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The Impact of Digital Learning on Creative Thinking Skills: A Case Study in Grade 12 at SMAIT Al-Multazam Kuningan

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ABSTRACT

This study aims to analyze the impact of digital learning on the creative thinking skills of Grade 12 students at SMAIT Al-Multazam Kuningan. This study used a qualitative approach with a case study design. Data collection was conducted through observation and in-depth interviews with five students selected using a purposive sampling technique based on their active involvement in digital learning. Data analysis was conducted using the interactive model of Miles and Huberman, which included the stages of data reduction, data display, and conclusion drawing. The results of the study showed that digital learning had a positive impact on students' creative thinking skills, as indicated by increased fluency in generating ideas, greater flexibility in developing alternative solutions, and greater originality in completing project-based tasks. The use of digital media, such as learning videos, visual media, and digital design platforms, serves as a stimulus that encourages broader exploration of ideas. The conclusion of this study shows that digital learning can be an effective strategy for developing students' creative thinking skills when supported by systematic learning planning and adequate technological infrastructure.

Keywords: learning, digital, creative thinking, innovation

INTRODUCTION

The development of digital technology has brought about significant changes in various aspects of human life, including education, particularly in how learning is designed and implemented to encourage students' higher-order thinking skills. The use of digital tools such as educational games, digital concept maps (digital mind mapping), and interactive learning environments has been shown to create more meaningful and challenging learning experiences, thereby encouraging students to think creatively. One application that is considered effective is the integration of the Problem-Based Learning (PBL) model with Digital Mind Mapping (DMM), in which students are faced with real problems while being facilitated to organize ideas and information systematically; thus, the process of obtaining information and analyzing problems becomes more efficient and has a significant impact on the improvement of students' creative thinking skills [1].

In addition, the practice of digital creativity in STEM education shows that the use of technology-based tools and learning models provides a positive impact on the main aspects of creative thinking, including fluency, flexibility, originality, and elaboration in developing students' ideas [2].

The integration of digital technology into the learning process encourages a shift from conventional teaching methods toward more flexible, interactive, and student-centered approaches. In the era of Society 5.0, the use of technology in education is no longer an option, but a necessity that educational institutions must address to prepare students with 21st-century skills [3]. However, the acceleration of digital technology adoption in learning is often not accompanied by the readiness of the learning system, infrastructure, or adequate pedagogical strategies, thereby creating various new challenges in educational practice [4].

One important skill expected to develop through digital learning is creative thinking. Creative thinking allows students to create new ideas, find innovative solutions, and adapt to rapid changes in social and academic environments. Digital technology provides various stimuli, such as visual media and interactive multimedia, and broad access to information, which can potentially enrich students' learning experiences. However, on the other hand, the implementation of digital learning is also faced with the issue of inequality in access to technology and infrastructure quality, especially in areas with limited internet connectivity and digital devices [2]. This inequality can hinder students' opportunities to explore creativity through the optimal use of digital technology.

Several previous studies have examined the relationship between the use of digital technology and the development of creative thinking skills. Research shows that the use of interactive multimedia and digital learning can improve students' creativity as well as higher-order thinking skills [5]. Other research emphasizes that the success of developing creativity through technology is strongly impacted by teachers' pedagogical design and the learning models implemented, such as multimedia-assisted collaborative learning [6]. In addition, digital learning is also reported to contribute to the improvement of students' self-regulated learning, which becomes a supporting factor in the development of creativity [7], [8]. At the early childhood education level, digital technology is used to create multisensory and immersive learning experiences.

The study by Sun et al. [9] also showed that digitally contextualized reading can significantly improve preschool children's creative thinking skills, especially in fluency, elaboration, originality, and abstract thinking. The use of digital technology in preschool mathematics and geometry activities can also develop children's imagination, logical reasoning, and creativity through interactive and visual approaches [10].

At the primary and secondary education levels, the use of digital technology consistently contributes to the development of creative thinking and digital competence. Learning activities based on robotic toys, such as Bee-Bot, have been proven to improve digital literacy as well as students' creativity through exploration and independent problem-solving [11]. In addition, the introduction of programming learning since elementary school also contributes to the development of computational thinking, which becomes an important foundation for creativity and higher-order thinking skills [12]. The design thinking approach integrated with digital technology at the secondary school level is also reported to be effective in encouraging computational thinking skills, creativity, and collaborative problem solving [13].

Based on the literature review above, there is a research gap that needs to be addressed, particularly regarding the impacts of digital learning on creative thinking skills at SMAIT Al-Multazam Kuningan (Integrated Islamic Senior High School Al-Multazam Kuningan), Indonesia. The scientific novelty of this research lies in the in-depth analysis of the impacts of digital learning on students' creative thinking skills at SMAIT Al-Multazam Kuningan, which not only emphasizes technology and creativity but also considers the context of Islamic values. This research also highlights the role of digital stimuli as an initial trigger for the emergence of creativity, even before more structured pedagogical interventions by teachers.

SMAIT Al-Multazam Kuningan was selected as the research location because it is an Islamic educational institution that has integrated digital learning into the daily learning process and is supported by facilities such as a computer laboratory and a digital library. However, this school still faces challenges in internet network stability that has not been fully optimal, which could impact the effectiveness of digital technology in developing students' creativity. This condition raises an important question about the extent to which digital learning truly impacts students' creative thinking skills within the context of an integrated Islamic school.

Based on this background, the research problem of this study is how digital learning impacts the creative thinking skills of Grade 12 students at SMAIT Al-Multazam Kuningan. Therefore, the objective of this study is to analyze the impact of digital learning on students' creative thinking skills in depth. The results of this study are expected to provide theoretical contributions to the development of digital literacy in Islamic Religious Education and to serve as a practical reference for educational institutions in designing innovative, contextual, and sustainable digital learning.

RESEARCH METHODS

This study used a qualitative approach to investigate the phenomenon in depth. Qualitative research is a research process to understand human or social phenomena by creating a comprehensive and complex description that can be presented in words, reporting detailed views obtained from informant sources, and conducted in a natural setting [14]. The approach used in this study was a case study. A case study is an empirical research method that aims to understand in depth a phenomenon that occurs in real life [15]. The research subjects were Grade 12 students (a total of 107 students, divided into five classes). The sampling technique used was purposive sampling. Purposive sampling is a sampling method based on certain considerations that are closely related to the focus of the research [16]. This technique was selected because not all individuals in the population have the understanding or experience relevant to the phenomenon being studied, particularly regarding the digitalization of learning. The researcher selected five students as informants, with each representing one of the five classes studied. The informants were selected based on the following criteria: actively participating in digital learning, willing to become informants, and representing class characteristics (science or social studies). Data were collected through observation and in-depth interviews. The selection of informants continued until it met the need for an in-depth description of the phenomenon (informationally rich cases). Observation was conducted by directly observing students in the classroom and examining the teaching and learning activities in detail. The researcher also interviewed the students to understand their perceptions of the learning materials and their impact on their creative thinking skills.

This study used a data analysis technique based on the Miles and Huberman model. According to [15], the Miles and Huberman model is an interactive approach to qualitative data analysis that continues until completion. First, data reduction, which involves filtering and selecting the most relevant information on

the implementation of digital learning and on indicators of students' creative thinking skills. At this stage, the researcher focused on key aspects and identified themes and patterns emerging from observations, interviews, and documentation. Second, data display, which involves presenting the reduced data in narrative form; thus, information regarding digital learning practices and students' responses becomes more structured and easier to understand. Third, conclusion drawing, which involves formulating research findings based on the patterns and relationships that emerge to determine the extent to which digital learning impacts the creative thinking skills of Grade 12 students at SMAIT Al-Multazam Kuningan.

RESULTS AND DISCUSSION

The results of the study showed that digital learning had a positive impact on students' creative thinking skills. This improvement is reflected in students' ability to generate diverse ideas, develop alternative solutions, and demonstrate flexibility in thinking when completing project-based tasks. Based on the results of the analysis of observation and interview data, the findings of this study are not interpreted as measurements of new variables, but rather as main themes that represent the dimensions of the impacts of digital learning on the development of students' creative thinking skills. These themes describe patterns of students' learning experiences during digital learning, as observed in the process of completing assignments and learning interactions.

The four main themes identified in this study include the development of creative thinking skills in generating new ideas, collaborative creativity in digital learning, digital learning technology as a driver of innovation, and gamification as a strategy for strengthening creativity. These four themes are understood as mechanisms and contextual supports for the development of students' creativity, rather than as independent variables tested separately.

1. Development of Creative Thinking Skills and Generating New Ideas

   Based on observations and interviews, students tended not to fixate on a single answer but to explore various possible solutions. This finding indicates the emergence of stronger divergent thinking after the implementation of digital learning. The improvement of creative thinking skills is influenced by the characteristics of digital learning used in the school, namely, project-based learning supported by visual media and creative digital applications. Students used various digital sources, such as learning videos, infographics, design templates, and other visual media, to complete assignments. The abundance of visual stimuli and information provided richer cognitive stimulation compared with conventional learning, thereby encouraging students to combine ideas, modify concepts, and produce more original solutions. Thus, digital technology served as an environmental trigger that facilitated the emergence of creative ideas.

   In addition, the interactive nature of digital technology allows students to explore and experiment more broadly. The process of trying, revising, and refining digital products provides continuous opportunities for reflection, which helps improve flexibility and originality in creative thinking. This finding shows that students' creativity is not only impacted by the learning content but also by how learning is designed and facilitated through digital media.

   The findings of this study align with various previous studies that emphasize that digital technology is viewed as a main catalyst in encouraging technological advancement, as well as improving environmental quality [17]. The use of digital technology contributes to the creation of more intelligent, efficient, and sustainable production processes, and also strengthens adaptive and responsive governance. In addition, this condition also opens opportunities for the emergence of various new applications and innovations in various strategic sectors, such as energy, transportation, and manufacturing [18]. However, this finding shows differences from several other studies that highlight the limitations of digital learning platforms. Some studies emphasize that digital learning platforms have often not been able to provide personal, student-centered learning experiences that aligned with individual student needs. As a result, the level of student engagement and learning motivation tends to be low, which impacts the overall effectiveness of the learning process [19], [20]. On the other hand, the digital learning environment also provides learning experiences that require students' active involvement. Unlike conventional learning, which tends to be one-way, digital learning facilitates two-way interaction between students, learning materials, and technology. The use of digital tools such as educational robots and systems based on Artificial Intelligence (AI) has been proven to stimulate higher-order thinking processes. Students are encouraged to analyze situations, formulate solutions, and evaluate results independently. The findings of Motukeeva et al. show that active interaction with digital technology significantly improves students' creative thinking and problem-solving skills [21], [22].

   In addition, digital learning enables personalized learning experiences. Digital technology enables educators to adjust the content, methods, and pace of learning to meet students' individual needs. This personalization becomes an important factor in fostering creativity because students are not forced to follow a single, uniform learning pattern. When students have the freedom to explore ideas according to their interests and abilities, the potential for creativity can develop more optimally. This is in line with the findings of

Semenescu et al. and Pikhart et al., which emphasize that adaptive digital learning can create learning conditions that support innovation and independent thinking [23], [24].

2. Collaborative Creativity in Digital Learning

The aspect of collaboration also plays an important role in fostering students' creativity in digital learning. Through online learning platforms, students have space to interact with one another, discuss, and collaborate on assignments and projects. This collaborative process not only encourages students to develop ideas independently but also allows them to expand and refine their ideas through the exchange of views and experiences with their peers. Harishree and Chu emphasize that technology-based collaborative interaction contributes positively to the improvement of students' creativity, especially in the context of developing 21st century skills [25], [26].

Digital learning plays a central role in maintaining the continuity of interaction and collaboration. Platforms that support real-time communication, such as digital whiteboards and online conferencing applications, allow students to conduct discussions and brainstorming simultaneously, whether they are in the same location or in different locations. This flexibility helps maintain the dynamics of learning while encouraging the emergence of creative ideas. Hain et al. emphasize that digital strategies that support collaboration can create work and learning environments that are conducive to creativity [27].

The implementation of gamification in digital learning has also been proven to be effective in improving collaborative creativity. Game elements such as challenges, points, and rewards encourage students to be actively involved in the learning process. Gamification not only increases motivation but also encourages students to think creatively when completing the given tasks and challenges. The studies of Wahab et al. and Leong show that gamified learning environments can significantly improve students' participation and creativity [28], [29]. The study of Ali et al. also found that gamification contributes to the improvement of aspects of creativity, such as fluency of thinking and originality of ideas [30].

3. Digital Learning Technology as a Driver of Innovation

When designed pedagogically, the use of digital technology in learning can foster an innovative mindset among students. One strategy that has been proven effective is the implementation of Problem-Based Learning (PBL) combined with digital tools, such as concept maps. Through this approach, students are encouraged not only to understand problems at a surface level, but also to examine them more deeply, connect various relevant concepts, and develop creative and contextual solutions. The study by Putra et al. shows that the combination of Problem-Based Learning (PBL) and digital technology has a significant impact on the improvement of students' creative thinking skills [1].

In addition to learning approaches, the provision of continuous feedback through digital platforms also plays an important role in fostering creativity. Formative assessment and consistent emotional support help create a safe and supportive learning environment. Under these conditions, students become more confident in expressing new ideas without fear of making mistakes. Bataineh et al. emphasize that pedagogical support based on digital contributes to the development of students' creativity and self-confidence [31].

However, the success of implementing digital learning largely depends on educators' readiness and competence. Therefore, teacher professional development is crucial. Teachers need to be equipped with pedagogical and technological competencies to integrate technology meaningfully. Dashkina et al. emphasize that digital transformation in education will have a positive impact on students' creativity when it is supported by adequate teacher competence [32].

4. Gamification as a Strategy for Strengthening Creativity

Gamification is increasingly viewed as an effective approach to fostering creativity in digital learning. By incorporating game elements into the learning process, learning activities become more engaging and challenging for students. This condition can naturally increase students' intrinsic motivation, which ultimately encourages them to be more confident in exploring ideas, trying various possibilities, and developing more innovative ways of thinking. Orak emphasizes that gamification not only increases learning engagement but also strengthens the development of global skills, including creativity [33].

Gamification also contributes to the development of higher-order thinking skills. Students involved in game-based learning show greater improvement in creative abilities than those in traditional learning methods. This finding indicates that gamification not only functions as a motivational tool but also as an effective pedagogical strategy in supporting creativity and innovation. The study by Bueno Baquero et al. states that the gamification approach can improve creativity as well as computational thinking skills [34].

The factors that lead to these results can be explained by three main aspects. First, the multimodal characteristics of digital media enrich students' cognitive stimuli. Second, the project-based learning design encourages students to solve problems independently and reflectively. Third, the availability of digital revision spaces allows students to develop ideas gradually until they reach a more refined form. The combination of these three factors forms a learning ecosystem conducive to fostering creativity.

In addition, the improvement of creative thinking skills among students at SMAIT Al-Multazam Kuningan also occurs because students are given opportunities to explore ideas more broadly in completing assignments. This condition encourages students to take initiative in selecting sources, developing approaches, and modifying solutions, thereby enabling creative thinking to develop more optimally. In the process of completing project-based tasks, students also have the opportunity to go through the stages of exploring, developing, and refining ideas. The availability of structured time in digital learning allows students to reflect and revise, ultimately strengthening the quality of their creative ideas.

Based on the discussion above, digital learning plays a strategic role in fostering creativity and new ideas by integrating interactive technologies, collaborative learning, personalization, and gamification, thereby forming a creative and sustainable learning ecosystem. This finding emphasizes the importance of designing digital learning that is not only oriented toward cognitive achievement, but also toward the development of creative thinking skills as a key competence of the 21st century.

However, this study has limitations: a relatively small sample size (five students from one school) and the absence of quantitative measurement for each indicator of creative thinking separately, so the results of this study cannot yet be widely generalized. Nevertheless, the implications of this study show that digital learning has the potential to become an effective strategy in improving students' creative thinking skills when it is supported by technological readiness and appropriate learning design, including the availability of adequate digital infrastructure; thus, the digitalization of learning not only contributes to the modernization of education, but also to the strengthening of creative thinking skills needed by students in the 21st century.

CONCLUSION

This study concludes that project-based digital learning supported by visual media, learning videos, and digital design applications has a positive impact on the creative thinking skills of Grade 12 students at SMAIT Al-Multazam Kuningan, as indicated by improvements in fluency in generating ideas, flexibility in developing alternative solutions, and the originality of assignment products. Digital learning facilitates the exploration of ideas through visual stimuli and platform interactivity, encouraging students to combine and modify ideas creatively when completing assignments. The effectiveness of improving creative thinking is influenced by the design of structured project-based learning and the readiness of the school's digital infrastructure, but the findings of this study are still limited to a small number of informants, so they cannot yet be widely generalized.

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