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THE ROLE OF GENERATIVE AI IN PERSONALIZED VISUAL LEARNING AND EDUCATIONAL CONTENT CREATION

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ABSTRACT

Generative Artificial Intelligence (AI) is transforming education by enabling personalized visual learning and the creation of interactive educational content. Traditional teaching methods may not fully address students' different learning needs and abilities. Generative AI can support learning by producing customized diagrams, illustrations, infographics, and visual explanations that improve student engagement and conceptual understanding. This study examines the role of generative AI in personalized visual learning and educational content creation using a qualitative approach based on existing academic literature. It explores the benefits of AI-powered educational tools, their impact on learning experiences, and challenges related to content accuracy, data privacy, and ethical use. The study highlights that generative AI can make education more flexible, accessible, and learner-centered when used responsibly. However, teachers' guidance and verification of AI-generated materials remain essential to ensure educational quality. The study concludes that generative AI should complement traditional teaching methods and support the development of effective, personalized learning environments.

KEYWORDS: Generative AI, visual learning, personalized learning, educational content creation, artificial intelligence.

INTRODUCTION

In the modern era, technological advancements have significantly transformed the education sector by introducing innovative approaches to teaching, learning, and educational content development. Among these advancements, Generative Artificial Intelligence (AI) has emerged as a promising technology with the potential to improve educational experiences and support personalized learning. Generative AI refers to artificial intelligence systems that can create new content, including text, images, diagrams, illustrations, presentations, and other digital learning materials. These capabilities are creating new opportunities for teachers and students to access educational resources that are more flexible, interactive, and responsive to individual learning needs. As educational institutions increasingly adopt digital technologies, understanding the role of generative AI in personalized visual learning and educational content creation has become an important area of academic research. Traditional educational approaches often rely on standardized textbooks, classroom lectures, and instructional materials designed for groups of students. Although these methods remain important, students differ in their learning abilities, prior knowledge, interests, and preferred ways of understanding information. Some students may understand complex concepts through written explanations, while others may benefit more from diagrams, images, charts, animations, and practical examples.. Generative AI offers opportunities to address these challenges by helping educators develop customized learning materials that present information in different formats and levels of complexity.

Personalized learning is an educational approach that adapts learning experiences according to students' individual needs, abilities, progress, and learning objectives. Rather than providing exactly the same instructional materials to every learner, personalized learning aims to make educational experiences more relevant and accessible. Generative AI can support this approach by producing customized explanations, practice questions, summaries, and visual representations based on specific learning requirements. For example, a student

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struggling to understand a scientific process may benefit from an AI-generated diagram accompanied by a simplified explanation. Similarly, a mathematics teacher may use AI to create step-by-step visual examples for students with different levels of understanding. Such applications can help make learning more flexible and provide alternative ways of understanding difficult concepts. Visual learning is particularly important because images and visual representations can help learners organize information, recognize relationships, and understand abstract ideas. Diagrams, infographics, illustrations, charts, and animations are widely used in education to communicate information clearly and support conceptual understanding. However, preparing high-quality visual materials can require considerable time, technical skills, and financial resources. Generative AI tools can assist educators by producing initial visual designs, creating illustrative examples, and adapting educational graphics to different subjects and student levels. Although this process is essential for effective teaching, it can require substantial preparation time, particularly when educators need to produce different versions of the same material for students with varying learning needs. Generative AI can support this process by assisting teachers in preparing educational content more efficiently and adapting it to specific classroom requirements. AI-powered tools can generate written explanations, suggest examples, create diagrams, develop presentation outlines, and assist in preparing learning activities.

For instance, an educator teaching biology may use generative AI to prepare an illustrated explanation of the human digestive system, while a history teacher may create a visual timeline of important historical events. Similarly, language teachers can use AI to develop vocabulary illustrations, visual storytelling activities, and reading exercises suitable for different proficiency levels. These applications demonstrate how generative AI can support the production of diverse educational materials while allowing teachers to retain control over instructional decisions. Research by Jauhiainen and Guerra (2024) examines the potential of generative AI for dynamically personalizing school learning materials. Their work highlights the relevance of adapting educational content to students' needs through AI-supported technologies. More broadly, research on generative AI in education has explored its potential applications in instructional design, content development, feedback, and personalized learning. However, the effectiveness of these applications depends on the accuracy of generated information, the suitability of the materials for the intended learners, and the quality of human supervision. An important advantage of AI-assisted content creation is the possibility of adapting existing educational materials rather than preparing every resource from the beginning. Teachers can use AI tools to simplify difficult explanations, create alternative examples, and develop visual summaries of lengthy topics. This flexibility may help educators respond to different classroom requirements and provide additional support to learners who need more explanation or practice. Nevertheless, AI-generated materials should be reviewed carefully to ensure that they are factually correct, appropriate for students' educational levels, and consistent with curriculum objectives. Personalized visual learning combines the benefits of individualized instruction with the use of visual educational resources.

This approach recognizes that students may require different explanations and representations to understand the same concept. Generative AI can support this process by creating multiple visual representations of a topic and adapting accompanying explanations according to students' needs. For example, a complex engineering concept can be presented through a labeled diagram, a simplified illustration, or a sequence of visual steps. Students can then use the representation that best supports their understanding. Another important benefit of personalized visual learning is its potential to increase student engagement. Visual resources can make lessons more interesting and provide learners with opportunities to interact with

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educational content in different ways. AI-generated illustrations, diagrams, and customized examples may help connect theoretical knowledge with practical situations. When students can access explanations that correspond to their learning needs, they may find it easier to participate in learning activities and revisit difficult topics independently. However, improvements in engagement or academic performance should not be assumed automatically; they depend on the instructional design, the quality of the materials, and the learners' educational context. Nevertheless, visual content should be designed carefully because some learners may require alternative formats, descriptive text, appropriate color contrast, or other accessibility features. Effective personalized learning therefore requires attention to both individual learning needs and the accessibility of educational resources. Despite its potential benefits, generative AI introduces several challenges that must be considered before it is widely integrated into educational environments. One major concern is the accuracy and reliability of AI-generated content. AI systems can produce incorrect explanations, misleading images, or visual representations that appear convincing but contain errors. If teachers or students accept such content without verification, misunderstandings may develop and affect the learning process. Therefore, educators should evaluate AI-generated resources against reliable academic sources and relevant curriculum standards before using them in teaching. Privacy and ethical concerns are also important. Some AI tools may process information entered by users, including educational records or personal details. Educational institutions must therefore consider data protection, informed use, and the privacy of students and teachers.

Algorithmic bias presents another challenge because generated content may reflect limitations or biases in the data used to develop AI systems. Responsible implementation requires suitable institutional policies, careful tool selection, and awareness of the ethical implications of AI-supported learning. Furthermore, unequal access to digital devices, reliable internet connections, and AI tools may prevent some students from benefiting equally from these technologies. Teachers consequently remain essential in guiding students, verifying content, encouraging critical thinking, and ensuring that AI supports rather than replaces meaningful learning activities. Against this background, the present study examines the role of generative AI in personalized visual learning and educational content creation. It explores how AI-generated diagrams, illustrations, infographics, and other educational resources may support individualized learning experiences and assist teachers in developing instructional materials. The study also considers the potential benefits and limitations of these technologies, including their implications for student engagement, accessibility, content reliability, and responsible use. Using a qualitative approach based on existing academic literature and relevant educational research, the study aims to develop a balanced understanding of the opportunities and challenges associated with generative AI in education.

RESEARCH OBJECTIVES

1. To investigate how AI-generated visual materials improve students' engagement and understanding of complex concepts.research

RESEARCH QUESTIONS

LITERATURE REVIEW

Generative Artificial Intelligence (AI) is becoming an important part of modern education because of its ability to create educational content according to students' needs, interests, and abilities. Personalized learning refers to an educational approach in which teaching methods, learning activities, and educational resources are adapted to individual students. Traditional teaching methods often provide the same materials to all students, even though learners may differ in their knowledge, learning speed, and understanding. Generative AI can help address

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these differences by producing customized explanations, examples, summaries, quizzes, and visual learning materials. Jauhiainen and Garagorry Guerra (2024) examined how ChatGPT could be used to personalize school learning materials according to students' existing knowledge. Their research demonstrated the potential of generative AI to support the development of learning materials suited to different educational needs. This approach can help teachers explain difficult concepts in simpler language and provide additional examples to students who need further support. It may also allow advanced learners to explore more detailed information about a subject. Generative AI can therefore contribute to more flexible learning experiences. However, effective personalization requires teachers to review AI-generated content carefully. The material should be accurate, appropriate for the students' educational level, and consistent with the curriculum. AI should support teachers in understanding students' needs rather than independently determining every aspect of their education.

Visual learning is an important educational approach that uses diagrams, pictures, charts, illustrations, infographics, and other visual representations to explain information. Visual materials can make complex ideas easier to understand by presenting information in a clear and organized form. Generative AI has expanded the possibilities of visual learning by allowing educators to create customized images and illustrations according to specific lesson objectives. Ali et al. (2024) explored the use of text-to-image generation technologies for developing educational materials for school students. Their research considered how educators could work with AI-generated images while addressing the practical and ethical issues associated with these tools. Similarly, Lee et al. (2024) investigated the integration of image-generating AI into STEAM education. Their work explored how students could use image-generation tools to express ideas and participate in creative learning activities. These studies indicate that generative AI may support visual learning by helping teachers prepare subject-specific illustrations, educational posters, and other visual resources. For example, a science teacher could develop an illustration to explain the structure of a cell, while a mathematics teacher could create visual examples of geometric shapes. Such resources can offer alternative ways of presenting information and may help students who find text-based explanations difficult.

Nevertheless, AI-generated images do not always represent concepts accurately. Some images may contain incorrect details or misleading information. Therefore, teachers must check the accuracy, relevance, and educational value of generated visuals before including them in classroom activities. Educational content creation involves preparing lesson plans, worksheets, presentations, quizzes, summaries, diagrams, and other materials that support teaching and learning. Preparing these resources can require considerable time and effort. Generative AI can assist educators by producing initial drafts and offering different versions of learning materials that teachers can modify according to their educational objectives. Qian (2025) reviewed pedagogical applications of generative AI in higher education. The review examined how generative AI is being incorporated into teaching and learning and highlighted the importance of connecting AI tools with appropriate pedagogical approaches. This suggests that AI-generated materials may be useful when they are carefully integrated into lesson planning and classroom instruction. Generative AI can also help teachers present the same topic in different formats. For example, a lesson can be supported through a written explanation, a visual diagram, a short summary, and practice questions. Students can then use different resources to strengthen their understanding. Teachers may also adapt the difficulty of these materials according to students' prior knowledge and learning requirements.

However, AI-generated educational content should not be used without verification. AI tools may produce incorrect facts, outdated information, or explanations that are unsuitable for the

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intended audience. Teachers must review the material, correct errors, and ensure that it meets the learning objectives. Thus, generative AI is best understood as a supporting tool that can improve the efficiency of content preparation while maintaining teachers' responsibility for educational quality. The combination of generative AI and personalized visual learning offers several potential benefits for students and teachers. One important benefit is the ability to provide multiple explanations of the same concept. Students who struggle with a topic may receive simpler explanations or additional visual examples, while students with stronger prior knowledge may explore more advanced material. Another potential benefit is improved student engagement. Interactive visual resources and AI-assisted creative activities may encourage students to participate actively in learning. Instead of only reading information, students may explore concepts by creating illustrations, developing presentations, or comparing different visual explanations. These activities can provide opportunities for creativity and independent learning. Generative AI may also support accessibility by helping teachers adapt materials for students with different language abilities and levels of understanding. For example, a teacher can simplify a complex explanation, provide examples related to familiar situations, or develop alternative visual resources. Such flexibility may help make educational content more approachable for a wider range of learners.

Despite these potential benefits, the actual impact of generative AI depends on how it is used. Producing attractive images or large amounts of content does not automatically improve learning. Educational materials must be meaningful, accurate, and connected to clear learning objectives. Teachers should also consider whether a visual resource genuinely helps explain a concept rather than simply making a lesson more attractive. Although generative AI creates new opportunities for education, several challenges must be addressed. One major concern is the accuracy and reliability of AI-generated information. AI systems can produce incorrect explanations, misleading diagrams, and biased content. If students rely on such materials without checking them, their understanding may be affected. Teachers should therefore verify the information before using AI-generated resources in lessons. Data privacy is another important issue. Students and teachers may enter personal information into AI platforms, creating concerns about how this information is collected, stored, and used. Educational institutions should establish clear guidelines to protect student information and encourage responsible use of AI tools.

Miao and Holmes (2023), in UNESCO's Guidance for Generative AI in Education and Research, emphasized the importance of human oversight, privacy protection, inclusion, and responsible implementation. Their guidance supports the use of a human-centered approach in which AI assists teachers and students while educational decisions remain guided by human judgment. Other challenges include unequal access to technology, copyright concerns, algorithmic bias, and excessive dependence on AI-generated answers. Students who lack reliable internet access or suitable devices may not receive the same benefits as those with better technological resources. Furthermore, overdependence on AI may reduce opportunities for students to develop independent thinking and problem-solving skills. These concerns highlight The present study addresses this research gap by examining the role of generative AI in personalized visual learning and educational content creation. It focuses on the potential benefits of AI-generated materials, their contribution to student engagement and understanding, and the challenges associated with their use. The study also considers how teachers can integrate these technologies responsibly while maintaining educational quality.

METHODOLOGY

This study adopts a qualitative research approach to examine the role of generative artificial intelligence (AI) in personalized visual learning and educational content creation. This approach is suitable because the study aims to understand the benefits, challenges, and

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educational applications of generative AI rather than measure its impact through numerical data. The research is based on secondary data collected from existing academic articles, research papers, systematic reviews, and relevant reports. These sources are used to explore how generative AI supports the creation of customized diagrams, illustrations, presentations, and other educational materials for students with different learning needs. The study also examines challenges related to content accuracy, data privacy, accessibility, and ethical use. The collected information is analyzed thematically to identify common ideas, patterns, and findings across the literature. This approach helps develop a broader understanding of how generative AI can support effective and personalized visual learning while maintaining educational quality and teacher supervision.

RESEARCH DESIGN

This study uses a **descriptive research design** to examine the role of generative artificial intelligence (AI) in personalized visual learning and educational content creation. The purpose of this design is to describe how generative AI is used to develop customized educational materials, including diagrams, illustrations, presentations, and visual explanations. The study is based on secondary data collected from published research articles, academic journals, systematic reviews, and relevant educational reports. The selected literature is reviewed to identify the potential benefits of generative AI, its contribution to student engagement and understanding, and the challenges associated with its use. The research also considers issues such as content accuracy, data privacy, accessibility, and ethical concerns. This design provides a structured way to understand existing research and identify gaps in knowledge about the effective and responsible use of generative AI in education.

DATA ANALYSIS

The data in this study are analyzed using thematic analysis based on secondary sources, including academic research articles, journals, systematic reviews, and educational reports. The collected information is reviewed to identify common themes related to the role of generative AI in personalized visual learning and educational content creation. The analysis focuses on four main themes: personalized learning, AI-generated visual materials, educational content creation, and challenges of AI implementation. Existing studies are compared to understand how generative AI can help teachers develop customized learning resources, improve student engagement, and explain complex concepts through visual representations. The analysis also examines concerns related to content accuracy, data privacy, accessibility, and ethical use. Finally, the findings from the selected literature are organized and interpreted to identify common patterns, research gaps, and opportunities for future research. This analysis helps develop an overall understanding of how generative AI can support effective and responsible educational practices.

FINDINGS

The findings of this study indicate that generative Artificial Intelligence (AI) has the potential to improve personalized visual learning and educational content creation. The reviewed literature suggests that AI tools can help teachers develop customized diagrams, illustrations, presentations, quizzes, and explanations according to students' different learning needs. These resources may make complex concepts easier to understand and encourage greater student engagement. The study also indicates that generative AI can save teachers time by supporting the preparation and adaptation of educational materials. However, several challenges have been identified, including inaccurate information, misleading visuals, data privacy concerns, unequal access to technology, and ethical issues. The findings further highlight the importance of teachers' supervision in checking the accuracy and educational quality of AI-generated content. Overall, generative AI can support flexible and learner-

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centered education when it is used responsibly alongside traditional teaching methods. Since this study is based on secondary sources, these findings represent patterns identified in the reviewed literature rather than results from a new experiment.

CONCLUSION

Generative Artificial Intelligence (AI) is playing an increasingly important role in personalized visual learning and educational content creation. It provides new opportunities for teachers and students to make the learning process more interactive, creative, and effective. By generating customized images, diagrams, videos, presentations, and other educational materials, Generative AI helps explain complex concepts in a simple and understandable way. It also supports different learning styles and allows students to learn according to their individual needs, interests, and abilities. Furthermore, Generative AI can save teachers time, improve educational content, and encourage creativity and independent learning among students. However, its effective use requires attention to accuracy, data privacy, ethical concerns, and the risk of overdependence on AI-generated materials. Human guidance and critical thinking remain essential to ensure the quality and reliability of educational content.

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