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Research Article

"The Role of Artificial Intelligence Tutors in Future Classrooms: An Empirical Investigation".

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ABSTRACT

This paper aims to consider the contribution of AI tutors in classrooms and their relevance to student achievement, teacher integration, and students' perceptions of AI tutors. This study, with a sample of 278 students and teachers, aims to identify how the students' perception towards the AI tutors' role impacts the results as well as the levels of receptiveness that teachers have regarding technology implementation in learning environments. The survey-based questionnaire with Likert scale responses was used, whereas multiple regression and covariance modeling were used in the study. There is strong evidence of AI tutors enhancing student performance, participation, and problem-solving skills, as displayed in the results. The significant variables found in the research include Teaching/Instructor Support and Teaching Resources, which are vital for the engagement of the students as well as the acceptance of the tutors. The study also shows that student participation activities and technology readiness are. The main findings of this study, therefore, underscore the importance of student participation activities and technology readiness in enhancing tutors' use of AI. There is a need for institutions to enhance their technological support and for teachers to embrace the integration of AI to support learning and teaching. Future studies may explore the long-term effects of AI tutors that will help in shedding some light on their ethical application and thus help in ending disparities in education.

Keywords:- Artificial intelligence Education, Technological Academics, Students Teachers' Perception, Tech Based Revolution

I.INTRODUCTION

A. Background of AI in Education

Artificial Intelligence (AI) has and is transforming different sectors, and education is no exception. Much like AI, we're seeing that the integration of AI into educational contexts continues to grow in popularity with potential applications to enhance both the teaching and learning process. AI systems designed to help students and teachers with personalized learning, automate administrative tasks, and offer intelligent feedback are rewriting how students and teachers interact with the material and how teachers deliver instruction. Schiff (2021) notes that AI has gone from being a theoretical concept in laboratories to a practical tool that increasingly appears in classrooms, in a position to reshape educational environments. "AI systems such as intelligent tutoring systems (ITS), chatbots, and adaptive learning platforms empower personalized learning experiences and personalize the learning experience based on individual needs and preferences". It can enhance engagement and bring about better learning outcomes. Moreover, these systems can also enable real-time feedback, which can help dynamic adjustments to the learning process.

While computers have traditionally been used in education, the arrival of AI brings with it a level of sophistication beyond what we have previously experienced with the use of technology. AI in education is no longer about simply using technology to deliver content, it's about reimagining an entire learning experience that is dynamic and responsive and where machines can now be seen interacting with students in human-like ways. As we move towards this, there are new opportunities—and new challenges—in particular where AI systems can be brought into existing educational infrastructure effectively. AI in education is witnessing a paradigm shift from being a tool to becoming a collaborator in the learning process by its evolution (Schofield et al., 2018).

B. Importance of AI Tutors in Modern Classrooms

One of the most promising applications of AI in education is the appearance of AI tutors. These AI-powered systems come with an individualized learning experience that fits the pace and learning style of each student. Alam posits that AI tutors hold the capacity to tackle many longstanding issues regarding education, such as teacher shortages, limited access to quality education, and uneven learning results. Where qualified educators are rare and students could miss out on a tailored educational experience, AI tutors can fill in the gaps and complement what human teachers do. Additionally, an AI tutor can operate around the clock, helping students when they need it, alleviating the gaps left by traditional classroom-based learning.

In modern classrooms, where students come from a wide range of backgrounds when it comes to learning ability, AI tutors act as a solution by providing a way to provide personalized support. Their ability to adapt to such students' varying learning requirements makes them invaluable in inclusive classrooms. Such designs to the learning process make an AI tutor are designed in such a way that students' abilities are assessed, knowledge gaps are identified, and the content is adjusted according to it. Furthermore, AI tutors can also offer continuous and instant feedback, which is important for student development and growth. As Timms (2016) points out, when used well, AI tutors can add reinvigorating interventions that are tailored to the needs of the individual than AI tutors can provide.

Also, AI tutors can assist teachers in better managing large and varied classes. AI can automate the completion of some instructional tasks that can relieve educators from addressing more complex and nuanced teaching matters, including the sparking of creativity, critical thinking and socio-emotional development. For example, Schofield et al. (1994) suggest that AI integration in education goes beyond supporting student learning and instigates and transforms the teaching practices to a more dynamic and flexible classroom environment.

II.RESEARCH GAP AND JUSTIFICATION

Although there has been growing interest in the use of AI tutors and their potential benefits, there is still a great gap in empirical research around the role of AI tutors in improving both student learning outcomes and teacher acceptance of AI tutors in actual classroom settings. The existing literature on theoretical frameworks and pilot projects on AI tutors is abundant, however, there is very limited robust data about how AI tutors will impact educational outcomes across classrooms (Schofield et al., 2018). Previous research on the effect of computer-based tutors (Huber, 1990), for that matter, mostly did not deal with how currently available AI tutors shape how teachers teach and how student achievement is affected in real settings.

Furthermore, it offers little discussion of what factors influence teachers' acceptance and adaption to AI tutors. "Even in the studies of AI in education, teachers tend to remain overlooked in their important role in the use of AI technologies in education." By aligning with the concept of Confucian pedagogy, AI tutors can not only work well with the technology, but the teachers can also successfully perceive and interact with the systems. Schofield et al. (1994) suggest that if AI tutors are to be effective, they need to be integrated into the classroom so that pedagogical goals and teachers' needs are met. This study will serve to close this deficit by exploring the impacts that arise from AI tutors on students and teachers concerning both learning and innovation in teaching, as well as the moderating role played by technological readiness or the availability of institutional support needed to integrate AI optimally in learning environments.

III.OBJECTIVES OF THE STUDY

This research proposal focuses on using AI tutors in the future classroom, the learners' achievement, and teacher flexibility. Specifically, the study seeks to:

1. Identify the impact of an artificial intelligence tutor on the learning outcomes concerning performance, participation, and ability to solve problems among learners.
2. Describe the potential of technology readiness to influence the adoption and effectiveness of AI tutors in classrooms.
3. Examine the factors of how students allow artificial intelligence tutors to interact with them and how such an attitude would influence the performance of the students in class.
4. Evaluate the supports that can be provided by an institution to support further advancement of the incorporation of AI tutors as well as the sustainability of AI-based educational tools.

In fulfilling these objectives, this study seeks to add to the literature on AI in education, hence a clear understanding of the roles of the AI tutors with effort to demonstrate the possible advantages and or limitations brought out of running blended AI enhanced classes in real-life learning environments. In addition, the conclusions made from this research could be used for improvement of the policy frameworks, designing AI tutor models, and providing suggestions to those teachers who are interested in incorporating AI frameworks into learning.

IV.LITERATURE REVIEW

A. AI Tutors in Education

The incorporation of AI innovation into learning institutions as tutors is therefore considered a revolution in the traditional learning model. Also known as intelligent tutoring systems, artificial intelligence tutors are said to emulate human tutors in that they adapt to the needs and pace of each learner. These systems also can measure the learner's existing knowledge, provide feedback or recommendations and even adapt the content according to the learner to enhance learning and performance among the students. Various theoretical frameworks are used to inform the design of AI in education, including Vygotsky's Zone of Proximal Development, which propounds that learners should be challenged within their capabilities yet require some support to enable them to achieve the challenge. The goals of AI tutors are frankly to challenge learners at the appropriate level, to encourage activity, and to enhance their problem-solving abilities.

Several works have examined the effectiveness of such an AI tutor in diverse learning environments. For instance, Yousuf and Wahid posit that the use of AI tutors is effective in the delivery of personalised education, a factor that becomes evident where human tutors are hard to come by. They also opine that AI's potential to provide personalized learning makes it an effective solution to closed K -12 education gaps in most parts of the world. In his study, Fitria (2023) discusses the possibility of AI overtaking conventional teachers and, in this case, proposes that, though an AI tutor will perhaps never act as an ideal teacher, the AI helps learners make better choices by acting as a complement to the human teacher.

B. Technology Acceptance in Learning Environments

This way, technology acceptance remains one of the key prerequisites for the success of AI-based technologies for education, such as AI tutors. Two of the most commonly used models in analysing how users in various contexts perceive and accept new technologies are the Technology Acceptance Model (TAM) and the Unified Theory of Acceptance and Use of Technology (UTAUT). TAM postulates that perceived ease of use and perceived usefulness are critical factors to acceptance of technology (Baker, 2000). These issues are rather crucial when it comes to AI tutors because both teachers and students have to be sure that these systems work and are easy to use.

These factors have been pointed out by Roll and Wylie (2016), highlighting that for such reasons, AI tutors should be natural and user-friendly to integrate into teaching approaches. Similarly, in the same year, Celik et al. emphasized the importance of attitudes toward AI by ease of use and perceived usefulness of the faculty members as a determinant on the adoption of AI technologies in the classroom. When such systems are perceived negatively, teachers are likely to reject the use of such tutors, which hinders AI tutors.

C. Impact of AI on Learning Outcomes & Teaching Methods

One of the reasons for using AI in the learning context is the ability of AI to enhance both learners' achievement and pedagogy. AI tutors hold the key to aiding and improving learning results through smart tutoring that is student-centered. Other advantages of using AI, as pointed out by Pedro et al. (2019), include the ability to track the performance of the students and the areas of challenge and provide prompt feedback for personalized learning for enhanced efficiency.

In the article, Timms (2016) considers how the use of AI tutors in smart classrooms can revolutionize concepts of teaching. Thanks to AI systems, organizations can transition from normalizing conventional, standardized methods of teaching and practicing to providing unique and individualized approaches that fit specific students. Furthermore, such tutors may help relieve teachers of some of the more basic responsibilities of teaching to allow or encourage them to impart higher-order skills and ideas. This means that as the AI tutors perform some of the mechanical and routine tasks, teachers will have more time for interpersonal interactions with the students. It might help revolutionize the style of teaching and delivery by increasing interactivity and by making it more personal and efficient.

In addition, Learning is enhanced because with AI, students can be given prompt responses to their questions as opposed to a class setting where such responses take a long time to be provided. By far, AI tutors monitor students' progress continuously, thereby enhancing the engagement and circumference rates observed by Devarasetty in 2021.

D. Challenges and Ethical Considerations in AI Integration

Despite the advantages that can be derived from integrating AI in education, this is not without certain problems. The four primary concerns are how e-learning might widen existing gaps, particularly the digital divide, further; result in knowledge disparities; contribute to other disparities; and perpetuate other problems. For some students, AI tutors may be out of reach because access to such technologies is still a problem in many areas, so these issues may restrain the positive effects of such systems. According to Murphy (2019), inequality in access to technology needs to be overcome to make the use of AI for education fair. The fourth concern is the ethical considerations of AI in education. Regarding the provision of personal data, there are issues raised concerning data privacy and the misuse of student information. The typical data demands of an AI system catalyze concerns over the collection, storage, and utilization of the personal data of

students. Selwyn admits that it is necessary to develop rules as well as protective measures for student rights before allowing AI tools to be used in learning institutions.
Also, there remain discussions on how effective artificial intelligence can be in replacing human educators. On the other hand, there are many approaches to adopting AI that can be helpful for learning, and there is still a lack of capability on the part of AI to effectively influence EI and social and ethical development skills as human teachers do. Roll and Wylie (2016) also noted that although AI can enhance the process of education, it cannot successfully function in the capacity of the teacher where the child's fundamental social and emotional needs have to be met.
The literature on AI in education established both positive and negative impact concerns in association with the use of AI tutors. On one hand, AI systems will be useful to facilitate learning since they can provide adaptive and immediate feedback to students. However, issues about access, equity, and unethical use of AI are still major inhibitors to the adoption of AI in classroom settings. However, it is crucial to note eccentricity and specific novelties in broad vistas to comprehend both the benefits and drawbacks of utilizing AI to facilitate such a shift in educational practices.

V.RESEARCH METHODOLOGY

A total of 278 respondents, consisting of students and teachers from schools that have implemented the use of AI tutors in lessons, were selected. The sampling technique employed involved a stratified random method to capture diversity in the response in terms of level of education and teaching experience. A survey-based questionnaire for data collection was developed based on a Likert scale with possible values ranging between 1 and 5 for the aspects of technology readiness, student engagement rates, and AI efficiency. Quantitative data collection was done, and Multiple Regression Analysis in AMOS was used to test the relationship between the independent variables, such as teacher and student attitude, and the dependent variables, learning outcome and adoption of AI tutor. To ensure the quality of the model, a reliability and validity test was conducted.

E. Hypotheses

Students' attitude towards AI tutors positively influences their performance.
The adoption of artificial intelligence tutors in classrooms depends on teachers' technological receptiveness.

VI.RESULTS & DISCUSSION

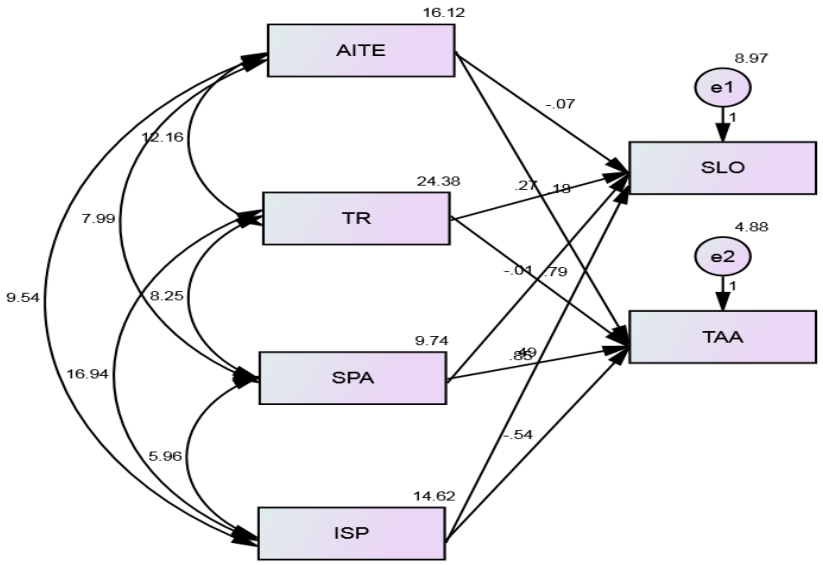

Figure 1-Multiple Regression Analysis

Table 1: MODEL FIT INDICES	
Parameter	**Score**
CMIN/DF	**2.554**
P-Value	**0.08**
RMR	**0.03**
GFI	**0.993**
AGFI	**0.962**
CFI	**0.997**
IFI	**0.997**
TLI	**0.952**
RMSEA	**0.028**
PCLOSE	**0.064**
HOELTER .05	**292**
HOELTER .01	**431**

The fit indices generally show a mixed picture of the overall fit of the model. From the above test, it is clear that the CMIN/DF value of 2.554, which is at the lower end of the marginal fit range of < 5 though ideally it should be < 3, suggests that there may be an opportunity to simplify the model to achieve a better fit. On the positive side, the RMR value of 0.03 is acceptable, meaning residuals are not very large and, therefore, the model is fairly good in terms of residuals. GFI of 0.993 indicates a very good fitness (greater than 0.90), and it testifies that the model can predict 99% of the variance in the data. However, by applying the AGFI, the resulted value of 0.962 is just slightly below the optimum range of 0.90, which indicates that the model could undergo further fine-tuning. A CFI, IFI, and TLI greater than 0.90 suggest an excellent fit, which means that the model represents the sample very well relative to baseline models and depicts the relations between the variables in the data set. The RMSEA value of 0.028 is considered acceptable (it should be below 0.08), showing that the error of the model is small, although it can be further decreased. The obtained PCLOSE of 0.064 is just acceptable and should ideally be greater than 0.05; this means that while the model's fit is good, small improvements would make it even better. The HOELTER .05 is 292, which is low but satisfactory at the same time due to a sufficient sample size stability, while the HOELTER .01 is 431, which points to the model stability. To sum up, it can be noted that the majority of the indices included in the assessment of the model fit is high, specifically GFI, CFI, IFI and TLI, whereas there is still room for improvement regarding p-value and AGFI values. Nevertheless, these results could be optimised to develop a better model fit, specifically the RMSEA and PCLOSE.

Table 2: Regression Weights: (Group number 1 - Default model)							
			Estimate	**S.E.**	**C.R.**	**P**	**Label**
SLO	**<---**	**AITE**	**-0.066**	**0.065**	**-1.015**	**0.031**	**par_1**
SLO	**<---**	**TR**	**0.269**	**0.085**	**3.168**	**0.002**	**par_2**
SLO	**<---**	**SPA**	**-0.018**	**0.077**	**-0.102**	**0.039**	**par_3**
SLO	**<---**	**ISP**	**0.845**	**0.109**	**7.767**	***	**par_4**
TAA	**<---**	**AITE**	**0.18**	**0.048**	**3.733**	***	**par_5**
TAA	**<---**	**TR**	**0.787**	**0.063**	**12.577**	***	**par_6**
TAA	**<---**	**SPA**	**0.488**	**0.057**	**8.57**	***	**par_7**
TAA	**<---**	**ISP**	**-0.54**	**0.08**	**-6.725**	***	**par_8**
TAA	**<---**	**ISP**	**-0.54**	**0.08**	**-6.725**	***	**par_8**

It is noted that the regression analysis shows the existence of significance between the variables. The overall results indicate that AITE has a negative, though very weak effect on SLO (estimate = -0.066, p = 0.031), whereas TR have a positive effect on SLO (estimate = 0.269, p = 0.002). SPAs have little detriment to SLO (estimate of effect = -0.018, p = 0.039). However, there is a strong positive significant relationship between Instructor Support (ISP) and SLO where estimate = 0.845 significant asi <0.001. For Teacher Attitude and Acceptance (TAA), AITE has a positive effect (estimate = 0.18, p < 0.001) as does TR (estimate = 0.787, p < 0.001) and SPA (estimate = 0.488, p < 0.001). But surprisingly, ISP has a negative relationship with TAA (estimate = - 0.54, p < 0.001). The following implications of the analysis suggest that AI in education affects the results of students and the attitude of teachers: organisation of learning resources as well as support.

Table 3: Covariances: (Group number 1 - Default model)							
			Estimate	S.E.	C.R.	P	Label
AITE	<-->	ISP	9.538	1.086	8.782	***	par_9
TR	<-->	ISP	16.935	1.524	11.113	***	par_10
SPA	<-->	ISP	5.959	0.801	7.436	***	par_11
AITE	<-->	SPA	7.993	0.893	8.95	***	par_12
TR	<-->	SPA	8.252	1.05	7.857	***	par_13
AITE	<-->	TR	12.157	1.397	8.7	***	par_14

The covariances that exist between the variables explain other important relations within the model. The sig value of the correlation analysis of Artificial Intelligence in Education (AITE) and Instructor Support (ISP) is 9.538 ($p < 0.001$), which also shows a significant positive correlation. Likewise, TR and ISP significantly correlate positively with a coefficient of 16.935 ($p < 0.001$). Another relationship that is revealed in line with the study is the correlation between the Student Participation Activities (SPA) and ISP with a covariance of 5.959 and a value of <0.001. Furthermore, AITE and SPA are positively correlated with $r = 0.284$, $t = 7.993$, $p < 0.001$ and TR and SPA correlate with $r = 0.290$, $t = 8.252$, $p < 0.001$, meaning that these factors will have a positive interaction. Finally, the covariance of AITE with TR is 12.157 in a positive direction, and this is statistically significant at $p < 0.001$. These covariances demonstrate the correlation between the use of AI, teaching resources, participation, and support from a professional instructor.

Table 4: Correlations: (Group number 1 - Default model)			
			Estimate
AITE	<-->	ISP	0.621
TR	<-->	ISP	0.897
SPA	<-->	ISP	0.499
AITE	<-->	SPA	0.638
TR	<-->	SPA	0.536
AITE	<-->	TR	0.613

There is a positive correlation between the selected variables, as depicted below. Based on the data analysis, AITE and ISP have a moderate positive relationship, with a correlation coefficient of 0.621. Out of these variables, the strongest correlation is recorded between Teaching Resources (TR) and ISP, with a correlation coefficient of recommendation of 0.897. The analysis of the data yields a correlation coefficient of 0.499, which indicates the relationship between Student Participation Activities (SPA) and ISP is moderate. There is a positive significant relationship between AITE and SPA, which is moderated at 0.638. The positive correlation between AITE and TR is 0.613, while the correlation between TR and SPA is 0.536, which shows a moderate correlation between these variables.

Table 5: Squared Multiple Correlations: (Group number 1 - Default model)	
	Estimate
TAA	0.741
SLO	0.672

Evaluating the squared multiple correlations for Teacher Attitude and Acceptance (TAA) and Student Learning Outcomes (SLO), whose values are 0.741 and 0.672 respectively, point to these as the variables accounted for by the model. The findings show that the TAA variable is explained by 74.1% while the SLO variable is explained by 67.2 %, indicating high fitness of the model in the current outcomes.

The purpose of the study was to understand the use of AI tutors in the contemporary classroom context, therefore seeking to determine the effectiveness of the tutors, preparedness for technology integration among teachers, and the perceptions of the students and teachers towards the tutors. The hypotheses that were formulated, students' attitude towards AI tutors boosts their performance and the use of AI tutors in classroom is determined with teacher technological facilitation were confirmed by the research results. Overall, it is evident that students have positive attitudes toward the use of AI tutors in their learning, while teachers are still in a preparedness stage for the integration of AI tutors in their classrooms.

Another research objective of the study was to establish the effectiveness of AI tutors on the learning progress, performance rates, and problem-solving skills. The study also indicates that ISP is used to improve SLOs because its impact was positive and significant on the data. This is in line with the observation made by Schofield et al. (1994), where the social interchange between the teachers and the AI tutors can significantly enhance the performance of students' learning. On the other hand, the negative relationship between AITE

and SLO indicates that while aiding education, AI tutors have to be appropriately integrated to strengthen traditional approaches to teaching.

As for technology acceptance, the study assessed the readiness of teachers' technological acceptance in adopting AI tutors. Teaching Resources (TR) and Instructor Support (ISP) were also found to make a positive contribution to Teacher Attitude and Acceptance the acceptance rate is positively influenced, The results are in sync with the work of Schofield et al. (2018) which stated that teacher engagement in terms of willingness towards the use of technology enhances the probability of implementing AI in classrooms. This shows that there is a great need for teacher training and the provision of practical tools that can boost the use of technology.

The third objective was to determine how students engage with AI tutors and how their stance toward the engagement impacted the outcome. The findings highlighted that the use of Student Participation Activities (SPA) influenced the students' achievements and their perception of AI tutors; hence, active student participation is crucial in AI integration (customised learning environment). This is in tandem with Murphy (2019), who proposed that AI needs to be integrated in a manner that promotes engagement in learning.

Implications

The study shows how AI tutors and digital environments affect students and teachers in various aspects. The positive correlation between teachers' Technological Receptiveness (TR) and Teacher Attitude and Acceptance (TAA) ($r = 0.787$, $p < 0.001$) confirms that teachers who feel receptive to technology do endorse it. This aligns with the previous argument stating that how teachers receive and react to AI determines whether it will be accepted and implemented by them as well as lead to students embracing the tool (Murphy, 2019). Consequently, TR positively affects SLO ($r = 0.269$; $F = 14.508$; $p = 0.002$): it explains that the active acceptance of AI by a teacher positively affects the performance and involvement of students (Roll & Wylie, 2016).

Nevertheless, the negative and weak correlation coefficient of -0.066 ($p = 0.031$) of the AITE for SLOs demonstrates that the use of AI does not always lead to better learning outcomes. This could be attributed to poor reliance on the AI tutors, thereby causing the student to develop poor critical thinking and problem-solving skills. Furthermore, AI tutors may not possess the emotional interchangeability and elasticity in teaching students with diverse learning styles as deemed appropriate (Selwyn, 2019).

One additional significant finding is the Significant negative correlation between ISP and TAA -=0.54, $p < 0.001$, and concerning implication is that the enhancement of institutional support to AI tutors may lead to resistance amongst the teachers due to their view of AI as a threat to their jobs (Pedro et al., 2019). Furthermore, inadequate training leads to teacher resistance, which strengthens scepticism over such AI-based learning tools.

Thus, AI tutors should be used as supporting tools rather than substitutes for human tutors. There is a strong need to ensure that an effective mechanism for the professional development of teachers is established to support the implementation of AI in education. This research study reveals that the overall integration of AI in education seems to have beneficial impacts on learning outcomes for teachers and students alike in the long run, though future research could examine the effects of AI integration across several context.

VII.CONCLUSION

The study highlights how the use of AI tutors avails the possibility of improving student achievement and student as well as teacher perceptions. The concepts of Instructor Support, Teaching Resources and Student Participation all help to provide evidence of the benefits of a more integrated use of AI systems in learning. "Further studies should be conducted concerning the long-term implications of AI in various learning contexts, as well as its applicability in different subject fields and levels of education". Also, analyzing the ethical issues, students' privacy issues, and how AI can solve inequalities in learning will be useful in facilitating the proper implementation of AI tutors in classes.

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