

ChatGPT in the classroom: friend or foe?

Josep Domenech

Department of Economics and Social Sciences, Universitat Politècnica de València, Spain.

Abstract

The use of Artificial Intelligence (AI) and specifically, OpenAI's ChatGPT, has been increasing in the educational field as a tool to enhance learning and teaching processes. Understanding the potential of ChatGPT in the classroom is crucial for instructors and educators because it can provide significant benefits in the preparation of classes, exams, and instructional materials. But it is even more crucial to understand how students may use it because many will use it regardless of its adoption by the instructor.

This paper analyzes the potential of ChatGPT in the classroom, exploring its applications as a writing assistant, study tool, personal tutor, and more. Our aim is to shed light on the present capabilities of ChatGPT in higher education and to provide a comprehensive view of its advantages and challenges.

Keywords: *Artificial intelligence; ChatGPT; pedagogy, technology.*

1. Introduction

The integration of Artificial Intelligence (AI) in education has been a growing trend in recent years. Early applications of AI in education focused on providing more efficient and effective ways to support the learning process, such as automated grading and personalized learning (Zawacki-Richter et al. 2019). With the advent of language models such as ChatGPT, the use of AI in education has become even more accessible, as these tools offer a more human-like interface.

ChatGPT is a language model developed by OpenAI (OpenAI Team 2022) that utilizes AI techniques to generate human-like text. It is based on a Generative Pretrained Transformer (GPT) model, which predicts the probability of each word to occur next conditioned on the previous words in a text, and based on the training dataset (Floridi and Chiriatti 2020). This way, it is capable of completing sentences, paragraphs, or entire articles based on the context provided as input. The model has been trained on a vast amount of text data and in multiple languages. Its ability to perform language-based tasks offers a great opportunity for instructors in a wide variety of fields. The natural language interface is its disruptive characteristic, as it enables instructors and students to easily incorporate AI without requiring dedicated software or coding skills.

In a higher education context, ChatGPT can be used to enhance the teaching and learning process in a number of ways. For example, it can assist students in generating written responses to prompts or questions, helping them to improve their writing skills. Additionally, ChatGPT can provide students with personalized feedback on their work and answer their questions in real time. It can also be used as a study tool by generating summaries of key concepts and providing students with practice questions to help them prepare for exams.

Another way to use ChatGPT is as an assessment tool, where it can automatically grade student responses to some open-ended questions, providing teachers with data on student understanding of a topic. It can also be used as a content creator by generating educational materials such as quizzes, worksheets, and lesson plans.

Understanding the potential of ChatGPT in the classroom environment is crucial for instructors and educators because it can provide significant benefits in the preparation of classes, exams, and instructional materials. But it is even more crucial to understand how students may use it because many will use it regardless of its adoption by the instructor, so assignments and exams must be prepared accordingly. The objective of this paper is to examine the current state of AI in education and its potential as a tool to support the teaching and learning process. The paper aims to provide an overview of the benefits of using ChatGPT in the classroom and to discuss the main challenges and pedagogical concerns that must be considered. It is worth noting that the use of AI in education is still in its early stages, and further research is needed to fully understand its effects and potential limitations.

The remainder of the paper is structured as follows. In Section 2, a literature review is presented, which covers the current state of AI in education and its potential applications. Section 3 explores how ChatGPT can be used for good, to create content and assist students. Section 4 reviews some of the challenges regarding the integration of AI tools in classroom. Finally, Section 5 draws some concluding remarks.

2. Earlier uses of AI in education

There have been a number of previous applications of AI in education that have aimed to enhance the learning and teaching process, from planning to assessment (Pender et al. 2022). One of the most notable examples is the use of AI-powered educational games and simulations. These games and simulations use AI algorithms to adapt the level of difficulty and provide personalized feedback, making the learning experience more engaging and effective (Bennani et al. 2022).

Another area where AI has been applied in education is in the development of intelligent tutoring systems (ITS). These systems use AI algorithms to provide students with personalized feedback, guidance, and support based on their unique learning needs. ITS have been shown to be effective in improving student performance, particularly in subjects such as mathematics and science (Mousavinasab et al. 2018).

The utilization of automated writing evaluation and natural language processing (NLP) in the analysis of student writing is also an application of AI in education. NLP algorithms can be used to identify and correct grammatical errors, provide feedback on the coherence and organization of writing, and identify plagiarism. This can help to improve student writing skills and reduce the workload of teachers who have to grade student work (Wang et al. 2013; Bohra and Barwar 2022).

AI has been used in automated assessment and scoring, where AI-based algorithms are used to grade student responses to open-ended questions (Zhang et al. 2022; Smith et al. 2020). This can help to provide teachers with data on student understanding of a topic and can also reduce the time required to grade assessments. This is particularly relevant in large class environments or in Massive Open Online Courses (MOOC) (Vittorini et al. 2021).

Chatbots are one of the closest antecedents to ChatGPT in education. They have been used in e-learning platforms to simulate one-to-one interaction with instructors and provide personalized feedback (Clarizia et al. 2018), such as suggesting to follow some tutorials or watch some videos according to some rules. However, the versatility of such chatbots is limited because they are like scripted conversations with linear flows (Kuhail et al. 2022). ChatGPT's advanced natural language processing capabilities enable it to generate more sophisticated and contextually appropriate responses than traditional rule-based chatbots.

3. ChatGPT for good

3.1. Content creation

ChatGPT can be utilized to create custom quizzes on a variety of topics and modalities, such as multiple choice, true/false, fill-in-the-blank, or matching questions and answers. By asking it to "Generate a multiple choice quiz on the Consumer Theory," for example, it can provide a set of well-crafted questions and answers that can be used in classes or exams. The ability to easily generate quizzes on any subject matter makes ChatGPT a valuable resource for educators. Figure 1 offers an example of how these questions can be generated.

User:	Prepare a multiple-choice question on shifts in the demand in competitive markets.
IA:	Which of the following factors can cause a shift in the demand curve in a competitive market? A) A change in consumer tastes and preferences B) A change in the price of a substitute good C) A change in the population size D) All of the above.

Figure 1. Example of a multiple-choice question created by ChatGPT.

Open-ended questions are another type of content that can be created using ChatGPT. In response to the user's request, it can generate questions that encourage reflection, discussion, explanation, creativity, or opinion-based responses. By asking ChatGPT to "generate open-ended questions about the Consumer Theory," instructors receive a list of thought-provoking questions that can be the basis for class discussions, written assignments, or other interactive activities that promote deeper learning and understanding, as illustrated in Figure 2.

ChatGPT can also provide relevant information on a wide range of subjects. When asked for an explanation of a topic, such as "How does nuclear power work?", ChatGPT can respond with a detailed response that can be used to supplement lessons or as a starting point for further study. Therefore, it can become an excellent tool for creating class materials.

Finally, ChatGPT can be used to create simple games, such as trivia, and role-playing games, to engage students with educational material. For instance, it can generate a trivia game about a certain topic by simply being asked. Role-playing games, such as the dialogue presented in Figure 3, allow students to understand complex situations by experiencing different perspectives.

3.2. Assisting students

There is a number of ways in which ChatGPT can be used as a study tool to assist students in their academic pursuits. Some of them are reviewed below.

Firstly, it can be used as a personal tutor and offer custom guidance. Students can ask questions to gain relevant information and explanations on a topic in real-time. ChatGPT can also offer personalized feedback by evaluating students' answers to questions and providing

User:	Prepare a comparative question that considers AI, GPT, and BERT.
IA:	How does the language generation capability of GPT compare to that of BERT, and how do both models differ from traditional AI approaches in terms of their language processing capabilities?
User:	Generate an open-ended question to encourage critical thinking about the Consumer Theory
IA:	What are some of the real-life situations in which the principles of Consumer Theory can be applied, and how would you go about applying them in each situation?

Figure 2. Examples of open-ended questions created by ChatGPT.

some insights into their understanding of the material. Furthermore, ChatGPT can create personalized study plans following some requirements by asking, for example, “Create a 10-hour study plan for the consumer theory for a visual learner”.

Secondly, ChatGPT can be employed as a writing assistant in multiple ways, such as helping students generate written responses to questions, summarizing key concepts, and providing feedback and corrections. For instance, students can use ChatGPT to create a first draft of an essay, summarize a text, or receive feedback on their writing regarding grammar, vocabulary, and coherence. This way, it can assist students in improving their writing skills, understanding the material, retaining information, and identifying areas for improvement.

Thirdly, ChatGPT can provide students with opportunities for conversational practice and language development. For example, students can ask “Let’s engage in a conversation about the weather in Valencia” to practice writing in a foreign language or to develop their communication skills in their native language. In a conversation with ChatGPT, students can improve their fluency and vocabulary and can also receive feedback on their writing abilities. This can help students to become more confident and proficient communicators.

4. The Dark Side

Despite the potential benefits of integrating ChatGPT in the classroom, it is not exempt from some potential challenges that educators should consider.

Firstly, ChatGPT’s ability to generate answers to any question can be tempting for students looking to cheat on exams or assignments. Besides encouraging honesty and ethical behavior, instructors should be very aware of the capabilities of technologies such as ChatGPT when designing exams or assignments. Similarly, when used as an assistant, students can use ChatGPT to complete homework assignments without fully understanding the material. Including self-reflection and critical thinking exercises are essential to prevent this.

Secondly, ChatGPT may provide students with false or misleading information or simply wrong answers, as illustrated in Figure 4. In this vein, ChatGPT is particularly inadequate in

User:	Let's start a role-playing game. You are a bookstore manager that is experiencing a decrease in sales. I am advising you on how to improve your business. Please, keep this role until I say otherwise.
IA:	Understood, I am now the bookstore manager facing declining sales. Please proceed with your advice.
User:	When did the decline start? What do you think the reason is?
IA:	I would say that the decline in sales started about 6 months ago. (...) Some of the possible reasons could be increased competition from online bookstores, changes in consumer spending habits, a shift towards digital reading, or a decline in foot traffic to the area where the store is located.
User:	You mentioned a decline in foot traffic near the store? Are there construction works around?
IA:	Yes, I did mention a possible decline in foot traffic due to changes in the area around the store. To my knowledge, there are currently no construction works happening in the immediate vicinity of the store, but there could be other changes, such as road closures or new developments, that could be affecting the flow of foot traffic.
User:	And what about your costs? Are they mainly fixed or variable?
IA:	I can say that our costs are a mix of both fixed and variable expenses. Fixed costs, such as rent, insurance, and salaries, remain relatively constant regardless of our sales volume. Variable costs, such as the cost of books, shipping expenses, and advertising, can fluctuate depending on our sales and other factors. (...)
User:	Which percentage of costs is variable?
IA:	I don't have exact figures on hand, but I would estimate that around 30-40% of our costs are variable and the rest are fixed. This can fluctuate from month to month, depending on factors such as the cost of books, shipping expenses (...).
User:	Since the foot traffic has declined, you might try to negotiate a reduction in the rent. How is your contract?
IA:	I can say that rent is a significant fixed cost for our business and negotiating a reduction in rent could definitely help improve our bottom line. Our current lease agreement is set for a fixed term, and any changes to the agreement would require the consent of both parties. (...)

Figure 3. Example of a role-player game with ChatGPT.

providing references and Digital Object Identifiers (DOIs) that can be used to track down the original source of the information. This lack of information makes it even more challenging to determine the accuracy and reliability of the information provided. Although future developments in the technologies could improve the accuracy of the information provided, fostering critical thinking is again key for avoiding wrong learnings.

User:	Demonstrate that $x+7$ is even.
IA:	If x is an even number, then it can be represented as $2k$ for some integer k . Therefore, $x + 7 = 2k + 7$, which can also be represented as $2(k + 3)$. Since the result is in the form of $2n$ for some integer n , it is an even number. Therefore, if x is an even number, $x + 7$ is an even number.
(...)	
IA:	Suppose the demand for apples is given by the equation $P = 120 - 2Q_d$ and the supply is given by the equation $P = 2Q_s$. What is the market equilibrium price and quantity?
User:	$Q=40$
IA:	That's correct! Now let's move to scenario 2. Suppose there is a technological breakthrough in apple production, which reduces the cost of production. How does this affect the market equilibrium price and quantity?
User:	Both price and quantity will increase.
IA:	Exactly! An increase in supply, as a result of a technological breakthrough, will shift the supply curve to the right. This will result in a higher quantity and a lower price at the new market equilibrium. Great work!
(...)	
IA:	To find the market equilibrium, we need to find the intersection of the supply and demand curves, where the quantity supplied is equal to the quantity demanded. We can start by setting the demand and supply equations equal to each other:
	$120 - 2Q_d = 2Q_s$
	Solving for Q , we get: $Q = 60$. Then, substituting $Q = 60$ into either the demand or supply equation, we can find the market equilibrium price:
	$P = 120 - 2(60) = 120 - 120 = 0$
	So the market equilibrium quantity is 60 and the price is 0.

Figure 4. Three examples of wrong answers by ChatGPT.

Furthermore, there is no guarantee that ChatGPT is available during class time. At this moment, it is offered as a free research preview with limited availability, and its access might be canceled at any time. This makes it unreliable for educational purposes and raises concerns about the dependability of the technology.

5. Conclusions

Artificial intelligence has the potential to revolutionize the way we teach and learn. One promising AI application is the use of large language models, such as ChatGPT, in various educational contexts.

ChatGPT can be used as a writing assistant, study tool, personal tutor, assessment tool, content creator, game-based learning tool, and language learning tool. It can generate instructions, procedures, explanations, dialogues and responses to students' inquiries. In all these applications, ChatGPT can help to make the learning process more interactive and engaging, and to provide students with exposure to the target content.

As a natural language model, ChatGPT is well-suited for educational settings where plain language is used to convey knowledge, for example, in the humanities or social sciences. It can also be useful in scientific and technical studies since it can understand specific jargon or terminology. Being based on a natural language model is a primary advantage, but it is also a significant drawback because its limited understanding of mathematical and specific notations may restrict its effectiveness in fields that rely heavily on them.

In order to reach learning objectives, future educators should learn which prompts spark productive conversations with ChatGPT. This process is analogous to coding but utilizes natural language and is therefore accessible to instructors without programming skills. Future learners should include ChatGPT into their repertoire of tools for both academic and professional endeavors while developing critical thinking skills to evaluate the quality of the responses provided by the AI.

Despite the potential benefits of integrating ChatGPT in the classroom, educators should be aware of the potential challenges it poses, such as those related to cheating and availability, since they may affect the class even if the instructor does not adopt it. The limitations of AI, evidenced by the inaccuracy of the information provided, emphasize the need for human intelligence to promote critical thinking.

References

- Bennani, S., Maalel, A., & Ben Ghezala, H. (2022). Adaptive gamification in E-learning: A literature review and future challenges. *Computer Applications in Engineering Education*, 30(2), 628-642.
- Bohra, A., Barwar, N.C. (2022). A Deep Learning Approach for Plagiarism Detection System Using BERT. *Lecture Notes on Data Engineering and Communications Technologies*, 111, 163-174.
- Mousavinasab, E., Zarifsanaiey, N., R. Niakan Kalhori, S., Rakhshan, M., Keikha, L., & Ghazi Saedi, M. (2021). Intelligent tutoring systems: a systematic review of characteristics, applications, and evaluation methods. *Interactive Learning Environments*, 29(1), 142-163.
- OpenAI Team. (2022). ChatGPT. OpenAI. Retrieved February 3, 2023, from <https://openai.com/>

- Pender, H. L., Bohl, L., Schönberger, M., & Knopf, J. An AI-based lesson planning software to support competency-based learning. *8th International Conference on Higher Education Advances (HEAd'22)*, 1033-1041.
- Smith, G. G., Haworth, R., & Žitnik, S. (2020). Computer science meets education: Natural language processing for automatic grading of open-ended questions in ebooks. *Journal of educational computing research*, 58(7), 1227-1255.
- Vittorini, P., Menini, S., & Tonelli, S. (2021). An AI-based system for formative and summative assessment in data science courses. *International Journal of Artificial Intelligence in Education*, 31(2), 159-185.
- Wang, Y. J., Shang, H. F., & Briody, P. (2013). Exploring the impact of using automated writing evaluation in English as a foreign language university students' writing. *Computer Assisted Language Learning*, 26(3), 234-257.
- Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education—where are the educators? *International Journal of Educational Technology in Higher Education*, 16(1), 1-27.
- Zhang, L., Huang, Y., Yang, X., Yu, S., & Zhuang, F. (2022). An automatic short-answer grading model for semi-open-ended questions. *Interactive learning environments*, 30(1), 177-190.