Using ChatGPT to Enhance Experiential Learning of College Students

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Abstract

This paper examines college students' perceptions and experiences of using ChatGPT to enhance their experiential learning. We designed a ChatGPT learning activity flow that corresponds to the four experiential learning steps: Experiencing – Reflecting – Thinking – Acting. Analysis of survey data collected from 39 students in a U.S. public university revealed that, under the guidance of the instructors, students learned to use ChatGPT to explore questions of various knowledge types at different cognitive processes. The findings suggest that the knowledge type of student-created prompts for ChatGPT and associated cognitive process depend on those of the first prompt provided by their instructors. Although students are generally satisfied with the quality of the ChatGPT-generated information, some students raised concerns about ChatGPT output. The study contributes to the literature on experiential learning and Bloom's Taxonomy and offers practical implications to educators and students on using generative artificial intelligence to achieve effective teaching and learning.

Keywords: ChatGPT, generative AI, experiential learning, Bloom's taxonomy, higher education

1. Introduction

The rapid advancement of artificial intelligence (AI) technologies has impacted our work and life, calling for academia and policymakers to consider designing guidelines and implementing programs to ensure the productive and ethical use of AI. One such AI tool is ChatGPT, a virtual AI chatbot based on generative AI technology that can mimic the grammar and structure of writing and produce content on a variety of topics. Built on the Large Language Models (LLM), ChatGPT is trained on a vast compilation of information scraped from the internet and real-time conversations with humans (Hao, 2023). Debuted in November 2022 by the start-up company OpenAI, ChatGPT reached 100 million monthly active users just two months after its launch (Milmo, 2023).

A professor at the Wharton School of the University of Pennsylvania found that ChatGPT would pass a final exam in a typical MBA class (Terwiesch, 2023), which sparked a national conversation about the ethical implications of using AI in education. While some educators and academics have sounded the alarm over the potential abuse of ChatGPT for cheating and plagiarism that could eventually affect student's creative thinking and reasoning (Arif et al., 2023; Belagere, 2023), others are optimistic about the potential benefits of using ChatGPT to support and enhance curriculum development and student learning. For example, Herft (2023) suggested that teachers could use ChatGPT to create prompts for formative assessment activities or generate quality rubrics that explain what students need to accomplish. They may also use ChatGPT to design distinct scenarios for students to collaborate in group activities, thus promoting a sense of community. In addition, Firat (2023) argued that by providing personalized and interactive support, direction, and feedback, ChatGPT can be useful for autodidactic or self-taught learners and online learners as it helps increase motivation and engagement among learners.

Despite these general arguments, our knowledge about the perceptions and use of AI technology in education is still limited, especially from the student's perspectives. Thus, in this paper, we aim to understand students' perceptions and experiences of using ChatGPT in their college education. In particular, the study seeks to answer two research questions: (*1) How do college students use ChatGPT to enhance their experiential learning? (2) How do college students perceive the quality of ChatGPT-generated information related to their learning?*

Experiential learning is "the process whereby knowledge is created through the transformation of experience" (Kolb, 1984, p. 38). It emphasizes the importance of experience in the learning process. In this study, we consider ChatGPT an exploratory tool in learning due to its interactive and adaptive nature and

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immediate responses. Therefore, we designed a ChatGPT activity flow to facilitate experiential learning and implemented it in four college classes. Students were also invited to a survey to share their perceptions and experiences with ChatGPT. The sample is a convenience sample of 39 undergraduate and graduate students in an urban, four-year public university in the United States. Guided by the Revised Bloom's Taxonomy (Anderson et al., 2001) and Kolb's Experiential Learning Model (1984), we employ a qualitative method to analyze the survey data in terms of different knowledge types and cognitive processes during continuous learning stages. Three themes emerged from student experiences with ChatGPT.

To our best knowledge, this is one of the first studies that use empirical data from student experiences and reflections about their use of ChatGPT in college learning. The study findings contribute to the literature on experiential learning and Bloom's Taxonomy. The study also offers practical implications to both educators and students on how to use AI technology and tools, especially ChatGPT, to enhance the effectiveness and efficiency of teaching and learning.

Following the introduction, the rest of the paper proceeds as follows: Section 2 discusses the theoretical background and framework including generative AI and education, Kolb's experiential learning model, and the Revised Bloom's Taxonomy; Section 3 describes the research methods; Section 4 reports research findings; Section 5 discusses the contributions and implications of the study; and Section 6 concludes the paper with suggestions for future research and policy making.

2. Theoretical background and framework

2.1. Generative AI and education

Generative AI is artificial intelligence capable of generating text, images, or other media, using large language models that learn the patterns and structure of their input training data and then generate data to respond to user inputs (e.g., natural language prompts). ChatGPT is such an AI system (chatbot) powered by generative AI and launched by OpenAI in November 2022. It is powered by a neural network model that relies on cutting-edge technologies such as machine learning, natural language processing, and deep learning and has been trained using a massive corpus of data to generate natural, coherent, and contextually appropriate responses (OpenAI, 2022). Other large language model chatbots include Bing Chat, Bard, and LLaMA.

The numerous capabilities of ChatGPT can assist individuals in writing essays, designing educational materials, creating software code, and summarizing documents. Due to its capabilities to understand natural human language and generate contextually coherent responses, ChatGPT has attracted substantial attention from industry to academia, as evidenced by its fast-growing users of over 100 million within two months of its launch (Milmo, 2023). In higher education, students have been found using ChatGPT as a tutor, a study partner, and a ghostwriter. Undoubtedly, this has caused the attention or concerns of college educators (e.g., Arif et al., 2023; Belagere, 2023; Terwiesch, 2023).

With the increasing use of ChatGPT on college campuses, it is important for educators to understand student use of ChatGPT and how it affects student learning. Focusing on the education in information systems (IS) field, a recent article calls for IS educators to not only be aware of the potential impacts of AI tools but also decide how to respond to the threats and opportunities from these new technologies (Van Slyke et al., 2023). The article pointed out two potential threats: one is students using ChatGPT to cheat on course assignments and the other is the negative effect of ChatGPT on student skill development for entry-level careers. The article recommended that faculty invest time in learning the general capabilities of emerging AI tools such as ChatGPT while keeping in mind that the capabilities of existing tools are constantly evolving. In addition, it encouraged faculty to experiment with the generative AI tools to consider how to modify course activities and assessments to encourage the ethical and effective use of AI tools by students. In this regard, our study has demonstrated the design and implementation of learning activities using ChatGPT to enhance student experiential learning.

2.2. Kolb's experiential learning model

Experiential learning refers to the process of knowledge acquisition through experience. Developed by Kolb (1984), the experiential learning model entails four steps: Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC), and Active Experimentation (AE). In the CE stage, the learner has hands-on experience in achieving a learning outcome. In the RO stage, the learner reflects and reviews the experience from a range of different perspectives. In the AC stage, the learner analyses and connects the experience to previous learning and develops new ideas about a subject matter. In the AE stage, the learner acts on their new ideas by experimenting in an experiential setting.

According to Kolb (1984), all four learning stages must be completed for learning to be most effective. As new ideas are put into action, a new cycle of experiential learning begins. The four-step learning process can be viewed as Experience – Reflect – Think – Act. The process is often applied multiple times in every interaction and experience. As such, knowledge is continuously gained through both personal and environmental experiences; learning is achieved through a continuous cycle of inquiry, reflection, analysis, and synthesis (Kolb, 1984). In the education process, the learner is an active participant.

Experiential learning should be differentiated from academic learning – the process of acquiring information through the study of a subject without the necessity for direct experience (De Stavenga Jong et al., 2006). Both learning approaches aim to instill new knowledge in the learner, but the two approaches differ in their focus and mechanisms. While academic learning emphasizes constructive learning and reproductive learning through more abstract, classroom-based techniques, experiential learning focuses on analysis, initiative, immersion, and active involvement of the learner in a concrete experience. In education, examples of experiential learning activities include applied research projects, case studies, field experience, simulations, and labs (Kolb & Kolb, 2017).

The experiential learning model has been adopted in the learning and use of information technologies. For example, Lai et al. (2007) investigated the contribution of mobile technologies in experiential learning and found that using technology while going through the four-stage process helped elementary school students improve their knowledge. Similarly, Deng and Chi (2015) adopted Kolb's (1984) experiential learning model as a framework to capture different aspects of individual learning experiences with a new enterprise system and presented experiential learning at two different levels (individual vs. community) in a knowledge network.

2.3. Revised Bloom's Taxonomy

Named after American educational psychologist Benjamin S. Bloom, Bloom's Taxonomy is a multi-tiered model of classifying thinking behaviors according to different cognitive levels of complexity in the learning process (Bloom & Krathwohl, 1956; Forehand, 2005). Since its inception in 1956, Bloom's Taxonomy has been reinterpreted and updated in a variety of ways. The Revised Bloom's Taxonomy by Anderson et al. (2001) expanded the concept into two dimensions: the knowledge dimension and the cognitive process dimension. The knowledge dimension refers to the four types of knowledge: factual, conceptual, procedural, and metacognitive. The cognitive process is the process of acquiring knowledge; it consists of six hierarchical levels: remembering, understanding, applying, analyzing, evaluating, and creating.

According to the Revised Bloom's Taxonomy, the knowledge dimension ranges from concrete (factual) to abstract (metacognitive). However, it is not a linear progression as procedural knowledge may not be more abstract than conceptual knowledge. Specifically, the different knowledge types can be defined as:

- **Factual**: knowledge of terminology; knowledge of specific details and elements.
- **Conceptual**: knowledge of classifications and categories; knowledge of principles and generalizations; knowledge of theories, models, and structures.
- **Procedural**: knowledge of subject-specific skills and algorithms; knowledge of subject-specific techniques and methods; knowledge of criteria for determining when to use appropriate procedures.
- **Metacognitive**: strategic knowledge; knowledge about cognitive tasks, including appropriate contextual and conditional knowledge.

On the other hand, the cognitive process follows a hierarchical order. The level of learning (Anderson et al., 2001) from low to high can be defined as:

- **Remembering**: Retrieving, recognizing, and recalling relevant knowledge from long-term memory.
- **Understanding**: Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
- **Applying**: Carrying out or using a procedure through executing or implementing.
- **Analyzing**: Breaking material into constituent parts and determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
- **Evaluating**: Making judgments based on criteria and standards through checking and critiquing.
- **Creating**: Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

3. Research method

To address the research questions, we applied the experiential learning model by designing a ChatGPT learning activity flow and creating an online survey of 28 multiple-choice and open-ended questions asking students about their perceptions and experience with ChatGPT as well as their academic and demographic background. The survey was approved by the Internal

Review Board (IRB) of the university where the study took place. We collected the survey data in May 2023 and analyzed the data using qualitative research methods to identify categories and themes. In addition, we supplemented the analysis with contingency tables and Fisher's exact tests to add more perspectives.

3.1. Participants

Students from an urban, four-year public university in the United States participated in the study. We first designed a ChatGPT learning activity flow to facilitate students in experiential learning. We then invited course instructors in the College of Business Administration and Public Policy to adjust the proposed ChatGPT activity to meet the curriculum standard of their specific courses. Four instructors agreed to participate in the study by adapting and implementing a ChatGPT learning activity in their classes and disseminating an online survey to their students. Participation in the study is voluntary and anonymous. An information sheet indicating the purpose, risks, benefits, and confidentiality of the study was provided to the students before they started the survey. The survey was distributed by the course instructors to their students and lasted for two weeks (May 1-14, 2023).

A total of 39 students from the four classes (with an overall response rate of 41%) completed the ChatGPT activities and responded to the survey, among which, 28 students indicated that they had no prior experience with ChatGPT. Among the 11 students who mentioned that they used ChatGPT before, they either learned it from another class or used it for job applications or other personal interests. The survey was well received by students as one student mentioned in the comment section of the survey: "This was a very insightful survey! I look forward to hearing about the findings you discover."

The university is known as a minority-serving institution with 60% of students being Hispanic or Latino, 15% Black or African American, 11% White, 11% Asian, and others. Consistent with the definition by the U.S. Department of Education (2021), we consider minority-serving institutions as institutions of higher education that enroll a high percentage of minority students such as African American, American Indian, Hispanic/Latino, and Pacific Islander. In addition, 54% of the students in this university are first-generation college students (FGCS); 64% are Pell-eligible (eligible to apply for U.S. Federal Pell Grants targeted at undergraduate students with exceptional financial needs); 74% are employed full-time; 64% are female; and 86% are undergraduates. In general, the sample statistics are consistent with the university student demographics with a slightly higher representation of male students, graduate students, FGCS, and fewer full-time employed students. This is a convenience sample. Table 1 provides the sample characteristics.

Table 1. Sample statistics (n=39)

	Frequency	Percent
By Gender		
Women	21	53.8%
Men	17	43.6%
Prefer not to answer	1	2.6%
By Class/Year		
Junior	8	20.5%
Senior	17	43.6%
Graduate	14	35.9%
By First-Generation Student Status		
FGCS	26	66.7%
Non-FGCS	11	28.2%
Prefer not to answer	2	5.1%
By Pell Grant Eligibility		
Eligible	25	64.1%
Not eligible	12	30.8%
Prefer not to answer	2	5.1%
By Marital Status		
Married	8	20.5%
Not married	31	79.5%
By Employment Status		
Employed full-time	23	59.0%
Employed part-time	13	33.3%
Not employed	3	7.7%
By Ethnicity		
Asian or Pacific Islander	5	12.8%
Black or African American	6	15.4%
Hispanic or Latino	20	51.3%
White / Caucasian	5	12.8%
Other	1	2.6%
Prefer not to answer	2	5.1%

3.2. Procedures

Based on Kolb's experiential learning model, we designed a ChatGPT learning activity flow that corresponds to the four continuous learning steps: Experiencing – Reflecting – Thinking – Acting.

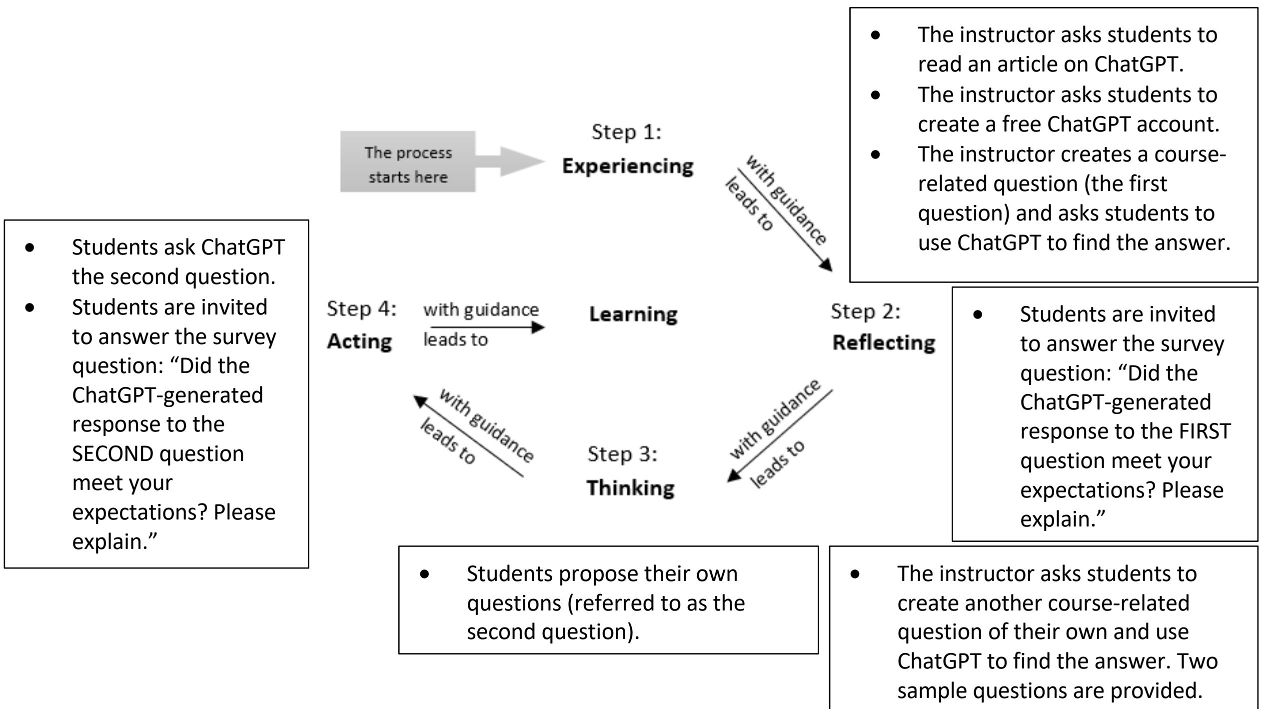
Step 1: Experiencing. The instructor first asked students to read the article titled "What Is ChatGPT? What to Know About the AI Chatbot" (Hao, 2023). The instructor then asked students to go to https://chat.openai.com/ and create a free account. Next, the instructor provided a course-related prompt (referred to as the FIRST question) and asked students to use ChatGPT to generate an output. The instructor also indicates that if students dislike the ChatGPT answer, they can click on "Regenerate response" to get another one.

Step 2: Reflecting. Students were invited to participate in an anonymous online survey created by the researchers and answered the survey question: "Did the ChatGPT-generated response to the FIRST question meet your expectations? Please explain."

Step 3: Thinking. The instructor asked students to create a course-related prompt themselves for ChatGPT. The instructor also provided two sample prompts for students as a reference. Students then created their own prompt (referred to as the SECOND question).

Step 4: Acting. Students entered the second prompt into ChatGPT for response and then answered the survey question: "Did the ChatGPT-generated response to the SECOND question meet your expectations? Please explain."

Thus, with the guidance of the instructors, students have completed the four steps of experiential learning depicted by Kolb (1984). Knowledge is expected to be continuously gained through the process.



Note: Adapted from Figure 1 of "Experiential Learning Theory" by Ali Asiri. https://opentext.wsu.edu/theoreticalmodelsforteachingandresearch/chapter/experiential-learning-theory/

Figure 1. ChatGPT learning activity flow based on the experiential learning model

3.3. Coding strategies

Guided by Anderson et al. (2001) Revised Bloom's Taxonomy, we first coded the instructor-provided ChatGPT prompts and student-created ChatGPT prompts in terms of different knowledge types and cognitive processes. Each researcher coded 39 responses independently. The inter-rater reliability, measured by the percentage agreement, ranged from 73% to 87% for the knowledge types and cognitive processes of the two ChatGPT questions. The two researchers then discussed the coding and resolved any coding disagreements. Table 2 provides the coding of the four instructor-created prompts for ChatGPT (one prompt per class).

The two researchers followed a thematic analysis procedure described by Braun and Clarke (2006) and coded student responses to the two open-ended questions asking whether ChatGPT-generated responses met their expectations. According to Braun and Clarke (2006), thematic analysis is a qualitative method for identifying, analyzing, organizing, describing, and reporting themes found within a data set. An initial coding conducted by the two researchers independently identified three themes in student responses. The researchers had disagreements about whether implicit student responses should be classified as Theme 2 instead of Theme 1. The researchers discussed these implicit student responses and agreed to use the number of times the student has asked the ChatGPT the same question as a reference when coding Theme 2. Thus, the researchers resolved the coding disagreement and reached a consensus on all coding.

4. Findings

Sections 4.1 and 4.2 report the findings of the first research question, with a focus on the knowledge and cognitive process dimensions of the ChatGPT questions used in student learning and the dependence of student-created prompts for ChatGPT on prior learning experience. Section 4.3 presents findings to the second research question, which focuses on student perception of the quality of ChatGPT-generated information.

4.1. Dimensions of the ChatGPT prompts

As the first guided experience with ChatGPT, 11 students practiced a ChatGPT prompt that involved understanding procedural knowledge; eight students practiced a ChatGPT prompt that involved applying conceptual knowledge; 14 students practiced a ChatGPT prompt that involved analyzing metacognitive knowledge; and six students practiced a ChatGPT prompt that involved creating metacognitive knowledge. Table 3 presents the number of students who used the instructor-created questions in terms of knowledge type and cognitive process.

When students were asked to create their own questions to seek answers from ChatGPT, 14 students raised questions that involved understanding conceptual knowledge, followed by five students whose questions involved applying conceptual knowledge, five students whose questions were related to the analysis of metacognitive knowledge, and others. Table 4 presents the distribution of the student-created questions by the dimensions of knowledge type and cognitive process.

Table 2. Coding of instructor prompts

Knowledge Type\ Cognitive Process	Instructor-Provided Prompt
Conceptual Knowledge\ Cognitive Process: Applying	A manager checked production records and found that a worker produced 200 units while working 40 hours. In the previous week, the same worker produced 130 units while working 32 hours. Did the worker's productivity increase, decrease, or remain the same? Explain.
Procedural Knowledge\ Cognitive Process: Understanding	How to create database SELECT queries using SQL GROUP BY?
Metacognitive Knowledge\ Cognitive Process: Analyzing	Please explain how the capstone project on [insert your topic here] helps improve your competencies and skills to lead and manage in public organizations and serve your communities effectively and ethically.
Metacognitive Knowledge\ Cognitive Process: Creating	For a research question "input your research question here," create a research design that uses survey methods. This should include Method Selection, Research Subjects (Sample), Data collection plan, Data collection materials, and Data analysis plan.

As shown in Tables 3 and 4, students seemed to be more interested in using ChatGPT to understand conceptual knowledge while instructors focused more on using ChatGPT to analyze or create metacognitive knowledge. Table 4 also shows that compared to conceptual knowledge, procedure knowledge and metacognitive knowledge appeared to be less popular among students; very few students created ChatGPT questions at a higher cognitive level such as evaluating or creating.

Table 3. Dimensions of the first prompt (provided by instructors and used by students)

Knowledge Type	Cognitive Process				Total
	Understanding	Applying	Analyzing	Creating	
Conceptual Knowledge	0	8	0	0	8
Procedural Knowledge	11	0	0	0	11
Metacognitive Knowledge	0	0	14	6	20
Total	11	8	14	6	39

Table 4. Dimensions of the second prompt (created by students)

Knowledge Type	Cognitive Process					Total
	Understanding	Applying	Analyzing	Evaluating	Creating	
Conceptual Knowledge	14	5	1	1	0	21
Procedural Knowledge	3	4	0	0	0	7
Metacognitive Knowledge	3	0	5	0	1	9
Total	20	9	6	1	1	37

4.2. Dependence of student-created prompts for ChatGPT on prior learning

Table 5 is a contingency table displaying the frequency distribution of the *knowledge types* of the two ChatGPT questions (instructor-provided vs. student-created). The result of the Fisher's exact test (p = 0.016) indicates a statistically significant association between the knowledge types of the two questions. That is, the knowledge type of student-created prompts for ChatGPT depends on the knowledge type of the first question that their instructor created for them to practice. If the first question is related to metacognitive knowledge, it seems to be more helpful for students to propose a ChatGPT question involving a variety of knowledge types.

Table 6 is a contingency table displaying the frequency distribution of the *cognitive processes* of the two ChatGPT questions (instructor-provided vs. student-created). The result of the Fisher's exact test (p < 0.001) indicates a statistically significant association between the cognitive process of the two questions. That is, the cognitive process of a student-created prompt depends on the cognitive process of the first prompt that their instructor provided. In particular, if the first prompt involves analyzing the level of cognition, it seems to be more helpful for students to create a ChatGPT prompt at various cognitive levels.

Table 5. Knowledge types of two ChatGPT prompts

Second Prompt (by Students)	First Prompt (by Instructors)			Total (column %)
	Conceptual Knowledge	Procedural Knowledge	Metacognitive Knowledge	
Conceptual Knowledge	4 (50%)	9 (81.8%)	8 (44.4%)	21 (56.8%)
Procedural Knowledge	4 (50%)	1 (9.1%)	2 (11.1%)	7 (18.9%)
Metacognitive Knowledge	0 (0%)	1 (9.1%)	8 (44.4%)	9 (24.3%)
Total	8 (100%)	11 (100%)	18 (100%)	37 (100%)

Fisher's Exact Test=10.788, p = 0.016; Cramer's V=0.419; Gamma=0.358

Table 6. Cognitive processes of ChatGPT Prompts

Second Prompt (by Students)	First Prompt (by Instructors)				Total (column %)
	Understanding	Applying	Analyzing	Creating	
Understanding	7 (63.6%)	3 (37.5%)	4 (33.3%)	6 (100%)	20 (54.1%)
Applying	4 (36.4%)	5 (62.5%)	0 (0%)	0 (0%)	9 (24.3%)
Analyzing	0 (0%)	0 (0%)	6 (50%)	0 (0%)	6 (16.2%)
Evaluating	0 (0%)	0 (0%)	1 (8.3%)	0 (0%)	1 (2.7%)
Creating	0 (0%)	0 (0%)	1 (8.3%)	0 (0%)	1 (2.7%)
Total	11 (100%)	8 (100%)	12 (100%)	6 (100%)	37 (100%)

Fisher's Exact Test=25.702, p<0.001; Cramer's V=0.523; Gamma=0.110

Table 7. Key themes revealed from data analysis

Themes	Frequently Used Phrases	Sample Quotes
Theme 1: Students are amazed and impressed by the responses generated by ChatGPT	Clear, correct, accurate, detailed, relevant, thorough, easy to understand, speed	"Yes, absolutely impressed by this ChatGPT feature. It provided informative and pretty accurate responses to my questions. It's clear and informative. It is truly remarkable, and I wish I knew of this feature earlier." (ID: 48)
Theme 2: Students are knowledgea-ble enough to evaluate the ChatGPT responses and conduct further inquiry	Wanted additional context; wanted a much longer and in-depth response	"Yes, it did meet my expectations. I did have an issue at the first response as it gave me a small and direct answer. I regenerated the response because I wanted a much longer and in-depth response." (ID: 67)
Theme 3: Students sometimes raised concerns about the responses by ChatGPT	Too vague; lack a lot of domain (database) terminology; same exact answer for all questions	"The answers it gave me would have sufficed for a brief description of what I needed to worry about. However, the lack of detail caused me to regenerate the answers, which gave me a similar quality." (ID: 69)

4.3. Student perceptions of the quality of ChatGPT-generated information

To understand how college students perceive the quality of ChatGPT-generated information related to their learning, we analyzed the qualitative data collected from the student responses to the open-ended survey questions asking whether ChatGPT-generated information has met their expectations. Our analysis revealed three major themes, which are summarized in Table 7 and elaborated in this section.

Overall, students responded positively to using ChatGPT as a learning tool. In general, students are satisfied with the quality of the ChatGPT-generated information in terms of accuracy, timeliness, clarity, depth, and organization. Student narratives reflect the overwhelmingly positive responses.

Theme 1: Students are amazed and impressed by the responses generated by ChatGPT for the three knowledge types. During both rounds of questions (instructor-provided and student-created), students submitted to ChatGPT questions that involved knowledge of various types, from conceptual to metacognitive. Our analysis revealed student satisfaction across all the knowledge types. In response to a ChatGPT prompt involving conceptual knowledge, a student responded "I would say it did meet my expectations because in the beginning, it stated what needs to be calculated in order to answer the question. It also showed the work and broke it down" (ID: 65; female, Hispanic, senior, FGCS).

In response to a ChatGPT prompt involving procedural knowledge, a student responded that "ChatGPT created a response where it outlined steps for me to take to create the query. ChatGPT gave me the steps and an example so I could follow along" (ID: 47; male, Hispanic, junior, FGCS).

In response to a ChatGPT prompt involving metacognitive knowledge, a student responded that "The ChatGPT-generated response … coincided with the research I had already done on the project. I also liked the format of the response" (ID: 43; female, Hispanic, graduate).

Theme 2: Students are knowledgeable enough to evaluate the ChatGPT responses and conduct further inquiry to achieve the optimal outcome of knowledge. The ChatGPT questions experienced by students involved the cognitive processes at different levels, from understanding to analyzing and creating. Students have shown competency in evaluating the first responses generated by ChatGPT and made further inquiries when they felt the first response did not provide sufficient details or missed context information. For the instructor-created first question, 21 students asked the ChatGPT once, 15 asked twice, and three students asked three times. For the second prompt that the students created, students seemed to have gained more confidence in ChatGPT: 29 students entered the prompt once, nine entered it twice, and one student entered three times.

For example, one student stated: "The initial response I received from ChatGPT met my expectations; however, I wanted to see what other response I would receive if I generated another response. The second response I received was similar to the first, but the second response provided formulas to solve the productivity rate as opposed to just the calculation." (ID:75; female, White, Pell-eligible, senior, FGCS). Another student mentioned "I would say that the responses that I was offered met my expectations. I had asked for a second response only to check if the system was sure about the first response that it gave me. It gave me a different response but with the same answer that I was looking for." (ID:64; male, Hispanic, Pell-eligible, senior, FGCS).

Theme 3: Students sometimes raised concerns about the responses by ChatGPT, mostly in the domain of metacognitive knowledge. In some cases, students found the first response generated by ChatGPT fell short of their expectations, which motivated them to make the second or third attempts for ChatGPT responses. By comparing the ChatGPT responses to the same prompt, students identified the weak portion of the ChatGPT output. These were reflected in the two student remarks: “I was a bit disappointed with the first response because it was too vague and lacked a lot of database terminology. It did meet my expectations after the second time” (ID: 40; A male, Hispanic, senior, FGCS). “It did meet most of my expectations because it did give a detailed and clear response. However, it failed in the data analysis part of the question because it seemed to produce the same exact answer for all questions it just changed the language” (ID: 77; female, Black, junior, non-FGCS).

5. Discussion

Using survey data collected from a sample of college students, our analysis shows that under the guidance of the instructors, students learned to use the AI tool – ChatGPT – to explore questions of various knowledge types at different cognitive processes through four steps of experiential learning. The findings also reveal that the knowledge type and cognitive process of student-created questions for ChatGPT depend on the first practice prompt provided by their instructor. In general, students are satisfied with the quality of the ChatGPT-generated information in terms of accuracy, timeliness, clarity, depth, and organization of the answers.

Based on empirical data of student experiences and reflections about their use of ChatGPT in college learning, the study contributes to the theory of experiential learning in two aspects. First, the use of AI tools such as ChatGPT makes experiential learning more individualized, interactive, and accessible, compared to traditional experiential learning activities such as case studies, field experiences, and simulations. Experiential learning through ChatGPT can be used to support students to undertake learning in a variety of course-related, project-based, and work-integrated contexts. Second, the careful design of the ChatGPT learning activity flow highlights the importance of the instructor as a facilitator in enhancing AI-based experiential learning. In a traditional experiential learning environment, a facilitator is not essential to experiential learning; rather, the essential mechanism is the learner's reflection on experiences using analytic skills (Rodrigues, 2004). However, our study shows that in the AI-enabled experiential learning process, not only does a clear step-by-step instruction matter but also the first training or practice activity provided to students affects the success of continuous learning.

The study contributes to Bloom’s Taxonomy as it shows that using ChatGPT to gain metacognitive knowledge at the analyzing level of the cognitive process seems to bring the most benefits to students in terms of expanding the scope of their learning. In addition, the study has practical implications for educators and students to enhance the effectiveness and efficiency of teaching and learning in the context of generative AI technology. Instructors need to think of creative ways to utilize the latest AI technology such as ChatGPT to meet the specific course learning objectives. Our ChatGPT-related activity required students to connect their ChatGPT experiences with class-specific topics, consistent with the recommendation by Van Slyke et al. (2023) to contextualize assessments and activities. By considering AI-enabled experiential learning in developing course or program content, instructors have a great opportunity to develop a framework for adapting varying teaching/learning techniques into the classroom (Rodrigues, 2004). It is important for a properly designed learning activity flow to include clear instructions and reflection activities. Equally important is to set a boundary for students regarding what is considered appropriate and ethical use of technology in education (Van Slyke et al., 2023). In this regard, students in our study have made efforts to identify biased, incorrect, and misleading information generated by AI, which requires critical thinking skills that cannot be replaced by AI. However, more research on student perception of ethical vs. unethical use of generative AI for education will generate further insights.

6. Conclusion

The study has its limitations. First, it uses a convenience sample, not a representative sample of the study population, which could limit the generalizability of the findings. Second, the sample size is insufficient for the quantitative analysis of the statistical relationships between variables. Finally, the study is based on student perceptions and self-reported learning outcomes. Future studies are suggested to conduct quantitative research using a large random sample and objective measures of student learning outcomes. In addition, the learning activities may require students to check the accuracy of the references provided by ChatGPT, which at times could be false. Also, instead of single classes, research at the program level that implements ChatGPT in a series of courses could help students construct a deeper understanding of this AI tool.

As stated by Baidoo-Anu and Owusu Ansah (2023), "integrating generative AI tools in the classroom and teaching students how to use it constructively and safely will also prepare them to thrive in an AI-dominated work environment after school" (p. 16). The authors called for policymakers, researchers, educators, and technology experts to work together and discuss the use of these evolving generative AI tools safely and constructively to improve education. To this end, our study has made an initial effort to understand and use generative AI tools in higher education.

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