Empowering Educators: Exploring the Role of Generative AI in Enhancing Teaching and Learning

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I. Introduction

Over the past few years, the world has seen the rise of Generative AI (GAI) and Large Language Models (LLMs) like ChatGPT. This has consequently increased the presence of AI in various communication contexts, including education. Whether it be students using GAI to skim through readings and produce efficient summaries in the matter of seconds, or students utilizing GAI as a writing and editing tools in short-form and long-form essays, the rise of GAI has completely transformed the education landscape recently. In April 2025, OpenAI introduced GPT-4.1 in the API format, including new use cases and a more efficient model.[1] More recently in May 2025, Perplexity gave all students a 1-month free trial of their Premium model.[2] With these GAI tools widely acceptable to the mainstream public, students from ages ranging from primary school to college and beyond have used these tools as efficient ways to learn more effectively.

As such, teachers are now facing new ways to use AI-powered tools that have become more sophisticated and accessible. Teachers are now able to leverage these technologies to streamline lesson planning, automate grading, and personalize instruction for different types of learners. For example, AI can generate lesson materials based on a student's past work and history, provide real-time feedback, and even adapt assessments based on individual

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[1] Open AI, https://openai.com/index/gpt-4-1/.
[2] Perplexity, https://www.perplexity.ai/referrals/join.

performance. This allows educators to focus more on meaningful interactions with individual students. However, there have also been issues raised such as academic integrity, students' excessive reliance on AI, and their unfamiliarity with AI tools.

These problems are also constantly changing, following suit the updated technology being released by tech firms. At the end of the day, the current status quo is that each teacher regulates their own students in a different manner. In my experience at Penn alone, I have had professors who have outright banned any use of AI in their class, to others who have encouraged students to learn to use GAI effectively as a means of helping their learning processes. This disparity confuses students and oftentimes leads to miscommunication, hindering proper learning.

Thus, this paper seeks to answer the following Research Question: How can teachers effectively integrate Generative AI into their teaching practices, and what are the implications for teacher agency, student engagement, and educational outcomes? Given that GAI will not be going away anytime soon, this paper will explore the communicative context of teacher-student interactions mediated by Generative AI, highlighting opportunities, challenges, and the implications for future educational practices.

II. Literature Review

Upon looking through JSTOR, I found this really interesting article called "Teachers' agency in the era of LLM and generative AI" by Yu-Ju Lan and Nian-Shing Chen in the January 2024 Volume of *Educational Technology & Society*.[3] This was a really in-depth study into the

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[3] Yu-Ju Lan and Nian-Shing Chen. "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents." *Educational Technology & Society* 27, no. 1 (2024): I–XVIII. https://www.jstor.org/stable/48754837.

use of GAI in the classroom, and holistically looked at both the teachers and students perspective.

At the core of their article, the tradeoff that Lan and Chen explore is the concerns about diminishing teacher control vs. opportunities for students to benefit from enhanced personalization and efficiency.[4] In this relationship, I will delve into the reasons why I think the growth of GAI creates an inevitable amount of decrease in terms of teacher control, and how the best way to approach this future would be to seize the opportunity for educators to also learn about GAYI technology and methods to best implement them. This would combat the potential for students to be at risk for superficial learning and over-reliance on AI for task completion, which could hurt their long-term development.

In terms of solutions, Lan and Chen propose a super riveting concept of team teaching, when Human educators and AI tools work together to best teach a student.[5] They delve deeper into the specific methods of collaborative learning, where the Human teacher focuses more on the interpersonal and emotional aspect of education, and the AI teacher serves as the proxy to learning material and inputs/outputs.

Their work ultimately calls for robust teacher professional development and the co-design of pedagogical AI agents to ensure that educators still remain at the center of education in an AI-augmented future. I found this concept really fascinating and something I think could really change the education landscape in the future, so I decided to continue with this topic for my paper.

Further, another article called "Factors Affecting the Adoption of AI-Based Applications in Higher Education" Youmei Wang, Chenchen Liu and Yun-Fang Tu in the July 2021 volume of

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[4] Lan and Chen, "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents."
[5] Lan and Chen, "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents."

Educational Technology & Society gives insights into the willingness of higher education teachers in using AI-based technology in their work.[6] The authors characterized instructors by key psychological factors of self-efficacy (SE), perceived ease of use (PEU), perceived usefulness (PU), attitude toward AI (ATU), and anxiety (AN), which explain the teachers' perspectives to adopt AI tools.

In this, self-efficacy was a dominant factor, where teachers confident in their ability to use AI tools would then perceive them as more useful and easier to integrate, creating a positive attitude towards adoption.[7] This underscores the need for targeted professional development programs that build technical competence and confidence, helping educators see AI as an accessible and beneficial addition to their instructional toolkit. On the other hand, anxiety negatively impacts adoption. These indicators in this study were interesting in creating the gateway to AI tool adoption for teachers, and shapes my perspective about how teachers' attitudes toward AI are crucial. By designing professional development with hands-on, experiential training that demystifies AI systems, institutions can help their educators overcome apprehension and be more inclined to use AI for education.

III. Analysis of Communicative Context: Teacher Use of Generative AI

Currently, challenges faced by teachers in the realm of using GAI for education can be bucketed into 3 categories: Students with over-reliance on GAS for assignments and homework, Teachers with lack of knowledge about finding the distinguishing features between student work

[6] Youmei Wang, Chenchen Liu, and Yun-Fang Tu. "Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling." *Educational Technology & Society* 24, no. 3 (2021): 116–29. https://www.jstor.org/stable/27032860.

[7] Wang, Liu, and Tu, "Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling."

produced by AI and students themselves, and finally, the knowledge gap among educators on AI's educational benefits to improve the effectiveness of instruction.

With these challenges as the foundation for the analysis of the current communicative context, GAI can be characterized as having created the following communicative shifts: changing dynamics of teacher feedback through AI-generated comments, and the use of AI as a "proxy teacher" providing real-time feedback and personalized learning paths.[8]

In terms of changing dynamics, it has been established that with proper use of AI, teachers can augment the learning experience for their students, and better provide personalized help and feedback. GAI platforms and tools that have been developed for learning use cases specifically have become widespread and have introduced both opportunities and complications for classroom communication. On one hand, AI-generated assignments and feedback enable students to receive immediate, objective responses to their work. However, this also risks reducing meaningful student-teacher interactions, and painting everything as black and white. To properly support students to use GAI, it is crucial that schools and institutions use careful planning and strategy to utilize AI technologies in a way that supports diverse learning approaches by providing students with personalized guidance.

Wang et al. focus on the idea of Artificial Intelligence in Education (AIEd), which is a formal term for describing a rapidly developing field where teachers have the key role of deciding and adapting to GAIN as a tool within their classrooms.[9] Previous research has shown that teachers' ability and attitude towards GAI and understanding of how to use AI technologies have been key in proper utilization of AI for learning.

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[8] Lan and Chen, "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents."
[9] Wang, Liu, and Tu, "Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling."

IV. Proposed Solutions: Integrating GAI Effectively

Following the Human + GAI Team-Teaching Model mentioned by Lan and Chen in "Teachers' agency", human educators prioritize mentoring and emotional intelligence, while GAI teachers manage immediate assessment, adaptive content delivery, and regular feedback.[10]

Some key things to think about in this scenario would be ensuring smooth role assignment so there is no overlap between the Human and GAI teacher, and consistent learning protocols that are followed in the classroom. Further, with this type of relationship educators would also then be able to also revamp the current evaluation tools that they are using for students. This can also spill over into feedback systems, which would also then integrate data collected by the GAI teacher. Successful Human-AI collaboration needs more than just introduction of new technology, as it needs decisive institutional support as well as intentional role delineation. Looking at "Factors Affecting Adoption" by Wang et al., it is apparent that institutions must develop explicit protocols regarding the interaction between human educators and AI tools during learning. Human educators should focus on mentoring, moral instruction, and critical thinking training, with the AI systems performing adaptive content dissemination, real-time evaluation, and data analysis. This methodological approach ensures the best utilization of human and AI capabilities without replication or vagueness. Mindful designing of curriculum is something institutions need to invest in to implement AI tools in learning objectives and teaching planning without discontinuity.

To create a structural approach to this system, (aided by LLMs for structuring) I broke down this teaching relationship into 4 concrete steps:

1. Define Clear Role Assignments and Boundaries

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[10] Lan and Chen, "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents."

a. Schools should establish explicit expectations for Human educators and GAI systems to ensure tasks are distinct without confusion

b. Human educators: Emphasis on mentorship, emotional support and development, ethical reasoning, higher-order critical thinking

c. GAI teachers: Handling adaptive content delivery, automated assessments, progress monitoring

d. Conduct regular check-ins for Human educators to ensure the GAI systems are working well in their role
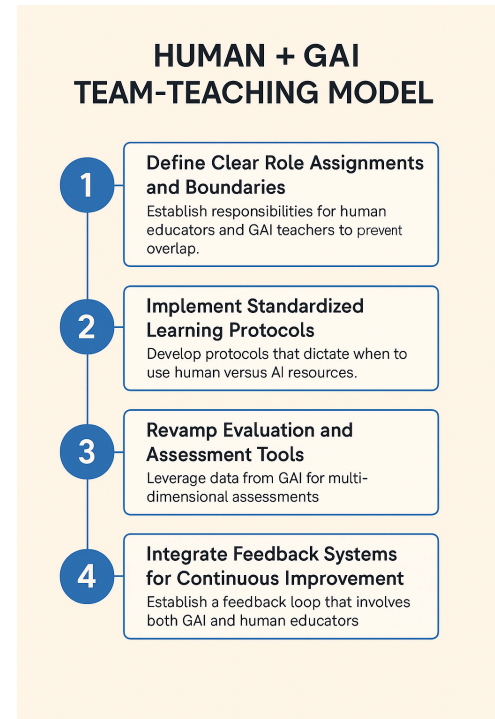
2. Implement Standardized Learning Protocols

a. Teachers should develop classroom protocols to dictate when students should be engaging with the Human teacher vs GAI system

b. Create a blended learning schedule to balance independent AI-facilitated learning time with human-facilitated group activities

c. Ensure protocols are both transparent and flexible, to allow students to understand how they can best benefit from both types of learning and adjust to their preferences

3. Revamp Evaluation and Assessment Tools

a. Leverage data collected by GAI tools to redesign current evaluation methods

HUMAN + GAI TEAM-TEACHING MODEL

1 **Define Clear Role Assignments and Boundaries**
Establish responsibilities for human educators and GAI teachers to prevent overlap.

2 **Implement Standardized Learning Protocols**
Develop protocols that dictate when to use human versus AI resources.

3 **Revamp Evaluation and Assessment Tools**
Leverage data from GAI for multi-dimensional assessments

4 **Integrate Feedback Systems for Continuous Improvement**
Establish a feedback loop that involves both GAI and human educators

     b. Use hybrid assessment models to allow students to show technical proficiency through A-graded assignments, but also application in real-world scenarios through Human teacher-evaluated presentations and assessments

4. Integrate Feedback Systems for Continuous Improvement

     a. Establish feedback loops for Human educators contextualize data provided from GAYI systems to offer targeted personalized feedback

     b. Collect student input on the effectiveness of both types of instruction to create a constant improvement loop

By following this type of structure, schools will be able to offer the best of both worlds, of Human teaching and GAI learning.

V. Consequences and Moral Issues

For educators:

There is a risk of diminished autonomy by integrating GAI teaching tools into the classroom. However, this risk can be mitigated by proper teacher empowerment through appropriate training. Schools and universities should implement programs for teacher professional development that emphasize AI literacy, allowing teachers to catch up with their students and be at the same level of technological know-how.[11] This can bridge the gap between students and teachers, allowing for there to be more effective communication between the two sides.

For pupils:

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[11] Lan and Chen, "Teachers' Agency in the Era of LLM and Generative AI: Designing Pedagogical AI Agents."

Students should be educated from a young age about striking a balance between encouraging real learning and using AI as a tutor. Though there are many use cases of AI in which students are able to benefit from using GAI, there is also the negative aspect of potential diminished critical thinking if excessive dependence is not controlled.[12] Given that students are using the internet at a younger age now, schools should be aware of this trend towards GAI and implement classes and frameworks for students to not become dependent on GAI for learning, but develop a healthy habit of using it as a tool and copilot.

Ethical dilemmas:

One of the most pressing issues with student-AI interactions nowadays is data privacy issues. The integration of generative AI in education raises questions about student data ownership, storage, and usage. When students interact with AI tools like ChatGPT or Perplexity, they often input personal information, show their learning patterns, and even provide their own reflections into these systems. For minors, this poses unique risks, as many AI platforms are not fully compliant with child data protection laws like the Children's Online Privacy Protection Act (COPPA) or the EU's General Data Protection Regulation (GDPR).[13][14]

Further, there is also an important discussion to be had about authenticity and academic integrity of student work. There exists a blurry line between "AI-assisted" and "AI-generated" work, which continues to be a controversial discussion. While some educators advocate for transparent AI use for brainstorming or editing, others argue that being able to use GAI for core cognitive tasks like structuring arguments or solving complex problems undermines the key

[12] Wang, Liu, and Tu, "Factors Affecting the Adoption of AI-Based Applications in Higher Education: An Analysis of Teachers Perspectives Using Structural Equation Modeling."

[13] FTC, https://www.ftc.gov/legal-library/browse/rules/childrens-online-privacy-protection-rule-coppa

[14] EU, https://gdpr-info.eu/

skills of critical thinking and intellectual ownership. There are the key challenges such as detection fallibility, where tools like GPTZero are not very good at identifying human-written vs. AI-generated text. The increased use of GAI also reduces student ability in tasks like summarization and coding will stunt student ability and development.

VI. Conclusion

Though there are challenges to using GAI, if integrated thoughtfully it can become a powerful tool for personalized and efficient education. In fact, given the quick rise of GAI as an emerging technology, schools and educators should act to gain a first-movers advantage and seize the opportunity to learn how to best use GAI for enhanced learning in the classroom. As a call to action: Teachers must develop AI literacy and participate actively in the design and ethical governance of pedagogical AI tools. Future research should explore long-term impacts of AI-mediated education on learning outcomes, teacher satisfaction, and student autonomy.

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