

Leveraging ChatGPT for Enhancing Critical Thinking Skills

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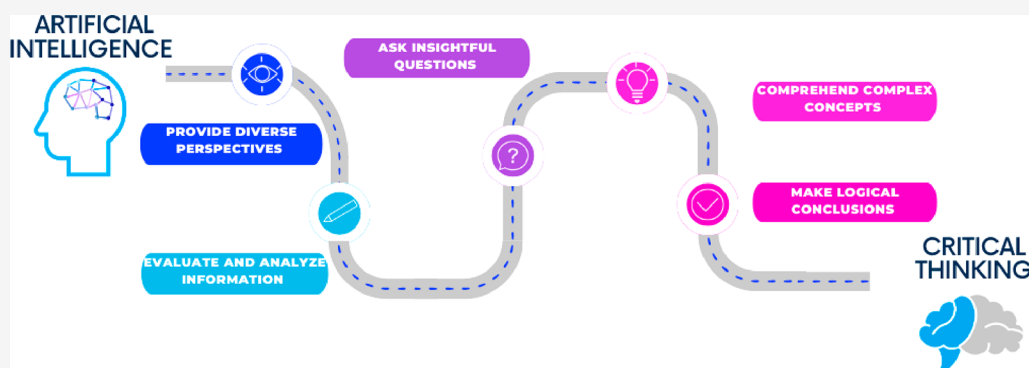
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ABSTRACT: This article presents a study conducted at Georgia Gwinnett College (GGC) to explore the use of ChatGPT, a large language model, for fostering critical thinking skills in higher education. The study implemented a ChatGPT-based activity in introductory chemistry courses, where students engaged with ChatGPT in three stages: account setup and orientation, essay creation, and output revision and validation. The results showed significant improvements in students' confidence to ask insightful questions, analyze information, and comprehend complex concepts. Students reported that ChatGPT provided diverse perspectives and challenged their current ways of thinking. They also expressed an increased utilization of ChatGPT to enhance critical thinking skills and a willingness to recommend it to others. However, challenges included low-quality student comments and difficulties in validating information sources. The study highlights the importance of comprehensive training for educators and access to reliable resources. Future research should focus on training educators in integrating ChatGPT effectively and ensuring student awareness of privacy and security considerations. In conclusion, this study provides valuable insights for leveraging AI technologies like ChatGPT to foster critical thinking skills in higher education.

KEYWORDS: *General Public, First-Year Undergraduate/General, Curriculum, Interdisciplinary/Multidisciplinary, Computer-Based Learning, Internet/Web-Based Learning, Student-Centered Learning*

INTRODUCTION

Higher education identifies critical thinking as one of the most desirable outcomes.^{1,2} Critical thinking serves as a tool of inquiry, and a powerful resource in personal and civic lives.² Academics and educators widely agree that critical thinking encompasses various elements such as reasoning, inference making, critical judgments, and critical creativity.³ While Facione defined critical thinking as “purposeful, self-regulatory judgment which results in interpretation, analysis, evaluation, and inference, as well as explanation of the evidential, conceptual, methodological, criteriological or contextual considerations upon which that judgment is based”,² there have been continuing discussions of specific skills, dispositions, and dimensions.^{2,4} With the broad and developing definition of critical thinking, the skills need to be properly assessed based

on the quality of students' reasoning.^{5,6} Further, critical thinking is regarded as a skill necessary for life as well.⁷

Scientific communities such as the Association of College and Research Libraries (ACRL) and the American Chemical Society (ACS) have attempted to establish and adopt frameworks for critical thinking.^{8,9} By their works, *Framework for Information Literacy for Higher Education* and *Chemical Information Skills*, respectively, they discussed the specific skills that are attributed to critical thinking, such as identifying key

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Table 1. Description of Problem-Based Research Projects

Stage	Activities	Critical Thinking Skills Used
Stage I: Account Setup and Orientation	<ul style="list-style-type: none"> • Offer students the choice to either create a new ChatGPT account or log into an existing one. • Encourage students to spend some time getting acquainted with the ChatGPT platform's features and functionalities by allowing them to explore it. 	
Stage II: Essay Creation	<ul style="list-style-type: none"> • Give students the opportunity to work in groups or alone during this phase. • Explain that the objective is to draft an essay on a subject that was addressed in the chemistry course that semester. • State the expectation of the finished essay and the sources used to support it. • Exhibit how to divide the primary objective into more manageable and doable subtasks. • Emphasize the need of creating relevant prompts that can produce valuable output from ChatGPT. • Advise students that to produce an essay with the right quality and content, they may need to revise their prompts several times. 	<ul style="list-style-type: none"> • Analyze • Evaluate
Stage III: Output Revision and Validation	<ul style="list-style-type: none"> • Inform students that this step entails verifying the results of ChatGPT. • Demonstrate skills in literature research that are not commonly taught in introductory chemistry courses. • Instruct students to thoroughly check ChatGPT's output and ensure the accuracy of the information by cross-referencing reliable sources and databases. • Ask students to revise the essay by finding other sources that complement the original work and rectify any errors or inaccuracies present. 	<ul style="list-style-type: none"> • Analyze, evaluate, and draw logical conclusions • Analyze, critique, and evaluate • Analyze, evaluate, critique, and draw logical conclusions • Analyze, evaluate, and draw logical conclusions

references on related topics and assessing the quality and utility of information, although these documents did not directly address the broad idea of the critical thinking itself.⁹ Furthermore, López-Fernández and co-workers provided that there were dimensions to critical thinking that included critical analysis of information, decision-making, and understanding.¹⁰

Artificial intelligence (AI) has revolutionized various aspects of daily life, progressing from mimicking human-like behaviors to advanced applications like machine learning and neural networks.^{11–14} AI utilizes large language models (LLMs) and the generative pretraining transformer (GPT). OpenAI's ChatGPT, an LLM, is trained using machine learning algorithms on vast text data sets, making it adept at interactive applications. It can be fine-tuned for specific tasks including translation, summarization, answering, and chatting.^{12,15,16} While AI and LLMs are extensively used in industry, their implementation in education, especially secondary education and research, is still in its early stages.^{11,16–19} Proposed educational uses include enhancing students' learning experiences and critical thinking skills.^{15,20,21} Even with the promising adoption of AI and LLMs including ChatGPT, which demonstrated great capabilities, there have been reported limitations and risks such as misleading information or disinformation, fake news, responses lacking higher-order thinking, and training data reliability.^{15,22–24} Recent literature provides an increasingly large volume of studies on the application of AI and LLMs in higher education and the critical evaluation of the reliability and quality of ChatGPT outputs in that context.^{16,23,25}

Due to the diverse takes that exist on critical thinking, there is currently no unanimously accepted, single definition of critical thinking.^{10,26–28} Thus, many sources describe it with wide-ranging qualities to posit that critical thinking is a multifaceted construct that encompasses various skills, which includes reflection, reasoning, communication,²⁹ the evaluation of arguments, assumptions,³⁰ chemistry-related argumentation,¹⁰ conceptualization and synthesis of information,^{26,31} and the capability to conduct comprehensive literature reviews for the purpose of identifying pertinent references.³²

Drawing upon pertinent literature,^{27,33} this study focuses on “critique”, involving identifying assumptions, reasoning, and credibility, and “evaluate”, encompassing the assignment of

value and meaning, as key skills assessed. Furthermore, critical thinking also includes the capacity to analyze and draw logical conclusions using limited knowledge, a competence evaluated in students.³³ This study explores the use of ChatGPT in fostering the above elements of critical thinking skills (critique, evaluate, analyze, and draw logical conclusions with limited knowledge), offering insights in strategies to adopt this technology-driven approach. The primary research questions addressed in this study are as follows:

Research question 1: Does the ChatGPT-based activity lead to an improvement in students' confidence to critically evaluate the credibility of information, analyze, and draw logical conclusions with limited knowledge?

Research question 2: Does the ChatGPT-based activity change students' perception of and future utilization of ChatGPT?

The findings from this study will inform educators about the potential benefits and considerations of incorporating ChatGPT into the curriculum,³⁴ ultimately empowering students to think critically, analyze information effectively, and make well-informed decisions.

METHODS

Description of ChatGPT-based Activity

This activity was implemented in the introductory chemistry courses in Spring 2023. During this activity, students interacted with ChatGPT in three different distinct stages (see Table 1). In the initial stage (Stage I), students were given the option to either log into an existing ChatGPT account or create a new one. This allowed them to become acquainted with the platform and experiment with various writing prompts. Moving on to Stage II, students had the choice to work individually or in groups as they engaged with ChatGPT. The objective for this stage was for students to generate an essay, complete with supporting references and information sources, on a topic they had studied during the chemistry course that semester. It typically took several iterations for students to develop the skills necessary to break down the overall task into smaller, manageable components and formulate effective prompts that would yield meaningful output from ChatGPT. In the final stage, students were tasked with validating the output

Table 2. Examples of Student Essays Performed as ChatGPT Activity

Selected Sections from Student Essays	Student Comments	Instructor Comments																				
<p><i>Student prompt: Give several examples of application of chemistry in Civil Engineering</i></p> <p>ChatGPT response: "Water Treatment: Water is a critical component of many Civil Engineering projects, including irrigation systems, water supply networks, and wastewater treatment plants. Chemistry is used to purify water by removing contaminants, such as bacteria and chemicals, and ensuring that it is safe for consumption."</p>	ChatGPT provided this reference which has been verified to be correct: Crittenden, J. C., Trussell, R. R., Hand, D. W., Howe, K. J., & Tchobanoglous, G. (2012). <i>Water treatment: Principles and design</i> . John Wiley & Sons.	Students precisely verified the accurate information sources presented by ChatGPT.																				
<p><i>Student prompt: Chemistry applied in kinesiology</i></p> <p>ChatGPT response: "Sports medicine: Chemistry is used in sports medicine to develop and test pharmaceuticals and supplements that can enhance physical performance or aid in recovery from injury. For example, creatine, a compound that occurs naturally in the body, is used as a supplement to improve muscle performance during high-intensity exercise."</p>	The reference provided by ChatGPT does not exist. Provided below is an additional verified reference: Banfi, Giuseppe, et al. "Metabolic markers in sports medicine." <i>Advances in clinical chemistry</i> 56. Suppl 3 (2012): 1-54	Students correctly identified the misinformation and found new references to support/strengthen the essay.																				
<p><i>Student prompt: Explain ICE Tables in chemistry</i></p> <p>ChatGPT response: "Here is an example of an ICE table for the reaction: $2A + B \rightleftharpoons C + D$ Initial concentrations: $[A] = 0.2 \text{ M}$, $[B] = 0.3 \text{ M}$, $[C] = [D] = 0 \text{ M}$</p> <table border="1"> <thead> <tr> <th></th> <th>I</th> <th>C</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>0.2</td> <td>-2x</td> <td>0.2 - 2x</td> </tr> <tr> <td>B</td> <td>0.3</td> <td>-x</td> <td>0.3 - x</td> </tr> <tr> <td>C</td> <td>0</td> <td>x</td> <td>x</td> </tr> <tr> <td>D</td> <td>0</td> <td>x</td> <td>x</td> </tr> </tbody> </table>		I	C	E	A	0.2	-2x	0.2 - 2x	B	0.3	-x	0.3 - x	C	0	x	x	D	0	x	x	ChatGPT provided the following reference that has been verified: Atkins, P. W., & de Paula, J. (2014). <i>Atkins' Physical Chemistry</i> (10th ed.). Oxford, UK: Oxford University Press.'	Students successfully validated the problem-solving process: the problem-solving process presented using ICE table was accurate and correct.
	I	C	E																			
A	0.2	-2x	0.2 - 2x																			
B	0.3	-x	0.3 - x																			
C	0	x	x																			
D	0	x	x																			
<p><i>Student prompt: Tell me about buffers in chemistry</i></p> <p>ChatGPT response: "In chemistry, a buffer is a solution that can resist changes in pH when an acid or a base is added to it. Buffers are important in many chemical and biological processes because they help to maintain a stable environment for reactions and biological functions to occur."</p>	ChatGPT provided the following reference that has not been verified: Berg, J.M., Tymoczko, J.L., & Stryer, L. (2002). <i>Biochemistry</i> (5th ed.). New York: W.H. Freeman and Company.	Students failed to verify correct information provided by ChatGPT. The reference provided by ChatGPT was relevant and valid, but the student was not able to verify.																				
<p><i>Student prompt: Give several examples of chemistry being used in emergency medicine</i></p> <p>ChatGPT response: "Blood Gas Analysis: Blood gas analysis is a chemical test used to evaluate the acid-base balance and oxygenation status of patients. It is a critical tool in emergency medicine for the assessment of respiratory and metabolic conditions."</p>	ChatGPT provided a source with a working link. The article was real but did not apply to this response. Below is a relevant citation that supports the information provided by ChatGPT: Severinghaus, J. W., Astrup, P., & Murray, J. D. (1998). <i>Blood Gas Analysis and Critical Care Medicine</i> . <i>American Journal of Respiratory and Critical Care Medicine</i> , 157(4), S114-S122.	Students successfully identified irrelevant information sources. The reference provided by ChatGPT exists, but it was not related to the topic presented in the essay.																				

produced by ChatGPT and making necessary modifications if any misinformation was identified in the original essay. This final stage proved to be the most time-consuming, as it required students to employ literature research skills that are not typically emphasized in introductory chemistry courses. Detailed instructions about the activity can be found in the [Supporting Information](#).

Sample and Data Collection

Georgia Gwinnett College (GGC) is a public, open-access liberal arts institution located in Lawrenceville, Gwinnett County. Established in 2006, GGC holds the distinction of being the first four-year college founded in Georgia in over a century, as well as the inaugural four-year public institution established in the United States during the twenty-first century.³⁵ According to data from the 2021 census, Gwinnett County has the second-highest population in the State and ranks 7th for ethnic diversity. GGC is a Hispanic Serving Institution with a 25% Hispanic/Latino population,^{36,37} and its student body represents a similar ethnic diversity. Additionally, the institution has historically served minorities as evidenced by the relevant demographic data.³⁸ By prioritizing small class sizes, individualized attention, fostering a diverse and inclusive culture, and providing comprehensive student mentoring programs, GGC effectively enhances student performance and promotes academic success.

After obtaining approval from the Institutional Review Board (IRB), a total of 29 students were recruited from various

sections of introductory chemistry courses, predominantly comprising STEM majors specializing in disciplines such as Information Technology, Chemistry, Biology, Environmental Science, Exercise Science, and Mathematics. A deeper exploration of the demographic characteristics of these participants can be found in earlier studies, offering comprehensive insights into the composition of the student body in these courses.³⁹

Assessment Methods

The primary assessment used was a newly developed survey ([Supporting Information](#)) adapted from a previous study⁴⁰ intended to assess students' confidence to think critically and their perception of Language Models (LLMs) like ChatGPT. The survey was administered anonymously both before and after the implementation of the activity. To determine the statistical significance between pre- and postsurvey data, the nonparametric Mann-Whitney test was utilized with a significance level set at 0.05. Additionally, Spearman's rank correlation was employed to assess the correlation between various critical thinking skills measured in the survey instrument. Nonparametric tests were used due to the sample size and non-normal distribution of results. All analyses were completed using Jupyter Notebook 6.0.3.

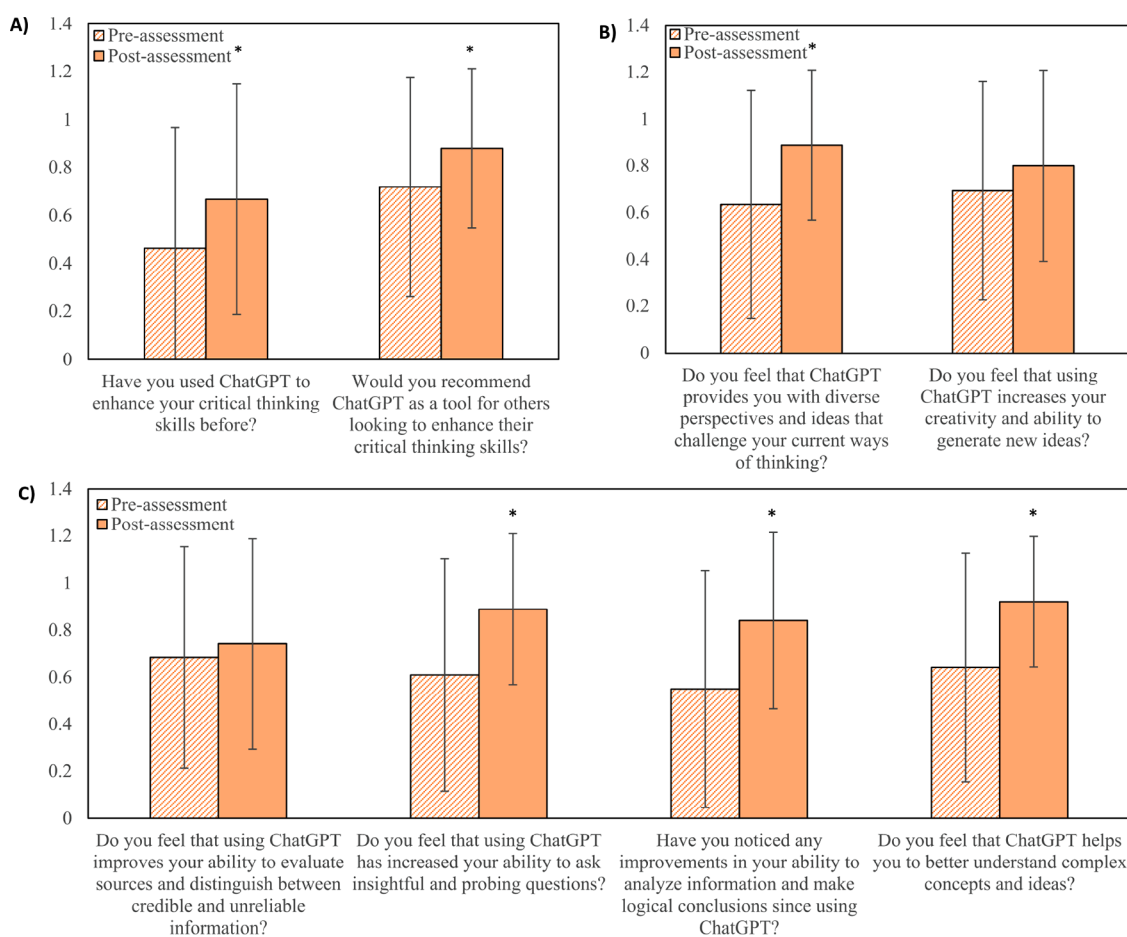


Figure 1. Students' self-reported levels of (A) usage of ChatGPT, (B) perception of ChatGPT, and (C) confidence to apply critical thinking skills before (striped) and after (solid) the implementation of ChatGPT-based activity ($n = 29$; 0 = no, 1 = yes). Note: * $p < 0.05$.

RESULTS

Examples of Students' Essays

Student work examples, including selected parts of the essays generated by ChatGPT, prompts, and comments on validation and revision, can be found in Table 2. An illustrative example highlighting the entire process of prompt revision and interaction with ChatGPT can be found in the Supporting Information. Students demonstrated their ability to write effective prompts and validate information using multiple sources.

Five essays were selected based on adherence to instructions and consistent quality. It is important to note that students were not always able to verify all sources provided by ChatGPT using platforms like Google Scholar or other databases. Students' responses/comments can be categorized as follows: (1) precise validation of accurate information from ChatGPT, (2) correct identification of misinformation accompanied by the discovery of additional references to bolster the essay's content, (3) illustration of problem-solving through examples, (4) instances of not verifying already correct information, and (5) adept identification and handling of irrelevant content. As shown in Table 2, most references obtained from ChatGPT were correct and verified by the students. When misinformation was identified, students found additional references to support and strengthen their essay. Even when ChatGPT provided nonexistent or inaccurate references, students were able to provide relevant evidence to

support ChatGPT's response. Open-ended prompts generated unique responses such as ICE tables with the explanations of the problem-solving technique used, demonstrating ChatGPT's ability to teach technical skills. This ICE table example highlights students' higher-order thinking skills by engaging chemical equilibrium knowledge and variable manipulation for problem-solving, emphasizing practical utility over abstract distinctions. Such observations support the potential of ChatGPT and other LLMs in higher education for fostering higher-order thinking.^{27,41} While some students mentioned difficulty in verifying sources from ChatGPT, the references provided by ChatGPT were relevant and valid. In one case, ChatGPT offered a working link to a real article, but it was not applicable to the response. The student identified the irrelevant information and supplemented it with a relevant citation supporting ChatGPT's provided information. This example highlights how LLMs can deliver misinformation and lack higher-order thinking, as well as the role of ChatGPT in developing critical thinking skills (critique, evaluate, analyze, and draw logical conclusions with limited knowledge) in students.

Examining Student Perceptions of Critical Thinking Competence

A total of eight questions were used in the survey to assess students' perceptions of their critical thinking competence and future utilization of ChatGPT. The results are summarized in Figure 1. After the completion of the activity, student reported

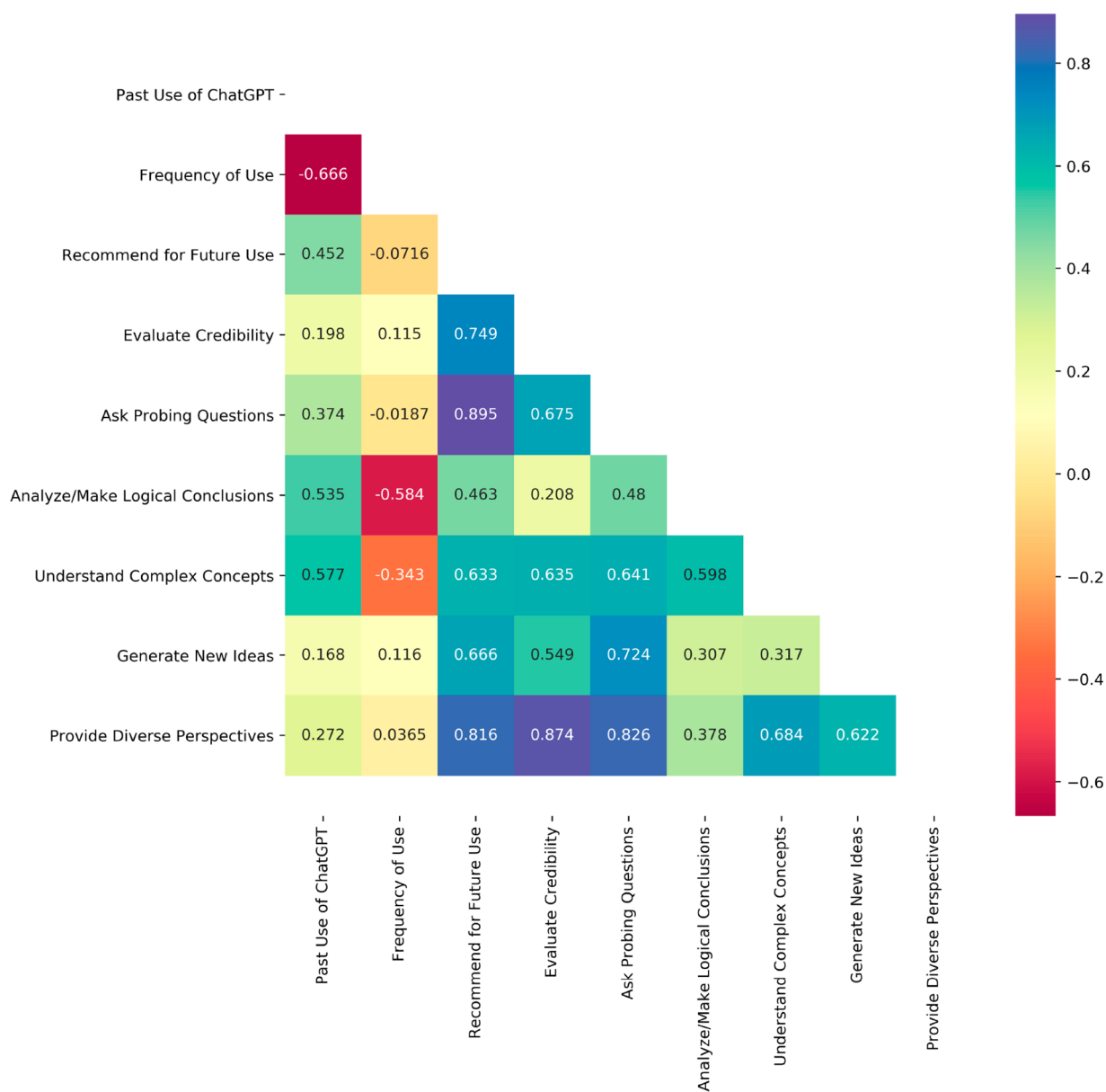


Figure 2. A heatmap showing pairwise Spearman correlation among different questions in the survey ($n = 29$; 0 = no, 1 = yes). The second question corresponds to frequency of using ChatGPT to enhance critical thinking skills (1 = never, 2 = seldom, 3 = occasionally, 4 = often, 5 = frequently).

statistically significant ($p < 0.05$) improvement in their confidence to ask insightful and probing questions (from 61% to 89%, $p = 0.03$), analyze information and make logical conclusions (from 55% to 84%, $p = 0.003$), and understand complex concepts (from 64% to 92%, $p = 0.005$). Regarding the perception of capability of ChatGPT, students agreed that ChatGPT can provide diverse perspectives and challenge their current ways of thinking (from 64% to 89%, $p = 0.006$) but not in creativity or generating innovative ideas ($p = 0.098$). As to the utilization of ChatGPT, students reported a rise in their usage of ChatGPT to boost their self-efficacy to think critically (from 46% to 67%, $p = 0.031$) and would recommend using ChatGPT as a tool for others to enhance their critical thinking skills (from 72% to 88%, $p = 0.039$). Importantly, it should be recognized that, even though every student actively engaged with ChatGPT during the instructional activity, not all students attributed this engagement to a perceived enhance-

ment in their competence to think critically. As a result, only 67% of the student cohort responded affirmatively to the postassessment query: "Have you used ChatGPT to enhance your critical thinking skills before?" However, this observed increase from an initial 46% to a postactivity 67% suggests a notable shift in students' perceptions, indicating that a larger proportion of the student population began associating their use of ChatGPT within this educational context with an amplified sense of self-efficacy in the application of critical thinking skills.

The correlation between the pre- and postsurveys for each survey question was further examined using Spearman's coefficient, as presented in Figure 2. Students who recommended using ChatGPT to enhance critical thinking skills were highly likely to self-report being more confident to evaluate the credibility of sources ($r = 0.749$), ask probing questions ($r = 0.895$), understand complex concepts ($r =$

0.633), and generate new ideas ($r = 0.666$). Similarly, students who perceived ChatGPT as a provider of diverse perspectives were strongly correlated with greater confidence to critically evaluate the credibility of sources ($r = 0.874$), ask probing questions ($r = 0.826$), understand complex concepts ($r = 0.684$), and generate new ideas ($r = 0.622$). Furthermore, strong positive correlations (correlation coefficient >0.6) were observed for the following pairs: (1) asking probing questions and generating new ideas ($r = 0.724$), (2) asking probing questions and understanding complex concepts ($r = 0.641$), and (3) evaluating credibility of sources and understanding complex concepts ($r = 0.635$). Students who reported being more confident to apply critical thinking skills from the interaction with ChatGPT during the activity were more likely to have a positive perception of ChatGPT (can provide diverse perspectives) and would recommend the tool for others to use. Notably, students who utilized ChatGPT more frequently reported less pronounced improvement in understanding complex concepts ($r = -0.343$) and making logical conclusions ($r = -0.584$). This indicates that excessive dependence on ChatGPT might undermine active critical thinking, potentially promoting passive information consumption instead. Excessive use of ChatGPT could lead students to pursue quick solution, potentially hindering their understanding and logical reasoning skills.

Limitations of ChatGPT

Students were also asked to comment on their overall experience of interacting with ChatGPT and any weaknesses/limitations they observed in the survey. The textual answers highlighted several limitations of ChatGPT based on students' experience during the activity. First, students expressed concerns about the reliability and accuracy of the information generated by ChatGPT. Instances of referencing nonexistent articles, inconsistent source retrieval, and the generation of unreliable sources were reported. Second, students noted the need for greater depth and length in the responses, as well as a desire for more precise and informative information. Third, students also commented on the lack of creativity, particularly when responding to basic prompts, indicating a potential limitation in generating original content. These findings were consistent with the results mentioned in Figure 1 where students did not perceive ChatGPT as being creative in generating new ideas. Lastly, several students noticed that the quality of responses can vary dramatically by the clarity and specificity of the prompts, emphasizing the importance of refining the prompts to elicit better and more relevant answers.

Implications

The study focuses on successful practices implemented in introductory chemistry courses, specifically targeting the enhancement of critical thinking skills. The findings reveal a notable improvement in students' perception of their critical thinking competence following the completion of the activity, indicating the effectiveness of the approach. Moreover, most students successfully completed the essay, underscoring the feasibility of integrating ChatGPT into the learning process. Detailed instruction and demonstration were identified as crucial factors contributing to the success of the activity. It is important to note that students who were unfamiliar with ChatGPT required additional time to navigate the learning curve, iterate, and formulate different prompts to obtain usable information. The approach employed in this activity can be

easily transformed and adopted in other chemistry courses or disciplines by adjusting the requirements of the essays. In higher-level chemistry courses, instructors may have higher expectations regarding the trustworthiness of references. Alternatively, in Information Technology courses, instructors may focus on reviewing codes rather than validating references. This study also highlights the shift in the instructor's role, where they function as a facilitator rather than a primary source of information, fostering student engagement and autonomy. These findings provide valuable insights for educators seeking to implement similar strategies in various academic contexts.

Several challenges were observed during the implementation of the activity. One significant challenge identified was the presence of low-quality comments from students, including instances of false verification and irrelevant information. Notably, students faced difficulties in verifying all the sources provided by ChatGPT using platforms like Google Scholar or other databases. This issue was compounded by factors such as limited access to full-text articles and the inclusion of source sections from books. These obstacles posed challenges for students in effectively validating the information sources. To address these challenges, potential solutions include implementing more comprehensive training on validating information sources, such as utilizing subscribed databases that offer a wider range of reliable resources. Additionally, extending the activity over the entire semester could provide students with increased exposure and practice in interacting with ChatGPT. Encouraging collaborative group work may also prove beneficial, as it can facilitate peer learning and enhance students' abilities to navigate the challenges associated with ChatGPT. By implementing these solutions, educators can enhance the quality of student engagement and improve the overall effectiveness of utilizing ChatGPT as an educational tool.

In terms of suggestions for future research and development in the field, three key areas can be considered. First, there is a need for strategies to effectively train educators on how to integrate ChatGPT into their teaching practices, ensuring that they possess a deep understanding of how LLMs like ChatGPT operate to provide appropriate guidance to students. Additionally, educators should stress the importance of not disclosing private or sensitive information when interacting with LLMs to students. Second, it is essential to develop guidelines that foster meaningful interactions between students and ChatGPT. These guidelines should outline best practices for students to engage with ChatGPT in a constructive and effective manner, promoting critical thinking, information evaluation, and responsible use. Lastly, while our study primarily focused on students' self-perceptions and beliefs regarding their interactions with ChatGPT, it is important to acknowledge that we did not conduct an in-depth analysis of their actual interactions/essays with ChatGPT. Future studies should consider integrating an analysis of students' actual interactions with ChatGPT to provide a more comprehensive assessment of their critical thinking abilities. By addressing these areas, future research and development can contribute to the successful integration of ChatGPT in educational settings, enhancing both teaching and learning experiences.

CONCLUSIONS

The pre- and postsurveys on the student perception on the usefulness of ChatGPT in developing critical thinking skills clearly denoted positive practicality toward the integration of

AI and LLMs in higher education. The findings reveal a significant improvement in students' self-perception of their critical thinking competence, particularly in the areas of posing incisive and probing questions, evaluating information and drawing logical conclusions, and comprehending complex subject matter. Furthermore, students acknowledged ChatGPT as a valuable resource for accessing diverse perspectives, although its effectiveness in fostering creativity or generating novel ideas was not perceived as significant. The recommendation by students to employ ChatGPT as a tool for enhancing critical thinking among their peers further underscores its potential contribution to the development and enhancement of students' critical thinking skills. The increased inclination of students toward ChatGPT usage and their heightened confidence to think critically following the conducted activities emphasize the need for its active adoption in higher education and call for further research and evaluation of related instructional practices.

The emergence of ChatGPT holds promising potential in developing and honing students' confidence to critique, evaluate, analyze, and draw logical conclusions with limited knowledge and conducting improved learning experiences. As such skills are pivotal in students' daily lives, future careers, and higher education, well-designed implementation of ChatGPT and related facilities in the classroom will provide the higher education community with a meaningful leap in ultimately adapting educational pedagogy into the digital era. The limitations and risks known to date remain as potential issues and may pose hesitation in the adoption of ChatGPT in the classroom. Blind and unmodulated applications of LLMs and AI could impair the existing higher education, and therefore, the collaboration between educators and researchers would need to ensure effective and timely exchange of feedback on respective observations.

■ ASSOCIATED CONTENT

SI Supporting Information

The Supporting Information is available at <https://pubs.acs.org/doi/10.1021/acs.jchemed.3c00505>.

Survey design and questions, detailed instructions of the ChatGPT-based activity (PDF)

Survey design and questions, detailed instructions of the ChatGPT-based activity (DOCX)

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Notes

The authors declare no competing financial interest.

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