Shared Practices in Faculty-Driven Integration of Generative AI into Teacher Education Courses

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Abstract: Generative Artificial Intelligence (GenAI) is shifting the types and uses of computing tools in classrooms, necessitating study of how and what decisions are made about the use of AI in courses. All teachers will need to understand and be able to make important choices about GenAI for their learners. In this project, 25 teacher educators took an AI professional development course, and this paper describes their reflections and final projects. Participants at two large southeastern universities represented teacher preparation programs across all grade bands and disciplines. The shared practices the teacher educators used revealed ways GenAI can be a tool to support, not replace, a teacher. Limitations of GenAI applications are also discussed. The inclusion of all teacher educators in the project, and not just "faculty", enabled more participation, along with the flexible timing of the online course, and personalization of the final project.

Introduction

The past two years have proven to be a watershed moment for Generative Artificial Intelligence (GenAI) in education. In May 2023, the U.S. Department of Education's Office of Educational Technology released a new report entitled "Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations" (U.S. DOE, 2023). This report provided an expansive look at the current state of AI and GenAI in schools, closing with a series of seven recommendations for supporting AI integration that is human-centered, equitable, accessible, and transparent. Related to teacher preparation, the International Society for Technology in Education (ISTE), the globally recognized education nonprofit providing support for educators to leverage technology for meaningful learning, released a new whitepaper entitled, "Evolving Teacher Education in an AI World" (ISTE, 2024). This whitepaper offered a clear and practical framework for Educator Preparation Providers (EPPs) to engage with when beginning to integrate GenAI tools and skills into teacher preparation pathways.

Alongside these national reports and frameworks, state offices of education and nationally funded research projects have also been releasing guidance and resources around AI to provide recommendations and support to K-12 teachers. For example, the California Department of Education has created a collection of resources, webinars, and other tools for teachers to use and learn from when exploring AI in their classrooms (see https://www.cde.ca.gov/ci/pl/aiincalifornia.asp). Further, the North Carolina Department of Public Instruction provided vision and guidance with Generative AI Implementation Recommendations and Considerations for PK-13 Public Schools to provide definitions, links, guidance for drafting policies at the school level, and recommendations for teacher use with students. (https://go.ncdpi.gov/AI_Guidelines). In addition, the NSF-funded project AI4GA has developed resources for middle school teachers in Georgia related to a 9-week AI elective course (see https://ai4ga.org/) and is expanding to Texas.

Across these efforts, it is clear that education entities believe GenAI could have a rapid, significant impact on teaching and learning. However, none of these resources are immediately applicable to K-12 classrooms without teachers who have enough knowledge and confidence to engage with and adopt them. In a nationwide survey, higher education administrators and faculty shared that they feel AI will change their institution but do not feel ready for that change (Johnson et al., 2024). In that survey, respondents shared a desire for training in how to better use and manage AI use. Perceptions of K-12 preparedness levels likely parallel those expressed in higher ed, but there is a dearth of information gathered thus far. Chiu (2021) studied teachers' ideas about AI and found all the teachers noted the widespread presence of AI technologies and recognized their students will be AI users. His work shows

that students and teachers alike must develop foundational AI and GenAI knowledge and skills. For K-12 students to be prepared for, or even benefit from, GenAI, teacher development will be key. In the same way, in order for teachers to be primed, education faculty will need their own foundational understanding. Student learning must include teacher development, and teacher learning must include teacher education faculty development. This paper suggests best practices discovered while implementing AI education in teacher preparation programs and in providing professional development to instructors and supervisors teaching in those programs.

Study and Project Description

As part of a larger project about integrating computing into teacher education programs, a group of teacher educators affiliated with two large state universities in the United States took an 8-week course on AI fundamentals for educators in both K-12 and higher education. The 15-hour, self-paced course was created by ISTE and includes content related to machine learning, AI perception, generative AI, data mining, and using AI in educational settings. An AI online community on Facebook group and a series of synchronous webinars were also embedded in the course. Learners submitted weekly assignments and received feedback from moderators. The course had a registration fee that was funded through an external grant. Teacher educators from both universities started taking the course in Spring 2023 and five groups participated in offerings of the course in small cohorts. The final project in the course was to create a lesson or activity in AI fundamentals, which could be applied in the educator's course, or in some other way.

This paper provides analysis of shared features across final projects (n=25) and teacher educators' reflections after the course, collected through focus groups. To guide this work, we asked the following research questions:

1. How did a group of Education faculty apply AI in their teacher preparation programs, across grade bands and disciplines, after taking an in-depth AI literacy course?
2. What features of the course impacted its efficacy for teacher educators?

University 1 included a total of 19 teacher educators. Nine were staff and adjuncts teaching courses and PD providers, 6 were graduate students who were also teacher educators (preservice), and 4 were faculty (tenure track or teaching track). Fourteen of those participants took the ISTE AI course, and 13 completed the final project, applying their knowledge to one of their courses or in another professional development setting. Similarly, at University 2, 11 faculty (tenure track or teaching track) and one graduate student who is also a teacher educator (and teacher) completed the course. The broad inclusion of teacher educators throughout each college of education led to a wide variety of interdisciplinary projects, reaching learners from Pre-K through graduate school. After the conclusion of the online course, participants at University 1 were invited to join an online sharing session wherein they were able to discuss what they learned and what feedback they had about the course. Participants also briefly shared their final projects and brainstormed ways to continue and extend upon their learning in the course.

The materials created by the educators who participated were compiled and analyzed for content and focus. Table 1 summarizes what was created, with the originating university, grade level addressed, discipline, primary objective(s) beyond defining AI, and computing tools used.

Table 1. Project Information (n=25)

University	Grade level	Discipline	Primary objective beyond fundamental AI concepts	Tool
1	All Grades	Inter-disciplinary	Assist teachers with managing multiple tools	Multiple
1	All Grades	Inter-disciplinary	Give examples of AI resources, introduce AI ethics resources	Multiple
1	K-8	Science	Explore tools and a sample lesson using an AI tool	Multiple
1	Elementary	Science	Explore and use AI tools in science education	Multiple
1	All grades	Special Ed	Create a chatbot to analyze classroom routine	Chatbot creator
1	All grades	Inter-disciplinary	Explore various AI tools, consider benefits and drawbacks for classroom use	Multiple, including ChatGPT

1	Graduate	Inter-disciplinary	Provide reasons for AI use, and remind of ethical considerations	Multiple, including ChatGPT
1	Elementary	Inter-disciplinary	Provide examples, stimulate discussion on ethical use and use in the elementary classroom	None featured - broad categories
1	Elementary	Inter-disciplinary	Specifically explain generative AI, compare output of AI to similar prompts	Craiyon
1	Elementary	Inter-disciplinary	Explain major types of AI, Stimulate discussion on ethical AI creation and use	None Featured - broad categories
1	Elementary	Inter-disciplinary	Consider AI use for designing assessments, especially in PBL.	Multiple
1	Graduate	Education	Learn key AI terms, sample AI tools, and begin exploring ways to use AI in a classroom setting.	Multiple
1	Graduate	Higher Ed	AI ethics, provide AI resources for collaborative learning	Multiple
2	Pre-K	Literacy	Create multicultural and multilingual learning experiences	ChatGPT
2	Elementary	Literacy	Create lesson plans and multilingual instructional materials for bi-literate children	MagicSchool, ChatGPT
2	Secondary	Dual Language	AI literacy for youths in Mexico	ChatGPT
2	Secondary	Language Arts/English	Analyze tone and structure of writing	ChatGPT
2	Secondary	Language Arts/English	Create rubrics and summaries of text and evaluate text	ChatGPT
2	Secondary	Language Arts/English	Create lesson plans related to science of reading principles	ChatGPT
2	All grades	Special education	Adjust the reading level of text	MagicSchool, ChatGPT
2	All grades	Special education	Create progress monitoring plans and modifying instruction	MagicSchool, ChatGPT
2	All grades	Inter-disciplinary	Understand issues related to AI ethics, bias, and ML	Teachable Machine
2	All grades	Inter-disciplinary	AI tools for higher education	Multiple
2	All grades	Inter-disciplinary	AI literacy for teachers	ChatGPT
2	All grades	Inter-disciplinary	Impacts of AI in teaching and learning, ethical concerns of AI, AI literacy and tools for teachers	Multiple, including Claude, ChatGPT, MagicSchool

Findings

RQ 1: How did a group of Education faculty apply AI in their teacher preparation programs, across grade bands and disciplines, after taking an in-depth AI literacy course?

Almost all of the participants at both locations provided definitions and key terms in AI for their learners, and seven pointedly included ethics and ethical issues surrounding AI. While most (9 of 13) from University 1 featured multiple computing tools in their products, University 2 participants tended to focus on one or two tools (10 of 12). Across both groups, half had an interdisciplinary focus and almost half (11 of 25) included ChatGPT specifically. When considering the participants' experience, products, and reflection, several best practices and limitations were revealed, which are likely to be further explored as the use of AI in education continues.

Shared Practices and Emergent Applications

The variety of content and target audiences across the items developed suggests the enormous potential of GenAI in education. In this wide range, the practitioners in this project prominently honed in on the use of GenAI as a tool to support, not replace, a teacher (Bozkurt, 2023). The products often evoked the teacher as an editor or director of content, orchestrating volumes of information and offloading tedious tasks. In 2020 a McKinsey Company report estimated that 20-40 percent of teachers' time is spent on activities that might be automated (Bryant et al., 2020). This use of AI (automating tasks) is often cited as a benefit that teachers might quickly leverage to help them spend less time planning and more time directly connecting with students (Slagg, 2023).

Participants presented examples of support from AI tools which lessens teachers' planning load, such as by structuring a skeleton of a lesson that would be fleshed out by the teacher, who is able to personalize and edit for their students' specific needs and the classroom context. Wider access to this type of tool is providing more opportunities for efficiency and innovation by teachers who might have previously paid for this type of service (van den Berg & du Plessis, 2023). For example, participants found MagicSchool AI can generate basic lesson plans, quiz questions, and other artifacts which may then be personalized and edited by the teacher for their specific learning context.

To help fill in these skeletons, participants shared instances wherein AI tools could generate examples and provide fodder for overcoming writing blocks or periods of indecision about lessons, activities, and/or assessments. The prevalent expectation in K-12 schools to differentiate for all students' needs is weighty and time-consuming when done properly. Tools that can present reading material with different Lexile levels or assessments fine-tuned with students' personal accommodations could multiply teachers' ability to provide what each student needs, when they need it. Along with this use of AI comes the caveat that examples created with such tools could contain incorrect information and should always be checked before distribution by students and teachers (Wang, 2023).

As pointed out, when trying to create a complete product, the AI will often include information that is incorrect or incorrectly applied. For example, when creating a worksheet about a grammar rule, the tool might label parts of speech incorrectly. Some educators use these AI-generated content and errors to let students practice evaluating content. They will either let students find the errors as part of the learning task, when age-appropriate, or they will explicitly ask students to evaluate, for example, the tone of content that was created by GenAI. In this way, educators have turned the AI getting information wrong into a feature, not a bug.

When using generative AI to create a fully-developed resource, such as a quiz about current content, educators found that they got better results when they included an exemplar or two of the type of product or format that they had in mind (Hays et al., 2024). This prompting strategy of including examples is called one-shot or few-shot prompting, and it is particularly useful when the educator has a particular type of output that they want from the AI.

Specifically, regarding modification for special education and student-specific accommodations, AI tools also provide ideas that could be leveraged when creating individualized education plans and collaborating with other teachers regarding student needs. AI tools can also specifically address some accommodations. From the ISTE AI course participants learned about AI speech-to-text technologies which can make writing by voice easier for visually impaired people and students with dysgraphia. Likewise, the Hand Talk plug-in uses AI to translate web content from English to American Sign Language to support deaf and hard-of-hearing students.

Finally, AI has enabled media creation that used to require an advanced skill set, such as making children's storybooks that are representative of the class or generating a story from students' ideas. In the ISTE AI course participants learned of multiple ways teachers and students alike can use AI technologies to support media creation in the form of images, video, music, and more.

Limitations for Use

Limitations noted by the participants, and expressed in the content of their works, show how GenAI cannot replace teachers. In terms of that training, GenAI is always an apprentice or intern, forever re-learning context from the prompts of the expert. The information expressed in the prompt cannot be applied in future contexts without express reference to said encounter.

Another glaring issue is the continual emergence of inaccuracies and blatant errors in the output of AI tools. Teachers cannot use AI to create materials, and then immediately step into the classroom to use them. Items

created must be checked for accuracy and compared to what the educator knows would be an appropriate application of said information. In one case, a participant created a chatbot for a course syllabus and LMS information, checked its responses, and released the tool to students. After a period of time, the chatbot started giving incorrect information in response to questions and the instructor had to discontinue use.

While many people are excited about the possibility of GenAI providing personalized feedback on assignments (Sarlin & Kornell, 2024), especially writing assignments, that would greatly reduce educators' workload, our educators were less enthusiastic about this possibility. A critical step of AI use is evaluating its output. Thus, an educator must be familiar with a student's work to evaluate whether the AI has provided appropriate feedback. While this process might save educators some time, it is not the self-contained process that many hope (or fear) (Vee, 2024).

Similarly, many people want AI to become an affordable, personalized tutor for every student. However, as just stated, a critical step of AI use remains evaluating its output. Students should not be required to determine whether feedback is correct or not. Thus, tutoring by an AI agent requires extremely well-defined tasks and responses or oversight from non-AI agents who are familiar enough with the content area to evaluate its output (Yang & Zhang, 2019). While the promise of learning from an AI tutor is enticing, it does not preclude the need for educators in the loop.

On a practical note, educators sometimes had to adapt their plans to account for the limitations of AI tools' free usage tiers. For example, they might run out of prompts when generating images without a paid subscription. In addition, they often could not use AI tools to process video files due to the high amount of data, and subsequent cost. In the case that educators had access to a premium AI tool, they could not count on their students having access to premium tools, making free tools their only legitimate option.

RQ 2: What features of the course impacted its efficacy for teacher educators?

Opening the ISTE AI course to "teacher educators" rather than just faculty enabled a wider reach of the course and materials produced. Preservice and in-service teachers in programs across the Colleges of Education have experienced and will continue to receive the benefits of instructors (not solely faculty) who have begun to integrate AI information in their courses and professional growth sessions. The flexibility of a self-paced course may have influenced higher participation in the ISTE AI course than other offerings attempted at university 1 during the study period. Sessions offered as stand-alone, synchronous presentations were not well attended. In addition, the high-quality materials used in the ISTE AI course were often integrated into the final projects. Finally, the open-ended nature of the final project allowed participants to apply concepts to their area. These areas varied from in-service teacher PD to pre-service graduate students in secondary science and bachelor's undergrads in elementary education. Most participants do not do research in computer science or technology. Participants have become part of an informal community sharing their work products with colleagues in addition to using them in their own teaching.

Conclusion

The best practices divined in this work largely center on the ability of AI computing tools to quickly analyze and organize information, provide examples, and potentially reduce the amount of time educators spend planning. Many of the valued features above are reflected in the work of Chan and Hu (2023) gathering higher ed students' perceptions on the potential value of using AI tools for learning. Those students cited personalized, immediate learning support, writing and brainstorming support, research and analysis support, visual and audio multi-media support, and administrative support.

The limitations of the tools and the ethical considerations presented by the participants call for balance between the operational and pedagogical dimensions AI use in the classroom (Cacho, 2024) and a teacher's work. Tools which might be used to create items and enhance productivity must also be filtered through the teacher's knowledge of what works in the classroom (based both on study of research and personal knowledge of the learners). Teacher educators (just like their students) will not be able to apply the information processing and outputs without applying their human skills and knowledge of context.

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