Development of Appy Pie Learning Media
Based on Metacognitive Approach
for Mathematical Reflective Thinking Ability in Geometry

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Abstract: This research aims to produce appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are appropriate for use in geometry. Feasibility of learning media in terms of validity, practicality, and effectiveness. The research method used is the Research and Development (R & D) method with ADDIE Model, namely Analysis – Design – Development – Implementation – Evaluation. In the implementation stage, on media trial step, the One-Shot Case Study type pre-experiment design research method was used. Based on the results of validation, the learning media is categorized very well with a validity percentage of 85.66%. Based on the results of the student response questionnaire, the learning media is categorized well with a practicality percentage of 84.12%. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%. Thus, appy pie learning media based on a metacognitive approach to mathematical reflective thinking skills is declared feasible on geometry.

Keywords: learning media, appy pie, metacognitive approach, mathematical reflective ability, geometry

Introduction

Implementation In the current era of digital development, lectures are not the only face to face, but can also be done online. With this online learning needs to be developed learning materials that can also be brought by students everywhere or can also be called mobile learning. Android-based learning media is one solution. Appy Pie learning media can be one of the learning tools of students in lectures because it is enough just to install Appy Pie media that has been developed according to the subjects in their respective mobile phones, students can already learn the material wherever and whenever. Appy Pie is a program that allows people to create and monetize apps. The app was later given support for more kinds of applications, including image sharing, event platform, and social networking.

Geometry is one of the compulsory subjects for mathematics education students. The geometry covered includes the geometry of fields and the geometry of space. Geometry learning at the lecture level is also constrained by the assumption of students that geometric material is abstract. For example, in the geometry of space in determining the angle between fields in space, the distance between fields in space, or in determining the area or volume in a space like a cone is constructed. Students have imagined the representation of the problems raised so that they are also confused in determining the solution. Even though today, there are many learning materials, applications, software or virtual manipulatives that can be accessed by students on the web. For this reason, it is necessary to have media as a learning tool for students who can minimize the difficulties of students in geometry material, especially space geometry.

When planning approaches to teaching and learning geometry, it is important to ensure that the provision in the early years of secondary school encourages students to develop an enthusiasm for the subject by providing opportunities to investigate spatial ideas and solve real life problems. There is also a need to ensure that there is a good understanding of the basic concepts and language of geometry in order to provide foundations for future work and to enable students to consider geometrical problems and communicate ideas. Students should be encouraged to use descriptions, demonstrations and justifications in order to develop the reasoning skills and confidence needed to underpin the development of an ability to follow and construct geometrical proofs (Jones, 2002).

In addition, in geometry learning, mathematical reflective thinking skills need to be developed. The ability of mathematical reflective thinking is the ability to think carefully, considered active, continuous and careful in dealing with a mathematical problem. Indicators of mathematical reflective thinking skills are: (1) determining solutions/answers with full consideration; (2) checking the correctness of the answers; (3) modifying understanding in order to solve problems; (4) correcting answers; and (5) aware of errors when using calculation skills and correcting them. One way to develop mathematical reflective thinking skills is through a metacognitive approach. According to Flavell (1985), metacognitive namely knowledge and regulation on a person's cognitive activity in the learning process. Metacognition refers to one's understanding of his knowledge so that a deep understanding of his knowledge will reflect its effective use or a clear description of the knowledge at issue. The metacognitive ability is an awareness of cognitive self, how the cognitive self-works, and how to regulate it. Indicators of metacognitive abilities are: (1) identifying tasks that are being worked on; (2) supervise the progress of their work; (3) evaluate this progress; and (4) predict the results to be obtained (Lestari & Yudhanegara, 2018).

Problem-solving situations are challenges and critical moments for students in an effort to find solutions. Polya suggested heuristic, wherein the last heuristic, looking back only tested the answer and used the results obtained to solve other problems (Polya, 1975). Of course, in finding a solution, students must think critically and creatively. However, if they stop when answers are found, they lose valuable momentum in the learning process they are going through. With hard work, they build designs and various strategies to solve problems. If at the time of solving the problem they are motivated then happy with the results achieved, then this motivation and pleasure must be maintained. The teacher can give new assignments to students, namely: "Complete the problem in another way", "Ask questions ... what if", "What's wrong", and "What will you do" (Krulik & Rudnick, 1999). Problem-solving situations think critically and creatively are the scope of mathematical reflective thinking abilities.

Based on the explanation, this study aims to produce Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are feasible to use on geometry material. Feasibility of learning media in terms of validity, practicality, and effectiveness.

Research Methods

This research is R & D (Research and Development). The researcher will develop Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that are feasible to use in geometry courses, especially space geometry. The media development model used is the ADDIE model, namely: Analysis - Design - Development - Implementation - Evaluation. According to Shelton et al., the ADDIE model is a generic learning design model that provides an organized process in the development of learning materials that can be used both for offline learning and online learning (Branch, 2009).

This research was conducted at Universitas Samudra mathematics education students who took geometry lectures in the even semester of the 2018/2019 academic year. The steps of the research conducted are:

Analysis

The analysis phase is a process of defining what students will learn and doing needs assessment. Activities at the analysis stage to determine the necessary components, namely: (1) determine the characteristics of students; (2) analyzing student needs in learning; (3) make concept maps based on initial research. Followed by designing a flow chart provides clear direction for making media; (4) determine the parts and contents of the media to be developed. Material is developed with a metacognitive approach; (5) analyze the constraints found; (6) designing an assessment to test student competency, in this case, mathematical reflective thinking skills. Accuracy in completing assignments, worksheets and quizzes; and (8) consider online pedagogical. Verbal, visual, tactical, auditory, and others.

Design

This stage is also known as the blueprint. Stages that need to be implemented in the media design process are: formulating learning objectives that are SMAR (specific, measurable, applicable, and

realistic). Then determine what the right learning approach should be to achieve that goal. Besides that, also consider other supporting sources, such as relevant learning resources that can be accessed offline or online.

Development

Development is the process of making blue-print or the design come true. At this stage, Appy Pie media was developed based on a metacognitive approach to geometry material. As a material for consideration, the geometry material that will be inputted in the Appy Pie media can also improve students' mathematical reflective thinking skills.

Implementation

Implementation is a real step to implement the learning system developed. That is, at this stage everything that has been developed is installed or set in such a way according to its role or function that it can be implemented. The implementation phase in this study was carried out by testing the media directly. The media trials were carried out in two stages, namely: the first stage of validity testing by material experts and learning media experts. The second stage of the practicality test was by the response of mathematics education students through filling out questionnaires. The results of this trial are used as the basis for implementing the evaluation phase.

Evaluation

The evaluation phase in this study was carried out until the formative evaluation aimed at revision needs. Based on the results of expert reviews and field trials that have been carried out at the implementation stage, the next two stages of data analysis are the analysis of qualitative and quantitative data. Qualitative data analysis is used to process data in the form of input, criticism and expert advice and field tests to be followed by gradual revisions to the development of media for the better. While the analysis of quantitative data is obtained from respondents' assessment in the form of numbers on the questionnaire given. All stages of this evaluation are aimed at the feasibility of the final product. Worth in terms of content, design, and user-friendly.

Results and Discussion

Analysis

In the analysis phase obtained:

1. Analysis of student characteristics

Based on the results of interviews, all mathematics education students who take geometry courses have smartphones, interested in web-based learning or mobile learning. In addition, students also give opinions that they are lazy to read lecture materials because they have to carry thick books, laptops or have difficulty getting learning resources. Students also like to learn interactive and virtual teaching materials.

2. Material analysis

The geometry course consists of the geometry of the field taught from the beginning of the lecture to before the midterm. Then starting from after the midterm to the final, students will study space geometry. Development of material inputted to the media is based on consideration of learning objectives in accordance with the syllabus, metacognitive approach and contains exercises or questions about mathematical reflective thinking skills.

3. Media analysis

The Appy Pie media can be accessed easily without paying on the following website: https://www.appypie.com/. Appy pie media development considers pedagogical online, for example: Verbal, visual, tactical, auditory, and others. The selected images, colors, and writing make the media Appy Pie an interactive learning resource.

Design

At this stage, the author designed the media with the contents of the material in accordance with the subject matter of geometry, specifically the geometry of space. In addition, a number of menus that will be displayed on the application, such as menu material, syllabus, videos, software, teaching materials on the web, exercises/quizzes and author profiles. In the material, section will be directed by

a metacognitive approach. It is intended that students have the ability to reflect on how their knowledge of the material presented. In the syllabus section, it is adjusted to the competency standards, indicators and learning objectives of the geometry course and is relevant to the learning implementation plan. On the video menu, software and teaching materials related to the material will be presented in the form of files can be directly downloaded or in the form of a URL. On the exercise or questions menu, students will be directed to answer questions that are adapted to indicators of mathematical reflective thinking ability on geometry material.

Development

The steps to create an application using Appy Pie are: (1) Open the web www.appypie.com; (2) Click Sign Up to register; (3) Fill in the identity according to the complete column; When you have signed up, then open the e-mail to enter the verification code sent by Appy Pie. Enter the verification code that was sent via e-mail then click verify, then Create App to create the application; (4) Fill in the application name (e.g. Geometry Space) and select the category "education" then click next; (5) Select the theme as desired, then click next. After that, a dialog box will appear; (6) Delete all pages that are not used by clicking on one page at a time and then selecting the trash button. After all, pages have been deleted, then add Text page. Then replace the image icon in accordance with what we want by uploading images, and giving the name of the page with material, syllabus, concept maps etc.; (7) Next fill out the profile application, and to see the display on the mobile screen click the android button; (8) Making the contents of the syllabus, concept maps, material, videos, software, teaching materials; (9) Making the contents of the Simulation by uploading learning videos that are in accordance with the material; (10) Making an Evaluation with Quiz, To make a quiz it is necessary to arrange according to the image below, namely by giving the name of the quiz and triggering all the small boxes on the quiz page. The quiz can be made if all applications have been completed (save and finish); (11) Creating a Banner (image running) Select the theme customization page then look for the advanced list setting then check the show banner then add images. After that, a dialog box will appear to upload the image. To set the font, font color, font size, and background colors in headings, click theme customization then style & navigation. To set the font, font color and font size for the material to be created, click theme customization then page style & color scheme; (12). Change the application icon and display splash, select theme customization. To replace the icon you can by uploading an image or selecting an icon that already exists on the web; (13) If all programs have finished waiting a few minutes, the application file will be sent to e-mail; (14) After receiving the application e-mail from Appy Pie the next step is to download the file by clicking URL is given; (15) After the download is done, the application file is moved to an android cell for installation; (16) The next step is to install the application on an android phone (install) by pressing the .apk file; (17) The application has been successfully installed and is ready to run.

Implementation

The implementation is done by installing the Appy Pie application on each student's cellphone, then testing the product includes: validity test, practicality test, and effectiveness test.

1. Validity test results

Test the validity of the media using a questionnaire instrument. The validation questionnaire instrument was filled by two design experts and multimedia experts who were competent in their fields, namely lecturers of Information and Communication Technology at Universitas Samudra and two material experts, namely lecturers of the Universitas Samudra mathematics education. Questionnaire for validity test to media experts consists of 20 items, which are divided into four aspects, namely: aspects of content validity, instructional aspects of design, aspects of appearance and aspects of language. In addition, in the validity test questionnaire, there is also a column for descriptive suggestions and criticisms that will be filled by experts as an evaluation for the perfection of the application developer. Overall the average rating obtained from two media experts shows a value of 85.66% in the Very Valid category.

2. Practical test results

The product practicality test also uses a response questionnaire instrument filled by 25 students. The questionnaire validity test sheet to media experts consists of 12 items, which are divided into 3 aspects, namely aspects of the media display, aspects of material content and aspects of application benefits. In addition, in the practicality test questionnaire, there was also a column for descriptive suggestions and criticisms that would be filled by students as evaluations for the perfection of the applications developed. Overall, the average rating obtained from two material experts shows the value of 84.12% with the Practical category.

3. Effectiveness test results

Effectiveness test was obtained by giving questions about mathematical reflective thinking skills to 25 mathematics education students at the end of the geometry lecture. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%.

Evaluation

After the author tests the product which includes validity test, practicality test, and effectiveness test, there are several things that are revised according to comments or suggestions from media experts and material experts in the assessment sheet, namely: (a) Media Experts, suggest: 1) Revision on the menu display it is recommended that you use a more interactive and interesting model; 2) Images, colors and sizes of writing in the media are better clarified; and 3) The meeting material for one and so on is arranged or grouped so that the material presentation becomes more sequential and systematic. In other words, it is used as a sub menu from the Material menu. (b) Material Experts, suggest: (1) In the example questions and questions it is recommended to contain contextual issues and the ability of High Order Thinking Skills (HOTS); (2) Display of material one and so on is recommended so that there are additional downloads of material, videos, and software related to the geometry material of space that can be accessed by students.

Conclusion

The development of Appy Pie learning media based on a metacognitive approach to mathematical reflective thinking skills that is feasible to use on geometry. Development is carried out using the ADDIE model. Based on the results of validation, the learning media is categorized as very valid with a validity percentage of 85.66%. Based on the results of the student response questionnaire, the learning media is categorized as practical with a practical percentage of 84.12%. Based on the results of the test of mathematical reflective thinking ability, the learning media was declared effective with the percentage of students who got a value of ≥ 70 of 79.16%.

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