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Original Research

AIEd Bloom's Taxonomy: A Proposed Model for Enhancing Educational Efficiency and Effectiveness in the Artificial Intelligence Era

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Abstract: This research presents a novel model, AIEd Bloom's taxonomy, which integrates artificial intelligence (AI) technologies with Bloom's taxonomy for learning objectives. The model comprises six levels: collect, adapt, simulate, process, evaluate, and innovate. Each level utilizes AI-powered platforms and tools to enhance the teaching and learning processes, such as organizing resources, creating adaptive learning experiences, simulating experiential learning, visualizing data for enhanced comprehension, and the providing evaluation tools for both formative and summative assessment. The proposed model aims to augment both the efficiency and effectiveness of educational processes in the context of the digital age. Designed for application within educational settings, this model has the potential to enhance learning through a variety of methods. Furthermore, its utility extends across a diverse range of cognitive levels, enabling the achievement of multiple learning objectives. This research constitutes a significant contribution to the burgeoning field of AI in education (AIEd) by presenting a cohesive framework that strategically aligns AI functionalities with Bloom's taxonomy, thus enriching the overall educational ecosystem.

Keywords: *Artificial Intelligence in Education, Bloom's Taxonomy, Cognitive Levels, AI-Powered Learning, Educational Efficiency, Educational Effectiveness*

Introduction

Recently, the educational system has undergone numerous rapid changes in the realms of scientific and technological advancements. These shifts have compelled it to alter its curricula, methodologies, and pedagogical strategies. This adjustment aims not merely to keep pace with technological evolution but also to adopt quality standards that allow for the establishment of an educational framework that harmonizes various dimensions—political, cultural, technological, and social—with both current and aspirational objectives. Given that the educational process is in a constant state of dynamism, trending toward the renewal of methods, approaches, and strategies in line with the demands of the times, the educational system has intensified its efforts toward developing an advanced electronic and technological version. This initiative is particularly evident in countries committed to the continuous development of their educational systems. This new version relies on the foundations of artificial intelligence (AI)

technologies, which extend through a range of tools and multimedia, from simple computer systems and applications to more complex electronic devices.

Recent research and studies in the field of integrating AI technologies into education suggest that the expansion of learning through modern technology provides opportunities for improving the educational system (Oke and Fernandes 2020; Sison et al. 2023; Yang 2022). AI plays multiple effective roles capable of developing this system and influencing it (Bhatt and Muduli 2022; Chan 2023; Hwang et al. 2020). Therefore, it has become imperative to examine how to adapt and take initiative in responding to the requirements of emerging technology, especially those linked to AI applications in education (Hwang et al. 2020). These are anticipated to cause a qualitative leap in the educational process, making it essential for countries worldwide to achieve the objectives of both education and learning processes to maximize their benefits (Leo et al. 2021).

AI has opened new horizons in instructional design, strategy construction, and all related matters, such as planning, organization, analysis, development, implementation, management, and evaluation (González-Pérez and Ramírez-Montoya 2022). This drives us to explore seizing the unique services and advantages provided by AI technologies in constructing and designing instruction based on sound principles that serve the educational process (Matos et al. 2017; Selwyn 2016). Despite the positives of AI, which benefit the educational system, opinions on the application of this type of education within educational institutions differ among educators, ranging from supporters who are extremely optimistic to opponents who are highly skeptical. This has led to shortcomings in presenting a proposed model that enables us to develop a pedagogical conception for integrating AI technologies in a way that enhances the educational environment (Zawacki-Richter et al. 2019).

Literature Review

Artificial Intelligence in Education (AIEd)

AI is defined as the capability of a computer system to think and act intelligently in various situations by accurately interpreting external data, learning from this data, and using this acquired knowledge to achieve specific objectives and tasks through flexible adaptation (Samoili et al. 2020). This includes problem-solving, eye tracking, speech recognition, data analysis, prediction, decision-making, and translation between languages (Buttazzo 2023; Fernandes, Rafatirad, and Sayadi 2023). The World Commission on the Ethics of Scientific Knowledge and Technology (Braunschweig and Ghallab 2021) further identifies AI as the ability to mimic certain functions of human intelligence, such as perception and the capacity for learning, thinking, problem-solving, linguistic interaction, and even the production of creative work.

The concept of AI in education (AIEd) encompasses everything from AI-based educational systems and dialogues, self-directed learning (Adiguzel, Kaya, and Cansu 2023),

AI-supported exploratory learning, student writing analytics, modern gamification strategies, and chatbots that assist students to adaptive learning that synchronizes with both the student and the specialized teacher, taking into consideration their level, progress, and previous learning gaps (Yolcu et al. 2023). It also includes individual student interaction with computers, smartboards, and smartphones, both inside and outside the classroom, as well as the entire curriculum in its new form that is compatible with AI technologies, interactive digital platforms, and much more (Drigas, Papanastasiou, and Skianis 2023). In addition, AIEd can also highlight educational and learning practices (Holmes, Bialik, and Fadel 2019).

AIEd is derived from theories and methodologies from related fields like AI, cognitive sciences, and education (Fiok et al. 2021; Nguyen et al. 2022; Zawacki-Richter et al. 2019). On the other hand, it raises its own set of larger research questions and issues: What is the nature of knowledge, and how is it represented? How can a student be assisted in learning? What are the effective patterns of pedagogical interaction, and when should they be used? What misconceptions do learners have (Woolf 2009)?

Concerning the benefits of integrating AIEd, it facilitates and accelerates the educational process through specific applications that perform a range of teacher tasks, starting from diagnosing educational situations to making decisions appropriate for the educational context (Chen, Chen, and Lin 2020). This allows teachers to focus on other tasks requiring precision and concentration (Al-Slehat et al. 2023). It also provides continuous access to 24/7 learning, enabling students to plan their day and schedule without being tied to a specific time or place based on their most productive hours. It alleviates stress, as specially designed lessons cater to the needs of different learning groups of students, avoiding the need for them to be compared to one another (Ahmad et al. 2022). Additionally, it saves time and increases the efficiency of knowledge acquisition in a way that aligns with each student's prior knowledge (Salas-Pilco, Xiao, and Hu 2022; Tan, Lee, and Lee 2022). AI technologies also help students visualize and interpret data in new and innovative ways that are not clear using traditional methods (Chen, Chen, and Lin 2020; Koedinger, McLaughlin, and Stamper 2012).

Role of Integrating AIEd

In the contemporary educational landscape, AI plays a multifaceted role, offering diverse opportunities for enhancing learning and administrative processes. According to Xia et al. (2023), AI can be implemented in six key educational domains: knowledge representation, case-based reasoning, natural language processing (NLP), intelligent tutoring systems authoring shells, distributed AI, and intelligence tutoring systems (Liu and Wang 2020). These domains range from presenting knowledge in an accessible manner to customizing educational experiences based on individual learning needs (Sanusi et al. 2022).

Ahmad et al. (2022) identifies several specific ways AI can improve educational outcomes. First, AI can automate and streamline administrative tasks, such as student assessment and feedback. Second, adaptive learning systems, supported by findings from Rosenberg and

Koehler (2015), can personalize educational content based on each student's knowledge gaps. Third, AI enables the production of intelligent educational content, which includes digital lessons, data visualization techniques, and real-time updates based on learning curves. Fourth, AI-driven personal tutoring systems offer individualized assistance, reducing the workload on human educators and alleviating the stigma for students who need additional help. Finally, AI technologies can make education more accessible for students with special needs, including those with hearing or visual impairments and autism spectrum disorders.

Complementing these perspectives, Zawacki-Richter et al. (2019) outline the roles AI can serve in academic support, institutional services, and administration, including diagnosis and prediction, assessment and evaluation, and the creation of adaptive and intelligent educational systems. Additionally, specific techniques for AI application in education can be categorized under various sub-domains, such as student assessment through adaptive learning and academic analytics; test evaluation using image recognition and computer vision; personalized learning through data mining and machine learning; smart schools employing face and speech recognition technologies; and mobile and remote education facilitated by virtual assistants and edge computing (Chan 2023; Chen, Chen, and Lin 2020).

Taxonomy of Educational Objectives

Bloom's Taxonomy

In 1950, Benjamin Bloom, an American educational psychologist, introduced a taxonomy for cognitive learning objectives that has remained seminal in education and pedagogy. Organized hierarchically, Bloom's taxonomy moves from simpler cognitive processes to more complex ones and serves as a comprehensive framework for educators to develop instructional objectives, curriculum, and assessment methods (Urgo, Arguello, and Capra 2019). Bloom's model has been lauded for its adaptability across diverse educational settings and its emphasis on promoting higher order thinking skills over rote memorization. The taxonomy is divided into six ascending levels: knowledge, comprehension, application, analysis, synthesis, and evaluation (Seaman 2011). At the base, knowledge involves simple recall and recognition of facts. Comprehension requires understanding and translating these facts. Application involves using the learned material to solve new problems. Analysis entails dissecting information into simpler parts and understanding their interrelationships. Synthesis requires the integration of different elements to form a coherent whole, often resulting in innovative solutions. Lastly, evaluation is about critiquing and making judgments based on established criteria. Bloom's taxonomy not only provides an educational blueprint for a graduated learning experience but also offers a versatile tool that aligns with different educational needs and contexts. Importantly, it addresses Bloom's original concern that education should extend beyond the mere transmission of facts to foster meaningful cognitive development (Anderson and Krathwohl 2001; Bloom 1956).

Revised Bloom's Taxonomy

Anderson and Krathwohl (2001) introduced a revised classification of Bloom's levels, replacing the fifth and sixth levels (synthesis and evaluation). They opted to use verbs instead of nouns at each level of knowledge. Each category or taxonomic element is associated with a number of key verbs. While the revised Bloom's taxonomy described many traditional classroom practices, behaviors, and procedures, it did not account for new activities associated with Web 2.0 technologies or the rapid growth in information due to increasing personal technologies and ubiquitous cloud computing in various fields. Figure 1 illustrates the newly introduced modifications.

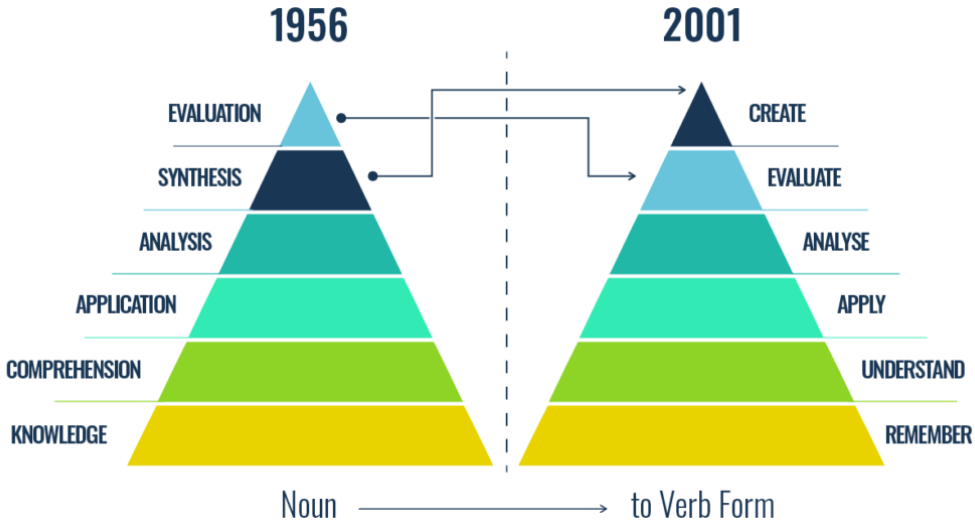

Figure 1: Revised Bloom's Taxonomy
Source: Cloke 2022

Additionally, Anderson and Krathwohl (2001) introduced a new innovation level at the top of the pyramid. In this domain, learners reorganize information in different ways and create new things or make novel modifications to existing ones.

Bloom's Digital Taxonomy

In 2008, with the advancement of technology, Andrew Churches (2008) introduced a new classification for Bloom's taxonomy levels that is based on web technology. This classification is more comprehensive in incorporating digital technologies and elevates the higher order thinking levels to align with the attributes of the digital age. Each level in this taxonomy contains a set of tools designed to facilitate smooth and effective learning for the student (Churches 2008). Figure 2 outlines this classification.

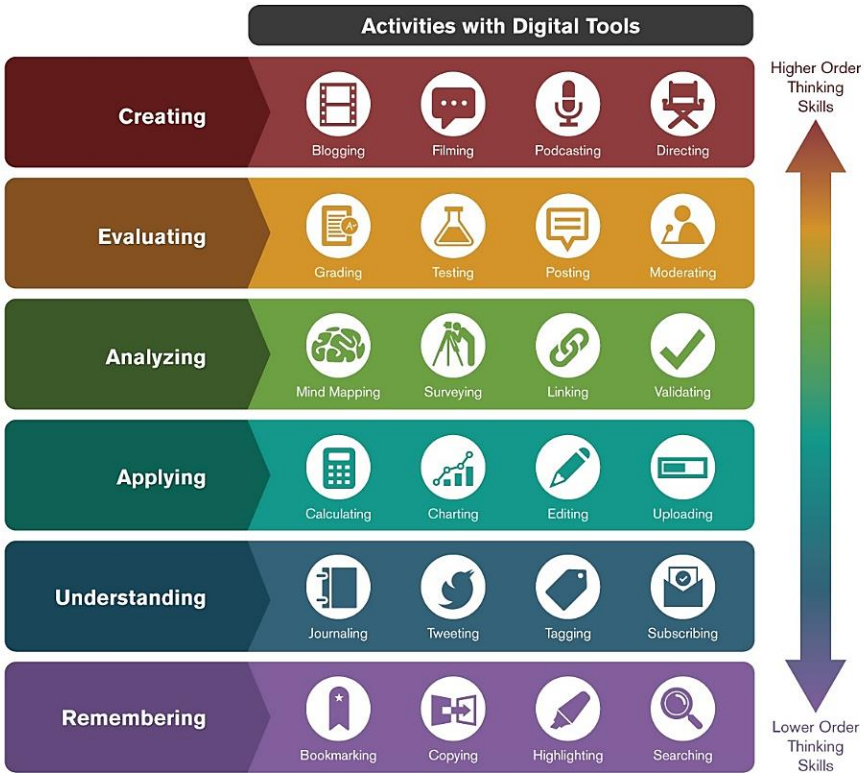

Figure 2: Bloom's Digital Taxonomy
Source: VET4Food, n.d.

The primary objective of Bloom's digital taxonomy is not merely to introduce modern tools, technologies, or applications. Rather, it also addresses how these tools can be employed to facilitate the educational process and achieve the desired levels of competency and quality. This taxonomy opens the doors for project-based learning and problem-solving. It requires students to work through a process of development and evaluation. Furthermore, the taxonomy underscores and illuminates the immense importance of the skill of collaboration, considered one of the essential twenty-first-century skills. In fact, collaboration can be viewed as foundational, as it is employed at all stages and levels of education. Based on this, we find that all the utilized applications and tools facilitate and stimulate the skill of collaboration, given its primary and aiding role in education and learning (Churches 2008).

Taxonomy of Educational Objectives in the Context of AI

The study by Mele et al. (2022) aimed to investigate the potential of enhancing learners' abilities through AI technologies, focusing on tasks and activities designed in accordance with the modified Bloom's taxonomy. Researchers developed a conceptual paper that allows for theory building, not restricted by experimental generalization requirements. The results confirmed

that not only do scholars need to understand how AI learns but also how it can support human learning capabilities. Indeed, the study demonstrated AI's ability to enhance human learning capabilities in information retrieval, recognition, comparison, and classification, thereby improving learners' immediate understanding and recall of information. The results also highlighted the role of AI in assisting with data analysis, predicting information, developing thinking and decision-making skills, enhancing the human learning ability to conduct detailed analyses and identify optimal problem-solving methods, implementing solutions in various contexts, and organizing information to support assessment activities.

In a recent descriptive study conducted by Abalkheel (2022), the objective was to explore the challenges faced by English as a Foreign Language (EFL) instructors and their learners in achieving sustainable development and to offer suggestions on how instructors could adapt while maintaining the cognitive and emotional well-being of learners. This was accomplished by examining the extent to which AI and digital Bloom's taxonomy play an innovative role in enhancing the quality and effectiveness of education in Saudi Arabia. The results indicated that, although instructors had access to technological platforms and applications, they encountered several challenges such as insufficient training, incompetence, weak internet infrastructure, lack of technical support, low motivation among instructors, and a focus on student interaction and presence at the expense of what they learned. Therefore, the integration of AI with digital Bloom's taxonomy could help to address these gaps and overcome them.

Parker and Jaeger (2016) conducted a study at the University of Calgary in Canada that explored the feasibility of applying Bloom's taxonomy to machine learning through AI. The results of the study found that the intelligence level of machines was examined at that time according to Bloom's taxonomy for learning. The study suggested that machine learning is comparable to, and sometimes exceeds, human learning at the lower levels of Bloom's taxonomy, notably in the area of recall. However, machine learning is extremely limited compared to human learning at the higher levels of Bloom's taxonomy, where machines have achieved roughly half of the learning capabilities possessed by humans in the three knowledge domains (what, how, why). The study also emphasized that, despite the vast number of capabilities attributed to advanced thinking machines, they lack motor skills like humans and do not have the ability to express emotions.

Findings and Discussion

The Proposed Model (AIEd Bloom Taxonomy)

After reviewing numerous prior studies, the researchers have developed a proposed model that integrates contemporary concepts in AI with levels of cognitive knowledge as per Bloom's taxonomy for learning objectives. This model functions within a modern and contemporary educational framework, providing teachers and students with tools and strategies that enhance both the teaching and learning processes and are adaptable in the face of rapid changes.

This model also offers a framework for designers of modern educational content to consider during the design process. The model includes six levels as follows in Figure 3.

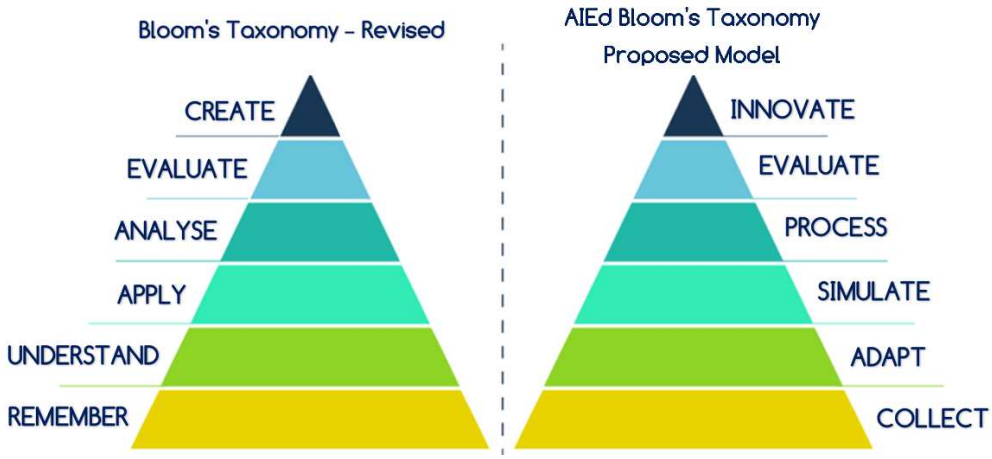

Figure 3: Proposed Model—AIEd Bloom's Taxonomy

1. *Collect:* Utilizing AI-powered platforms to assist students in identifying and organizing relevant resources on the internet, thereby saving time and enhancing the efficiency of knowledge acquisition in a manner that aligns with each student's prior knowledge (Salas-Pilco, Xiao, and Hu 2022; Tan, Lee, and Lee 2022).
2. *Adapt:* Using AI-powered platforms to create interactive educational experiences adaptable to the pace of progress or decline of each student and their level of understanding. Studies have shown that adaptive learning systems can help deepen students' understanding, thus improving their learning outcomes (Rosenberg and Koehler 2015).
3. *Simulate:* Employing AI-driven simulations to apply students' knowledge to real-world scenarios, thus developing their problem-solving skills. Technologies such as Extended Reality (XR) allow students to explore complex concepts in a virtual, safe, and controlled space for experimentation and exploration, enhancing their learning and engagement in the learning environment (Hmoud et al. 2023; Mayer 2017; Rogers and Franklin 2021; Vlachopoulos and Makri 2017).
4. *Process:* Using AI-powered tools and resources to aid students in visualizing and interpreting data in new and innovative ways that are not apparent when using traditional methods (Koedinger, McLaughlin, and Stamper 2012).
5. *Evaluate:* Using AI-powered platforms to provide students with tools and resources that enable them to take responsibility for their learning and monitor their progress. In addition, these platforms offer teachers detailed insights into student performance and progress, allowing for timely, specific feedback and support (Khaligh-Razavi et al. 2020; Zawacki-Richter et al. 2019).

6. *Innovate:* Providing students with access to the latest research and technologies that allow them to explore new ideas and solutions, including machine learning tools and resources that enable them to develop and test their own AI models (Boden and Edmonds 2019).

The integration of AIEd, specifically through the utilization of models such as the proposed model (AIEd Bloom's taxonomy), signifies a substantial advancement beyond traditional educational models. This progression is rooted in AI's capacity to individualize learning experiences, dynamically respond to the needs of individual students, and offer insights into learning processes that were previously unattainable (Luan et al. 2020; Srinivasa, Kurni, and Saritha 2022).

In contrast to conventional models that frequently employ a standardized approach, AIEd Bloom's taxonomy employs data-driven insights to tailor educational content and methodologies based on the unique profiles of learners. This customized approach is supported by extensive research, which demonstrates how AI technologies can enhance learning outcomes by adapting to the cognitive and emotional states of students (Chen, Chen, and Lin 2020; Rane, Choudhary, and Rane 2023). Moreover, the proposed model distinguishes itself by integrating a comprehensive understanding of Bloom's taxonomy into an AI framework, thus enabling a more nuanced and effective application of educational principles. By aligning AI capabilities with the cognitive levels outlined in the taxonomy, the model facilitates a deeper connection between teaching strategies and learning objectives. This signifies a significant advancement over previous models that may not have fully capitalized on the potential of AI to engage with the complexities of educational theory.

The proposed model underscores the significance of integrating pedagogical theories with AI, illustrating how this fusion can lead to more effective and engaging learning environments (Allil 2024; Hmoud et al. 2024). This interdisciplinary approach not only enhances the educational experience but also pushes the boundaries of what can be achieved in teaching and learning. Hence, the proposed model distinguishes itself not just through its exceptional amalgamation of AI and Bloom's taxonomy but also due to its valuable contribution to a developing educational approach that encompasses both technology and pedagogy.

Applications of the Proposed Model

In an educational context, the unit on photosynthesis in the twelfth-grade biology curriculum serves as an exemplar for the application of Bloom's cognitive taxonomy model. Objectives were formulated in collaboration with the subject teacher and were designed to span both lower and higher cognitive levels (Jaiswal and Arun 2021). To achieve the educational objectives for the lesson on photosynthesis, the proposed model (AIEd Bloom's taxonomy) was employed as follow:

- *Objective 1:* The student will recall the fundamental equation for the photosynthesis process: 6CO2 + 6H2O + light → C6H12O6 + 6O2.
  - *Bloom's Taxonomy Level:* Remember.
  - *AIEd Bloom's Taxonomy Level:* Collect.
  - *Tools Used to Apply Activity:* Computer, tablet, and smartphone.
  - *Activity:*
    - Utilizing a computer or a smart tablet, the Quizlet application is accessed.
    - Review the smart interactive flashcards for the photosynthesis lesson, which aid us in memorizing the essential components of the photosynthesis equation.
    - Answer direct questions that assess the ability to retain the information presented through the smart interactive flashcards.
    - Share with the instructor a list of the essential components that constitute the photosynthesis equation.
  - *Activity Reviewing:* The Quizlet application utilizes AI to create educational flashcards and interactive games, aiding students in memorizing and recalling key concepts such as the photosynthesis equation and its components. This is achieved by intelligently adapting the presentation of information to fit the student's learning pace, ensuring that each piece of data is reviewed at optimal intervals. This method enhances memory retention by revisiting concepts at strategically spaced intervals, tailored specifically to the individual's memory capabilities.
- *Objective 2:* The student will elucidate the photosynthesis process, including the role of sunlight, chlorophyll, and the conversion of carbon dioxide and water into glucose and oxygen.
  - *Bloom's Taxonomy Level:* Understand.
  - *AIEd Bloom's Taxonomy Level:* Adapt.
  - *Tools Used to Apply Activity:* Computer, tablet, and smartphone.
  - *Activity:*
    - In collaboration with a classmate, open one of the AI-supported virtual assistants or chatbots, such as ChatGPT or Bard.
    - Pose questions to them concerning the process of photosynthesis and its components.
    - Summarize the key information provided by the virtual assistant.
    - Discuss this information with your classmate in front of the class.
  - *Activity Reviewing:* AI-supported chatbots enable students to engage in their learning process by fulfilling their cognitive needs, thereby deepening their understanding. These systems are capable of generating responses and explanations that are adaptive to the student's level of comprehension and queries.

This use of technology serves as a supplement to traditional learning methods, offering a more interactive and personalized learning experience.

- *Objective 3:* The student will conduct an empirical experiment to address factors affecting photosynthesis such as light intensity, carbon dioxide concentration, and temperature, and they will observe their impact on the rate of photosynthesis**.**
  - *Bloom's Taxonomy Level:* Apply.
  - *AIEd Bloom's Taxonomy Level:* Simulate.
  - *Tools Used to Apply Activity:* Virtual Reality (VR) technology equipment.
  - *Activity:*
    - Use VR glasses and a controller to access the Labster application.
    - Enter the photosynthesis experiment within the program.
    - Implement the photosynthesis equation by adding the virtual components available in the application, controlling their intensity and concentration.
    - Document any interesting findings you arrive at.
  - *Activity Reviewing:* The Labster program provides a quasi-realistic virtual environment that allows students to manipulate variables such as light intensity, carbon dioxide concentration, and temperature to observe their effects on the rate of photosynthesis. The application also provides real-time feedback and guidance during the experiment, enhancing the educational experience and facilitating deeper comprehension of the subject matter.
- *Objective 4:* The student will analyze data from the experiment to discern patterns and relationships between manipulated variables and the rate of photosynthesis.
  - *Bloom's Taxonomy Level:* Analyze.
  - *AIEd Bloom's Taxonomy Level:* Process.
  - *Tools Used to Apply Activity:* Computer.
  - *Activity:*
    - Leverage the extensive data available on the internet, including images, videos, and various types of files, to gather information related to photosynthesis and its impact on biofuel production and pollution reduction.
    - Populate Google Data Studio with the data that has caught your interest.
    - Use the platform to generate charts and visualizations that assist you in connecting and analyzing the patterns within the selected data.
    - Document any intriguing findings and share them with your teacher in class.
  - *Activity Reviewing:* The AI algorithms used in the Google Data Studio platform assist students in analyzing the data they have gathered from their virtual experiments or external sources. These algorithms identify patterns and automatically generate charts without requiring programming skills. This results in visualizations and insights that help students interpret the data and draw conclusions.

- *Objective 5:* The student will evaluate the significance of photosynthesis in the ecosystem and its impact on other living organisms.
- *Objective 6:* The student will discuss the ramifications of factors that may either limit or enhance photosynthesis in different environments.
  - *Bloom's Taxonomy Level:* Evaluate.
  - *AIEd Bloom's Taxonomy Level:* Evaluate.
  - *Tools Used to Apply Activity:* Computer.
  - *Activity:*
    - Open your computer's web browser.
    - Write an electronic report on photosynthesis, addressing the following two prompts:
      1. What is the significance of photosynthesis in the ecosystem and its impact on other living organisms?
      2. Discuss the effects resulting from factors that may limit or enhance photosynthesis in different environments.
    - Use all the resources available on the internet that you need for writing the report.
    - Utilize a platform that employs NLP techniques to evaluate the reliability of the sources you have obtained from the internet.
    - Proofread your report according to the reliability assessment results.
    - Revise the report based on the feedback you have received.
  - *Activity Reviewing:* Platforms utilizing NLP technologies, backed by AI, offer powerful capabilities in assessing the reliability of sources obtained from the internet. These platforms can analyze images, videos, and textual content; discern their credibility; and produce results accordingly.
- *Objective 7:* The student will design a video or schematic diagram illustrating the photosynthesis process and its key components and steps.
  - *Bloom's Taxonomy Level:* Create.
  - *AIEd Bloom's Taxonomy Level:* Innovate.
  - *Tools Used to Apply Activity:* Computer.
  - *Activity:*
    - Use the Adobe Express platform to create an innovative, interactive video about the process of photosynthesis.
    - Utilize the platform's AI-powered suggestions feature to develop and enhance the video.
    - Share the video you have created on the Flipgrid platform with your classmates.
  - *Activity Reviewing:* The Adobe Express platform offers the capability to create presentations or interactive videos in an innovative manner. The AI technologies

embedded within these platforms provide templates and suggestions that assist students in improving the quality of their creations.

Conclusion

The integration of AI technologies with Bloom's taxonomy in the educational process can significantly enhance the learning experience and outcomes. The proposed model provides a comprehensive framework that aligns AI technologies with different levels of cognitive knowledge, thereby facilitating a more interactive and personalized learning experience. The use of AI-powered platforms and tools, such as Google Data Studio, AI-supported chatbots, and platforms utilizing NLP technologies, can assist students in various learning activities, ranging from data analysis and interpretation to information retrieval and reliability assessment. Furthermore, the integration of AI with digital Bloom's taxonomy can help address the challenges faced by educators and learners in the current educational system. However, it is crucial to ensure that these technologies are used effectively and appropriately, taking into consideration the cognitive and emotional well-being of learners. Future research should continue to explore and evaluate the potential of AI technologies in enhancing human learning capabilities and the quality and effectiveness of education.

Recommendations

Further research is recommended to explore the full potential and implications of the AIEd Bloom's taxonomy model in different educational contexts and disciplines. It is also suggested that educators receive adequate training on the use of AI technologies and the application of the AIEd Bloom's taxonomy model to ensure its effective implementation in the classroom. Future studies should also consider the emotional well-being of learners when integrating AI technologies into the educational process. More research is needed to understand how AI technologies can support human learning capabilities, particularly in the areas of information retrieval, recognition, comparison, and classification. Lastly, it is suggested that future studies explore the role of AI in assisting with data analysis, predicting information, and developing thinking and decision-making skills.

Limitations

The study was largely theoretical and did not involve empirical testing of the AIEd Bloom's taxonomy model. The research did not consider the potential negative impacts of AI technologies on the cognitive and emotional well-being of learners. The study did not address the challenges associated with the implementation of AI technologies in the classroom, such as insufficient training, incompetence, weak internet infrastructure, lack of technical support, and low motivation among instructors. Lastly, the study did not explore the potential of AI technologies in enhancing motor skills and emotional expression, which are important aspects of human learning.

AI Acknowledgment

The author declares that generative AI or AI-assisted technologies were not used in any way to prepare, write, or complete essential authoring tasks in this manuscript.

Conflict of Interest

The author declares that there is no conflict of interest.

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