

GenAI-Enhanced Learning: A Framework to Align the Third Level of Bloom's Taxonomy

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Abstract: Since the first release of ChatGPT, every aspect of today's world has been impacted. Artificial intelligence is no longer confined to high-tech companies or large industrial R&D departments. Countless smartphone applications are being continuously launched and immediately adopted by end users. In view of this, ethical concerns have been raised in several studies, emphasizing the urgent need for the responsible use of generative AI. The education system is no exception. Students across academic levels now use generative AI for essay writing, coding, and project-based assignments. Pedagogical and EdTech researchers worldwide express increasing concern about the future of education. However, the detrimental effects of using these tools have become evident. Recent studies have observed a significant decline in students' competencies in fundamental subjects such as mathematics and languages. Furthermore, the role of teachers extends beyond presenting information to students. Teaching is a complex process that involves providing learner support, closely guiding students, and offering learning paces tailored to their needs. While AI cannot replace educators, action plans are needed to adapt to the undeniable presence of generative AI in education. Thus, this study asks how we can harness the power of AI to assist teachers to design classroom activities, rather than focusing on student use of these tools or imposing bans in schools and universities. We therefore explored the alignment of Bloom's Taxonomy levels with AI-enhanced learning, specifically leveraging the third level of Bloom's Taxonomy, "Applying". This paper introduces a framework to assist teachers in designing workshops and learning activities. By applying acquired knowledge through AI-powered simulations, and grounding this approach in Kolb's Experiential Learning Theory, the framework aims to reinforce cognitive domain concepts from Bloom's Taxonomy while placing experiential learning at its core and offering substantial added value to the learning experience.

Keywords: AI-enhanced Learning, Generative AI, Bloom's Taxonomy, Learning Activities, Educational Technology, Kolb's Experiential Learning Theory.

1. Introduction

Artificial intelligence began in the late 1950s, and has since evolved into complex systems. With the release of the publicly shared applications, accessible to end users, ChatGPT and other applications that generate content have become emergent. In the last decade, AI has become omnipresent in many fields, from social media and healthcare to education (Yue Yim, 2024). In the field of education, different academic institutions around the world have implemented grading systems based on AI and have already started using intelligent tutoring systems (ITS). Nevertheless, the powerful capability of generating responses to every question has raised concerns in the education sector. Students across disciplines use ChatGPT for most homework except in hands-on tasks like art or cooking.

In our study, we discuss the cognitive learning level of the Bloom's Taxonomy and its adaptability in the generative AI era, and we suggest a framework based on Kolb's Experiential Learning Theory to assist teachers in creating their learning activities. The main research questions for this study are:

RQ 1: How can Bloom's "Applying" level and Kolb's theory guide a framework to help teachers design AI-supported learning activities?

RQ 2: What are the practical benefits of using the proposed AI-enhanced framework in terms of scenario creation, preparation time, and teacher usability?

Six main sections are presented in this paper. Following the introduction, the second section provides an overview of generative AI and its influence on education. The third section highlights the evolution of Bloom's Taxonomy, exploring its relevance in the digital age, as well as an overview of Kolb's Experiential Learning Theory. The fourth section reviews related work on the integration of AI tools with Bloom's cognitive taxonomy and lesson design supported by AI. The fifth section presents the methodology used in this study to develop and test the proposed framework and details the AI-enhanced framework for the design of workshop and learning activities. The final section describes the pilot implementation of the framework, including a demonstration of its practical application and effectiveness in a real educational context.

2. Theoretical Background & Related Work

2.1 Generative AI and Education

AI advances began with early projects like Eliza (Martin, 1993). Since then, many chatbots have been developed with more complex analytical functionalities. In the field of education, chatbots are widely used by students nowadays to provide immediate answers. ChatGPT can generate essays or solve math tasks with high accuracy. The quality of generated content in all formats depends on both the training data of the model and the quality of the prompts provided by the user.

As AI tools have become an undeniable player of the educational process, numerous research studies have been conducted to analyze several aspects of this inclusion. (Elmourabit, Asmaâ Retbi, and Nour-Eddine El Faddouli, 2024) conducted a comparative study to analyze and compare human and AI-generated exams and has shown that generative AI can enrich learning and assessment when used as a partner with teachers. AI-guided resource selection and content review have provided the most effective outcomes. In the field of engineering education, (Rebelo, 2025) emphasizes that educators should consider adapting engineering education to take advantage of generative AI while mitigating potential drawbacks. Relevant data were collected by (Ouhaddou, Retbi and Bennani, 2023) on students to propose an approach using large language models (LLMs) to support student orientation with a focus on identifying key factors that affect student academic orientation.

2.2 Core Learning Theories: Bloom's Taxonomy and Experiential Learning

Created in 1956, Bloom's Taxonomy has been applied for decades by educators to classify cognitive learning objectives (Wilson and Leslie, 2016). Anderson and Krathwohl published a revised version in 2001, to address a more dynamic learning process (Coşgun Ögeyik, 2022). In 2008, Churches proposed the digital Bloom's Taxonomy (DBT), which includes three levels related to digital technology (Gunarso *et al.*, 2024). In our study, we focus on the "Applying" level of the Taxonomy. This level consists of carrying out or using learned concepts through execution or implementation (Wilson and Leslie, 2016).

To support real-world knowledge use, Kolb's experiential learning theory (Kolb and Kolb, 2022) includes case studies, fieldwork, and simulations. Focusing on the "Applying" level of the revised Taxonomy and grounded in experiential learning theory, this paper explores the active use of knowledge in real-world contexts.

2.3 Related Work on AI-Supported Learning: Applying Bloom's Taxonomy and Experiential Learning

Several researchers have studied AI and Bloom's Taxonomy as intersecting paths to enhance pedagogy and empower learning experience. (Jiménez Romanillos and Andersson, 2024) and (Almatrafi and Johri, 2025) reported how generative AI enhanced educational design and creativity, leveraging Bloom's Taxonomy for improved learning. Teachers experiences with AI tools for preparing educational content have been discussed in several studies. (Ding, Li and Hui, 2025) tested the impact of teacher-AI collaboration and found a valuable effect on engagement. (Romero, 2024) proposed a template for pre-service teachers to co-design learning activities to facilitate the design process. The structured approach suggests a step-by-step process that enables the synergy of human and AI co-creativity.

Previous research has studied integrating AI within instructional design. (Park *et al.*, 2023) and (Cooper, 2023) highlighted how generative AI and ChatGPT support science education and instructional design. Their studies demonstrated the utility of ChatGPT in designing science courses and quizzes. (Gunawan *et al.*, 2020), (Lee and Zhai, 2024), and (Shamir-Inbal, Levi and Blau, 2024) analysed lesson planning with generative AI, highlighting benefits in preparation, time efficiency, and instructional design. Simulations used in science classes by (Falloon, 2019) in their study, applying the experiential learning theory, are beneficial for the class engagement, and enable the practice of higher order skills. (Falloon, 2019) emphasizes the need for further research to explore pedagogical models for using simulations in class and assist fundamental learning processes.

To the best of our knowledge, while prior studies have explored the use of AI tools in educational design, few have proposed structured frameworks grounded in established learning theories. Building on this gap, our study introduces a theoretically grounded model that integrates Bloom's "Applying" level and Kolb's experiential process to support AI-assisted workshop design for teachers.

3. Methodology & Proposed Framework

This study is based on a design-based research approach (DBR) that combines theoretical development and practical application in the educational field. The goal is to suggest a framework to help teachers design workshops focused on Bloom’s “Applying” level and Kolb’s Experiential Learning.

This research was conducted in two phases:

Phase 1: Framework development:

Prior research was reviewed on AI in education, digital Bloom’s Taxonomy, Kolb’s model, and instructional design. Key observations were incorporated into a structured framework to support teachers in designing workshops that improve “Applying” learning outcomes.

Phase 2: Framework testing through a pilot implementation:

The framework was utilized for primary school science workshop design. Teachers were guided in using AI tools during the pilot implementation, with specific recommendations tailored to the workshop.

3.1 Nested Theoretical Foundation for AI-Enhanced Learning Activities Design

In this section, we introduce a structured framework to support educators in designing workshops and learning activities. This framework allows educators to integrate generative AI tools into the design process. The proposed framework is based on Kolb’s Experiential Learning Theory (ELT). The stages are aligned with the phases of ELT and supported by generative AI tools. It also relies on the “Applying” level of Bloom’s Revised Taxonomy, ensuring the focus on using knowledge in real-world and practical contexts for the learning activities and workshops.

The diagram (Figure 1) represents our suggestion for the nested theoretical foundation of AI-Enhanced learning activities design.

The diagram presents the layered structure of the proposed framework. Bloom’s “Applying” level defines learning goals (‘what’) and Kolb’s experiential model defines the process (‘how’). At the core, the proposed framework provides the practical implementation tools (‘how to’).

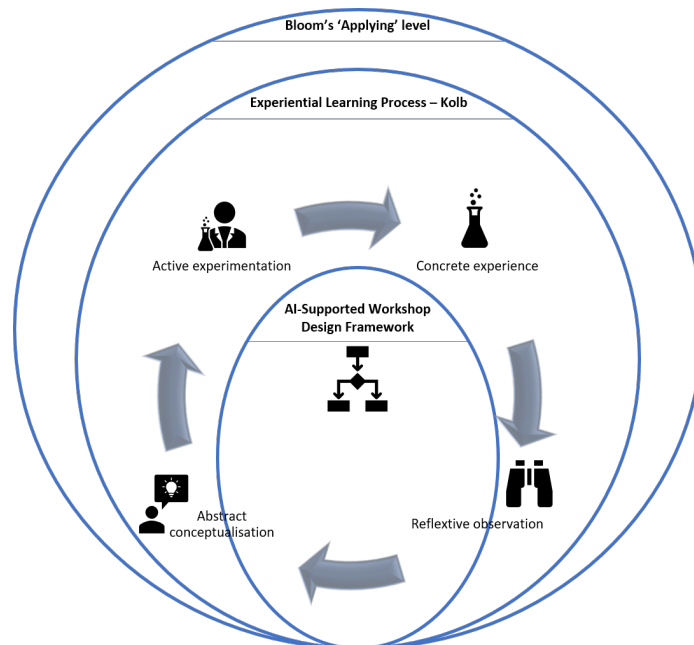


Figure 1: Nested foundation for AI-Enhanced activity design

3.2 Framework Design and Components

In view of the main goal of this study, by assisting teachers in designing workshops in a human-AI collaborative mode, application of knowledge in practical contexts and strengthen cognitive engagement can be achieved.

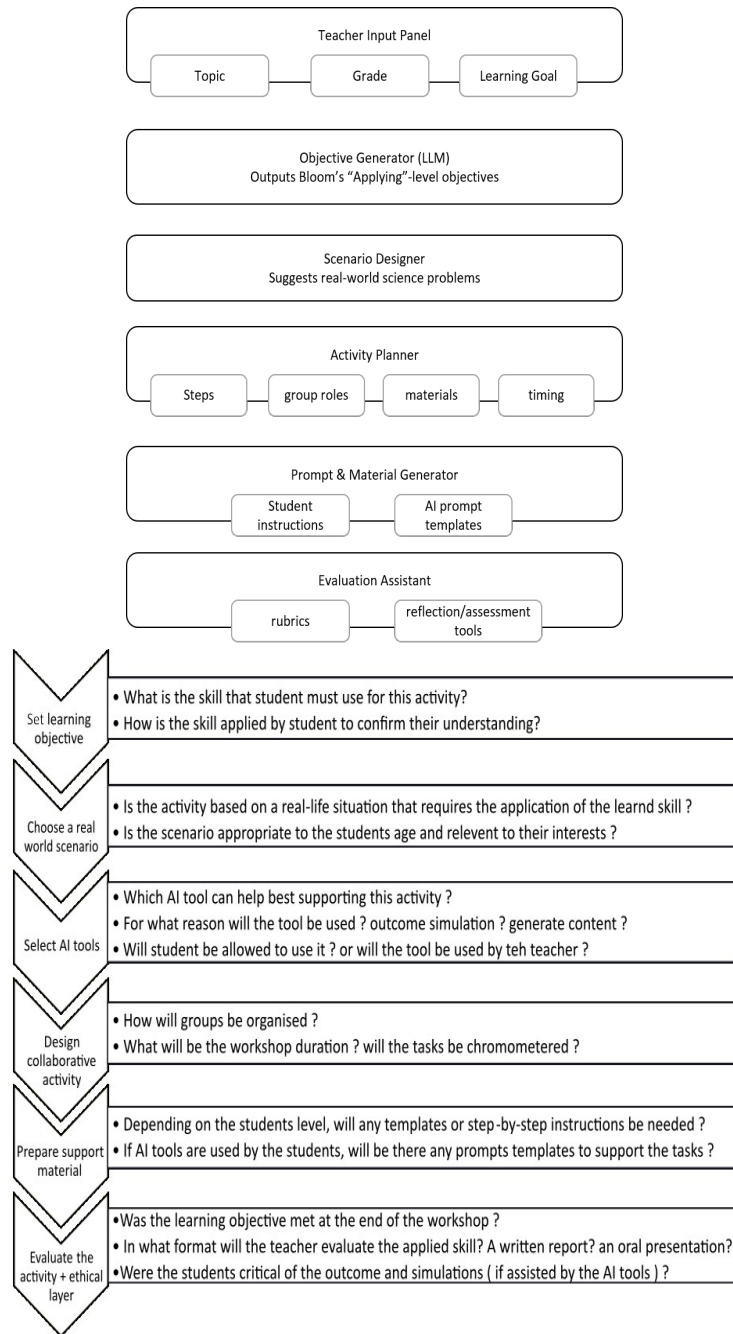


Figure 2: Overview of AI-enhanced workshop design framework

The framework (Figure 2) provides teachers a step-by-step structure for designing workshops. In the following clarification of the process, we outline the progression of pedagogical components, from defining learning goals to evaluating outcomes.

The elements describe how generative AI is used not only for content generation but also to enhance the design of real-world scenarios. This approach underlines the teacher's irreplaceable role while using AI as a co-pilot to increase efficiency and adaptability in instructional design.

- Stage 1: Define learning objectives, aligned with "Applying" Bloom's Taxonomy level

At this first stage, teachers define measurable learning objectives using action verbs. AI tools such as ChatGPT or Eduaide.ai can help teachers refine and clarify outcomes.

- Stage 2: Choose real-world scenarios for the activity

Teachers use AI to generate relevant scenarios and up-to-date problem. ChatGPT or Eduaide.ai can be helpful tools for role-playing dialogues.

- Stage 3: Select appropriate AI tools

Tools like Scratch or Google Teachable Machine can support simulations aligned with target skills.

- Stage 4: Design collaborative activity

Planning tools like Miro help organize instructional tasks and workshop timing.

- Stage 5: Prepare support material

AI tools help prepare instruction sheets and prompt templates.

- Stage 6: Evaluate the activity and ethical considerations

A pre- and post-workshop checklist is recommended to reflect on Bloom's alignment, AI integration, and framework usability.

4. Implementation

To illustrate the application of the proposed framework for AI-enhanced workshop design, we present a pilot implementation in this section from a primary school science class. The chosen topic focuses on the "Water Cycle" course. This case study demonstrates the framework's application in a real classroom.

The workshop objective for this class is the application of their knowledge from the "Water Cycle" course. The students will be able to simulate environmental scenarios and propose solutions to current weather problems. Concepts such as evaporation, condensation, precipitation, and collection will be observed.

We present in the following the preparation of the workshop, based on the proposed framework.

Stage 1: Set learning objectives

AI assistance tool: ChatGPT

Proposed prompt: Generate learning outcomes for a 1h primary science class workshop on the water cycle, targeting the third level of Bloom's Taxonomy.

Stage 2: Choose a real-world scenario

AI assistance Tool: [www.Eduaide.ai](https://www.eduaide.ai)

Eduaide suggested a hands-on water cycle model using everyday materials. The Hands-on Model activity was described in detail by the AI. The generated output is presented in Figure 3.

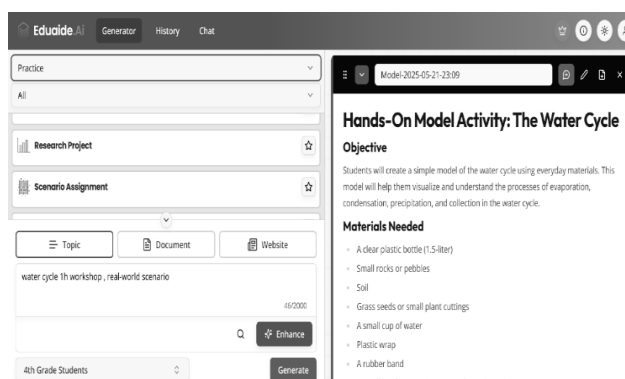


Figure 3: AI-generated hands-on plan for a primary science workshop

The possibility of adjusting the model and adapting it to the number of students, the available and affordable materials, or any given condition makes it highly adaptable.

The strengths of this platform include outputs that are aligned with Bloom's learning goals, class levels, and disciplines. Also, it allows tuning to match cognitive domains.

Stage 3: Select AI tools

If the teacher is willing to create their own simulation or interactive activity, detailed steps can be prompted from ChatGPT, and the simulation or interactive tool can also be suggested.

Depending on students' access to personal laptops and internet access during the workshop, the learners can be invited to co-create the activity with the teacher, either in pairs or in groups. Step sheets can be adapted for use by primary school students.

In our implementation, among the suggested interactive tools, we selected Scratch from <https://scratch.mit.edu/>

Every step of the creation is detailed, from background design to animation.

Stage 4: Design collaborative activity

AI can help share and design the roles for the activity and suggest collaboration assistance. The activities can be run in pairs or small groups.

Proposed AI platform: <https://www.eduaide.ai>

For our implementation, the prompted subject was about engaging collaborative activities. The output generated was interesting and enjoyable to implement.

4.1 Results and Discussion

The framework implementation showed promising results. AI effectively supported learning objectives, aligned with Bloom's "Applying" level. Preparing interactive activities was efficient. The AI-generated simulation sheets were adaptable and saved teachers significant preparation time. These results show the framework enhances practical learning through AI.

The framework guides teachers through stages to support adaptive learning. The implementation shows how generative AI can be an efficient partner for teachers in designing their activities at every stage of the workshop process.

AI-driven workshops engage students in "Applying" knowledge in real-world environments. AI tools let students simulate real-life situations and observe outcomes.

The framework was also tested by a group of three education trainees, who were asked to prepare different science learning activities, both with and without AI Tools, following the given framework. Table 1 compares preparation times for three science workshops, with and without AI.

Table 1: Preparation time for science workshops with and without AI

Topic	Manual Preparation	With AI Tools	Time saved
Water Cycle	3.5 hours	1.5 hours	2 hours
Pollination	4 hours	1.5 hours	2.5 hours
States of Matter	3 hours	1.2 hours	1.8 hours

The estimated preparation times reflect common teacher workflows, where manual planning involves searching for lesson objectives, drafting activity instructions, sourcing materials, and designing assessment tools. In contrast, using AI tools like Eduaide.ai for scenario design, ChatGPT saved between 1.8 and 2.5 hours.

In addition, the three primary educators reviewed the framework through a usability study.

Table 2 shows teacher ratings of the framework's usability on a 4-point scale.

Table 2: Teacher ratings of AI-supported workshop design

Criteria	Description	Rating (1-4)		
Alignment with learning objectives	The framework helped define objectives aligned with Bloom's "Applying" level.	3	4	3
Support in scenario creation	AI tools helped generate real-world learning scenarios.	4	2	3
Efficiency of planning process	The framework reduced time and effort in planning.	4	4	4
Clarity and usability	The steps, tools, and resources were clear and easy to follow.	2	2	3
Confidence in AI integration	Teacher felt confident integrating AI tools into instructional design after using the framework.	1	1	3

Teachers' feedback highlighted the clarity of the scenario builder and the usefulness of AI prompt suggestions.

However, confidence in using AI tools was reported as moderate in the teacher rubric (see Table 2), prompting further investigation. To explore this issue among a broader group of educators, we conducted interviews with primary school teachers from pioneer schools in the Rabat region of Morocco.

Additionally, based on a dataset of 20 teachers, questionnaires were administrated to identify existing gaps in support needs. The results revealed that 55% had never used any technological tools to prepare their learning activities (aside from basic internet browsing for information), and 40% reported facing challenges due to a lack of training and technical support.

4.2 Limitations and Further Work

This study explored using generative AI to support Bloom's "Applying" level, based on Kolb's Experiential Learning model. The framework is an initial step to align pedagogy with AI capabilities. In our study, while the proposed framework demonstrates the benefits of integrating AI into workshop design, several limitations should be considered. The framework was not tested across various disciplines, and thus, the generalizability can be limited. Additionally, digital literacy and the small-scale pilot (with feedback from three trainee teachers) are also limitations. Future work should involve testing with more educators. We aim to develop a platform where teachers can input course information and generate structured AI-enhanced activities. Future developments will focus on building a digital platform that integrates the framework's components and supports teachers in real time. Additional features may include LMS integration, collaborative tools, and AI-guided prompt generation.

Additionally, many researchers cited in the related work section have presumed that the integration of AI in the educational system will not be effortless. (Ng, Chan and Lo, 2025) assume the need to further examine how teachers will adopt generative AI and how their perception will be of this new technology. In the same context, the UNESCO report raised the question of how education will prepare humans to live with AI (*Transforming education towards SDG 4: report of a global survey on country actions to transform education - UNESCO Digital Library*, 2024). (Habiballa *et al.*, 2025) point out that the rapid evolution of AI applications and models report the demand for more diverse studies, taking into consideration various samples and educational parameters. Another consideration was raised by (Jiménez Romanillos and Andersson, 2024), stating that it will be problematic to understand the teacher's role in the GenAI-enhanced learning process when it is affordable to skip the first two fundamental categories in Bloom's Taxonomy; remembering and understanding. Nevertheless, Salman Khan discussed how the emergence of AI tools into the academic field can be leveraged, raising a "call for educated bravery" (Khan, 2024).

5. Conclusion

We proposed a theoretical framework to help teachers design AI-enhanced workshops, aligned with the “Applying” level of Bloom’s Taxonomy and based on Kolb’s experiential learning theory. This framework was piloted in a classroom setting, and the results showed its potential to enhance pedagogy while maintaining the educator’s role. As generative AI becomes increasingly an embedded practice in the educational field, adapted approaches such as the framework presented in our study provide a roadmap to responsibly harnessing this emerging technology and leverage meaningful human-AI collaboration. The nested framework, grounded in Bloom’s taxonomy and Kolb’s experiential learning model, contributes to a structured and theory-aligned design approach. However, further refinement is recommended to ensure adaptability across various educational disciplines.

Our work represents an initial exploration into the potential of generative AI to support educational technology. Looking ahead, future efforts will focus on developing an integrated solution for teachers using large language models (LLM) and Retrieval augmented generation techniques (RAG). The solution development will also emphasize refining prompt engineering methods to improve interaction with AI systems and provide a more accurate learning experience. Preliminary feedback suggests gains in teacher satisfaction and a reduction in preparation time when using the proposed framework.

Ethics and AI Declaration

This research did not involve data collection requiring ethical declaration.

ChatGPT was used for grammar correction. Also, during the implementation phase, AI tools were used to apply the framework stages and generate workshop content, which was reviewed by the author.

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