



The Effect of Digital Learning Media Using Scratch Game Based Learning on Student Problem Solving Skills

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Abstract: In the current digital era, education has undergone a significant transformation, providing students with rapid and convenient access to a vast pool of knowledge. Through a Research and Development (R&D) approach and the ADDIE model, Scratch-based digital game-based learning media is created and evaluated, demonstrating its effectiveness in significantly improving students' problem-solving abilities, motivating learners, and providing a positive learning experience. In this digital age, educators are encouraged to embrace technology, particularly game-based learning, as it holds the potential to enhance student engagement and cultivate vital 21st-century skills. The research findings conclude that the use of digital game-based learning media using Scratch is effective in enhancing students' problem-solving skills. This learning media offers an engaging and effective learning experience, boosts student motivation, and cultivates critical, creative, and problem-solving skills relevant to the demands of the era. Therefore, Scratch can serve as an effective and innovative alternative to address educational challenges in the digital age.

Keywords: digital era, education transformation, Scratch-based learning media, problem-solving skills, student motivation, 21st-century skills, technology integration, innovative education.

Introduction

Education in the digital era allows students to gain abundant knowledge quickly and easily to fulfill their skills abilities. Skill abilities are very important because they enable students to effectively deal with matters relating to social, emotional, and cognitive development in line with increasing the compatibility of their problem solving (Prajapati et al., 2017).

The digital-based education paradigm involves the innovative use of digital tools and technology during the learning process (Halik et al., 2022; Makri et al., 2021; Rahmatullah et al., 2022). Digital-based education will produce digital learning in schools that functions, among other things to make learning more realistic and contextual; serves as a learning medium; make students more sensitive to technological advances; facilitate the

implementation of exams or assessments; and (5) learning becomes more fun (Indahsari & Sari, 2020).

In the digital era, access to knowledge becomes easier, more practical, and faster, enabling students to meet learning needs in abundance. The application of digital-based education is also known as the knowledge era which was triggered by the emergence of science and computer technology (Anisa & Hasanah, 2022). Advances in science that continue to develop provide impetus for efforts to update and utilize technology in the teaching and learning process (Mulyani & Haliza, 2021). Through digitization, a new vision of the world of education can be responded to from a technological perspective, provide solutions, and focus on analysis of human interaction with the digital world.

To maximize the role of digital technology in education today, it is necessary to use appropriate learning methods. In the digital context, optimization

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can be achieved through various supporting applications, not just limited to the traditional lecture approach. Digital learning provides opportunities to develop skills in identifying problems, searching, organizing, analyzing, evaluating, and communicating information (Utama & Mashfufah, 2016). One of the technologies that can be utilized is Scratch.

The function as a learning medium for the implementation of digital-based education can be realized through the development of scratch-based digital learning media. Scratch is an application designed to introduce computer programming concepts in a simple way so that they can be understood from various backgrounds. Scratch has a visual programming language for a learning environment that allows beginners to quickly learn to make a program without having to think about writing the syntax correctly or incorrectly. Basically, Scratch is a multimedia product in the form of programming by a project website that makes it possible to develop children's creativity in an interactive and fun way (Pratama, 2018).

Scratch isn't just used for making games, it can create animation, text, stories, music, and more. Scratch can be used at the age of 8 - 16 years to learn computer programming while working on learning projects such as animated stories and games (Maloney et al., 2010). Scratch allows students the opportunity to play around, but also the need to increase focus also goes hand in hand with the development of design knowledge in developing teacher professionalism (Dohn, 2020). Scratch provides a variety of conveniences to be developed into a learning media. Scratch enables teachers to create conceptual and visual learning with animations that help visualize difficult concepts for students. The ease of using media can be concretized in the form of modeling simulations so that they can be understood as messages from teachers to students or vice versa so that the learning process can take place effectively (Abi Hamid et al., 2020).

Digitalization implemented by schools is an innovative step in enriching various aspects of teaching. In supporting the development of students' skills, education must be seen as an opportunity to practice skills that will continue to develop during the learning process (Greenberg et al., 2017). This skill is very important because it allows students to effectively deal with challenges in social, emotional, and cognitive development, as well as develop their ability to solve problems (Prajapati et al., 2017). The digital-based education approach includes the innovative use of digital tools and technology during the teaching and learning process. The focus of learning will be given to the development of intellectual abilities, critical

thinking, and skills that are closely related to problem solving abilities.

The era of digitalization has an important role for students. The journey in utilizing digital media in learning is still limited to the use of PowerPoint, videos and images. Even though the facilities at the school are technologically adequate, they have not been used optimally to develop various learning media. Realizing the diversity of learning technology today. Teachers need to have the ability to develop themselves as facilitators. The abilities possessed by teachers are used to guide students in exploring and utilizing technology to strengthen a larger foundation than just the use of digital media. One approach that can support this is game based learning. The use of game-based learning can interact with subject matter through interesting and interactive stimulation. So that it can increase learning motivation, provide interesting challenges, and facilitate problem-based learning to help understand concepts in depth.

Relevant research related to the implementation of game based learning methods for learning shows that games make it easier for students to practice 21st century skills by providing real experiences. The results of a meta-analysis that collected 20 studies with a total of 1,974 participants showed that students' 21st century skills improved well after being taught using game-based learning (Mao et al., 2022). Unfortunately, scratch-based digital game-based learning media has not been widely developed by elementary school teachers because of their limited abilities. The results of a study conducted by (Durak & Güyer, 2022) showed that initial knowledge of computer literacy is as important as successful programming. The results of research by Hartt et al. (2020), show that students like and more involved in game-based learning. So, it can be concluded that gamification is very suitable for educational planning.

Method

The method used in this study is Research and Development (R&D), which is a research method used to produce certain products and test their effectiveness (Sugiyono, 2010). The model testing phase in R&D research is crucial for evaluating the suitability of the model being developed (Zakariah et al., 2020). This research has a longitudinal or gradual nature because it aims to produce certain products that will be used.

The development model used is the ADDIE model which consists of five stages, namely analysis, design, development, implementation, and evaluation (Branch, 2009). The procedure for developing digital game-based learning media using scratch is carried out using the

ADDIE model. By conducting development research, researchers seek to create effective products to be applied in the learning process (Apriansyah & Pujiastuti, 2020).

Product validation was carried out on draft-1 digital learning media products produced at the development stage. Validation was carried out to experts in the field of material, media, and assessment experts. These experts will be taken from lecturers at State University of Malang who are experts in the field of elementary thematic materials, in the field of learning media, and experts in the field of learning evaluation who have at least a Masters degree in their field.

The results of expert validation will be used to improve digital learning media products that are in the category of draft-1 so that they are produced into draft-2. Product trials were carried out on digital learning media products that were categorized as draft-2. The try-out will be carried out on fifth grade students of SD Lowokwaru 2 Malang in stages which include individual tests (one-to-one trial), small group trial (small group trial), and large group test (field tryout) (Branch, 2009). The results of the product trials will be used to improve digital learning media products that are in the category of draft-2 so that a final product is ready to be implemented. Product implementation will be carried out using a quasi-experimental research with a pretest-posttest design with non-randomized group segregation. The research subjects were fifth grade students of SD Lowokwaru 2 Malang.

Result and Discussion

This study aims to examine the effect of using Scratch-based digital game-based learning media on improving students' problem-solving skills. The Research and Development (R&D) method with the ADDIE model was chosen as the main approach in the development and evaluation of this learning media. The R&D stages which include analysis, design, development, implementation, and evaluation are used to ensure that the learning media produced are in accordance with the needs of students and are effective in achieving learning objectives.

The analysis phase is carried out to understand the learning context which includes the curriculum, learning objectives, students, and infrastructure and facilities in schools (Fatchurahman et al., 2022; Wijaya et al., 2021). Curriculum analysis shows that this learning media must be in accordance with the 2013 curriculum for grade 5, with a focus on theme 8 and sub-theme 1 of learning 2. Learning objectives are adjusted to these themes and sub-themes, so that learning media can support the achievement of the learning objectives set.

Student analysis illustrates that students are more responsive and enthusiastic in learning when teachers use learning media (Lathifah et al., 2023; O'Grady-Jones & Grant, 2023; Syahidi et al., 2019). They more easily understand the material and feel interested in learning when there are interactive elements and games in learning. Thus, the use of digital game-based learning media based on Scratch is in accordance with the preferences and needs of students, and can increase motivation and active participation in the learning process (Alam, 2022).



Figure 1. Display of Digital Learning Media Using Scratch

Expert tests were conducted to evaluate the quality of digital game-based learning media based on Scratch. Material experts, media experts, and assessment experts provide input and assessments of the media being developed. The results of the validation by material experts, media experts, and assessment experts show a very good level of feasibility, with a percentage of more than 80%, which indicates that the learning media is in accordance with quality standards and learning needs.

Formative evaluations through individual, small group and large group trials are carried out to test the performance of learning media in real situations (Lin et al., 2023). The evaluation results show that this learning media gets a positive response and enthusiasm from students (Lampropoulos et al., 2019; Safitri et al., 2022). In addition, there is a change in the attitude of students which leads to a more positive direction towards learning. Formative evaluation data shows that instructional media has succeeded in improving students' problem solving skills (Adipat et al., 2021), as reflected in the posttest results which experienced a significant increase.

The implementation stage is the final stage of developing Scratch-based digital game-based learning media. Implementation of learning media is done by providing access to students to use the media in the

learning process. The average yield of product percentage calculations at the evaluation stage reaches 90%, which indicates that this learning media is very effective in improving students' problem-solving skills.

The results of the output table from the t-test show that there is a significant difference in improving students' problem-solving skills before and after being given digital game-based learning media using Scratch. This is shown by the sig value which is smaller than α (alpha) 0.05, so that H_0 is rejected and H_a is accepted. Thus, this learning media has a positive and significant effect on improving students' problem-solving skills.

From the results and discussion, it can be concluded that Scratch-based digital game-based learning media is effective in improving students' problem-solving skills. The use of interactive media provides an interesting and effective learning experience, so that students are more enthusiastic and motivated in the learning process. Thus, Scratch digital learning media can be an effective and innovative alternative in facing educational challenges in the digital era. The use of technology in education is increasingly important to create a learning environment that facilitates students in developing critical thinking skills, creative and problem-solving abilities that are relevant to the demands of the times.

Conclusion

This study reveals that the use of digital game-based learning media based on Scratch has a significant effect on improving students' problem-solving skills. The Research and Development (R&D) method with the ADDIE model has succeeded in producing effective and innovative learning media. The results of the analysis stage show that this learning media is in accordance with the 2013 curriculum for grade 5 with theme 8 and sub-theme 1 learning 2. In addition, the use of Scratch-based learning media is recognized as a tool that motivates and increases student participation in the learning process. The development of instructional media is carried out carefully through the process of design, data collection, flowcharts and storyboards. The development stage involves collaboration between content developers and technologists to create engaging interactive content and games. The results of the expert test and formative evaluation confirm that Scratch-based digital game-based learning media achieves a very good level of feasibility. The positive response and enthusiasm of students indicates that this learning media is effective in increasing motivation and understanding of concepts. The implementation of learning media in the school's computer laboratory also runs smoothly with a success rate of 90%. The results of the t-test show that there is a significant difference in improving problem solving

skills before and after using this learning media. Overall, Scratch-based game-based learning digital learning media is an innovative and effective educational solution in the digital era. The use of interactive technology in learning allows students to develop critical thinking skills, creative, and problem-solving abilities that are relevant to face future challenges. This learning media can improve the quality of learning and has the potential to have a positive impact on the development of education in the digital era.

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Conflicts of Interest

The authors declare no conflict of interest.

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