
**GenAI does NOT negate Bloom’s Taxonomy
for Sustainable Learning Outcomes – An Analysis of
ChatGPT Prompts by Students**

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Will the use of Generative Artificial Intelligence (AI or GenAI) software such as ChatGPT negate the standard – often sequential – learning phases according to Bloom’s taxonomy: ‘knowledge, understanding, applying, analyzing, evaluating, and synthesizing?’ or will GenAI help bypass or even invert the Bloom taxonomy where the students gain knowledge and basic understanding through synthesis and evaluation (Damaševičius, 2023). To answer this question, we analyzed student queries, answers, and reflections using AI software ChatGPT in undergraduate business (finance, supply chain management) and chemistry classes. The student queries were classified according to Bloom’s taxonomy; most of the student queries were basic and introductory asking for definitions and explanations. With consistent practice, the students showed improvements in their querying capabilities. A non-linear, circular learning process is identified that encapsulates the accelerated learning potential presented by the GenAI software. Overall, this exercise using ChatGPT queries add credence to the fact that students should learn the basics (understanding, remembering) before the advanced levels (creating/synthesizing, evaluating). Incorporation of ChatGPT indeed markedly improve the pace of learning in the classrooms. The students showed distrust with the system upon realizing the wrong numerical answers and their inability to verify the correctness of the answers.

Introduction

With the advent of the Generative Artificial Intelligence (GenAI) software such as ChatGPT, a large language model (LLM) for dialogue from OpenAI, the knowledge building has assumed significantly different and newer dimensions (Baidoo-Anu & Ansah, 2023; Grassini, 2023; OpenAI, 2023). Despite the philosophical questions on whether GenAI would further

or hamper human-centric development, the AI will define the future of learning in myriad ways (Chomsky et al., 2023; Fui-Hoon Nah et al., 2023; Williams, 2023); including that of academic pedagogy in a significant manner (Haque, 2022; Wardat et al., 2023). Will the use of GenAI software such as ChatGPT negate the standard – often sequential – learning phases according to Bloom’s taxonomy: ‘knowledge, understanding, applying, analyzing, evaluating, and synthesizing?’ or will GenAI help bypass or even invert the Bloom taxonomy where the students gain knowledge and basic understanding through synthesis and evaluation (Damaševičius, 2023).

Given the nature of GenAI such as ChatGPT to generate answers and refresh them regularly, there are high chances that the student will be forced to ‘Learn, Unlearn, and Relearn’ (LURE) which can create exhaustion or lack of urgency to learn new concepts (Ramkumar et al., 2023). This will affect how the students retrieve the needed information later (Adeshola & Adepoju, 2023; Ambrose et al., 2010; Zhai, 2022). Since GenAI has tremendously improved the variety, novelty, and retrievability of the answers, it affects how students learn concepts, build knowledge, and the ways employed to learn them with creativity, efforts, classroom delivery modes, among other factors (Afkar et al., 2024; Jones et al., 2015; Levin-Banchik, 2018). The extent of GenAI use will vary significantly with the teachers and their efforts in the classrooms (Firat, 2023; Huallpa, 2023; Wang et al., 2024); the teachers have a rather exciting and challenging time having to deal with a whole gamut of unknowns and GenAI flaws and shortcomings such as hallucination that result in non-existent source materials, incorrect numerical answers, incipient and equivocal answers, and important ethical issues such as copyright violations. This has created a whole series of questions for the teachers such as inherent biases, falsities, and factually incorrect answers with long term negative impacts such as cheating, plagiarism, and academic dishonesty (Anders, 2023; Chomsky et al., 2023; Lo, 2023; Tyson, 2023)? When students rely too much on ChatGPT and other GenAI software, how does it impact their long-term learning and creative thinking?

GenAI software can even decimate well established older frameworks such as Bloom’s taxonomy by leapfrogging students’ learning beyond the basic concepts and advance to more advanced concepts rather quickly and effectively (Damaševičius, 2023; Spanos, 2024). Does GenAI such as ChatGPT negate the well-established Bloom’s taxonomic principles? That is the primary question we tried to address in this research paper: we

introduced ChatGPT to our students in a diverse set of undergraduate classes – introductory finance (with 28 students), food supply chains management (SCM, 19), and general chemistry II (16); we used the free version 3.5 that was widely made available during 2023 and 2024 (OpenAI, 2023). We document how students approached querying the AI software ChatGPT on these subjects, classify the student questions according to the Bloom’s taxonomic level, classify the nature of student learnings, and the (early/initial) impressions of using such software for long-term sustainable outcomes.

Our results indicate that the students in introductory courses still need to learn the basic concepts and their questions to ChatGPT are at the basic Bloom levels of remembering and understanding for comprehension and basic knowledge (figure 1). The students performed more intense questioning according to their personal interests, but the teachers still need to be present helping students create better prompts and evaluate the GenAI responses. The alignment of the GenAI use with the course objectives and assessments is critical; combined with generating good prompts, the students seek clear instructions on when and how to use AI answers, what is acceptable or not, and how it will be graded. The repeated use of ChatGPT in the classroom instructions resulted in a salient outcome: students queries evolved more quickly into advanced concepts indicating that students employed non-linear, circular learning pathways, that can be situated within the traditional Bloom’s taxonomy.

Research Question and Approach

For this research, we studied our students ChatGPT query questions and how their prompt engineering, that is, honing questions to get better answers (Giray, 2023; Heston & Khun, 2023; Meskó, 2023; Poola, 2023; White et al., 2023). The students were free to query anything of interest to them within the course or subject matter; these responses were classified and categorized according to the Bloom’s taxonomy of thinking and learning – ‘remember, understanding, application, analysis, synthesis, and evaluation’ (Forehand, 2005a, 2005b; Krathwohl, 2002); see figure 1 below.

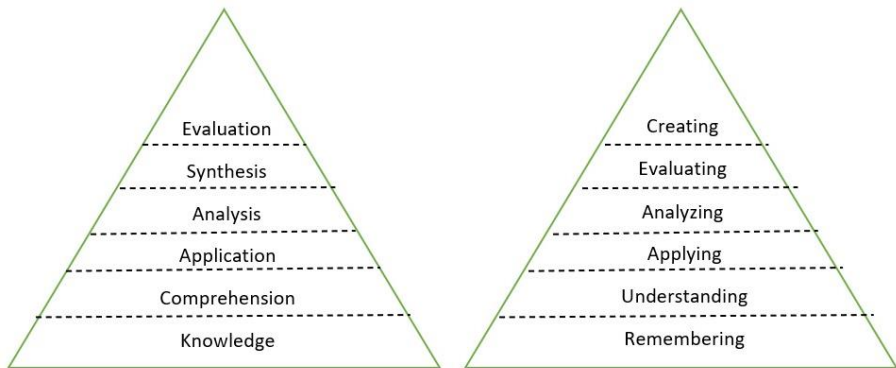


Figure 1. Bloom's Taxonomy – Old (left) and New (right) Versions (reproduced from Forehand, 2005b)

The Bloom's taxonomy is chosen because it has been a bedrock of pedagogical assessments (Nkhoma et al., 2017; Tabrizi & Rideout, 2017). Bloom's taxonomy emphasizes sustainable learning through building a solid foundation (knowledge and comprehension) which can lead to more significant critical thinking skills (synthesis and creation). Besides, Bloom's taxonomy has been extensively studied and expanded: for instance, the Fink's taxonomy emphasizes that students should learn and integrate their knowledge across multiple dimensions and developing a systematic framework to learn how to learn further: 'foundational knowledge, application, integration, human dimension, caring, and learning how to learn' (C. Fallahi, 2011; Fink, 2003). GenAI make it easy 'creating or synthesizing' (an advanced level) with relative ease – hence, there is concern that Bloom's taxonomy might be relegated and become irrelevant with the widespread use of GenAI (Damaševičius, 2023). Indiscriminate or cursory use of GenAI can result in weak foundations of the subject matter resulting in poorer reflection, judgment, and critical thinking skills as given in the additional variations of Bloom's taxonomical categories: 'knowledge/understanding, followed by engagement/motivation, performance/action, reflection/critique, judgment/ design, and commitment/identity' (C. R. Fallahi & LaMonaca Jr, 2009; Shulman & Hutchings, 2004). Our students used only ChatGPT due to its widespread availability and its status as a first mover within the GenAI LLM industry. There are many other alternatives such as Google's Bard, Baidu AI, Microsoft's Copilot, and other software in various stages of development

and deployment (Baidu - AI, 2023; Google - Bard, 2023; Rahsepar et al., 2023; Ram & Pratima Verma, 2023; Rebelo, 2023; Waisberg et al., 2023).

Methods

Demonstration of ChatGPT in the Classroom

The lead author taught the business courses in finance and food supply chains (SCM). In the finance class, the demonstrations included querying the software for concepts such as ‘basic definitions of financial terms, financial systems and institutions, and more advanced concepts and numerical questions involving monthly mortgage payment amounts and interest and principal payment schedules.’ The students were informed which of these answers were reliable (often, the textual content) and which were not reliable (the numerical answers, the citations, equivocal answers, etc.). The numerical errors with ChatGPT (in its version 3.5) is well documented because of its inability to distinguish between the numerical answer that is correct vs. any other number (Amaro et al., 2023; Fergus et al., 2023; Gregorcic & Pendrill, 2023); subsequent improvements to ChatGPT (version 4.0) have enabled better reference sources that can predict correct numerical answers. In the SCM class, the students were shown how to query ChatGPT about the business principles of supply chains. Later, the students completed homework assignments (appendices A through D), that included both open-ended questions and their reflections on the applicability, use, and trust of the ChatGPT.

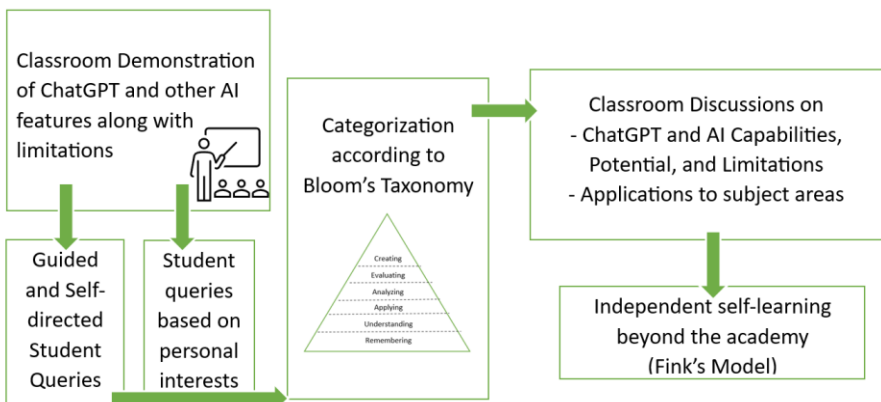


Figure 2. Implementation of ChatGPT in Classroom Instruction

Student Responses by Bloom's Taxonomy

Finance Class

Most of the student questions in the finance class were focused on basic knowledge/understanding type of questions such as *'what is finance/cash flow statement/time value of money/Net Present Value (NPV)/Internal Rate of Return (IRR)/ income statement; should I use NPV or IRR to choose among projects?'* Even without any direction, the students chose to ask questions related to their personal finance *'what is the best time to make a large purchase; suggested monthly deposits for their savings account; tips for (stock market) investing; things to consider while purchasing a car; and should I start investing when I am young?'* Upon repeated questioning, they honed their question prompts to compare two or more concepts (as in analysis or evaluation) *'what is the best way to compare NPV, IRR, and modified IRR; is it smarter to take a loan or purchase it in cash; how to determine the right kind of loan terms; how to payoff student loans right out of college; considerations for a used car vs. new car; and why or how do banks fail?'* It is important to note that these questions were generated by students based on their personal knowledge, experience, and interests.

The student responses were classified by both authors and three different GenAI software (Copilot GPT-5, Gemini 3, and ChatGPT 5.3; see table 1). There is general agreement regarding how human authors and GenAI classified the student responses. According to human author classification, about 60-70% responses fell under Bloom's lower levels of 'knowledge or comprehension' while the same classification was 50-70% according to GenAI software. This shows that students' use of GenAI remains introductory in these finance and supply chains undergraduate classes. Very few questions were rated as higher order 'evaluation and synthesis:' only 6-9% of student responses were rated as higher order questions by human authors, while 5-19% of the responses were rated as higher order questions by GenAI.

The three GenAI rating classifications were different contributing to the wider ranges in GenAI classifications. It also indicates that GenAI classifications may not be taken to be neither objective nor to be taken or trusted independently of each other. Slight differences do exist between the human and GenAI ratings, but it could be due to wideranging differences among the GenAI classifications. The students might have avoided the

analytical questions (only 2% of the queries sought numerical calculations) in the finance class because the students had learned through classroom demonstration that ChatGPT responses could result in numerical errors (with an earlier version of ChatGPT 3). It should be noted that GenAI has rapidly evolved in the recent past and the classroom implications can be very different in the future. Also, the students can be purposely taught how to ask more detailed, higher order questions and use it to improve their overall understanding of the subject matter and develop their expertise.

Table 1a. Classification of Students’ GenAI Queries according to Bloom’s Taxonomy in the Finance class

	Human Authors		GenAI classification*			Average Score	
	Author 1	Author 2	Copilot (GPT-5)	Gemini 3	ChatGPT 5.3	Human Authors	GenAI
Knowledge	44%	27%	27%	40%	26%	36%	31%
Understanding	29%	42%	20%	27%	14%	36%	20%
Application	15%	7%	18%	18%	12%	11%	16%
Analysis	2%	12%	18%	9%	14%	7%	14%
Synthesis	3%	0%	17%	6%	34%	2%	19%
Evaluation	7%	7%	0%	0%	0%	7%	0%

1b. Classification of Students’ GenAI Queries according to Bloom’s Taxonomy in the Food Supply Chains class

	Human Authors		GenAI classification*			Average Score	
	Author 1	Author 2	Copilot (GPT-5)	Gemini 3	ChatGPT 5.3	Human Authors	GenAI
Knowledge	30%	36%	59%	54%	60%	33%	58%
Understanding	24%	36%	14%	20%	23%	30%	19%
Application	12%	0%	1%	16%	4%	6%	7%
Analysis	26%	26%	16%	7%	9%	26%	11%
Synthesis	2%	1%	9%	3%	4%	2%	5%
Evaluation	6%	1%	1%	0%	0%	4%	0%

* There are slight variations in the GenAI classifications and calculations depending on the free or paid versions

The students' reflective comments indicated the perception of ChatGPT to be *'efficient and quick; ability to generate quick summary; help study for exams; learning some new things beyond things discussed in the classroom; a way to confirm that classroom lessons are relevant for their learnings, being able to ask insightful questions; and the ability to obtain the perspectives of another 'person'.*' Some students expressed concerns about the *'non-reliability due to numerical errors; ChatGPT answers being convoluted and difficulty to use it for understanding; and the necessity or inability to cross-verify the ChatGPT answers in some cases.'*

Student Reflections on GenAI

In the final exam for the finance class, the students reflected on how they could employ ChatGPT and AI software for their careers and farming profession. There was near-unanimous recognition that AI software could help improve their knowledge, ability to process and assimilate information, improve their creativity, higher order thinking, and expand their overall knowledge. The students also emphasized the importance of adapting and learning new AI tools to become more marketable in their careers. Nonetheless, a few student responses highlighted the falsities and potential pitfalls in trusting ChatGPT information in its current form; those students also indicated a preference for simpler, traditional online search engine tools that are already available.

Knowledge vs. Effort

While the students generally agreed with the relevance of ChatGPT for their learnings, they displayed different levels of interest and effort while employing ChatGPT to generate their queries and write reflective answers. We computed correlation coefficients (r) between the final exam grades with the extent of their explanations for the query to ChatGPT (number of words), explanation of their understanding (number of words), and their reflective essays (number of words). Particularly, these correlations can explain whether the traditionally low performing students gained more interest in using GenAI software, that is easy to use and implement, improve their knowledge and eventually lower the efforts to fill their knowledge gap. The corresponding null hypothesis would be $H_0: r \leq 0$ indicating that the correlation coefficients (r) would indicate no or negative

relationship between the students’ final grades and their efforts on GenAI assignments. The corresponding alternative hypothesis would be H1: $r > 0$ indicating that the high performers continue to benefit the most from the GenAI software usage. The t-test statistics were computed as $t = r \sqrt{\frac{n-2}{1-r^2}}$ with (n-2) degrees of freedom where r is the correlation coefficient and n is the number of observations (Webb, 2023). The test results and statistical significance calculated based on 1-tail t-test are given tables 2 and 3 for the finance classes in 2023 and 2024 spring semesters, respectively.

Table 2a. Summary statistics of student responses on ChatGPT assignments in Finance class – 2023

	Range		Did not attempt (# of students)	Average
	Minimum	Maximum		
Course Grade	37%	100%	0	83.30 %
Query Extent (# words)	15	42	8	17.4
Explanation words (#)	44	218	9	102.5
Final Reflective Essay (#)	98	333	4	173.5

Table 2b. Correlation Matrix for Finance Class Assignments and Grades - 2023

	Final Grade	Query Words	Explanation Words	Final Reflective Essay
Final Grade	1	0.715***	0.591***	0.535***
Query Words		1	0.603***	0.233
Explanation Words			1	0.136
Final Reflective Essay				1

***, **, and * indicates statistical significance at 1%, 5%, 10% levels.

The correlation values ranged from +0.136 to +0.715 during 2023 and +0.120 to +0.705 during 2024. All positive values indicate that the high

performing students continued to show more interest in using and reflecting upon the ChatGPT assignments. The students continued to view the ChatGPT as an assignment rather than a tool that can contribute to their long-term professional successes. The final grade correlations with the assignment and reflective questions were all statistically significant at 1% level during 2023 and at 1% and 5% levels in 2024. It is noteworthy that the statistical results were consistent across the two terms during 2023 and 2024.

Table 3a. Summary statistics of student responses on ChatGPT assignments in Finance class – 2023

	Range		Did not attempt (# of students)	Average
	Minimum	Maximum		
Course Grade	63.69%	100%	0	83.78%
Query Extent (# words)	18	62	8	23.5
Explanation words (#)	98	190	10	65.3
Final Reflective Essay (#)	90	314	0	156.5

Table 3b. Correlation Matrix for Finance Class Assignments and Grades - 2024

	Final Grade	Query Words	Explanation Words	Final Reflective Essay
Final Grade	1	0.454**	0.572***	0.522**
Query Words		1	0.705***	0.120
Explanation Words			1	0.382*
Final Reflective Essay				1

***, **, and * indicates statistical significance at 1%, 5%, 10% levels.

Supply Chains Class:

The taxonomical composition of student queries in the SCM class were very similar to that of the finance class with most of the queries being

at the lower orders of thinking (knowledge and understanding) and fewer queries at the higher levels of thinking (synthesis and evaluation). One marked difference was (table 1b) the slightly higher proportion of analysis questions in the SCM class where the students wanted to know what critical factors would determine better prices and profits for their products. The answers in the supply chains class generally did not contain any numerical values for the student queries; while some students continued to query more to get numerical values, there was a tendency for the students to trust those values blindly without further verifications.

Chemistry Class:

The coauthor taught the general chemistry class and followed a similar approach: ChatGPT was introduced by demonstrating the query process using questions such as *'what is pH/buffer/strong acid/pH of 0.1M HCl/pH of 0.01M NH₃; differences between acids and bases; what is the resulting of pH of mixing two solutions of different molarity, etc.'* Less than half of the students had heard about ChatGPT in the chemistry class in 2023. During the demonstration, the students indicated that answers to simpler questions were easy to understand and were more trusting of those answers, while the responses to more complex questions were viewed with skepticism or difficulties in comprehending and verifying those answers. The chemistry classroom demonstration showed that some of the explanations given by ChatGPT were neither simple nor straight forward, but highly convoluted. In some cases, the explanations were so complicated, that students vehemently rejected ChatGPT to learn scientific concepts that require numerical calculations further; a total of nine out of 16 students rejected or expressed distrust in using ChatGPT for understanding advanced chemistry concepts.

The student responses in the chemistry class (survey in appendix C) were generally introductory and could be classified mostly as basic at the levels of 'knowledge or understanding' in Bloom's taxonomy. The student queries to ChatGPT included questions such as *'what is the electron configuration for Ni²⁺; percentage of sulfur in iron sulphate; second law of thermodynamics; calculate entropy for heat released from a system; number of electrons in 2p orbital of calcium;'* and some analytical questions such as *'conversion of 0.2 grams of calcium into moles of calcium, concentration of salt in a solution after dilution, etc.'* Like the finance class, the chemistry students were unable to confirm ChatGPT responses for more advanced

questions primarily due to lacking of prior knowledge. Many students merely expressed skepticism reading through the voluminous textual output from ChatGPT and suggested minimal use of ChatGPT; the students even commented that ChatGPT would be more useful in courses such as English and History, rather than science courses such as chemistry. These outcomes may be limited to this set of students and there was not enough data.

Key Observations

This exercise uncovered three main aspects of using AI in the classroom instruction:

(i) students' interest in ChatGPT queries focused on topics of personal interest to them; they lacked the knowledge to verify the authenticity, reliability, and subsequently interpret the results to improve their knowledge and understanding of the subject matter. Most of the questions were at basic level; while the advanced level queries such as 'evaluations or synthesis' may not occur immediately, but they may appear at the end of a series of repeatedly honed queries. These observations indicate that the student learnings occur in a non-linear, circular manner as given in a conceptual model – see figure 3 – as opposed to the linear, pyramid structures used to depict Bloom's taxonomy (figure 1). *The most value with the use of GenAI software lies not in a single instance of querying but in continuous repetition of the querying process with GenAI software; the students can learn and direct their own self-guided learning for sustainable learning outside of the educational institutions after their graduation.*

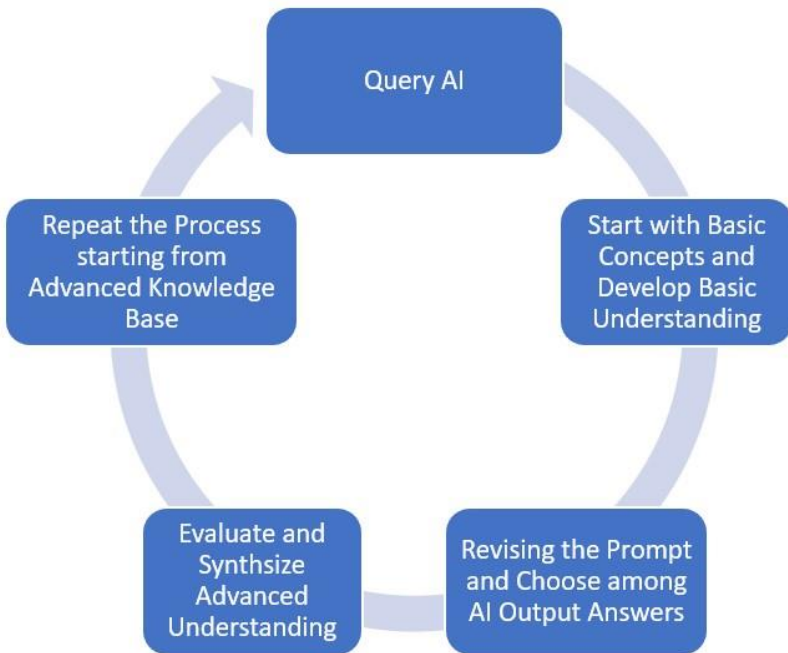


Figure 3. A Conceptual Model of Accelerated Non-linear, Circular Learning Approach with Bloom’s Taxonomic Categories (Source: Authors)

(ii) Another major advantage with GenAI software is in learning that occurs at a much faster scale, that may differ in content and dimension based on the individual student’s queries. Incorporating the traditional Bloom’s framework (for example, analyze, evaluate, and synthesize) itself can result in more advanced knowledge (Das et al., 2022; Newton et al., 2020; Stanny, 2016). *The teachers should anticipate and be prepared for rapid pace of learning and a broader understanding of the subject matter.*

(iii) The student queries resulted in slightly different answers; their follow-up queries gradually diverged and the student comprehension varied based on what answers they received. Sometimes, the in-class querying exercise resulted in widely varying answers and outcomes and can even become intractable. This provides both an opportunity and a challenge for the instructors, where they would need to impart a collective overall understanding for all the students in the class. Some of the ChatGPT responses created an awareness for topics and discussions that would

otherwise not have been covered in traditional classroom settings. *The teachers must recognize the challenges with diverse GenAI responses, the necessity to create an integrated understanding, and the unique opportunity to cover supplementary topics, often at a much rapid pace.*

Difficulties

The students that participated in these exercises were unable to verify the correctness of ChatGPT answers, especially in the science classes and questions related to numerical calculations. Such intractability led to quickly waning interest among the students who eventually lost trust and interest. Coupled with the unreliability of numerical answers (Amaro et al., 2023), some explanations were unnecessarily complex and verbose that a human being could teach it better than GenAI software. ChatGPT is often trained to answer in a generic way without giving specific answers which reduces the usefulness of it beyond a certain point. Once the novelty of the AI software wears off, the adept users will recognize that GenAI software is simply repeating the information from various databases it was pre-trained on.

Various other shortcomings and limitations are documented by the researchers as well (Azaria, 2022; Tyson, 2023), such as biases – natural or built-in (Roose, 2023); plagiarism, exhibiting apathy and obviation (Chomsky et al., 2023). Recently, the authors faced with a situation in one of our classes where the student had used it unauthorized for a classroom assignment despite its being prohibited for that particular assignment, as given in the syllabus. Such instances can lead to confusions and academic misconduct investigations by the departments, colleges, and universities. Hence, with the widespread growth of GenAI software, the educators are increasingly facing pressures to ensure their academic integrity while also providing superior learning environment by adopting these high-tech software resources (Azoulay et al., 2023; Cotton et al., 2023; Currie, 2023).

Conclusions

The students used the artificial intelligence (AI) software ChatGPT in undergraduate business (finance, supply chain management) and chemistry classes to query and learn the subject matter. The student queries were classified according to Bloom's taxonomy; most of the student queries were basic and introductory asking for definitions and explanations. While some students asked more advanced analytical questions, they were unable to

verify the correctness of those responses due to lack of knowledge and the general mistrust with the ChatGPT provided answers for numerical calculations. With consistent practice, the students showed improvements in their querying capabilities. A non-linear, circular learning process is identified that encapsulates the accelerated learning potential presented by the AI software. Overall, this exercise using ChatGPT queries add credence to the fact that students should learn the basics (understanding, remembering) before the advanced levels (creating/synthesizing, evaluating). Incorporation of ChatGPT indeed markedly improve the pace of learning in the classrooms. With careful planning and clear guidance, the students can certainly benefit with the use of GenAI software for their long-term self-learning. Given that ChatGPT and other AI software are still in their early stages of development, the future improvements will create considerably more pedagogical opportunities and implications. But in the very long term, the philosophical and societal questions of the implications of AI for human lives remain.

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Appendix A: Finance Class Homework Question

What can you reliably learn from ChatGPT? Higher Education is all about 'Solving Problems by Asking the Right Questions.' In this assignment, you can ask any finance related question such as

Sample Basic Questions: What is _____ in finance? what does _____ do? what are the important topics or issues in _____ area of finance?

More Advanced Questions: how to take action to improve the company's financial prospects for this set of balance sheet / income statement numbers? which project to choose given the Cash Flows when the projects are mutually exclusive for these numbers? what things should I consider while buying _____ vs _____?

ASSIGNMENT

-
1. Ask any THREE questions of your interest. Copy-Paste the three questions and ChatGPT answers for your questions (no word limit)
 2. Do you consider the answers RELIABLE? are the NUMERICAL calculations reliable? How will you verify if these answers are reliable? Did you ask follow-up questions to clarify?
 3. How can you sharpen your skills in asking the right questions?
Was this assignment helpful to improve your understanding of finance and how to get additional info about finance? You can ask any question based on any finance concept that we have discussed so far (various chapter titles)

Appendix B: Finance Class – Final Exam Question

- A) Artificial intelligence software can provide more reliable calculations and numerical results soon. If they can be improved, what do you see as applications in Business Finance? in your farming business operations?
- B) What skills can you learn to position yourself and your business finances to succeed in a world that is increasingly taken over by the technology?

Appendix C: Supply Chains Management Class – Homework Assignment

Creating Better Prompts through Artificial Intelligence Software: Choose any agricultural product of your interest. Open a new chat and ask a series of questions. Here are some examples: what are the critical components of corn (*or a product of your interest*) supply chain? what is high quality corn that is eligible for price premium? what is the ideal moisture content for corn for premium pricing, etc.

Prompt using a series of queries for a product of your interest to delve deep inside the supply chain features and characteristics (consumer demand, producers, industry, costs, prices, globalization, etc.). Try to find numerical values in terms of units, prices, quality specifications.

1. In your own words, give a summary of what you learned about your product and its supply chains! What can you do to make your supply chain successful based on what you learned?
2. Copy-paste all the answers from ChatGPT.

Appendix D: Chemistry Class – Survey Questionnaire

1. Have you heard of the artificial intelligence software called **ChatGPT**? Yes / No

2. Log into ChatGPT; type a few questions related to our class content (atomic structure, pH concepts, thermodynamics, chemical equilibrium, etc.) and copy-paste your conversation with ChatGPT. Ask a few follow-up questions to ChatGPT, raise doubts that its answers are confusing or wrong, or ask it to explain more or give you a reliable source.

3. What do you think about the power of ChatGPT to help you find answers? Is this a resource you would use for chemistry? Do you trust these answers?

4. If not for chemistry, what other courses can you use ChatGPT for? Do you consider using ChatGPT as academic plagiarism? Should the instructors in your classes adopt or prohibit artificial intelligence software such as ChatGPT?

Based on your experience so far, how does ChatGPT compare with search engines such as Google? What issues do you anticipate with using ChatGPT rather than traditional internet search engines?