Board 40: Work in Progress: Generative AI to Support Critical Thinking in Water Resources Students

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WIP: Generative AI to support critical thinking in water resources students

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Abstract

In the realm of water resources education, harnessing the power of artificial intelligence offers a promising avenue to enhance classroom instruction and practical learning experiences. So artificial intelligence tools can contextualize students. Artificial intelligence (AI) as a field has been developing over the course of these last decades, but in the past few years has taken more importance in the field of higher education, specifically in careers such as Civil Engineering. As a result, the purpose of this study is to explore the development of critical thinking in Water Resources students by using artificial intelligence programs. Platforms such as ChatGPT can assist students in interpreting given information, such as waterway sizing, water supply and environmental laws to facilitate the learning process. Civil engineering students from the Universidad San Francisco de Quito USFQ who are focused on Water Resources studies were surveyed. They were asked to use AI programs as a tool to be prepared and have background information before class, and data was collected to identify whether their performance had improved after using these programs.

INTRODUCTION

Today the use of artificial intelligence is becoming more common both for tasks related to electronics or telecommunications and for new areas such as education [1,2]. Tools like ChatGPT have gone from being niche to having broader use [3,4]. It is becoming increasingly common to interact with products that appear "intelligent", although the label "artificial intelligence" may have been replaced by other euphemisms [5,6]. Since November 2022, with the emergence of the ChatGPT tool, there has been an exponential increase in the use of artificial intelligence across all domains. Although ChatGPT is just one of many generative AI technologies, its impact on teaching and learning processes has been notable [7]. Today this tool is no longer exclusive to people who are in the world of programming or related to these fines and now it is given to them as much as in part of medicine, research, manufacturing and security and education, as in this case, the focus of this document [8].

However, knowing that AI can work faster than humans and cover skills almost as well as humans do, there is a blind spot for AI now of creating ideas and critical thinking. Machines cannot use to emulate themselves, so human interaction is still need and robots will not replace us as most people fear[9]. For the use of ChatGPT, normally it would be needed first to give it the context and the subject, then based on the questions it gets asked it will develop an answer for every possible outcome. That is why human criteria have an important place in it, and asking specific questions might help the bot create better responses to any question it gets asked, but it cannot improve on its own.

Artificial Intelligence (AI) integration in education is becoming more and more important in a world that is becoming more and more digital. This work in progress focuses on the ways that generative AI—like ChatGPT—can enhance critical thinking in the context of teaching water resources.

Based on critical thinking questions and reformulating them, the research was conducted at Universidad San Francisco de Quito, to its Civil Engineering student that take Water Resources related class. We will look at how students' perceptions have changed [10–12], how their learning experiences have improved, and how improved academic outcomes have resulted from the use of ChatGPT in the classroom. Furthermore, we'll look at how this technology has influenced students' viewpoints on the matter and ascertain their preferences and recommendations for the incorporation of AI into their education going forward [13,14]. This research project aims to evaluate how students view the use of AI in their education on water resources and to ascertain how students view the use of AI in their studies, especially when it comes to water resources; and to enhance the educational experience with a particular emphasis on how AI may efficiently support the learning process.

BACKGROUND

Critical thinking is a crucial skill that individuals should cultivate from an early age [15]. This skill is multifaceted, encompassing various abilities and knowledge that require time and effort to master [16]. The key components of critical thinking include interpretation, analysis, inference, evaluation, explanation, and self-regulation [17].

Interpretation in critical thinking refers to understanding and making sense of information or texts. It involves identifying the purpose, context, viewpoints, implications, and possible multiple interpretations [18,19]. **Analysis** involves breaking information down into its fundamental parts, examining the key elements and components, and understanding how they are related to each other [20,21]. This involves the ability to identify patterns, connections, underlying assumptions, and implicit assumptions. **Inference** in critical thinking refers to drawing logical and reasonable conclusions based on the available evidence. It involves using reasoning in a particular way towards the general, and deductive reasoning that goes from the general to the particular to reach well-founded conclusions [22,23].

Evaluation aims assessing the quality, relevance, and reliability of the information, arguments, or sources provided. It involves critically examining the arguments presented and the methods used to support the assertions or conclusions offered [18,24]. **Explanation** encompasses the ability to clearly communicate and articulate thoughts, ideas, and arguments in a way that is coherent and understandable to others. This includes the ability to provide reasons and evidence to support claims made [25]. **Self-regulation** in critical thinking includes the ability to critically reflect on one's own thinking and assess its logic, coherence, biases, or weaknesses. It implies being aware of personal limitations and prejudices and being open to reconsider or modify one's own beliefs or points of view based on new evidence or arguments [26,27] .

For critical thinking a person must be related to certain values for this process, such as (i) autonomy, which is being able to control the process of reasoning and mental analysis; (ii) humility, which is being able to know the limits and the scope of the knowledge that one has; (iii) trust in reason: refer to the fact that this knowledge will benefit society [28]; (iv) fortitude,

which is having the ability to detach from stereotypes and beliefs, for the purpose of accepting the truth based on knowledge, regardless of whether it is contrary to what we know or think we know, (v) empathy, which is being able to put yourself in someone else's shoes and understand their position to inform; (vi) integrity, which is being honest in recognizing how much intellectual standards are lacking within knowledge, (vii) impartiality, which is being able to put emotions aside to be able to participate in knowledge even if this information is against us; and, (viii) perseverance, which is being able to face the difficulties of knowledge and not stop inquiring to reach the goal [29–31] .

The learning activities described in this study are specifically designed to support students' development as critical thinkers. This project attempts to actively engage students in the process of interpretation, analysis, inference, evaluation, explanation, and self-regulation by incorporating interactive exercises, problem-solving scenarios, and group discussions [32,33]. In addition, each project is designed to help students apply critical thinking to real-world situations related to water resources classes in accordance with the following objectives: Examine how students view the inclusion of AI: students consider how AI, such as ChatGPT, can help students. learn about water by developing their analytical and interpretive skills through interactive exercises and discussions.

Also, to improve educational process through collaborative discussion and real-world problem solving are used to improve understanding and application of fluid concepts [34,35]. To Improve learning outcomes such as analytical and thinking skills are enhanced by providing opportunities for students to assess reliability and draw logical conclusions, such as through research projects and case studies [36,37].

METHODOLOGY

This exploratory study encompasses the results of using ChatGPT as a tool to aid critical thinking in water engineering students. The instrument was a survey developed by researchers and validated by experts [38,39]. An anonymous survey was distributed to the students during Spring 2022 to civil engineering in their 5^{th}, 6^{th} and 8^{th} semester who took Fluid Mechanics (n=18), Hydraulics (n=16) and Sanitary Engineering (n=20) respectively. At the beginning of each course students were asked to use ChatGPT for specific assignments like watching videos to contextualize students about a topic and then formulate questions to the bot so they get critical thoughts based on the subject. At the end of the semester, we established questions to measure students` perception regarding the activity effectiveness, how easy was to use the tool, how they think we can improve or expand its use and if they liked it. Surveys were distributed online and data was imported using Excel. The responses were categorized by cluster through thematic analysis [40] and the organized by themes.

Results

The results are presented below, based on the previously outlined survey methodology. Data collection involved multiple-choice questions and responses to open-ended questions at the conclusion of the sanitary engineering, fluid mechanics, and hydraulic engineering course. Participants shared their insights and feedback, providing a more comprehensive understanding of their educational experience. Analysis of multiple-choice responses revealed identifiable patterns in areas of higher and lower satisfaction, while responses to open-ended questions

offered qualitative insights into specific challenges and suggestions for improvements. These findings serve as a foundation for assessing the effectiveness of the course and offer opportunities to enhance the educational quality in the engineering fields mentioned. The results in percentage for all the courses showed the following:

Description	No	Yes
1. Before the ICV - 4002 course, had you heard of ChatGPT?	58.30%	41.70%
2. Before the ICV - 4002 course, had you used ChatGPT?	75.00%	25.00%

Description	No	Few Times	Sometimes	Often	Yes, in all
3. During the ICV - 4002 course, did you use ChatGPT to summarize the videos?	16.70%	-	16.70%	41.70%	25%
4. During the ICV - 4002 course, did you use ChatGPT for the video reflections?	8.30%	8.30%	8.30%	16.70%	58.30%
5. During the ICV-4002 course, did you use ChatGPT to ask questions about the topics presented in the assignments?	0.00%	-	83.30%	16.70%	0.00%

In accordance with the methodology employed for the multiple-choice survey, five inquiries were posed to ascertain the prior knowledge of the utilization of ChatGPT in the respondents' water resources course. In the initial assessment, it was revealed that more than half of the participants were unfamiliar with ChatGPT before enrolling in the water resources course. Merely 41.7% had awareness of ChatGPT, and only 25% of the class had engaged with ChatGPT prior to the commencement of the course.

After gaining familiarity with ChatGPT, students began employing the tool to summarize instructional videos utilized in the course. This observation manifested in 83% of the students utilizing ChatGPT at least once for video summarization, with 25% utilizing ChatGPT for summarizing all videos. Furthermore, a notable 91.7% of students utilized ChatGPT for reflective exercises after viewing instructional videos, and the entirety of the participants, amounting to 100%, employed artificial intelligence to respond to queries related to the course project.

Close-Ended Questions	
Question 6:	
How did you find the use or application of ChatGPT in the ICV - 4002 course?	
Innovative	91%
Tedious	9%
Question 7:	
How could the use or application of ChatGPT in the ICV - 4002 course be improved?	

Should no longer be used (unreliable source).	25%
Participation	8%
Investigation	67%
Question 8:	
How did you like the Youtube videos presented in the ICV - 4002 course?	
Interesting	92%
Lengthy and tedious	8%
Question 9:	
How could the use of YouTube videos in the ICV - 4002 course be improved?	
Activities and participations	50%
Forums	17%
Reducing the number of abstracts	33%
Question 10:	
Any suggestions or criticisms regarding the use and application of GPT Chat and/or YouTube videos related to the ICV - 4002 course?	
None	90%
Use more ChatGPT as a complement to videos	10%

In the responses provided by the participants, patterns in word choice were identified in answering the open-ended questions. Specifically, in question number six, it was highlighted that 91% of respondents found the use of ChatGPT innovative in the context of water resources classes, while 9% perceived it as tedious. This high percentage showing a similar opinion supports the general preference for the use of ChatGPT in activities related to water resources courses. In exploring how ChatGPT could be employed to enhance water resources classes, it was observed that 67% of the respondents suggested the application of artificial intelligence (AI) to conduct more research activities. Eight percent suggested its use in participatory activities, and 25% considered that its current use was adequate to optimize summaries and reflections on the audiovisual material used in class.

Regarding the perception of the audiovisual material provided through platforms such as YouTube, students were consulted about their experience with the videos presented in class. In this regard, 92% agreed that the videos were interesting, while only 8% expressed that they were long and tedious. Additionally, inquiries were made about possible improvements in the use of YouTube in the water resources course, and the responses varied: half of the respondents suggested its greater use in activities related to visual content, 17% advocated forum discussions after watching the videos, and 33% thought that the number of summaries should be reduced. Finally, 90% of the participants mentioned that they would not make any suggestions or criticisms regarding the use and application of ChatGPT and/or YouTube videos related to the course.

Additionally, it was noted that many students expressed appreciation for the opportunity to provide feedback on the overall course experience. This suggests an active interest in

improving the quality of teaching and learning in the context of water resources. The diversity of opinions reflects a variety of perspectives on how the use of technologies such as ChatGPT and YouTube can be optimized to enrich the educational experience.

DISCUSSION

The findings were consistent with the predetermined expectations outlined by the objectives. One of the primary aims was to gauge students' perceptions regarding the integration of new technologies, such as Artificial Intelligence (AI), into their daily academic responsibilities, with a focus on optimizing the learning experience in technical subjects. The discernment of student perceptions was facilitated through the analysis of their responses.
The utilization of innovative digital platforms and tools, such as artificial intelligence, has been shown to enhance learning outcomes in disciplines related to water resources by streamlining the assimilation of information. Artificial intelligence enables concise responses to queries that would otherwise necessitate extensive exploration for an answer [41].

The feedback from students who participated in the study highlights that the inclusion of ChatGPT during instructional hours has significantly contributed to enhancing their comprehension, resulting in noticeable improvements in their learning outcomes. Consequently, it is plausible to assert that artificial intelligence has enriched the educational experience in water resources classes. The incorporation of social media platforms in civil engineering assignments has the potential to reshape students' perspectives on the complexity of the subject matter.

The responses obtained underscore students' inclination towards engaging in more activities facilitated by artificial intelligence, such as participation in forums and utilization in research endeavors. Thus, this initiative contributes to the cultivation of novel ideas and concepts, thereby enhancing students' comprehension.

It is imperative to acknowledge that while language models like ChatGPT serve as potent tools for text generation and dissemination of general information, they are not tailored for accessing reliable sources or verifying the accuracy of information [42]. Consequently, caution must be exercised when relying solely on such models for research purposes. Language models derive responses from patterns ingrained within pre-existing datasets, lacking the capacity to authenticate the veracity of the information or distinguish between credible and unreliable sources [43]. Despite drawing upon diverse sources, including web pages, articles, and online forums, the reliability and accuracy of the information generated may vary significantly [42,43].

CONCLUSION

In analyzing the responses provided by participants, distinct patterns in word choice emerged, particularly evident in the feedback concerning the integration of ChatGPT in water resources classes. Notably, 91% of respondents perceived ChatGPT as innovative, while a minority, constituting 9%, found it tedious. This overwhelming consensus reflects a clear preference for the utilization of ChatGPT in activities associated with water resources courses. Moreover, the survey highlighted the students' suggestions for optimizing the use of artificial intelligence (AI) in their academic endeavors. Approximately 67% advocated for employing AI in research activities, while 8% proposed its integration into participatory engagements, and

25% deemed its current usage adequate for enhancing summaries and reflections on course material.

The findings underscore a robust interest among students in leveraging technological advancements to enrich their educational experience in water resources. Notably, the majority expressed satisfaction with the audiovisual materials presented in class, signaling a positive reception towards innovative teaching methods. Additionally, the students' diverse recommendations for enhancing the utilization of platforms such as YouTube and ChatGPT underscore their active engagement in improving the quality of teaching and learning. This collective effort towards innovation signifies a promising trajectory towards harnessing technology to foster deeper comprehension and engagement within the realm of water resources education. As the present work is a work in progress, it is important to note that a future analysis will be conducted to quantitatively compare the mean grades of students who used AI in their water resources classes versus those who did not. This comparison is intended to realistically denote whether the use of AI influences the improvement of water resource classes, thus visualizing whether the use of AI allows for a better overall understanding of the subject.

References

[1] George, B., and Wooden, O., 2023, "Managing the Strategic Transformation of Higher Education through Artificial Intelligence," Adm. Sci., **13**(9), p. 196.

[2] Sadiku, M. N., Musa, S. M., and Chukwu, U. C., 2022, *Artificial Intelligence in Education*, iUniverse.

[3] Padilla, R. D. M., 2019, "La Llegada de La Inteligencia Artificial a La Educación," Rev. Investig. En Tecnol. Inf. RITI, **7**(14), pp. 260–270.

[4] Haleem, A., Javaid, M., and Singh, R. P., 2022, "An Era of ChatGPT as a Significant Futuristic Support Tool: A Study on Features, Abilities, and Challenges," BenchCouncil Trans. Benchmarks Stand. Eval., **2**(4), p. 100089.

[5] Kuleto, V., Ilić, M., Dumangiu, M., Ranković, M., Martins, O. M., Păun, D., and Mihoreanu, L., 2021, "Exploring Opportunities and Challenges of Artificial Intelligence and Machine Learning in Higher Education Institutions," Sustainability, **13**(18), p. 10424.

[6] Villarroel, J. J. G., 2021, "Implicancia de La Inteligencia Artificial En Las Aulas Virtuales Para La Educación Superior," Orb. Tert.-UPAL, **5**(10), pp. 31–52.

[7] García-Peñalvo, F. J., Llorens-Largo, F., and Vidal, J., 2024, "La Nueva Realidad de La Educación Ante Los Avances de La Inteligencia Artificial Generativa," RIED-Rev. Iberoam. Educ. Distancia, **27**(1), pp. 9–39.

[8] Franganillo, J., 2023, "La Inteligencia Artificial Generativa y Su Impacto En La Creación de Contenidos Mediáticos," Methaodos Rev. Cienc. Soc., **11**(2), p. 15.

[9] Ray, C., Mondada, F., and Siegwart, R., 2008, "What Do People Expect from Robots?," *2008 IEEE/RSJ International Conference on Intelligent Robots and Systems*, IEEE, pp. 3816–3821.

[10] Cartuche, D., Guerra, M. A., and Murzi, H., 2023, "Work in Progress: Influence of COVD-19 in Cultural Dimensions in Civil Engineering Students In," *2023 ASEE Annual Conference & Exposition Proceedings*, ASEE Conferences, Baltimore , Maryland, p. 44287.

[11] Cartuche, D., Guerra, M. A., and Murzi, H., 2023, "Board 2A: WIP: Opportunities in Cultural Dimensions between Architecture and Civil Engineering Students in Ecuador," *2023 ASEE Annual Conference & Exposition*.
[12] Guerra, M. A., Murzi, H., Woods Jr, J. C., and Diaz-Strandberg, A., 2020, "Understanding Students' Perceptions of Dimensions of Engineering Culture in Ecuador," *2020 ASEE Virtual Annual Conference Content Access*.
[13] Ubidia, J., Guerra, M. A., Viteri, V., and Murzi, H., 2022, "Understanding Student's Perceptions of Cultural Dimensions in Construction Majors: Deconstructing Barriers between Architecture and Civil Engineering Students," *2022 ASEE Annual Conference & Exposition*.
[14] Acosta, J., Ubidia, J., Guerra, M. A., Guerra, V., and Gallardo, C., 2022, "Work in Progress: Collaborative Environments in Architecture and Civil Engineering Education– Case Study," *2022 ASEE Annual Conference & Exposition*.
[15] Zhou, Z., 2018, "A Study on the Cultivation of Critical Thinking Ability of English Majors," Theory Pract. Lang. Stud., **8**(3), pp. 349–353.
[16] Haber, J., 2020, *Critical Thinking*, MIT Press.
[17] Ghanizadeh, A., and Mirzaee, S., 2012, "EFL Learners' Self-Regulation, Critical Thinking and Language Achievement," Int. J. Linguist., **4**(3), pp. 451–468.
[18] Lai, E. R., 2011, "Critical Thinking: A Literature Review," Pearsons Res. Rep., **6**(1), pp. 40–41.
[19] Moon, J., 2007, *Critical Thinking: An Exploration of Theory and Practice*, Routledge.
[20] Vanek, D. M. K., 2013, *Análisis y Pensamiento Crítico Para La Expresión Verbal*, Editorial Digital del Tecnológico de Monterrey.
[21] Toscano, R. E., Guerra, V., and Guerra, M. A., 2023, "Work in Progress: Introducing a Coffee Break to Improve Exam Performance and Reducing Student Stress in Construction Majors," *2023 ASEE Annual Conference & Exposition*.
[22] Tittle, P., 2011, *Critical Thinking: An Appeal to Reason*, Routledge.
[23] Umotong, I., and Udofia, C., "CRITICAL REASONING."
[24] Guerra, M. A., and Gopaul, C., 2021, "IEEE Region 9 Initiatives: Supporting Engineering Education during Covid-19 Times," IEEE Potentials, **40**(2), pp. 19–24.
[25] Willard, C. A., 2003, *A Theory of Argumentation*, University of Alabama Press.
[26] Hyytinen, H., Ursin, J., Silvennoinen, K., Kleemola, K., and Toom, A., 2021, "The Dynamic Relationship between Response Processes and Self-Regulation in Critical Thinking Assessments," Stud. Educ. Eval., **71**, p. 101090.
[27] Murzi, H., Ulloa, B. C. R., Gamboa, F., Woods, J. C., Guerra, M. A., Soto, K. D. M., and Azar, R. H., 2021, "Cultural Dimensions in Academic Disciplines, a Comparison between Ecuador and the United States of America," *2021 ASEE Virtual Annual Conference Content Access*.
[28] Jimenez, M. I., Velásquez, H. J., and Guerra, M. A., 2023, "Work in Progress: Measuring Interdisciplinary Teams\' Sustainable Design with an SDG Lense–Case Study," *2023 ASEE Annual Conference & Exposition*.
[29] Paul, R., and Elder, L., 2019, *The Miniature Guide to Critical Thinking Concepts and Tools*, Rowman & Littlefield.
[30] Guzmán Silva, S., and Sánchez Escobedo, P., 2006, "Efectos de Un Programa de Capacitación de Profesores En El Desarrollo de Habilidades de Pensamiento Crítico En Estudiantes Universitarios En El Sureste de México," Rev. Electrónica Investig. Educ., **8**(2), pp. 1–17.
[31] Acosta, J., and Guerra, M. A., 2022, "Validating Guerra's Blended Flexible Learning Framework for Engineering Courses," *2022 ASEE Annual Conference & Exposition*.

[32] Ji, M., 2015, “Exploiting Activity Traces and Learners’ Reports to Support Self-Regulation in Project-Based Learning,” PhD Thesis, Lyon, INSA.
[33] Granja, N., Guerra, M. A., and Guerra, V., 2022, “Give Me a Coffee Break! Pilot Study on Improving Exam Performance and Reducing Student Stress,” *2022 ASEE Annual Conference & Exposition*.
[34] Bedón, A., Velásquez, H., Guerra, M. A., and Jiménez, M., 2022, “Exploring Interdisciplinary Contributions to More Sustainable Solutions in the Built Environment and Infrastructure Development Students,” *2022 ASEE Annual Conference & Exposition*.
[35] Paucarina, S. E., Batallas, J. D., Guerra, M. A., and Guerra, V., 2023, “Board 44B: Work in Progress: TikTok Format Videos to Improve Communicating Science in Engineering Students,” *2023 ASEE Annual Conference & Exposition*.
[36] Bonilla, J. M., Valarezo, M. S., Villacrés, B. D., and Guerra, M. A., 2023, “Board 44A: Work in Progress: Unannounced Frequent Examinations to Contribute Student Learning and Building Academic Integrity,” *2023 ASEE Annual Conference & Exposition*.
[37] Guerra, M., and Shealy, T., 2018, “Teaching User-Centered Design for More Sustainable Infrastructure through Role-Play and Experiential Learning,” J. Prof. Issues Eng. Educ. Pract., **144**(4), p. 05018016.
[38] Yin, R. K., 2013, *Case Study Research: Design and Methods*, Sage publications.
[39] Guerra, M. A., and Shealy, T., 2018, “Teaching User-Centered Design for More Sustainable Infrastructure Through Role-Play and Experiential Learning,” J. Prof. Issues Eng. Educ. Pract.
[40] Saldana, J., 2015, *The Coding Manual for Qualitative Researchers*, SAGE.
[41] Kamyab, H., Khademi, T., Chelliapan, S., SaberiKamarposhti, M., Rezania, S., Yusuf, M., Farajnezhad, M., Abbas, M., Jeon, B. H., and Ahn, Y., 2023, “The Latest Innovative Avenues for the Utilization of Artificial Intelligence and Big Data Analytics in Water Resource Management,” Results Eng., p. 101566.
[42] Sánchez, M. D. G., 2023, “El Abordaje de ChatGPT: El ‘Rinoceronte Gris’ de La IA Conversacional,” IUS Sci., **9**(1), pp. 46–68.
[43] Diego Olite, F. M., Morales Suárez, I. del R., and Vidal Ledo, M. J., 2023, “Chat GPT: Origen, Evolución, Retos e Impactos En La Educación,” Educ. Médica Super., **37**(2).