

Enhancing Student Independence through the Integration of Learning with Artificial Intelligence Tools

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Abstract

This academic paper examines the incorporation of artificial intelligence (AI) tools as an efficient method to enhance students' self-reliance in the learning process. The rapid advancement of information technology necessitates inventive approaches in education, where AI can be integrated to offer a more individualized and effective learning experience. The study devises instructional strategies that leverage AI technology to provide a more dynamic and flexible learning environment. Applying AI across various aspects can aid students in accessing content tailored to their unique learning styles, fostering captivating learning experiences. The paper also underscores AI's advantages in supplying immediate feedback, guiding students, and encouraging creativity. However, it is essential to consider ethical and privacy considerations alongside the integration of AI in educational settings. With a comprehensive understanding of the potential and challenges, the utilization of AI can play a pivotal role in cultivating student autonomy and advancing education in the digital age.

Keywords: Artificial Intelligence, Learning in Digital Era, Personalized Learning, Education Technology.

Background

Education in the digital era is undergoing a fundamental shift in the learning paradigm, driven by rapid technological advancements. The integration of technology and communication has transformed how knowledge is accessed, understood, and interacted with. Learning is no longer confined to conventional classroom spaces but has become a more flexible and personalized learning experience. Education is now not just focused on the transfer of knowledge but also emphasizes the development of skills relevant to the ever-changing job market. Technologically-driven education concepts, such as online learning, the use of artificial intelligence, and information technology integration, are becoming increasingly dominant. Learners can access learning resources from various platforms and participate in collaborative projects globally. Education in the digital era is cultivating 21st-century skills such as problem-solving, creativity, and critical thinking. Although challenges related to accessibility and digital divides need to be addressed, education in the digital era opens opportunities to create a more inclusive, responsive, and relevant learning environment to meet the demands of the times. The goal of education in this era is to prepare individuals to adapt to rapid and continuous changes, facilitate innovation, and create future leaders capable of addressing complex global challenges (Hajri, 2023).

Adapting education to the evolving digital era is crucial. In this context, education needs to shift from its traditional approach to create a more responsive learning environment that caters to individual needs. By utilizing technology, education can offer customized learning experiences based on students' learning styles and interests. Adaptive learning systems, data analysis, and online platforms enable a tailored teaching approach, ensuring each student can optimize their potential. Education, beyond merely providing information, should focus

on nurturing 21st-century skills such as collaboration, creativity, and critical thinking. Embracing these changes allows education to play a pivotal role in preparing the upcoming generation to confront continually developing global challenges.

The utilization of Artificial Intelligence (AI) has become a prominent trend in various fields, including education. In the continuously evolving digital era, integrating AI in the context of learning is increasingly crucial to enhance the efficiency and effectiveness of the education process. One primary focus of leveraging AI is to improve the capability of providing personalized learning experiences tailored to the needs of each learner. With AI support, educators can offer more focused learning guidance customized to individual learning styles, abilities, and interests, thereby fostering student autonomy in learning. The utilization of Artificial Intelligence (AI) aims to stimulate the enhancement of student autonomy through innovative and personalized learning approaches. The use of AI can provide solutions tailored to individual student needs, designing learning experiences that trigger critical and creative abilities. In an era where learning challenges are highly varied, the use of AI is relevant as it can provide quick responses to the specific needs of students, facilitate the development of independent thinking skills, and explore the unique potential of each individual. Thus, the use of AI to enhance student autonomy is not just a technological innovation but also a critical strategy to prepare the future generation to face dynamic changes and the increasingly complex demands of society.

Artificial Intelligence (AI), often referred to as Kecerdasan Buatan in Indonesian, pertains to the ability of computer systems or machines to mimic and execute tasks that typically require human intelligence. AI encompasses various techniques, including machine learning, natural language processing, pattern recognition, and decision-making, with the goal of creating systems that can adapt and learn from experiences (Russell, 2010). The primary objective of artificial intelligence is to develop machines that can learn, understand, plan, and adapt to perform tasks independently. Professor John McCarthy, a computer scientist, played a pivotal role in introducing the concept of artificial intelligence (AI) in 1956. AI comprises various technologies such as machine learning, chatbots, augmented reality (AR), virtual reality (VR), and many others. These technologies open up numerous new possibilities in the learning process, both inside and outside the classroom, thereby enhancing the overall quality of education. Techniques and approaches include natural language processing, computer vision, fuzzy logic, machine learning, as well as combinations of several methods (Karyadi, 2023).

The implementation of Artificial Intelligence (AI) can involve various technologies such as machine learning, chatbots, augmented reality (AR), virtual reality (VR), and various other technologies. These technologies open up diverse new opportunities in the learning process, both inside and outside the classroom, and enhance the overall quality of education. Artificial intelligence (AI) refers to the ability of computer systems to perform tasks that typically require human intelligence. The fundamental concept of artificial intelligence involves the development of algorithms and computational models that enable machines to learn from data, recognize patterns, and make decisions independently. Machine learning, a crucial branch of AI, allows systems to improve their performance over time based on experience and received data. Principles such as deep learning, artificial neural networks, and natural language processing form the foundation for the development of AI applications capable of processing information, recognizing complex patterns, and providing solutions to various challenges in various fields, including education.

The independence of student learning refers to the ability of students to manage and organize their learning processes without excessive dependence on guidance or supervision from others. Independent learning involves a range of skills and attitudes, including the ability to plan learning, manage time, set goals, self-motivate, as well as evaluate and reflect on learning outcomes. AI can support constructivism by providing students with access to relevant learning resources and delivering personalized learning experiences, enabling students to actively construct their knowledge. Artificial intelligence, also known as AI, is a current trend in various aspects of society, including education. The use of AI in education involves machine learning and deep learning. AI works by analyzing data and providing information based on that data to the user. In its application to learning, this can facilitate students in obtaining information about the learning material they are studying. Research conducted by Álvarez & Falcon produced data on the success of students in effectively and efficiently completing problem-solving tasks given to them with the assistance of AI text analysis. The use of AI can facilitate students in independent learning as long as it is used in the context of learning (Dalu, 2023).

This research discusses the utilization of artificial intelligence (AI) in enhancing student independence. In the midst of rapid changes, education in the digital era requires a responsive and progressive approach to meet evolving learning demands. This study addresses issues related to how AI can design learning experiences tailored to the needs and learning styles of individual students, as well as the introduction of AI applications in education and how this can enhance student independence. The article aims to detail the significant contributions of AI in designing personalized and customized learning experiences, creating environments that stimulate creativity and problem-solving, and preparing students for future challenges. Additionally, this research aims to determine the extent to which artificial intelligence is utilized in learning. The existence of AI platforms is expected to enhance interest, attractiveness, interaction patterns, and academic skills. Through this research, it is hoped that we can gain a deeper understanding of how AI technology not only serves as a tool but also as an effective partner in shaping a generation that is independent and ready to face the dynamics of a technology-based society.

Research Method

This research employs the design research method, which is a systematic educational intervention consisting of design, development, and evaluation activities aimed at improving or enhancing the quality of educational activities or programs (Putrawangsa, 2019). Design research is an approach designed to formulate solutions for the complexity of problems that arise in educational practices, where these problems do not yet have precise solutions or clear guidelines for resolution (Putrawangsa, 2019). According to Plomp, design research is a systematic study of designing, developing, and evaluating educational interventions (such as programs, strategies, learning materials, products, and systems) as solutions to complex problems in educational practices. It also aims to advance our knowledge of the characteristics of these interventions and the design and development processes (Plomp, 2013). This method is chosen when the research aims to create innovation or improve a system, focusing on the practical development of solutions to real-world problems.

Design research is considered a highly relevant research model for improving the quality of education, especially in learning, as it can bridge the gap between theory and practice, producing applicable and practical learning designs (Lidnillah, 2012). There are several models for implementing design research steps, and this study utilizes the Plomp model, which consists of three stages: preliminary research, prototyping stage, and assessment phase.

Result and Discussion

In the digital age, recognizing the self-directed learning requirements of students is a crucial factor affecting the efficiency and continuity of the educational process. Students must acquire self-directed skills to independently navigate learning through digital platforms. Vital components include the capacity to comprehend online instructions, effectively manage time, and possess digital literacy skills, all of which are pivotal in adapting to the evolving dynamics of learning in this era. Furthermore, having the ability to filter and assess information from diverse digital sources is a crucial competency. Consequently, pinpointing the necessities for student self-directedness should be a central focus in developing curricula and learning strategies to meet the constantly changing demands of the digital era.

The capabilities of AI technology play an integral role in meeting the self-directed learning needs of students in the digital era. Through the adoption of AI in learning platforms, students can access individually tailored learning experiences. Artificial intelligence systems can analyze learning styles, student progress, and levels of understanding to provide recommendations that align with the unique learning needs of each student. Moreover, AI virtual assistants and tutors can offer instant assistance in answering questions, explaining concepts, and providing feedback to enhance student comprehension. Thus, AI's ability to deliver adaptive and individually responsive learning experiences contributes to shaping student independence, enabling them to take an active role in their own learning processes amid the dynamics of the digital era.

Artificial Intelligence (AI) is a field of study focused on enabling machines, particularly computers, to carry out tasks and functions comparable to those performed by humans. More specifically, AI seeks to imbue machines with intelligence based on human-like behavior. The primary objective of AI is to empower computers to execute commands with capabilities that can match those of humans. In the realm of AI, there are four principal approaches outlined by Cholissodin et al. (2020): (1) Acting humanly: AI systems can perform tasks or interact with the environment in a manner similar to humans. (2) Thinking humanly: AI systems possess the ability to think and process information in a way that mirrors human cognition. (3) Think rationally: AI systems are capable of engaging in logical and rational thinking, particularly in decision-making processes. (4) Act rationally: AI systems can act and respond to situations in a rational manner, guided by predefined logic and objectives

The benefits of Artificial Intelligence (AI) in education are highly significant and impactful. In the context of learning, AI has opened doors for profound innovations and changes in the methods and approaches used in the learning process.

1. **Personalized Learning:** One of the primary advantages of AI in education is its ability to provide personalized learning experiences tailored to the needs and understanding levels of each individual. By analyzing data on students' progress and weaknesses, AI can identify areas that need improvement and present suitable learning materials.
2. **Increased Student Engagement:** The use of interactive technology supported by AI makes learning more engaging and interactive for students. Learning applications incorporating game elements or AI-based simulations can help students become more deeply involved in their learning processes.
3. **Instant Feedback:** AI enables the provision of instant and in-depth feedback on students' work. Learning platforms utilizing AI can indicate where mistakes are made, provide explanations, and recommend corrective steps. This helps students understand their errors and learn from them quickly.
4. **More Effective and Developed Curriculum:** By analyzing data from various sources, AI can assist in identifying trends and learning needs that may not be immediately apparent to teachers. This can aid in the development of a more effective and relevant curriculum for students.
5. **Higher Quality of Open and Distance Learning:** Particularly in the context of remote learning, AI can help overcome communication and interaction challenges. This technology can facilitate online discussions, adaptive testing, and collaboration among students, creating a more integrated learning experience.
6. **Saving Resource and Time:** AI can assist in automating administrative tasks such as assessment and reporting. This allows teachers to concentrate more on activities that require human interaction, such as providing guidance and mentoring (Diantama, 2023).

Here is a brief explanation of some concepts and applications related to Artificial Intelligence (AI) in the context of learning:

Tutor Virtual Personal

Personal Virtual Tutor is a concept where artificial intelligence is employed to create a personalized learning experience for each student. This system analyzes the behavior and learning performance of students to formulate a learning plan that aligns with their individual understanding levels and learning styles. The Personal Virtual Tutor can provide recommendations for materials, additional exercises, and learning strategies tailored to the individual understanding levels and learning styles. It offers individual guidance, provides real-time feedback, and adjusts learning materials to meet the needs of each student, adapting the learning content based on their requirements and comprehension levels (Cheng, 2014).

Adaptive Learning System

Adaptive learning system utilizes artificial intelligence to recognize and dynamically respond to the learning needs of students. By monitoring learning progress and detailing learning styles, this system can adjust the curriculum, teaching methods, and difficulty levels of materials. This ensures that students receive content tailored to their understanding levels, enhancing learning efficiency and improving learning outcomes (VanLehn, 2005). Example: Khan Academy employs an Adaptive Learning System. By tracking students' progress on

specific topics, the system adjusts difficulty levels and provides additional exercises or explanations based on individual student needs.

Chatbot Learning

Chatbot Learning is a computer program that uses artificial intelligence to provide responses and learning assistance to users through conversation. They can answer questions, provide explanations, and offer learning support. Learning chatbots enhance accessibility and provide instant assistance (Papadakis, 2018). For example, Duolingo, a language learning application, uses a chatbot to provide instructions, answer questions, and give feedback when users practice speaking or writing in the target language.

Game-based Learning

Game-Based Learning incorporates gaming elements to enhance student engagement, motivation in learning, and facilitate the understanding of concepts. AI can be used to adjust difficulty levels based on students' understanding, provide feedback, and personalize the gaming experience (Hamari, 2014).

AI AI-Based Assessment System

AI-Based Assessment Systems use artificial intelligence technology to automatically assess student performance. This may include evaluating assignments, exams, or projects, enabling quick and objective assessments. These systems help teachers save time, provide more accurate feedback, and support a fair assessment process.

Educational Data Analysis

Educational Data Analysis involves using AI to analyze data regarding student performance, learning patterns, and other factors. This information can be utilized to make better educational decisions and understand trends in the learning process. Additionally, this analysis supports decision-making and helps enhance learning strategies (Romero, 2013).

Automated Evaluation

Automated Evaluation uses artificial intelligence to assess assignments or exams and automatically evaluate students' answers and other performance outcomes. This helps reduce the workload for teachers and provides quick feedback to students. Additionally, with the analysis of student responses, this system offers fast and objective assessments, reducing the burden on teachers and ensuring consistency in evaluations (Wang, 2017). Example: Turnitin is an automated evaluation system used to detect plagiarism in essays or assignments. Using artificial intelligence, Turnitin analyzes text and compares it to a reference database to assess the authenticity of the work.

All these concepts reflect how the integration of artificial intelligence in education can enhance overall efficiency, personalization, and learning quality. The following are the stages of integrating artificial intelligence into learning using design research with the Plomp model consisting of three stages: preliminary research, prototyping stage, and assessment phase. In the first stage, preliminary research directs researchers to identify problems, conduct a literature review, and analyze needs. This step serves as the foundation for formulating conceptual designs in the next stage. The prototyping stage involves creating conceptual designs and prototypes that can be tested with students. Prototyping testing and continuous iteration allow researchers to obtain valuable feedback and enhance optimal designs. Finally, in the assessment phase, the effectiveness of the solution is evaluated by analyzing the extent to which goals and needs are met. The implementation of the solution into a real context is followed by ongoing monitoring and evaluation to ensure the sustainability and suitability of the solution over time. With this iterative approach, the Plomp model provides a robust framework for researchers to develop, test, and improve design solutions that can have a positive impact on practical problem-solving.

1. Preliminary Research

In this stage, the researcher will investigate the specific needs of students in developing self-directed learning in the digital era. A literature review will be conducted to detail the theoretical foundations of AI in the educational context and identify recent trends and innovations that can be integrated. The

analysis also includes a profound understanding of the expected role of artificial intelligence in enhancing student self-directedness. By detailing the context, objectives, and issues, this analysis stage will provide a strong foundation for designing an appropriate research methodology and formulating relevant research questions. Additionally, there will be a focus on exploring the latest AI technologies that can significantly contribute to the development of student self-directedness in the context of digital learning. The results of this analysis stage include several applications or systems that can be integrated into learning.

- A. Magick Pen (Learning Device Creation) AI that assists teachers in creating lesson plans. This artificial intelligence can be utilized by subject teachers to facilitate the completion of school administrative processes related to lesson plans and lesson implementation.
- B. ElevenLabs (Voice Assistant) ElevenLabs is a voice Artificial Intelligence software claimed to be the most realistic, providing a lifelike voice for storytelling needs. This AI utilizes Artificial Intelligence to generate high-quality voices. ElevenLabs uses a highly sophisticated learning model to produce intonation similar to human speech and can adapt its delivery based on the given context.
- C. Doratoon (Learning Animation Video Maker) A free animation video maker or cartoon creator that eliminates the need to switch from one website to another. Launched in 2015, Doratoon has gathered over one million active users in more than 160 countries over the years.
- D. Quillbot (Essay Writing) QuillBot is an online platform that offers text paraphrasing and text rephrasing services using Natural Language Processing (NLP) and Artificial Intelligence (AI) technology. Users can input or paste text, and QuillBot generates a rephrased version with different words and sentence structures. Its key feature is the ability to provide translated or rephrased text while retaining the basic meaning of the original text. It is useful for editing, creating content variations, or understanding different ways to convey information. Users should exercise caution and review the results to ensure accuracy and content cohesion.
- E. Conker.ai (Evaluation Process) AI that assists teachers in quickly creating quiz questions. Suitable for teachers of all subjects, it serves as a quick tool to help teachers think about the quiz they want to give.
- F. Curipod (Evaluation Process) AI that aids teachers in creating presentations accessible to students within a specified timeframe.
- G. Gamma App (Presentation Maker) AI that helps teachers create more detailed presentations.
- H. ChatGPT ChatGPT has various useful applications in the learning context. In online learning, ChatGPT can function as a virtual assistant, providing individual support to students by answering their questions, providing additional explanations, and guiding them through challenging concepts. Its ability to provide contextual responses and instant feedback allows students to overcome difficulties more effectively. Additionally, ChatGPT can be used to design interactive role-playing simulations or learning scenarios, enhance students' language skills, and assist with assignments or projects. With intelligent integration into learning platforms, ChatGPT enriches students' learning experiences by providing anytime access to personalized learning resources and assistance tailored to individual needs, supporting student self-directed learning in the learning process.

Prototyping Stage

In this stage, the researcher focuses on creating a conceptual design and a prototype that can be tested. The process begins by detailing ideas that emerge from the preliminary research stage, resulting in a conceptual design that serves as the basis for prototype development. This prototype is then realized in the form of a model or simulation that can be tested. Testing this prototype is essential to gather valuable feedback on functionality, usability, and satisfaction. The results of these tests help the

researcher identify the strengths and weaknesses of the proposed design solution. The subsequent iterative process involves refining and improving the prototype based on the findings from testing, ensuring that the generated solution reaches the desired level of maturity. The success of this prototyping stage lays the foundation for moving on to the next phase, the assessment phase, where the design solution will be further evaluated against the pre-established goals and requirements. The following are the outcomes of this stage.

LEARNING STRATEGY

a. Rules and Goals

In this artificial intelligence technology or platform, learners are not merely passive observers; instead, they actively participate and engage directly in the learning process. This is achieved by providing learners with opportunities to explore anything they want to know, such as gathering data, sharing insights, drawing conclusions, and the teacher providing information so that learners can draw conclusions from their explorations.

b. Corelation with Media

Learners are given the opportunity to explore what they want to know and observe new things through tools or applications that are suitable for the learning process.

c. Idea Conception

After learners use artificial intelligence technology or platforms, they need to summarize their observations, ideas, and reflections related to this learning experience. Subsequently, learners can share the results of their experience through discussion.

SUGGESTIONS FOR THE USE OF ARTIFICIAL INTELLIGENCE IN LEARNING

a. Artificial Intelligence As A Tool

Artificial Intelligence technology or platforms are not intended to replace previously available technologies but rather serve as complementary tools to existing technologies in supporting the learning process.

b. Security and Comfortability

The use of artificial intelligence technology or platforms is recommended for learning materials that require extensive exploration by students. This helps students observe the learning process through experiences using various tools or platforms based on artificial intelligence. Before starting the learning process, the teacher should provide guidelines for using artificial intelligence that can offer a personalized learning experience. Points to consider include: (a) guiding students to process information obtained from artificial intelligence tools or platforms, (b) ensuring the accuracy and relevance of information needed for learning, and (c) ensuring the security of the tools or platforms used.

c. Hardware that Used on the Learning Process

- Internet: Used to provide access to online learning media.
- PC/Laptop: Utilized for further information exploration.
- Headphones: Used to reduce disturbances and enhance the learning experience, especially when using speakers.
- LCD Projector: Useful for displaying materials presented by the teacher.
- Smartphone: Can be used to explore available content.

Assessment Phase

The assessment phase in the design research method is a crucial step that marks a thorough evaluation of the developed design solution. In this stage, the researcher focuses on assessing the effectiveness and sustainability of the solution by analyzing the extent to which the goals and needs set in the preliminary research stage have been met. This evaluation may involve measuring performance, user responses, and the impact of the solution on the context it addresses. The implementation of the solution in real-life situations is also an integral part of this stage, and ongoing monitoring is conducted to understand how well the solution addresses practical challenges in the long run. The assessment process provides critical insights into the success of the design solution, and the evaluation results can

be used to make recommendations for improvement, further development, or even additional innovation. Thus, the assessment phase ensures that the resulting design solution is not only relevant and effective but also contributes positively to addressing challenges in the research context. In this stage, the final result is a learning module integrated with artificial intelligence (AI) technology.



Image 1. AI Module Cover
(Source: canva.com, 2023)

LEARNING OBJECTIVE

Learning Objective

After undergoing the learning process through the Discovery Learning model, participants are expected to:

1. Explain how green plants produce food.
2. Elaborate on the light and dark reactions of photosynthesis.

Achievement Indicators:

1. Identifying the main components of photosynthesis.
2. Describing the stages of photosynthesis.
3. Illustrating factors that influence photosynthesis.
4. Explaining energy changes in photosynthesis.

LEARNING PREPARATION

To ensure that learning can proceed effectively and achieve the set goals, several preparations are needed, including the following:

Learning media and content

1. Doratoon dan ElevenLabs (Video)
2. Conker.ai (Quiz)
3. Curipod.com (Interactive Presentation)
4. Gamma.app (Learning Material)
5. ChatGPT (Exploring the Learning Material)
6. Google Document (Discussion Result Slide)
7. Askyourpdf.com (Evaluation)

	the photosynthesis process and the light and dark reactions.		
Data Processing	Discussion The teacher engages students in a discussion regarding the material on the process of photosynthesis, including both light and dark reactions. The discussion takes place within the groups assigned by the teacher. Students, working in their respective groups, compile a written report summarizing the discussion.	Curipod.com	
Verification	Result Presentation Students present the results of their group discussions on issues related to the environmental ecosystem associated with the process of photosynthesis. Each group discusses problems occurring in the surrounding environment linked to photosynthesis.	Google docs	
Generalization	Material Generalization Based on the results of group discussions and class discussions, students draw conclusions from the learning material. The teacher assesses the group discussion documents on photosynthesis and the light and dark reactions. The teacher points to the most active group to present the conclusions of the photosynthesis material.	Askypdf.com	
Closing			
Closing	The teacher, along with the students, concludes today's learning activities by engaging in a game as an evaluation, reviewing some of the topics that have been discussed.	Educandy	15 Minutes

Conclusion and Suggestion

In conclusion, the integration of artificial intelligence (AI) has significant potential to enrich the learning experience and enhance student autonomy. In the context of learning integration, research findings indicate that utilizing AI tools specifically can boost student autonomy. Learning integration focused on AI applications provides opportunities for developing independent skills, including problem-solving, critical thinking, and creativity. Students engage in a more active and dynamic learning process when AI technology is directly used in instructional content. Emphasizing the use of AI as an assistive tool in learning tasks helps students sharpen their independent abilities, explore concepts in-depth, and enhance their sense of responsibility for personal learning. By leveraging AI technology, students can access learning resources tailored to their needs, design personalized learning experiences, and improve their understanding of critical concepts. Additionally, AI virtual tutors can offer individual support, answer questions, and provide instant feedback, assisting students in overcoming challenges.

The utilization of artificial intelligence (AI) to support learning does not replace the role of teachers. The crucial role of teachers is to instruct, educate, and train to enhance students' skills, knowledge, and ethics. This research highlights the importance of the teacher's role in sorting and selecting suitable applications to enhance student autonomy. The research findings emphasize that the right choice of AI applications can significantly contribute to the development of student autonomy through providing relevant feedback, stimulating critical thinking, and fostering independent skills. Teachers, as learning facilitators, have a critical responsibility in choosing and integrating this technology into the curriculum, ensuring that the applications used align with the students' needs and learning objectives. Here are some recommendations for integrating AI into learning and suggested applications.

- (1) **Personalized Learning:** Involves delivering learning materials tailored to the abilities, learning styles, and individual needs of students. This may include adjusting the difficulty level, providing additional assignments, or presenting materials differently based on students' learning preferences. Applications that can be used for this purpose include MagickPen, Coursera, and Khan Academy to provide customized learning plans based on the abilities and needs of each student. Learning materials are adjusted based on the results of students' exercises and exams.
- (2) **Automated Assessment:** Automatic Assessment involves the use of technology to evaluate tasks or exams automatically. This system can detect errors, score, and provide instant feedback without human intervention. Recommended applications for this purpose include Quizizz, Wordwall, Kahoot, and various online quiz platforms that allow teachers to create interactive quizzes for students.
- (3) **Virtual Tutor:** AI-based learning assistants help students understand the material, provide explanations, and offer support in completing assignments or exercises. Applications that can be used for this purpose include Google Classroom, Microsoft Teams, Zoom, and various collaboration platforms designed for online teaching and learning.
- (4) **Smart Content:** Smart Content refers to the use of artificial intelligence to present learning materials that align with the preferences, comprehension levels, and individual needs of students. Some applications that can be used for this purpose include GammaApp, Flipboard, ChatGPT, and various machine learning tools to analyze audience preferences and provide personalized content recommendations.
- (5) **Voice assistant:** Voice-based technology provides responses to voice commands, offers information, and can be used in educational contexts to provide assistance and quick access to information. Recommended applications include ElevenLabs, Microsoft Cortana, Google Assistant, Apple Siri, and various platforms that can help with tasks such as answering questions, playing music, and controlling smart devices.

The use of AI in education, however, raises ethical, privacy, and technological dependence considerations that need attention. Therefore, the implementation of AI in the context of learning requires a holistic approach that considers both benefits and challenges, involving teachers as guiding leaders. By understanding its potential and limitations, the utilization of AI can be an integral part of the learning revolution in the digital era, positively contributing to student autonomy and achievement. In implementing learning integration with the use of AI, it is advisable for educational institutions to develop concrete guidelines that guide the use of AI tools in each subject. Special training for teachers in designing and managing AI-enabled learning effectively is crucial. Additionally, involving students in the continuous evaluation and improvement process related to the learning experience with AI is essential. Schools should pay attention to data security aspects and the ethics of using AI technology, as well as provide adequate infrastructure support. Further research can focus on the development of more specific and measurable learning models to enhance student autonomy using AI.

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