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Increase Interest in Learning Mathematics for 5th Grade Students Using Android Game-Based Learning Media

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ABSTRAK

Artikel penelitian ini didasari oleh data observasi yang menunjukkan gaya belajar siswa, media pembelajaran yang sering digunakan dalam kegiatan belajar dan mengajar, nilai matematika siswa kelas 5 yang rendah, serta ketidakmampuan siswa dalam memahami materi yang sedang diajarkan. Tujuan yang akan dicapai dalam penelitian ini adalah menaganalisis minat belajar siswa terhadap muatan pelajaran matematika dengan menggunakan media pembelajaran berbasis game edukasi. Penelitian dilakukan pada kelas 5 dengan jumlah siswa sebanyak 26 orang. Metode penelitian yang digunakan adalah Penelitian dan Pengembangan (R&D), dan model pengembangan yang digunakan adalah model pengembangan ADDIE. Produk game diuji oleh para ahli dan juga siswa untuk mengetahui kevalidan produk game edukasi. Hasil uji para ahli menghasilkan 92% dari uji ahli isi mata pelajaran, 94,67% dari uji ahli desain pembelajaran, 94,44% dari uji ahli media pembelajaran, 100% dari uji coba perorangan, dan 92,92% dari uji coba kelompok kecil. Responden dalam penelitian ada sebanyak 26 siswa kelas 5 Sekolah Dasar. Hasil uji efektifitas menunjukkan bahwa adanya perbedaan yang signifikan antara hasil matematika siswa kelas 5 sebelum menggunakan media pembelajaran berbasis game android dan sesudah menggunakan media pembelajaran berbasis game android. Disimpulkan bahwa media pembelajaran berbasis game android mampu meningkatkan minat belajar siswa terhadap muatan pelajaran matematika kelas 5 Sekolah Dasar.

ABSTRACT

This research article is based on observational data that indicates students' learning styles, frequently used instructional media, low math scores of 5th grade students, and students' inability to comprehend the taught materials. The objective of this research is to analyze students' learning interest in mathematics subjects using game-based educational media. The study was conducted in a 5th grade class with a total of 26 students. The research method used was Research and Development (R&D), and the development model employed was the ADDIE development model. The game product was tested by experts and students to assess the validity of the educational game. The results from expert evaluations yielded 92% for subject matter expertise, 94.67% for instructional design expertise, 94.44% for instructional media expertise, 100% for individual testing, and 92.92% for small group testing. The research involved 26 respondents who were 5th grade students in a primary school. The effectiveness test results showed a significant difference between the math scores of 5th grade students before and after using game-based Android instructional media. It can be concluded that game-based Android instructional media can enhance students' learning interest in 5th grade mathematics subjects at the primary school level.

1. INTRODUCTION

Learning is a change by learners, both knowledge and behaviour, which is caused by one or several experiences. Learning is defined as a relatively permanent human change in behavioural potentiality that has an impact due to reinforced practice. Education can help learners develop various information, abilities, and personality traits while encouraging active learning (Greenhow & Chapman, 2020; Khoiriyah et al., 2015). Education must be of high quality to achieve the goal. With quality education, one can achieve educational goals and improve academic standards (Noor, 2020; Noviyani et al., 2022). The development of technology and information can encourage the creation of innovative, effective, and efficient in use of learning media. For this reason, digital-based learning media is needed to improve student learning outcomes (Agustina & Rusmana, 2019; Lubis et al., 2023). Technology is an application or platform as a learning media integrated with games. A game is a learning strategy that combines aspects of a game or video game to inspire learners to learn and create a sense of fun in the learning process (S. Y. Cheung & Ng, 2021; Solviana, 2020). The existence of increasingly advanced and popular technology has given rise to a new term: educational games stimulate students' thinking to

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concentrate on formulating problems (Haleem et al., 2022)(Qohar et al., 2019). Education and learning process can take place anywhere. As with other fields, technology in education can make it easier for teachers to carry out the learning process, including the evaluation process and assignment (Ananda & Liana, 2022; Li et al., 2022).

Globalization has formed a new path in worldwide education, and teachers play an active role in the teaching and learning process (Fajarwati et al., 2021; Santi et al., 2020). Games are means that can be entertaining; game also act as a media combined with material and questions that have been summarized and are expected to arouse the spirit of learning for each individual (Li et al., 2022; Setiawan et al., 2019). In human life, there is no stopping learning, with changes, demanding learning activities that never stop, including in daily human life activities. Learning and learning emphasize learning activities by students through planned efforts by manipulating learning resources so that the learning process can occur (S. K. S. Cheung et al., 2021; Marcella, 2022). The main characteristic of learning activities is the existence of an interaction. The interaction in learning can occur to the learner with the learning environment, whether it is interaction with the teacher, his friends, tutors, learning media, and or other learning resources (Ansari & Khan, 2020; Marcella, 2022).

In Law number 20 of 2003 concerning the National Education System in Indonesia, it is stated that the obligations of educators or teachers are regulated in article 40 paragraph (2) (Anwar et al., 2020) The article states that educators or teachers and education personnel are obliged to (a) create a meaningful, creative, fun, dynamic and dialogical educational atmosphere, (b) have a professional commitment to improve the quality of education (Anwar et al., 2020). Based on this law, the role of educators or teachers is expected to make the learning and learning process more meaningful, fun, and creative (Ramli et al., 2020)(Mee Mee et al., 2020). This can be realized by involving learning media in the learning elements. With the existence of learning media, students gain broader insights in various ways. Using learning media can create a fun and motivating learning atmosphere (Gocheva et al., 2021)(Satria & Herumurti, 2021).

The existence of learning media in learning activities is expected to achieve the planned learning objectives. The media that are commonly used by teachers and educators include video, audio, pictures, books, slides, and so on. Learning media makes it easier for teachers to convey learning to students. Learning media has an understanding, namely everything that can be used to channel messages from sender to receiver, so that it can stimulate thoughts, feelings, attention, and interests, as well as the willingness of students in participating in the learning process in order to achieve learning objectives effectively (Gading et al., 2018; Siburian et al., 2020). Learning media functions as an intermediary or introduction to material that is difficult to present or show directly to the recipient of the information. By utilizing learning media properly, the learning and learning process becomes more interesting and varied. In general, the media includes people, materials, equipment, or activities that create conditions that allow students to acquire knowledge, skills, and attitudes.

One of the fields of study or subject content that has an important role in the world of education and in dealing with the problems of everyday life is the field of mathematics (Maass et al., 2019; Vankúš, 2021). Mathematics is a subject content given to all levels starting from elementary school which aims to equip students with the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to work together. Mathematics is used as a source of other sciences, this is because in these other sciences the discovery and development depend on mathematics, so that mathematics content is very useful for students as a basic science for application in other fields.

Interviews and observations were conducted at SDN 2 Banyuning, Buleleng Subdistrict, Bali, on August 22, 2022 with the 5th grade teacher. Based on the results of these interviews and observations, it can be seen that, (1) based on the report card grades shown by the teacher, the KKM grades used vary from 10 subjects. The subjects with grades in the A to B range are Religion and Budi Pekerti, Civics, Indonesian Language, PJOK, while those with grades in the B to C range are Mathematics, Science, Social Studies, SBdP, Balinese Language, and English, (2) based on the report card grades of 22 students in semester 1, the average math score is still below the KKM average. The low score is because according to students, the content of math lessons is too difficult so that students pay less attention to focus and correct when learning is carried out. Also, during the observation, there were learning problems experienced by grade 5 students at SDN 2 Banyuning, namely students experiencing obstacles in learning focus, lack of self-confidence, and teacher ignorance about students during learning activities at home. Students use smartphones as a means of accessing learning media provided by teachers during learning and learning activities at home. In addition, many students use their smartphones to access various applications, one of which is games. Based on the results of interviews and observations that have been presented, the learning media used have not been varied. Also, based on the habits of students who use their smartphones to play, the solution that can be provided is to create and develop new and fun learning

media for students, namely learning media based on android games which are expected to attract interest in learning so as to improve the results and quality of learning of grade 5 students at SDN 2 Banyuning.

Educational games are useful as learning media to convey information, knowledge or subject matter in an interactive and interesting way for students, besides those educational games can stimulate students' minds and creativity (Hikmah et al., 2020; Sun et al., 2021). Games have become increasingly important in education, this can be seen from studies examining the impact of various game elements on students showing results such as engagement, motivation, fun, performance, and achievement (Alawamleh et al., 2022; Brewer et al., 2013). Based on several studies that support the importance of educational games, it is necessary to develop more learning media that has never been applied to grade 5 students at SDN 2 Banyuning which is fun to use as a learning medium and can train students' intelligence in playing educational games, namely by developing android game-based learning media for Mathematics content.

2. METHOD

Educational game development using the ADDIE development model. The first step is to analyse the achievement competencies, learner characteristics, and subject matter. The second stage is the design stage, which is designing the flowchart and storyboard. The third stage is the development stage, which is the stage where the game is developed using Construct 2 software and the review stage is carried out by experts. The next stage is the implementation stage, in this stage student trials are carried out. In the last stage, namely the evaluation stage, pretests and postests are conducted to students (Tegeh & Jampel, 2017). The data collection methods used in this development research are questionnaire and test methods. Questionnaire is a data collection method that uses a list of questions to research subjects which include learning content experts, learning design experts, learning media experts, individual trials, and small group trials (Sugiyono, 2013). Test is a method of collecting data by giving a series of questions or tasks to the research subject, namely to all 5th grade students. The test is used to determine student learning achievement before and after using learning media, namely android-based games. The data source comes from the test subjects, namely experts and students. The details of the test subjects are (a) expert consisting of, subject content experts, learning design experts, and learning media experts, (b) Individual test, and (c) small group test. The grid of expert test instruments, trials to students, and objectives test is presented in Tables 1, Table 2, Table 3, Table 4, and Table 5.

Table 1. Learning Content Expert Instrument Grid

No	Aspects	Indicator
1.	Content	a. Suitability of the material to KD, indicators, and learning objectives b. Evaluation according to indicators c. Knowledge and Materials
2.	Language	a. Language Use b. The ability to arouse curiosity
3.	Eligibility of Presentation	a. In-game message achievement b. Presentation of material c. The content of the media does not contain SARA d. Knowledge development through games e. Media operation
4	Evaluation	a. There is an evaluation b. Suitability of evaluation to learning objectives and material c. Feedback available

Tabel 2. Learning Design Expert Instrument Grid

No	Aspects	Indicator
1.	Media	a. Clarity of media titles b. Attractiveness of media display c. Clarity of instructions
2.	Tujuan	a. Suitability of indicators and learning objectives
3.	Strategi	a. The order of presentation of the material

No	Aspects	Indicator
		b. Method suitability
		c. Ease of use of media
		d. Awaken students' abilities and motivation
		e. Illustration suitability
4	Evaluasi	a. Adequacy of practice question
		b. Evaluation feedback
		c. Evaluation is easy to understand

Tabel 3. Learning Media Expert Instrument Grid

No	Aspects	Indicator
1.	Display	a. Attractiveness of media display
		b. Title highlights
		c. Type, shape, color and size of the font
		d. Color
		e. Voice
		f. Animation, image, video, etc
2.	Accessibility	a. Can motivate students in learning
		b. Button/navigation compatibility
		c. Ease of operation
		d. Program no errors

Tabel 4. Individual and Small Group Test Instrument Grille

No	Aspects	Indicator
1.	Display and Serving	a. Students are interested in the look and content of media content
		b. Color
		c. Clarity of text and material
		d. Music quality
		e. Video quality
		f. Media operation
2.	Content	a. Students are interested and motivated by the media
		b. Ease of learning process with media
		c. Questions in media content can make students think
		d. The content is easy for students to understand
		e. Presentation of questions in accordance with the material

Tabel 5. Objective Test Instrument Grid for Students

No	Aspects	Indicator
1.	Explain data related to students or the surrounding environment and how to collect it	a. Explain data collection by means of direct logging
		b. Explain how data is collected by filling out a questionnaire
		c. Explaining how much data is in accordance with its distinctive features
2.	Identify data related to students or the surrounding environment and how to collect it	a. Collect data by taking live notes
		b. Create a questionnaire to collect data
		c. Group data by type
3.	Explain the presentation of data related to students and compare with data from the surrounding environment in the form of lists, tables, figure charts, bar charts, and line charts.	a. Describes how to present data in list form
		b. Explain and define steps to present data in tabular form
		c. Understand and explain different diagrams
		d. Describe the presentation of data in the form of an image diagram
		e. Describes the presentation of data in the form of a line chart
		f. Determine the information contained in a data presentation
4.	Organize and present data related to students and compare with	a. Present data in list form
		b. Compiling the results of presenting a data in the form of

No	Aspects	Indicator
	personal data of the surrounding environment in the form of lists, tables, picture charts, bar charts, and line charts	tabel c. Present data in diagram form d. Present an image diagram of a piece of data e. Present data in the form of garis charts f. Read and conclude the information contained in a data presentation

3. RESULT AND DISCUSSION

Result

The development of android game-based learning media applied to grade 5 students of SDN 2 Banyuning uses the ADDIE development model. The structure of the ADDIE development model starts from analysis, design, development, implementation, and evaluation. The first stage of the ADDIE development model on android game-based learning media is analysis. In the analysis stage, there are 3 steps, namely competency analysis of achievements, student characteristics, and also material analysis according to competency achievements. The competence of student achievement can show understanding in learning grade 5 students at SDN 2 Banyuning. The characteristics of students in general indicate a visual learning style as well as kinesthetic. The subjects developed are the content of mathematics lessons. The next stage is design or design. At this stage, learning media is designed to be addressed to students with achievements to better understand learning. The material presented is mathematics material in the statistics chapter of data presentation, the material is designed in order and packaged into a game that can be accessed on smartphones and there is an evaluation in it. The design stage consists of making storyboards and flowcharts as reference materials in making learning products. The material taken to be included in the game is the content of even semester math lessons chapter 4 which discusses statistics.

This android game-based learning media was developed with a simple design ranging from object layout, coloring, text size, typeface, sound, illustrative images, supporting tables, and videos. Game display design design is made using the Canva application, while game design is made using Construct 2 software. Before this game was applied to students, the product had gone through 3 expert tests, namely subject content expert tests, learning design expert tests, and learning media expert tests, then trials were also carried out on students, namely individual trials and small group trials applied to the upper class, namely grade 6 at SDN 2 Banyuning. The results of improvement and product development are applied to learning to determine whether or not there is an influence on learning outcomes. At this stage, a test was carried out for grade 5 students of SDN 2 Banyuning through pre-test and post-test. The last stage, which is the evaluation stage. At this stage, improvements are made at each stage of ADDIE. The display of learning media based on android games that have been developed is presented in Figure 1.

Figure 1. Display of Learning Media Based on Android Games

Discussion

Based on the results of validation by subject content experts, grades that are at very good scores are obtained. The excellent qualification score is obtained through various aspects tested in the subject content expert test, namely, aspects of material content, language aspects, aspects of feasibility of presentation, and aspects of evaluation. Android game-based learning media in the content aspect is considered appropriate between the material with basic competencies, learning indicators and learning objectives. The compatibility between the material and KD, indicators and learning objectives makes learning regularity in students later. Learning objectives are designed by teachers to weigh the students to be taught, weigh the expected learning behavior to achieve KD, weigh the realization of learning conditions, and weigh the success rate according to the learning conditions applied (Agusdianita et al., 2020)(Budiastuti et al., 2021). In the media that has been developed, there is also a variety of knowledge in the form of facts, principles, and concepts in mathematics learning that are presented very well. This will make students better understand the material through media that provide useful knowledge in

students' daily lives. Based on this explanation, the learning media from the subject content expert test received a very good assessment.

Based on the results of validation by learning design content experts, a very good score was obtained. With excellent qualification scores obtained through various aspects tested on subject content expert tests, namely, media aspects, objective aspects, strategy aspects, and evaluation aspects. Android game-based learning media is packaged clearly and interestingly. Content on android game-based learning media has objectives that are in accordance with KD, indicators, and clear learning objectives. Android game-based learning media is designed with the aim of making it easier for students to understand the material and make it easier for students to use it, as well as providing opportunities for students to practice independently. Students can practice their knowledge by using games repeatedly as part of deepening the material, this is supported in instructional design where the provision of exercises or assignments can help learners in mastering the material (Al-Samarraie et al., 2020)(Ruliah & Pratiwi, 2021).

Based on the results of validation by learning media content experts, a very good score was obtained. With excellent qualification scores obtained through various aspects tested on subject content expert tests, namely, display aspects and accessibility aspects. In accordance with the assessment of learning media experts on the harmony and composition of the colors and buttons / navigation in the game makes students comfortable in operating the game as a tool for learning, besides that it can make students not easily bored with the appearance presented in the game. Color is included in a sharp element that has the aim of touching one's visual sensitivity so as to stimulate one's feelings, attention, and interest (Rodrigues & Silva, 2022)(Purnama, 2010). In addition to presenting colors that make students comfortable when playing it, the layout of images and other objects on each slide of the game is arranged appropriately so that it is easy for students to read and see clearly. The layout of objects becomes the main positive aspect that makes students able to operate the media.

Based on the results of validation by trials, students obtained grades that were on very good scores. With excellent qualification scores obtained through various aspects tested on subject content expert tests, namely, aspects of content, design, and appearance. This is due to students who are interested, curious, and easy to understand because of the presentation of the game ranging from colors, illustrations, and also the game itself which are all well organized and interesting. This android game-based learning media is easy to use by students because the operation of the game is designed simply so that students have no difficulty operating it. Android game-based learning media shows excellent potential in improving learning, students enjoy games and want to play them again (Laksita et al., 2020; Qohar et al., 2019).

Research and development of android game-based learning media for grade 5 students at SD Negeri 2 Banyuning was carried out using tests, which previously this android game-based learning media received decent and valid qualifications based on the results of assessments from experts and students. Assessment is carried out by subject content expert lecturers, learning design expert lecturers, learning media expert lecturers, and individual and small group trials by students. Learning outcomes research was conducted to determine the magnitude of the increase in mathematics learning of grade 5 students at SD Negeri 2 Banyuning before using android game-based learning media and after using android game-based learning media. Research conducted shows that android game-based learning media can improve student learning outcomes on mathematical statistics material.

Android game-based learning media was developed using the Construct 2 application and the Canva website to create the design of the game. This game-shaped learning media is designed with an attractive appearance and content that is in accordance with the material to be presented that can make students interested in playing and learning. This can be seen from the assessment during student trials where students are interested in playing this android game learning media. Students are interested in this android game-based learning media because of several influencing factors, namely, student interest in the display of media (in the form of composition and harmony of colors, text, sound, images, videos, and buttons/navigation) and the content of content in the game. These factors make students easily operate the game which means making students easily play the game while learning the material. Based on that, most studies directly support that learning using games can make students have high motivation and learning effectiveness (Jensen & Skott, 2022; Kao et al., 2023). Learning media is made with feedback or responses that make students have a sense of curiosity about the content of the game presented. Students can also learn anywhere and anytime by using this android game-based learning media.

With all the responses and assessments obtained in the development of android game-based learning media makes students more interested in using it because the information is conveyed very well. This is very important in the learning process, the cause is the student's interest in something new which makes the focus increase so that students better understand the information conveyed by the media.

Learning can be said to be planned communication where it can produce changes in the form of attitudes, skills, and knowledge in designed learning (Jeong & So, 2020; Koesoemadinata, 2022). Therefore, this android game-based learning media has effectiveness on student learning outcomes.

The main positive implication of this research is the potential to increase interest in learning mathematics in grade 5 students. If Android game-based learning media is effective, this could open the door to the application of similar strategies in teaching mathematics at higher levels. This research can contribute to strengthening the use of technology, especially Android-based game media, as a tool in education. This could provide impetus for more research and development in incorporating technology in the curriculum. However, this research has limitations. The main limitation is the possible difficulty of generalizing the research results. Results may only apply to the 5th grade group of students and may not be easily applicable to different grade levels. In addition, this research may not be able to fully take into account individual factors that influence interest in learning. Each student has different learning styles and preferences, which are difficult to fulfill with one type of learning media.

4. CONCLUSION

Based on the discussion previously described, it can be concluded that the objectives of the research and development carried out have been achieved, namely educational games can attract interest in learning in elementary school students. This statement has been proven by the results of the review by the experts previously described. Researchers provide suggestions for researchers who will carry out further research and development is to make the game more interesting and add components that were not previously there.

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