to the criteria of Table 1. The values obtained were then converted into four-scale data according to Table 2 below. This interactive multimedia is said to be feasible if it gets a minimum average rating of good.

Table 1. Expert and User Assessment Data Criteria

Interval	Criteria	Information
3,26 < score 4,00	Very good	Valid without revision
2,51 < score 3,25	Good	Valid with revision
1,76 < score 2,50	Not good	Less valid
1,00 < score 1,75	Very not good	Very less valid

RESULTS AND DISCUSSION

Interactive multimedia development using the Lectora Inspire 17 application. The product of this development research is a computer program in the form of interactive multimedia that can be stored on a CD or flashdisk or PC and can be run offline. This multimedia contains materials, lecturer explanation videos via YouTube links, and practice questions developed for learning media in number theory courses. The development of this multimedia refers to metacognitive stages which include planning, monitoring, and evaluating. The development process in this study begins with determining the objectives and learning materials that will be poured into interactive multimedia based on the results of interviews in the preliminary study stage. The next step is to design interactive multimedia by creating a flowchart or storyboard. Then develop multimedia by combining text, images, sound and video to become a complete multimedia display.

The results of the development of interactive multimedia in the early stages were validated by media expert validators and material experts. The material expert validator is a mathematics education expert who assesses aspects of content feasibility, material presentation, and metacognitive skills aspects in interactive multimedia. The media expert validator is an IT expert whose assessment includes graphic aspects and aspects of interactive multimedia feasibility. The results of interactive multimedia validation by material experts were 3.66 (very good) and the results of interactive multimedia validation by media experts were 3.75 (good). The results of expert validation indicate that the media product is feasible to continue in a limited trial with several improvements according to the results of expert validation.

Limited trials were conducted by testing interactive multimedia on 13 students of the Mathematics Education Study Program, UIN Raden Mas Said Surakarta. The results of the trial showed an average of 3.38 to 4, which means that interactive multimedia is very practical for students to use for number theory courses. However, there is one assessment item that shows that interactive multimedia is practical for students to use, namely assessment item number 4. This can also be seen from the total average obtained 44 values 3.58, which means that interactive multimedia is very practical for students to use for number theory courses.

The usage trial was conducted by testing interactive multimedia on three lecturers of the Mathematics Education Study Program, UIN Raden Mas Said Surakarta. Of the 13 assessment items in the usage test, the average was 3.33 to 4, which means that interactive multimedia is very practical to use by lecturers for number theory courses. However, there is one assessment item that shows that interactive multimedia is practical to use by lecturers, namely assessment item number 5. This can also be seen from the total average value obtained of 3.69, which means that interactive multimedia is very practical to use by lecturers for number theory courses. This interactive multimedia emphasizes the active involvement of students in learning. Interactive multimedia designed as a learning aid can help students understand concepts more easily, practice problem solving, and activate students during the teaching and learning process because there is interaction between students and learning media.

Based on comments on the questionnaire responses of lecturers and students, the final results of interactive multimedia to improve the metacognitive skills of students of the Mathematics Education Study Program, UIN Raden Mas Said Surakarta are:

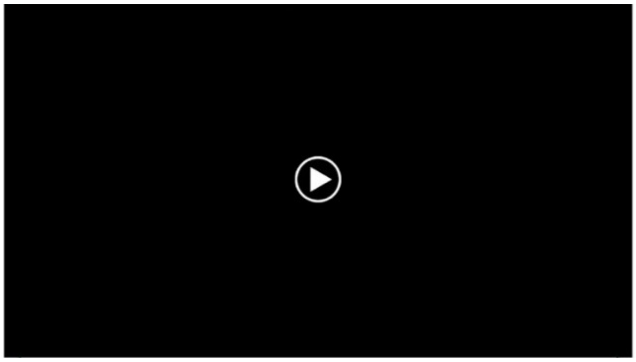

Figure 1. Intro

Figure 2. Login Page

Figure 3. Introduction

Figure 4. Introduction for Use

Figure 5. Menu

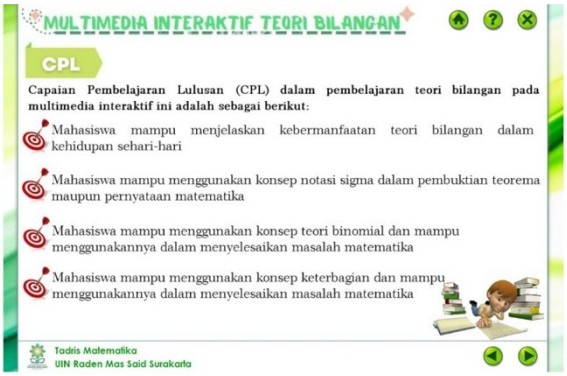

Figure 6. Learning Outcomes

Figure 7. Aspects of Metacognitive Skills in Planning

Figure 8. Aspects of Metacognitive Skills in Monitoring

Figure 9. Aspects of Metacognitive Skills in Evaluating

Figure 10. Material

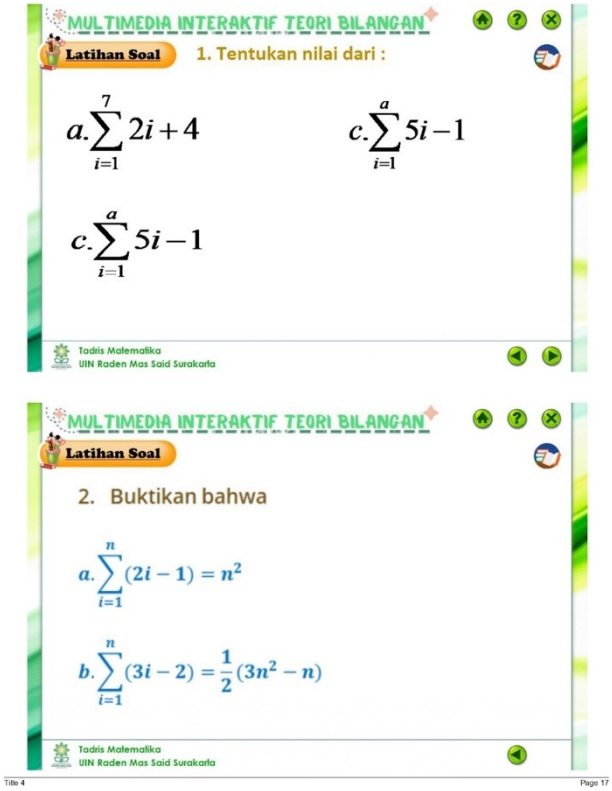

Figure 11. Exercises

Figure 12. Profile

Figure 13. References

CONCLUSION

The development of interactive multimedia to improve metacognitive skills of students of the Mathematics Education Study Program, UIN Raden Mas Said Surakarta is valid for use with an average aspect of the feasibility of the content of the material of 3.59 or a percentage of 89.75%, the aspect of the feasibility of the presentation of the material of 3.79 or a percentage of 94.75%, the aspect of metacognitive skills of the material of 3.6 or a percentage of 90%, the aspect of the feasibility of graphics in the media of 3.75 or a percentage of 93.75% and the aspect of the feasibility of language in the media of 3.75 or a percentage of 93.75%. Interactive multimedia to improve metacognitive skills of students of the Mathematics Education Study Program, UIN Raden Mas Said Surakarta is practical for use with an average assessment item by students of 3.58 or a percentage of 89.5% and an average assessment item by lecturers of 3.69 or a percentage of 92.25%.

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