

# ChatGPT User Experience: Implications for Education

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**Abstract**—ChatGPT, a general-purpose conversation chatbot released on November 30, 2022, by OpenAI, is expected to impact every aspect of society. However, the potential impacts of this NLP tool on education remain unknown. Such impact can be enormous as the capacity of ChatGPT may drive changes to educational learning goals, learning activities, and assessment and evaluation practices. This study was conducted by piloting ChatGPT to write an academic paper, titled Artificial Intelligence for Education (see Appendix A). The piloting result suggests that ChatGPT is able to help researchers write a paper that is coherent, (partially) accurate, informative, and systematic. The writing is extremely efficient (2-3 hours) and involves very limited professional knowledge from the author. Drawing upon the user experience, I reflect on the potential impacts of ChatGPT, as well as similar AI tools, on education. The paper concludes by suggesting adjusting learning goals—students should be able to use AI tools to conduct subject-domain tasks and education should focus on improving students’ creativity and critical thinking rather than general skills. To accomplish the learning goals, researchers should design AI-involved learning tasks to engage students in solving real-world problems. ChatGPT also raises concerns that students may outsource assessment tasks. This paper concludes that new formats of assessments are needed to focus on creativity and critical thinking that AI cannot substitute.

**Index Terms**—ChatGPT, NLP, Education, OpenAI

## I. INTRODUCTION

The increasing development of artificial intelligence (AI) is significantly reshaping the labor market where education serves, thus raising concerns about what to teach and how to teach the next generations. Such concerns highlight the need for education to prepare future citizens with essential skills and competence to survive in the rapidly changing society [1]. To address this concern, it is critical to understand what AI can do. AI is expected to substitute humans’ efforts in conducting routine work to save time and cost [2]. Such advance has been seen in many sectors of society such as grading students’ homework [3]. The recent development of AI also has shown the potential for AI to substitute or partially substitute creative work that has usually been accomplished by skilled professionals, such as academic writing, coding, and arts [4]. An exemplary area of AI that has transformed

many areas in society is natural language processing (NLP). Particularly with the availability of large datasets, researchers have developed Chatbots and conversational AI systems, such as ChatGPT, offering a new approach to providing conversational responses to human prompts [5, 6]. ChatGPT can reply to exam-style questions, address homework assignments, draft academic essays, and automatically generate contracts. It is well acknowledged that completing these complex tasks needs not only knowledge but also “creative intelligence.” AI such as ChatGPT is making milestone contributions for automation and creativity.

This study focuses on ChatGPT, a powerful tool for conducting human work. I specifically question what education should offer to students and what adjustments to education are needed to fulfill the needs of students. Stokel-Walker [7] suggests that ChatGPT is a “game changer” with the potential to end some traditional sorts of assignments and assessments such as essay writing. The potential impacts may be even larger than expected. To address these concerns, we need to understand both the potentials and challenges of ChatGPT, to identify what skillsets remain essential for students to succeed in their future. This study focuses on ChatGPT as it represents one of the most intelligent machines nowadays. Examining the intelligence that ChatGPT demonstrates helps us understand the status quo of AI and its potential impacts on education. I pilot ChatGPT to draft a paper, a highly intelligent work that professionals can conduct so that I can understand the accuracy, organization, flow, and insight of ChatGPT in writing. The article written titled Artificial Intelligence for Education (see Appendix A), in an area that the author is working on. All the texts were directly generated by ChatGPT and I only added subtitles and slightly organized them in a logical way. By experiencing the power of ChatGPT, the author is able to comment on the implications for education. In the below, I first introduce ChatGPT and then articulate the piloting procedures and results of ChatGPT. Then, I present the implications for education.

## II. CHATGPT

ChatGPT is a general-purpose conversation chatbot based on the GPT-3 language model developed by OpenAI. It

This study was funded by National Science Foundation(NSF) (Award 2101104, 2100964, 2101166, 2101112, 2138854).

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is designed to generate human-like text based on a given prompt or conversation and has the ability to engage in natural, open-ended conversations on a wide range of topics [6]. Different from the prior language model, ChatGPT was trained in a conversational way using reinforced learning from human feedback. Humans provide feedback (i.e., rewards) by ranking machine responses' quality to fine-tune the model using Proximal Policy Optimization. Due to the new development approach, ChatGPT is capable of answering follow-up questions, admitting mistakes, challenging incorrect premises, and rejecting inappropriate queries [8]. Compared to other AI language models such as Meta's language tool or dubbed RoBERTa, ChatGPT offers "more creative" responses [9].

This study intends to identify the creativeness of ChatGPT to better understand its interventions in education. To serve this goal, I employed ChatGPT to draft a paper in a given area—AI for Education.

### III. PILOTING CHATGPT FOR ESSAY WRITING

To pilot ChatGPT, I used a list of queries (see Appendix B) to compose the paper, Artificial Intelligence for Education (see Appendix A). The list of queries was developed while I interacted with ChatGPT via trials. I first asked ChatGPT to write the introduction to a scholarly paper on how AI will be used to promote education. ChatGPT introduced the background of AI for Education and narrowed the scope of this paper,

*Artificial intelligence (AI) refers to the ability of computers and other machines to perform tasks that would normally require human intelligence, such as learning, decision-making, and problem-solving. With advances in machine learning and natural language processing, AI has become increasingly prevalent in a wide range of industries, including education. In this paper, we will explore the various ways in which AI is being used in education and discuss the potential benefits and challenges of using AI in the classroom. We will also examine the ethical considerations involved in using AI in education and consider the potential impact on teacher roles and the overall learning experience. Finally, we will discuss the future of AI in education and the potential for it to drive innovation and improvement in the field.*

Based on the scope, I further identified the structure of the paper—The potential and challenges of AI for Education, as well as the future research direction. For the potential section, I queried the history of AI for Education, which returns three paragraphs describing the history from the 1960s till now. The description is chronicle and includes examples and milestone developments,

*The use of artificial intelligence (AI) in education has a relatively short history, but it has rapidly gained popularity in recent years. Early examples of AI in education can be traced back to the 1960s and 1970s, when researchers began using computers to deliver personalized instruction*

*and adapt to the needs of individual learners. This early work laid the foundation for the development of more advanced AI-powered educational tools and platforms that have become common in classrooms today.*

*In the 1980s and 1990s, the proliferation of personal computers and the internet enabled the development of more sophisticated educational software and online learning platforms. These early efforts were largely focused on delivering content and assessment, rather than providing personalized instruction or adapting to the needs of individual learners.*

*In the early 2000s, advances in machine learning and natural language processing led to the development of more advanced AI-powered educational tools. These tools were able to adapt to the needs of individual learners, provide personalized instruction, and even grade assignments. Today, AI is being used in a variety of ways in education, including for personalized learning, automating administrative tasks, and even for tutoring and mentorship. As the field of AI continues to advance, it is likely that we will see even more innovative uses of AI in education in the future.*

In writing above, it specifically described three types of applications of AI for education—Personalized learning, automating administrative tasks, and tutoring and mentorship. To further explore the typical uses of AI for education, I queried the use cases of the three types of applications respectively. Each query returns the definition of the application, a list of typical uses, and a summary of the applications. For example, the query for personalized learning returned a definition and a list of use cases,

*Artificial intelligence (AI) has the potential to revolutionize the way we teach and learn by providing personalized learning experiences for students. Personalized learning refers to the use of technology to tailor educational content and experiences to the unique needs, abilities, and interests of individual learners. There are a number of ways in which AI can be used for personalized learning, including adaptive learning, personalized recommendations, individualized instruction, and early identification of learning needs. In all, the use of AI for personalized learning has the potential to increase student engagement and improve learning outcomes by providing tailored experiences that meet the unique needs of each learner.*

To further explore the use cases, I further queried the use cases and history of each way of personalized learning, which returned four specific uses. The results cover the definition of the uses, the history, evidence of potential, and a summary.

***Adaptive Learning:*** *AI-powered educational software can analyze a student's progress and adjust the difficulty of content in real-time to ensure that it is appropriately challenging. Adaptive learning is a teaching and learning approach that uses technology to automatically adjust the content and difficulty of a learning experience based on a*

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student's performance. This approach is designed to help students learn more efficiently and effectively by providing them with personalized learning experiences that are tailored to their individual needs and abilities.

The history of adaptive learning can be traced back to the early 1960s, when computer-based adaptive testing was first developed. In the decades that followed, adaptive learning technology has evolved significantly, and it is now used in a wide range of educational settings, including K-12 schools, higher education institutions, and online learning platforms.

There is some evidence that adaptive learning can be effective in improving student learning outcomes. For example, a review of the literature on adaptive learning published in the *Journal of Educational Computing Research* found that adaptive learning systems can improve student performance on a variety of measures, including test scores and course grades.

However, the authors of the review also noted that more research is needed to fully understand the potential of adaptive learning, and to determine the best ways to implement and use adaptive learning technology in educational settings.

Overall, the potential of adaptive learning is significant, as it has the potential to provide students with personalized learning experiences that are tailored to their individual needs and abilities, which can lead to improved learning outcomes. However, further research is needed to fully understand the potential of this approach and to determine the most effective ways to implement it in educational settings.

**Personalized Recommendation:** AI can analyze a student's interests and learning style and provide personalized recommendations for content and resources. Personalized recommendations can be used in education to help students discover new learning materials or activities that are tailored to their individual needs and interests. These recommendations can be based on a student's past performance, their learning style, or other factors such as their goals or interests.

The history of personalized recommendations in education can be traced back to the early days of online learning, when educational websites and platforms began using simple algorithms to recommend learning materials to students based on their past activity. In the decades that followed, personalized recommendations in education have become increasingly sophisticated, and they are now used in a wide range of educational settings, including K-12 schools, higher education institutions, and online learning platforms.

There is some evidence that personalized recommendations in education can be effective in helping students discover new learning materials or activities that are tailored to their individual needs and interests. For example, a study published in the *Journal of Educational Computing Research* found that personalized recommendations in edu-

cation can improve student engagement and motivation, and can lead to higher levels of student satisfaction.

However, the use of personalized recommendations in education has also raised concerns about the potential for algorithmic bias, as well as the potential for these systems to reinforce existing biases or perpetuate stereotypes. As a result, it is important to carefully consider the potential consequences of using personalized recommendations in education, and to ensure that these systems are designed and implemented in a way that is fair and transparent.

Overall, the potential of personalized recommendations in education is significant, as they have the ability to help students discover new learning materials or activities that are tailored to their individual needs and interests and can improve student engagement and satisfaction. However, it is important to carefully consider the potential consequences of using these systems, and to ensure that they are designed and implemented in a way that is fair and transparent.

**Individualized Instruction:** AI can be used to provide individualized instruction to students, using techniques like one-on-one tutoring or personalized lesson plans. Artificial intelligence (AI) can be used to support individualized instruction, which is a teaching and learning approach that aims to tailor the learning experience to the unique needs and abilities of each student. Individualized instruction can take many forms, including one-on-one tutoring, small group instruction, or self-paced learning.

The history of AI for individualized instruction can be traced back to the early days of computer-based education, when educational software was first developed to support self-paced learning. In the decades that followed, AI has been used to support a wide range of individualized instruction approaches, including intelligent tutoring systems, adaptive learning platforms, and personalized learning environments.

There is some evidence that AI can be effective in supporting individualized instruction. For example, a review of the literature on AI-based individualized instruction published in the *Journal of Educational Computing Research* found that AI can improve student performance on a variety of measures, including test scores and course grades.

However, the authors of the review also noted that more research is needed to fully understand the potential of AI for individualized instruction, and to determine the best ways to implement and use AI in educational settings.

Overall, the potential of AI for individualized instruction is significant, as it has the ability to provide students with personalized learning experiences that are tailored to their individual needs and abilities, which can lead to improved learning outcomes. However, further research is needed to fully understand the potential of this approach and to determine the most effective ways to implement it in educational settings.

**Early Identification of Learning Needs:** AI can analyze student performance data to identify areas where students may be struggling and provide additional support or re-

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sources. Artificial intelligence (AI) can be used to support the early identification of learning needs, which refers to the process of identifying and addressing students' academic, social, or emotional needs as early as possible. Early identification of learning needs is important because it can help to prevent learning difficulties from becoming more serious, and can help to ensure that students receive the support they need to succeed in school.

The history of AI for early identification of learning needs can be traced back to the early days of computer-based education, when educational software was first developed to support the assessment of students' learning needs. In the decades that followed, AI has been used to support a wide range of approaches to early identification of learning needs, including adaptive learning platforms, personalized learning environments, and intelligent tutoring systems.

There is some evidence that AI can be effective in supporting the early identification of learning needs. For example, a study published in the *Journal of Educational Computing Research* found that AI-based intelligent tutoring systems can accurately identify students' learning needs and provide appropriate support, which can improve student performance on a variety of measures, including test scores and course grades.

However, the authors of the study also noted that more research is needed to fully understand the potential of AI for early identification of learning needs, and to determine the best ways to implement and use AI in educational settings.

Overall, the potential of AI for early identification of learning needs is significant, as it has the ability to help educators identify and address students' academic, social, or emotional needs as early as possible, which can lead to improved learning outcomes. However, further research is needed to fully understand the potential of this approach and to determine the most effective ways to implement it in educational settings.

Similarly, for Automating administrative tasks in education, ChatGPT returned the definition, description, use cases, and summary,

*Automating administrative tasks in education refers to the use of technology, such as artificial intelligence (AI) and automation software, to streamline and automate various administrative tasks in the education system. These tasks can include tasks such as data entry, scheduling, and financial aid processing, as well as tasks related to student and faculty management, such as enrollment and course management.*

*The goal of automating administrative tasks in education is to improve the efficiency and accuracy of these tasks, as well as to free up time and resources for more important tasks, such as teaching and learning. By automating administrative tasks, educators and administrators can focus on the core mission of education, which is to provide high-quality learning experiences for students.*

*There are many potential benefits to automating administrative tasks in education. For example, automation can help to reduce errors and improve accuracy, as well as to reduce the workload of educators and administrators. Automation can also help to improve the efficiency of the education system, by reducing the time and resources required to complete administrative tasks.*

*Artificial intelligence (AI) can be used to automate a wide range of administrative tasks in education, including: Enrollment and registration, student record management, grading and assessment, course scheduling, and financial aid.*

*Overall, the use of automation and AI to automate administrative tasks in education has the potential to greatly improve the efficiency and effectiveness of the education system, by enabling educators and administrators to focus on the core mission of education and by providing students with a more seamless and efficient learning experience. However, it is important to note that automation is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators and administrators.*

I further queried the history and potential of the five use cases of automating administrative tasks in education respectively and received the following results,

*Automating administrative tasks in education refers to the use of technology, such as artificial intelligence (AI) and automation software, to streamline and automate various administrative tasks in the education system. These tasks can include tasks such as data entry, scheduling, and financial aid processing, as well as tasks related to student and faculty management, such as enrollment and course management.*

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*Artificial intelligence (AI) can be used to automate a wide range of administrative tasks in education, including:*

***Enrollment and Registration:*** *AI can be used to automatically process enrollment and registration forms, which can save time and reduce the workload for administrators. Artificial intelligence (AI) can be used to support the enrollment and registration process in education, which refers*

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to the process of enrolling students in courses or programs and registering them for classes. AI can be used to automate various tasks related to enrollment and registration, including processing forms, verifying information, and updating student records.

The history of AI for enrollment and registration can be traced back to the early days of computer-based education, when educational software was first developed to support the management of student records and other administrative tasks. In the decades that followed, AI has been used to automate a wide range of enrollment and registration tasks, and it is now used in a variety of educational settings, including K-12 schools, higher education institutions, and online learning platforms.

There is some evidence that AI can be effective in automating enrollment and registration tasks. For example, a study published in the *Journal of Educational Technology and Society* found that AI-based systems can accurately process enrollment and registration forms, and can save time and reduce the workload for administrators.

However, the authors of the study also noted that more research is needed to fully understand the potential of AI for enrollment and registration, and to determine the best ways to implement and use AI in these settings.

Overall, the potential of AI for enrollment and registration is significant, as it has the ability to save time and resources, and can help to ensure that student records are accurate and up-to-date. However, further research is needed to fully understand the potential of this approach and to determine the most effective ways to implement it in educational settings.

**Student Record Management:** AI can be used to automatically classify, sort, and index student records, which can make it easier to find and retrieve specific records. Artificial intelligence (AI) can be used to support student record management, which refers to the process of organizing, storing, and accessing student records. AI can be used to automate various tasks related to student record management, including classifying, sorting, and indexing records, as well as verifying and updating information.

The history of AI for student record management can be traced back to the early days of computer-based education, when educational software was first developed to support the management of student records and other administrative tasks. In the decades that followed, AI has been used to automate a wide range of student record management tasks, and it is now used in a variety of educational settings, including K-12 schools, higher education institutions, and online learning platforms.

There is some evidence that AI can be effective in automating student record management tasks. For example, a study published in the *Journal of Educational Technology and Society* found that AI-based systems can accurately classify, sort, and index student records, and can save time and reduce the workload for administrators. However, the authors of the study also noted that more research is needed

to fully understand the potential of AI for student record management, and to determine the best ways to implement and use AI in these settings.

Overall, the potential of AI for student record management is significant, as it has the ability to save time and resources, and can help to ensure that student records are accurate and up-to-date. However, further research is needed to fully understand the potential.

**Grading and Assessment:** AI can be used to automatically grade assignments and assessments, which can save time and reduce the workload for teachers. Artificial intelligence (AI) has been applied to various aspects of education, including grading and assessment, for many years. One of the earliest examples of using AI for grading and assessment was the Intelligent Essay Assessor (IEA), developed by the Educational Testing Service (ETS) in the late 1990s. The IEA was designed to evaluate the quality of written responses to essay questions and provide feedback to students on their writing skills.

Over the years, AI has been increasingly used to automate various aspects of grading and assessment, including the scoring of multiple-choice tests and the evaluation of essays, projects, and other types of assignments. The use of AI for grading and assessment has the potential to improve the efficiency and accuracy of the grading process, as well as to provide more personalized feedback to students.

There are also many potential applications for AI in educational assessment beyond grading. For example, AI can be used to analyze student data to identify patterns and trends, which can help educators understand how students are learning and identify areas where they may need additional support. AI can also be used to design personalized learning experiences for students, based on their individual needs and abilities.

Overall, the use of AI for grading and assessment has the potential to greatly improve the effectiveness of education, by providing students with more personalized feedback and support, and by enabling educators to more accurately and efficiently assess student learning. However, it is important to note that AI is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators.

**Course Scheduling:** AI can be used to automatically schedule courses and assign teachers and classrooms, which can save time and reduce the need for manual scheduling. Artificial intelligence (AI) has been applied to various aspects of education, including course scheduling, for many years. One of the earliest examples of using AI for course scheduling was the Course Timetabling Problem (CTP), which was introduced in the early 1980s as a mathematical optimization problem. The CTP involves generating a schedule for a set of courses and students, taking into account various constraints such as the availability of classrooms, the availability of instructors, and the preferences of students.

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Over the years, AI has been increasingly used to automate various aspects of course scheduling, including the generation of schedules, the assignment of classrooms and instructors, and the optimization of schedules to maximize utilization and minimize conflicts. The use of AI for course scheduling has the potential to improve the efficiency and effectiveness of the scheduling process, as well as to provide more personalized scheduling options for students.

There are also many potential applications for AI in educational scheduling beyond course scheduling. For example, AI can be used to optimize the scheduling of other resources, such as lab equipment or study spaces, or to design personalized schedules for students based on their individual needs and preferences.

Overall, the use of AI for course scheduling has the potential to greatly improve the efficiency and effectiveness of education, by enabling educators to more easily and accurately schedule courses and other resources, and by providing students with more personalized scheduling options. However, it is important to note that AI is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators.

**Financial Aid:** AI can be used to automatically process financial aid applications and determine eligibility, which can save time and reduce the workload for administrators.

Artificial intelligence (AI) has been applied to various aspects of education, including financial aid, for many years. One of the earliest examples of using AI for financial aid was the development of automated systems for processing financial aid applications and awarding aid to students. These systems were designed to improve the efficiency and accuracy of the financial aid process, by automating tasks such as data entry, verification, and calculations.

Over the years, AI has been increasingly used to automate various aspects of financial aid, including the analysis of student data to identify patterns and trends, the prediction of student success and retention, and the optimization of financial aid packages to maximize student success. The use of AI for financial aid has the potential to improve the efficiency and effectiveness of the financial aid process, as well as to provide more personalized financial aid options for students.

There are also many potential applications for AI in educational financial aid beyond the traditional financial aid process. For example, AI can be used to design personalized financial aid plans for students based on their individual needs and preferences, or to optimize the allocation of financial aid resources to maximize student success.

The use of AI for financial aid has the potential to greatly improve the efficiency and effectiveness of the financial aid process, by enabling educators to more easily and accurately award financial aid to students, and by providing students with more personalized financial aid options. However, it is important to note that AI is not a replacement for human judgment and expertise, and that it should be used

as a tool to augment and support rather than replace the roles of educators and financial aid administrators.

Overall, the use of automation and AI to automate administrative tasks in education has the potential to greatly improve the efficiency and effectiveness of the education system, by enabling educators and administrators to focus on the core mission of education and by providing students with a more seamless and efficient learning experience. However, it is important to note that automation is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators and administrators.

The query for AI for tutoring and mentorship returned similar results except for a list of use cases. I thus did not conduct a follow-up query as I did for the other two types of AI applications. However, the results also mentioned different types of uses such as intelligent tutoring systems (ITS), the delivery of personalized instruction and feedback, the identification of student learning needs and challenges, and the design of personalized learning plans.

Artificial intelligence (AI) has been applied to various aspects of education, including tutoring and mentorship, for many years. One of the earliest examples of using AI for tutoring was the development of intelligent tutoring systems (ITS), which were designed to provide personalized instruction and feedback to students based on their individual needs and abilities. These systems were typically implemented as computer-based programs that were used to supplement traditional classroom instruction. Over the years, AI has been increasingly used to automate various aspects of tutoring and mentorship, including the delivery of personalized instruction and feedback, the identification of student learning needs and challenges, and the design of personalized learning plans. The use of AI for tutoring and mentorship has the potential to improve the efficiency and effectiveness of the learning process, as well as to provide more personalized learning experiences for students. There are also many potential applications for AI in educational tutoring and mentorship beyond traditional one-on-one tutoring. For example, AI can be used to provide group tutoring or mentorship, or to design personalized learning experiences for students based on their individual needs and preferences. Overall, the use of AI for tutoring and mentorship has the potential to greatly improve the effectiveness of education, by providing students with more personalized instruction and support, and by enabling educators to more accurately and efficiently identify student learning needs and challenges. However, it is important to note that AI is not a replacement for human judgment and expertise, and that it should be used as a tool to augment and support rather than replace the roles of educators and mentors.

For the second scope of work, I queried the challenges of using AI in the classroom. ChatGPT returns a list of

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challenges directly, including ethical concerns, technological limitations, teacher buy-in, student engagement, and integration with existing systems. To better understand the challenges, I queried each challenge identified and the potential solutions respectively. Results are as follows,

*There are several challenges associated with using artificial intelligence (AI) in the classroom. These challenges include:*

***Ethical Concerns:*** *Some people have raised ethical concerns about the use of AI in education, such as the potential for AI to perpetuate biases and reinforce existing inequalities. These concerns have led to a need for ethical guidelines and best practices for the use of AI in education.*

*There are several ethical concerns associated with the use of artificial intelligence (AI) in education. These concerns include:*

- *Bias: AI systems can perpetuate biases that are present in the data they are trained on. This can lead to unequal and unfair outcomes for students, particularly if the bias is related to factors such as race, gender, or socio-economic status.*
- *Privacy: AI systems often involve the collection and processing of large amounts of student data. This can raise concerns about student privacy and the security of this data.*
- *Replacement of human jobs: There is a concern that the use of AI in education could lead to the replacement of human educators and other education professionals, potentially leading to job loss and economic disruption.*
- *Lack of transparency: Some AI systems can be difficult to understand and interpret, making it difficult for educators and students to understand how decisions are being made.*

*To address these concerns, there are several potential solutions that can be implemented, including:*

- *Developing ethical guidelines and best practices for the use of AI in education.*
- *Ensuring that AI systems are designed and implemented in a way that minimizes bias and promotes fairness.*
- *Implementing strong data privacy and security measures to protect student data.*
- *Ensuring that the use of AI in education is transparent and that decisions made by AI systems are explainable.*
- *Providing training and support for educators to help them understand and effectively use AI in their classrooms.*

*Overall, it is important to carefully consider the ethical implications of using AI in education and to implement appropriate measures to address these concerns.*

***Technological Limitations:*** *AI systems can be complex and require significant resources and expertise to develop and maintain. This can be a challenge for schools and educators who may not have the necessary resources or expertise to implement and use AI effectively.*

*There are several technological limitations associated with the use of artificial intelligence (AI) in education. These limitations include:*

- *Complexity: AI systems can be complex and require significant resources and expertise to develop and maintain. This can be a challenge for schools and educators who may not have the necessary resources or expertise to implement and use AI effectively.*
- *Integration with existing systems: AI systems often need to be integrated with existing systems and processes, which can be a challenge for schools and educators. This can involve technical issues, as well as issues related to data security and privacy.*
- *Internet connectivity: Many AI systems rely on internet connectivity to function properly. This can be a challenge in areas where internet access is limited or unreliable.*
- *Upfront costs: The initial costs of implementing AI systems can be significant, which can be a barrier for schools and educators who do not have the necessary resources.*

*To address these technological limitations, there are several potential solutions that can be implemented, including:*

- *Providing training and support for educators to help them understand and effectively use AI in their classrooms.*
- *Developing simpler and more user-friendly AI systems that are easier for educators and students to use.*
- *Ensuring that AI systems are compatible with existing systems and processes, and providing assistance with integration if needed.*
- *Investing in infrastructure, such as internet connectivity, to support the use of AI in education.*
- *Providing funding and other resources to support the implementation and use of AI in education.*

*Overall, it is important to carefully consider the technological limitations of using AI in education and to implement appropriate measures to address these limitations.*

***Teacher Buy-in:*** *In order for AI to be effective in the classroom, teachers must be willing to adopt and use it. However, some teachers may be resistant to using AI, either because they are unfamiliar with it or because they are concerned about its potential impact on their role and responsibilities.*

*There are several challenges related to teacher buy-in when it comes to using artificial intelligence (AI) in education. These challenges include:*

- *Unfamiliarity with AI: Some teachers may be unfamiliar with AI and may not know how to effectively use it in their classrooms.*
- *Concerns about the impact on their role: Some teachers may be concerned about the potential impact of AI on their role and responsibilities, and may be resistant to using it.*
- *Lack of support: Teachers may be hesitant to use AI if they do not feel that they have the necessary support*

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and resources to effectively implement and use it in their classrooms.

To address these challenges and promote teacher buy-in, there are several potential solutions that can be implemented, including:

- Providing training and support for teachers to help them understand and effectively use AI in their classrooms.
- Communicating the benefits of AI and how it can support teaching and learning.
- Ensuring that teachers have the necessary resources and support to effectively implement and use AI in their classrooms.
- Engaging teachers in the decision-making process and seeking their input on the implementation and use of AI in their classrooms.
- Ensuring that the use of AI does not replace the role of teachers, but rather supports and enhances their teaching and learning efforts.

Overall, it is important to carefully consider the concerns and needs of teachers when it comes to using AI in education, and to implement appropriate measures to address these concerns and promote teacher buy-in.

**Student Engagement:** AI systems can be impersonal and may not be able to engage students in the same way that a human teacher can. This can be a challenge in terms of maintaining student interest and motivation.

There are several challenges related to student engagement when it comes to using artificial intelligence (AI) in education. These challenges include:

- **Impersonal nature of AI:** Some students may find AI systems to be impersonal and may not be engaged by them in the same way that they would be by a human teacher.
- **Lack of human interaction:** Some students may prefer the human interaction and support provided by a teacher, and may not feel as motivated or engaged when learning from an AI system.
- **Technological barriers:** Some students may not have access to the technology or internet connectivity needed to use AI systems, which can impact their engagement with these systems.

To address these challenges and promote student engagement, there are several potential solutions that can be implemented, including:

- Ensuring that AI systems are designed to be engaging and interactive, and incorporating elements such as games and simulations to increase student interest.
- Providing opportunities for students to interact with human teachers and mentors, in addition to using AI systems.
- Offering support and resources to students who may be experiencing technological barriers, such as providing access to technology and internet connectivity.

- Encouraging students to take an active role in their learning and providing them with choices and opportunities to personalize their learning experiences.
- Seeking feedback from students and using this feedback to improve the design and implementation of AI systems.

Overall, it is important to carefully consider the concerns and needs of students when it comes to using AI in education, and to implement appropriate measures to address these concerns and promote student engagement.

**Integration with Existing Systems:** AI systems often need to be integrated with existing systems and processes, which can be a challenge for schools and educators. This can involve technical issues, as well as issues related to data security and privacy.

There are several challenges related to integrating artificial intelligence (AI) into existing educational systems. These challenges include:

- **Compatibility with existing systems:** AI systems may need to be integrated with existing systems and processes, which can be a challenge if they are not compatible.
- **Data security and privacy:** AI systems often involve the collection and processing of large amounts of student data. This can raise concerns about data security and privacy, particularly if the systems are not properly designed and implemented.
- **Training and support:** Educators and administrators may need training and support to effectively use and integrate AI systems into their classrooms and schools.

To address these challenges and facilitate the integration of AI into existing educational systems, there are several potential solutions that can be implemented, including:

- Ensuring that AI systems are designed and implemented in a way that is compatible with existing systems and processes.
- Implementing strong data security and privacy measures to protect student data.
- Providing training and support for educators and administrators to help them understand and effectively use AI in their classrooms and schools.
- Engaging stakeholders, including educators, administrators, and students, in the decision-making process and seeking their input on the implementation and use of AI in their classrooms and schools.
- Ensuring that the use of AI is transparent and that decisions made by AI systems are explainable.

It is important to carefully consider the concerns and needs of educators, administrators, and students when it comes to integrating AI into existing educational systems, and to implement appropriate measures to address these concerns and facilitate the integration of AI into these systems.

Overall, the use of AI in the classroom can present a number of challenges, but with careful planning and consideration, it is possible to effectively and ethically use AI to enhance and support teaching and learning.



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For the third scope of work, I queried the future of AI for education. ChatGPT returned five potential developments, including Increased use of AI for personalized learning, Development of AI-powered educational games and simulations, Increased use of AI for tutoring and mentorship, Use of AI to automate administrative tasks, Development of AI-powered education platforms.

*The future of artificial intelligence (AI) in education is likely to involve a continued expansion of its use and integration into various aspects of the education system. Some potential developments that we may see in the future include:*

- *Increased use of AI for personalized learning: AI has the potential to provide personalized learning experiences for students based on their individual needs and abilities. This could involve the use of AI to generate customized lesson plans, provide personalized feedback and support, and track student progress.*
- *Development of AI-powered educational games and simulations: AI has the potential to create educational games and simulations that are designed to engage students and help them learn in a fun and interactive way.*
- *Increased use of AI for tutoring and mentorship: AI has the potential to provide personalized tutoring and mentorship to students, by delivering personalized instruction and feedback based on their individual needs and abilities.*
- *Use of AI to automate administrative tasks: AI has the potential to automate various administrative tasks in education, such as data entry, scheduling, and financial aid processing, as well as tasks related to student and faculty management, such as enrollment and course management.*
- *Development of AI-powered education platforms: AI could be used to create education platforms that are designed to provide personalized and interactive learning experiences for students.*

*Overall, the future of AI in education is likely to involve the continued expansion of its use and integration into various aspects of the education system, with the goal of improving the efficiency and effectiveness of teaching and learning. It is important to carefully consider the ethical, technological, and other challenges associated with the use of AI in education, and to implement appropriate measures to address these challenges and ensure that AI is used ethically and effectively in the education system.*

At last, I asked ChatGPT to write the conclusion of an academic paper describing how AI can drive innovation and improvement in education. The conclusion first re-highlights the potential of AI in driving innovation and improvement in education. Further, it reminds the limitations of AI by emphasizing the ethical, technological, and other challenges associated with the use of AI in education, and implementing appropriate measures to address these challenges and ensure

that AI is used ethically and effectively in the education system.

*In conclusion, artificial intelligence (AI) has the potential to drive innovation and improvement in education in a number of ways. By providing personalized and engaging learning experiences for students, improving the efficiency of teaching and learning, and supporting research and development in education, AI has the potential to transform the way we think about education and how it is delivered. However, it is important to carefully consider the ethical, technological, and other challenges associated with the use of AI in education, and to implement appropriate measures to address these challenges and ensure that AI is used ethically and effectively in the education system. As AI continues to evolve and advance, it is likely that it will become an increasingly important tool for driving innovation and improvement in education, and it will be important to continue to monitor and assess its impact on teaching and learning.*

#### IV. IMPLICATIONS FOR EDUCATION

In the piloting process, I followed the scope proposed by ChatGPT to provide follow-up queries to unpack the study. The entire process, including generating and trying queries, adding subtitles, and reviewing and organizing the content, took 2-3 hours. The work involved very low human intelligence. The writing demonstrates four characteristics: Coherent, (partially) accurate, informative, and systematic. For each query, the responses cover the key information and flow well between paragraphs. While I changed the topic but asked the same aspects, the responses were formatted in identical manners. For example, I queried the use cases for adaptive learning and personalized recommendations respectively. ChatGPT first introduces the topic, and then a brief history of the topic, following some evidence of the potentials and limitations, and the last present a summary of the topic. I slightly changed the wording and ChatGPT returned the same results indicating that ChatGPT could address queries with varying wordings. In this process, ChatGPT has shown a powerful ability to organize and draft components of articles.

With this exciting and capable NLP tool, as well as others with similar capacities, educators have to consider adjustments to the educational learning goals, learning tasks, and assessments and evaluations to better prepare future citizens. Although there is no consensus on a unique taxonomy of educational learning goals, it is common knowledge that education should prepare students with cognitive, social, and emotional skills, as well as subject-specific knowledge to deal with real-world problems [10, 11]. With these skill sets, one is competent in conducting certain tasks professionally. In this piloting study, I observed how efficiently computers processed information. The writing proficiency of AI is way over a general student. The text AI wrote reads professional, and the content is coherent and (relatively) accurate. Compared to human beings, AI finds needed information efficiently.

It seems like educators need to revisit the requirements for literacy in education. In drafting the article with AI, I used very limited professional knowledge. I basically have to follow the rationale that ChatGPT provided and develop the queries. This experience implies that it is critical for students to develop the ability to use AI language tools, and the ability to write accurate sentences seems less important than before. Generalizing this finding with similar capable AI, we may conclude that using AI tools to conduct subject-domain tasks should be part of the educational goals in the future. Education should focus on improving students' creativity and critical thinking rather than general skills. More research is needed to study both human intelligence and AI—which part of human intelligence can be substituted by AI and which part is not [12]. By understanding the differences, we are able to better set forth learning goals for students.

Second, educators have to revolutionize learning tasks to cultivate students' unique skills that are beyond the capabilities of AI. Besides information processing, AI is superior in reliability when conducting work. AI is capable of accumulating and presenting knowledge. However, limited effort has been made to include AI in learning tasks in subject domains. Integrating AI in domain learning tasks is critical as it reflects how humans are solving real-world problems. Nowadays, scientific endeavors are increasingly relying on AI. Scientists and engineers utilize supercomputers to predict, classify and infer to solve complex problems. One limitation that has been recognized is that current computers are capable of artificial narrow intelligence—designed to perform specific and narrowly defined tasks [13]. ChatGPT represents the effort that computer scientists are making to pursue artificial generalized intelligence—ChatGPT is not only capable of knowledge accumulating, but also coding, and debugging programs. This new development toward artificial generalized intelligence provides unique opportunities for educators to design AI-involved learning tasks to engage students in learning.

The third area of education that ChatGPT may impact is assessment and evaluation. Essay writing and constructed response tasks are commonly used in assessing students' abilities in the classroom. It seems like ChatGPT is able to conduct such work easily. This raises the concern that students may be outsourcing their writing [7]. Therefore, assessment practices may need to change both the focus and the formats. That is, general writing skills may be easily outsourced compared to critical thinking and creativity. Assessment practices, especially those that target evaluation purposes, should alter the goals. This change aligns with the needs of society and the corresponding changes in educational learning goals. In addition, educators may have to consider innovative formats of assessments, particularly those that could carry out creativity and need critical thinking.

In all, ChatGPT represents state-of-the-art of AI and is driving the reform of education. This piloting study suggests that ChatGPT is capable of processing information accurately, efficiently, systematically, and informatively. It significantly reduces human intelligence working load and can potentially

alter the market needs of capable workers. In education, adjustments to the educational learning goals, learning activities, and assessment practices are pressing and essential to prepare students to succeed in their future lives.

#### ACKNOWLEDGMENT

This study was funded by National Science Foundation(NSF) (Award 2101104, 2100964, 2101166, 2101112, 2138854). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the NSF.

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