Clinical Practice and the Opportunities of Technology

Joanne M. Van Boxtel
Vanguard University
Heather E. Taylor
California State Polytechnic University Pomona

Abstract

Clinical practice offers preservice teachers (PSTs) the opportunity to learn from experienced educators, gaining the knowledge, skills, and dispositions necessary to become profession-ready. Teacher education scholars emphasize the importance of acquiring knowledge-in-practice for reflection and theoretical development as well as a developmental approach to clinically-based teacher preparation. Building on this notion, we propose that embedding technology through structured coursework and field experiences throughout the arc of clinical practice enhances PSTs' ability to apply innovative technologies in teaching and deepen self-reflection. Educator preparation programs can capitalize on the utility of innovative technologies to enrich the clinical practice experience through: (a) authentic microteaching, (b) explicit teaching of AI literacy, (c) case study instruction, (d) AI-generated resources, (e) performance feedback and formative assessment, and (f) video-based remote supervision. Drawing from

Joanne M. Van Boxtel is an associate professor and faculty director of special education in the School of Education at Vanguard University, Costa Mesa, California. Heather E. Taylor is a professor and coordinator of the education specialist program in the College of Education and Integrative Studies at California State Polytechnic University Pomona.. Email addresses: joanne.vanboxtel@vanguard.edu & hewizikowski@cpp.edu

literature and reflecting on our experiences, we examine the use of technology throughout the arc of the clinical experience of education specialist PSTs, from early fieldwork to advanced student teaching, to prepare profession-ready inclusive educators. We address ethical considerations for technology use in teacher preparation, particularly AI, and best practices for technology-enhanced clinical experiences.

Keywords: clinical practice, teacher preparation, technology integration, practice-based teacher education

Introduction

Clinical practice is an opportunity for preservice teachers to learn from experienced educators with support and guidance to become "profession-ready" with the knowledge, skills and, dispositions needed when they enter the classroom (Commission on Teacher Credentialing [CTC], 2022.; National Education Association [NEA], 2020). Teacher education scholars have proposed that the "acquisition of knowledge-in-practice" is essential for reflection and theoretical development, and arranging preservice teachers' (PSTs) experiences developmentally is a first step for clinically-based teacher preparation programs (Henning et al., 2016). We build on this notion and propose that by embedding technology through structured coursework and field experiences throughout the arc of clinical practice, PSTs become more adept at applying innovative technologies to teach content and engage in self-reflection. For the purposes of this article, we draw from Dieker et al.'s (2024) notion that innovative technologies in teacher preparation are those that require faculty to adopt both a rapid iterative mindset and a continuous improvement mindset as technology continues to evolve at a rapid pace. Similarly, we employ Mishra and Koehler's (2006) Technological Pedagogical Content Knowledge (TPACK) framework and *learning technology by design approach*. The TPACK framework asserts that technological knowledge, content knowledge, and pedagogical knowledge are dynamic and cannot be taught in isolation but rather in an integrated and purposeful manner. Our approaches to innovative technology integration into our teacher preparation courses align with the *learning technology by design approach*, where "... emphasis is placed on learning by doing, and less so on overt lecturing and traditional teaching" (p. 1035).

We propose that educator preparation programs can efficiently capitalize on the utility of innovative technologies to enhance the clinical practice experience, beginning with early field experiences to advanced clinical practice (e.g., student teaching). through: (a) authentic microteaching, (b) explicit teaching of AI literacy, (c) case study instruction, (d) AI-generated resources, (e) performance feedback and formative assessment, and (f) video-based remote supervision. Further, we illustrate through reflections of our experiences how ensuring PSTs use innovative technology within their programs can facilitate teacher self-efficacy with technology, which has been shown to predict pre-service teachers' use of technology in the classroom (Zee & Koomen, 2016). We draw from the literature and our reflections on utilizing technology throughout the arc of clinical experiences for education specialist PSTs, from early fieldwork to advanced student teaching, to prepare profession-ready, inclusive educators. We also reflect on important considerations for ethical use of technology for teacher preparation, especially Artificial Intelligence (AI), as well as best practices for technology-enhanced clinical experiences.

Scaffolding Practice-Based Early Field Experiences with Technology

Contemporary teacher education must be able to adapt to the rapidly evolving landscape of technology and the increasing complexity of TK-12 classroom dynamics (Darling-Hammond & Hyler, 2020). By integrating AI and diverse technology tools into teacher education, we can move beyond traditional pedagogical approaches and offer pre-service teachers richer, individualized, and more authentic experiences through the learning technology by design approach (Holmes et al., 2019; Mishra & Koehler, 2006). Ultimately, the goal is to empower future educators with the critical thinking, adaptability, and technological fluency required to navigate diverse student populations and create inclusive, equitable, effective transitional kindergarten (TK)-grade 12 learning environments (UNESCO, 2024). The following section describes how we have sought to innovate our practices and better prepare our PSTs for the challenges and opportunities of 21st-century teaching. Our focus is on practical application through enhanced microteaching, AI-generated case studies, and personalized learning resources, which can cultivate deeper understanding and proficiency (Zawacki-Richter et al., 2019).

Authentic Microteaching

Microteaching using video-recorded lessons and mini-lessons employs the *learning technology by design approach*, and it is an effective way to scaffold the student teaching experience in a supportive and confidence-building manner. Microteaching is a practice-based learning opportunity that offers the opportunity for PSTs to demonstrate the application of theory and research to practice with their peers through analysis of their video lessons under the guidance of their instructor. PSTs video record themselves implementing a specific teaching practice or behavior with their peers, and they are guided in reflecting on their emerging expertise using structured assessment protocols to facilitate explicit, targeted feedback from peers (CEEDAR, 2025a). Microteaching involves four stages: planning, implementation, reflective commentary, and collaborative reflection. In the planning stage, the faculty ensures PSTs have a foundational understanding of explicit instruction and then models how to develop an explicit instruction lesson plan aligned to baseline student data. In the implementation stage, PSTs are divided into groups of three and collaborate to teach the lesson with one student as the teacher and two peers as students, with one of the peers video recording the lesson. As PSTs then move into the reflective commentary stage, the instructor provides guidance and models how to complete a data-based lesson analysis where instructional events are tallied and connected to theories of learning and research they have learned. PSTs then watch the video lesson and pause the lesson at specific points to make meta-cognitive comments about what they observed. Finally, in collaborative reflection, PSTs deepen their ability to reflect and analyze their instruction using a Collaborative Assessment Log (CAL), where they respond to probing questions about the students' learning as well as what they learned about their students through the experience. A lesson template, reflection commentary template, and sample syllabus explaining the process are all available on the CEEDAR Microteaching HLP #16 webpage (CEEDAR, 2025a).

We have introduced microteaching in literacy and mathematics instructional methods courses with teacher PSTs using video analysis and feedback platforms such as Edthena (2025) and GoReact (2025). For our respective programs, microteaching experiences are connected to signature assignments of intervention case studies. We have found microteaching to be effective for numerous reasons. Microteaching represents a practice-based experience in a more low-stakes environment where PSTs teach minilessons and receive feedback from peers. It has also provided us with insight into gaps or misconceptions between theory and practice at an early stage in the program when reteaching or individualized PST support may be needed. Microteaching with video-based performance feedback gives PSTs an introductory experience with capturing and preparing videos for upload to the high-stakes Teacher Performance Assessment (TPA) and reduces potential technological barriers and anxiety associated with the performance assessment experience. Finally, microteaching helps prepare PSTs for advanced student teaching where we have used video-based remote supervision with the same platforms. We have found that early experiences with microteaching also provide instructors with several benefits in addition to insight on PSTs' understanding of teaching practices or behaviors associated with the methods course content. Those benefits are: (a) opportunities to provide individualized coaching and mentoring to students through annotated, timestamped feedback, (b) enhancing community building amongst PST cohorts within methods courses, and (d) a chance to guide PSTs in reflecting more meaningfully on feedback.

Explicit Teaching of AI Literacy

Artificial Intelligence (AI) has incredible potential for use in clinical practice and has numerous applications of the TPACK framework. At the most foundational level, AI can reduce administrative tasks and enable PSTs to spend more time being creative in their teaching. Platforms like Magic School, PlaygroundIEP, and SchoolAI can draft IEP academic and behavioral goals based on student data. Reports and emails can be easily drafted and translated using Large Language Models (LLMs) (e.g., ChatGPT, Gemini, Co-Pilot). Lesson plans and classroom activities can be developed in minutes using a wealth of AI tools. Social stories, summaries, and study guides are created quickly and easily. But there is so much more AI can do.

Guan, Zhang, and Gu (2025) and Abualrob (2025) studied PSTs and their perceptions and capabilities with AI use in the classroom. While many PSTs believed they were successful at using AI, most of them had very little understanding of how AI could be integrated into their practice. Most PSTs used LLMs as a de facto search engine to find information on a particular topic or to create a lesson plan or activity. They had very little actual AI technology literacy and saw AI as a manipulative tool rather than educational technology that could revolutionize education. Not only can AI be used as a teacher tool, but the implications for individualized learning, student agency, and engagement are incredible. This is the knowledge that teacher preparation programs need to be developing in PSTs.

We need to develop clinical practice experiences for our PSTs that allow them to use AI tools to acquire knowledge, deepen application, and then leverage their AI literacy to create and transform classrooms (UNESCO, 2024). Most PSTs come to us with basic AI skills (i.e., search and lesson plan tool). They can quickly learn how to use AI to assist in their clinical placement. Our PSTs complete the MagicSchool Level 1 and 2 Certification courses during one of their foundational courses that focuses on Universal Design for Learning (UDL) and learner variability (MagicSchool, 2025). These learning modules give PSTs best practices of AI use in education, including ethical concerns and considerations. There is also a newly launched California State University (CSU) systemwide learning microcredential for students that has modules on how AI works, ethical considerations, and effective prompt engineering skills (CSU AI Commons, 2025) Modules such as these give PSTs a good foundation of AI knowledge. But we need to assist them in deepening their knowledge of AI use. We need PSTs to be a part of ongoing discussions and practice related to the transformative power of AI in the classroom. For example, when provided the prompt: "As a teacher preparation faculty member for preservice special education teachers, how can I assist preservice teachers deepen their knowledge of AI use in the classroom, as well as being able to create innovative learning experiences for students with disabilities? Create a bullet list of 10 points that I can share with colleagues." Chat GPT 2.5 Flash gave the following response. (Response has not been edited.)

- *Integrate AI Literacy Across the Curriculum*: Don't relegate AI to a single module. Weave discussions and practical applications of AI into various courses (e.g., assessment, instructional strategies, behavior management) so preservice teachers see its relevance across their future roles.

- *Showcase Practical AI Tools for Special Education*: Introduce and provide hands-on experience with specific AI-powered tools that directly benefit students with disabilities. Examples include text-to-speech/speech-to-text programs (e.g., Microsoft Immersive Reader), adaptive learning platforms (e.g., DreamBox Learning), AI-powered communication aids (e.g., InnerVoice), and tools for generating differentiated materials (e.g., Eduaide.ai, MagicSchool AI, Brisk Teaching).

- *Emphasize Differentiated Instruction and Personalization*: Highlight how AI can significantly enhance differentiated instruction by providing personalized learning paths, adaptive feedback, and tailored content based on individual student needs and progress data.

- *Focus on IEP Development and Data Analysis with AI*: Explore how AI can streamline administrative tasks related to IEPs, such as drafting reports, summarizing data, and suggesting educational goals. Discuss how AI can help analyze student data to inform instructional decisions and progress monitoring.

- *Address Ethical Considerations and Bias*: Dedicate specific time to discussing the ethical implications of AI in special education, including data privacy, algorithmic bias, equitable access, and the importance of human oversight. Encourage critical thinking about the responsible and ethical use of AI.

- *Foster Creativity in AI-Enhanced Learning Design*: Challenge preservice teachers to move beyond basic AI applications and design truly innovative learning experiences. Encourage them to think about how AI can facilitate multisensory learning, gamification, virtual reality experiences, and interactive content for diverse learners.

- *Encourage Collaboration and Peer Learning*: Create opportunities for preservice teachers to share their explorations of AI tools and strategies with one another. Facilitate group projects where they design AI-supported interventions or lessons for specific disability types.

- *Bring in Guest Speakers and Practitioner Perspectives*: Invite current special education teachers who are successfully using AI in their classrooms to share their experiences, challenges, and successes. This provides real-world context and inspiration.

- *Promote Research and Evidence-Based Practices*: Encourage preservice teachers to critically evaluate AI tools and strategies, looking for evidence of their effectiveness for students with disabilities. Discuss the importance of ongoing research in this rapidly evolving field.

- *Model Lifelong Learning and Adaptability*: Emphasize that AI is constantly evolving. Encourage preservice teachers to develop a mindset of continuous learning and adaptation regarding new technologies, recognizing that their professional development in AI will be ongoing.

Technology-driven and AI-generated Case Studies

Case-based instruction, often synonymous with case study, is a research-based method to prepare PSTs for the classroom through reflection and analysis of a realistic and contextually situated classroom situation presented in a narrative form of a scenario or a vignette (Kagan, 1993; Helleve et al., 2023; Merseth, 1990). Case-based instruction has been utilized in teacher preparation programs for decades to bridge the theory-to-practice gap by addressing common purposes for case uses, such as studying teacher cognition and belief (Kagan, 1993), introducing PSTs to key concepts and knowledge needed to teach (Gravett et al., 2017), and analyzing complex situations highlighted by theory (Helleve & Ulvik, 2023).

PSTs who have experienced case-based instruction in their teacher preparation programs have reported its effectiveness in multiple studies. For example, in Gravitt et al.'s (2017) study of approximately 350 PSTs in a four-year undergraduate teacher preparation program, findings indicated that PSTs who participated in small group case-based instruction were actively engaged. In addition, PSTs reported a high degree of satisfaction with the method as well as appreciation for the opportunity to vicariously "think like a teacher" (pg. 379) and the opportunity to better appreciate the relevance of theory and literature in relation to teaching practice. In a similar investigation of 55 PSTs' perceptions of case-based instruction within a teacher preparation program, Helleve and Ulik (2023) reported that all participants were for case-based instruction within their program. Common themes of candidate perceptions of the benefits of case-based instruction that emerged from their data were: (a) cases show every situation is unique, (b) cases link theory to practice, and (c) cases can be perceived in multiple ways. Both investigations highlighted the ability of PSTs to develop critical professional judgement in relation to socioculturally contextualized situations in the classroom.

We have incorporated technology-based case studies for a variety of purposes within our respective teacher preparation programs as a springboard for the *learn by doing approach*. One effective method is using carefully vetted practitioner videos that highlight effective and high-leverage practices (HLPs). Using the Teacher Performance Expectations (TPEs) for California and evidence-based practices for instruction and positive behavior supports, we have designed small group case study opportunities in both in-person and online environments. For example, we have integrated the Council for Exceptional Children's (CEC) HLP videos demonstrating collaboration, data-driven planning, instruction in behavior and academics, and intensifying interventions to meet student needs as well as the Teaching Channel Exemplar Videos to both illustrate effective instruction and provide opportunities for small group discussion and analysis of "look fors" within the selected videos. We have also used AI to generate authentic vignettes by creating prompts for case generation, ensuring prompts align with Merseth's (1990) three key elements of case studies. That is, case studies must be descriptive and based on a real-life problem or incident, they must seek to present an unbiased, multidimensional perspective, and the situation presented must require analysis, planning, decision-making, or action. By engineering a well-defined contextualized prompt for case study generation, we have saved time in writing scenarios through recall of experiences and/or through researching to locate open-source, vetted scenarios. We have crafted basic details of a student demographic and learning needs profile and prompted AI to generate vignettes where

PSTs are required to analyze and discuss the student profile and make decisions about nuanced classroom situations. This simulates what it is like to make in-the-moment decisions while encouraging PSTs to demonstrate application of theory and practice regarding student learning, student engagement, positive behavior, and social-emotional learning supports, etc. We have used AI-generated vignettes as a formative assessment of PSTs' understanding and application of pedagogical expertise for individual assignments, as well as discussion prompts, so PSTs can analyze the case study and make decisions based on multiple perspectives. One such example of a case study prompt and follow-up prompts are included here, using Google Gemini 2.5 Flash. We discuss effective prompt generation in greater detail later in this article.

- ◆ I am a professor teaching an educator preparation class on the topic of inclusive education. My students are learning how to apply UDL principles in the general education classroom to make learning accessible for all TK-12 students. Write a two-page case study on applying Universal Design for Learning during a co-taught science lesson in the elementary classroom for preservice general and special education teachers to complete in mixed groups of three. Be sure to include learner variability elements in descriptions of the students in the classroom. Include an activity at the end that has students solve a challenge of making content accessible for all students in an inclusive classroom. Be sure they need to apply the UDL principles in their response.
- ◆ Add more detail to the classroom context.
- ◆ Include elements of curriculum design.
- ◆ Create a challenge for preservice teachers based on this case study to complete in groups of three collaboratively.
- ◆ Create a scoring rubric for the challenge activity in table form.
- ◆ Create a case study and rubric on the same topic using the same initial prompt for secondary preservice teachers.

AI Generated Resources

AI resources, generated by faculty or clinical practice supervisors, are an excellent way to model the learning technology by design approach while simultaneously providing "just in time" support for PSTs during fieldwork experiences and during clinical practice. Table 1 lists resources we have used in our respective programs. It is important to keep in mind the essential human role and double-check AI-generated resources for clarity, correctness, and bias. For example, when asking an AI tool to create a lesson plan for a 5th grade class on the water cycle, it is important to be sure that: (1) the content is correctly aligned to the Next Generation Science Standards (NGSS) and Framework; (2) the lesson plan is created using best practices; (3) the output does not contain bias towards any group of students and; (4) the lesson is accessible to all learners, and small tweaks need to be made either using the AI tool to correct errors or editing the resource yourself to be sure you are sharing a high-quality, standards-based resource with your PST (see Table 1).

Table 1
AI-Generated Resources to Support PSTs in Clinical Practice

Resource	*Example*	*Example of Tools Used*
Strategy "Cheat Sheets"	Higher-order thinking skills (HOTS) suggestions tailored to the PSTs' placement	ChatGPT (https://chatgpt.com) Co-Pilot (https://copilot.microsoft.com/chats/VySx7f1bkn2AKhaMstACV) Gemini (https://gemini.google.com/app) Magic School (https://app.magicschool.ai/tools) EL (https://app.customgpt.ai/projects/14678/ask-me-anything?embed=1&shareable_slug=233792c3a0deb7bcfac31baaab211673)
Professional Development	Supervisor created learning module or information brief tailored to PST's specific area of need	Any of the above tools
	Learning bot programmed by the instructor where the PSTs can ask content, strategy, and/or pedagogy questions tailored to their individual needs.	PlaylabAI (https://www.playlab.ai/) Raina the chatbot on Magic School (https://www.magicschool.ai/) Ludia (https://poe.com/Iudia) EL (https://app.customgpt.ai/projects/14678/ask-me-anything?embed=1&shareable_slug=233792c3a0deb7bcfac31baaab211673) Gemini gems (https://gemini.google.com/gems/view)
Lesson Plan Development	Lessons focused on standards, UDL strategies, and differentiation - focusing on the strategies or pedagogy the preservice teaching may be struggling with. This is followed by a discussion of the strategy during a coaching session.	Any of the above tools

(Table 1 continued on next page)

Table 1 (continued)
AI-Generated Resources to Support PSTs in Clinical Practice

Resource	*Example*	*Example of Tools Used*
Lesson Plan Revisions	PSTs can be shown how to revise lesson plans using AI to include stronger elements of differentiation, specially designed instruction, or UDL, for example.	Any of the above tools
Grading Rubrics	Rubrics based on individual student goals or whole class rubrics based on a project or assignment prompt	Any of the above tools
Personalized Assessment and Progress Monitoring (CBM)	Individualized for students in the PST's classroom (e.g. word chains for reading intervention focus skill).	Any of the above tools Google Forms (https://docs.google.com/forms/u/0/) Microsoft (https://forms.office.com/Pages/DesignPageV2.aspx)
Personalized Learning bots for TK-12 Student Use	Bots can be created that deliver content and reinforcement, build vocabular and language development, provide review and practice support, provide AT, such as text to speech, speech to text, or visual aids, develop personalized learning pathways, provide emotional and social support, and enhance engagement and motivation through gamified learning, personalized feedback and support, and interest-based learning. They can also be developed to answer basic student questions, provide reminders and organization, break down tasks, and facilitate group work. (Diliberti et al, 2024)	PlaylabAI (https://www.playlab.ai/) Raina the chatbot on Magic School (https://www.magicschool.ai/) Ludia (https://poe.com/Iudia) EL (https://app.customgpt.ai/projects/14678/ask-me-anything?embed=1&shareable_slug=233792c3a0deb7bcfac31baaab211673) Gemini gems (https://gemini.google.com/gems/view).

Prompt Engineering

Prompt engineering, or prompt crafting, is an important component to be purposeful in applying the TPACK framework to design learning experiences and ensure higher-quality output from AI tools. Prompt engineering is one example of why the human element of AI use is so important. Our prompts guide the AI, and the clearer we can be, the more precise, relevant, and correct the output will be. This decreases the time spent trying to get the responses we need from the LLM. With clear prompts, we can also control the tone, style, and format of AI responses as well as mitigate bias that may occur in the output (Google, 2024). One model we use to be sure we are getting effective output is the Five S Model.

1. *Set the scene*. Begin your prompt with relevant information about you (your role, level of experience, etc.) and the environment you're working in to provide context for the tool's output. Example: "I am faculty in a teacher preparation program preparing education specialists."

2. *Be specific*. Clearly define the task and what you want included. Example: "My preservice teacher I am supervising is struggling with integrating higher-order thinking skills into their daily lessons. They are currently teaching math to students in grades 6-8 with mild to moderate support needs in the classroom. The students have disabilities such as dyslexia, ADHD, and autism." *This is a good place to remember to protect privacy. No information should be input, such as school name, district, university name, student names, or teacher name.*

3. *Simplify language*. Avoid jargon and acronyms and use everyday conversational language to state your request. Example: "I am looking for higher-order thinking skills that they can easily scaffold into their lessons."

4. *Structure the output*. State what form you want the output to take (a table, a list, etc.) and include a rubric. You can also ask for the output to include specific sources (e.g., CEEDAR, IRIS Center, PBIS.). Example: "Create a bulleted list for this preservice teacher of 10 higher-order thinking skills they can integrate into their math lesson plans that are appropriate for this range of grade levels. Please be sure to use the Reading Rockets website as one reference source."

5. *Share feedback*. Remember that this is a chat conversation. Continue to provide feedback and make adjustments until you generate the desired content. For example, you could ask, "What difficulties might my preservice teacher have when implementing this list?" (Adapted from AI for Education, 2025).

Technology and Performance Feedback

As PSTs progress through their teacher preparation programs, it is essential to teach and model reflective teaching, and microteaching is highly conducive to deepening reflective ability. Nagro (2020) has demonstrated that PSTs can be taught to "focus on others before focusing on themselves" (p. 430) through video analysis that is highly structured and scaffolded using a reflection continuum aligned to an instructional framework. Using tools like GoReact (2025) for initial microteaching experiences provides a rich opportunity for PSTs to practice self-reflection, as instructors can facilitate deeper reflection by identifying specific criteria and providing guided prompts to deepen and strengthen the quality of peer feedback. For example, applying Nagro's (2020) work, criteria for PSTs to look for in microteaching lessons can include *creating a positive and safe learning environment, establishing expectations for content-specific learning*, etc. PSTs then comment to peers with a describing statement (e.g., I heard and saw you review the lesson objective with your student, and you described what the student would know and be able to do, which establishes expectations for content specific learning), an analysis statement (e.g., I saw that you modeled the CRA approach to teaching place value in this lesson), a judgement statement (e.g., I noticed that when you modeled how to use the base 10 manipulatives, the student was engaged and appeared to understand the concept of place value), or an applied statement (e.g., You might want to consider incorporating a vocabulary graphic organizer to facilitate student understanding of the precise mathematical terminology you are using and teaching).

We have built on the benefits of microteaching by adding an authentic teaching experience of delivering an explicit instruction lesson to a focus student as a component of a case study signature assignment. During the implementation phase of microteaching, we required PSTs to teach and video record an explicit lesson they developed with a focus student twice during the semester. Lessons were uploaded to GoReact (2025) for peer feedback. PSTs were grouped to provide feedback through the platform based on the grade level of the focus student and/or the content area of their selected intervention (e.g., teaching decoding skills, teaching basic computation skills). We provided explicit directions for the peer review process. Peers were directed to link a minimum of 2 teaching strengths in the video to specific TPEs, as well as a suggestion for improvement linked to a TPE. Examples and non-examples of this feedback were provided and reviewed prior to the assignment. Peers were also instructed to note if the components of an explicit intervention lesson were present: advance organizer, direct instruction, modeling, guided practice, independent practice, and closing. Through this adaptation, we have found that the benefits of microteaching are multiplied as PSTs teach in a more authentic classroom situation while also reaping the benefits of explicit feedback from the instructor and peers.

We further augmented the microteaching experience and impact of peer feedback on microteaching lessons by having PSTs present their case study findings via a poster session symposium. The goals of the symposium were threefold: 1) to assess PSTs' growth toward TPE 6: Developing as a Professional Educator via anonymous peer review, 2) to facilitate PSTs' expertise with using technology for data collection of TK-12 students through modeling and practice (Zee & Koomen, 2016), and 3) to conduct anonymous formative assessment from PSTs of their perceptions of the case study assignment and symposium experience. To achieve our goals, we designed two formative assessment tools using Google Forms to ensure anonymity, which has been suggested in the literature as a way to mitigate students' concerns about the social nature of peer feedback (Senden et al., 2024). We created QR codes for both forms and labeled them accordingly before posting them at various places around the presentation room. We first grouped PSTs into three presenter groups. While each presenter group was sharing their intervention case study poster, the other two groups of peers rotated and conducted an anonymous peer review. Peers scored the presenters on items such as ability to engage with peers, effectiveness in answering questions, and expertise in explaining case study findings. Each PST completed an exit ticket with Likert items that required them to self-assess the effectiveness of the assignment in implementing specific HLPs aligned to the case study and symposium. We geared open-ended items toward eliciting PSTs' descriptive feedback on strengths and areas of improvement for the case study assignment and symposium experience, and we have found both the quantitative and qualitative data from this formative assessment to be more helpful and specific in terms of continuous improvement than aggregate data available from formalized end-of-course evaluations.

We continue to pilot innovations in technology for reflective feedback and formative assessment of PSTs' scaffolded clinical experiences. Recently, Kennedy et al. (2021) have developed a free research-based multimedia tool for video analysis and automated and editable feedback called COACHED. This web app is designed to provide "practice-based feedback and PD to teacher PSTs" (Kunemund et al, 2022, p.71) and includes five key components: a classroom teaching

(CT) scan observation tool, an automated and editable feedback form, content acquisition podcasts (CAPS), self-reflection matrices, and a data dashboard. PSTs upload their video lessons to COACHED, and the instructor observes the lesson while providing data-based, time-stamped feedback to the PSTs. Upon completion of the observation, an editable coaching feedback form will be generated automatically and shared with the PSTs. What is unique to the CT scan is that the observer uses the tool to "document, not evaluate" teaching (p. 72) using quality indicators called implementation markers that serve as quality indicators for specific evidence-based practices such as modeling for explicit instruction. We are piloting COACHED with teacher PSTs and see great potential and utility since it is freely available.

Advanced Clinical Practice/Student Teaching

Video-based Supervision Models

Video-based remote supervision of advanced clinical practice/ student teaching has proven essential for teacher preparation in the post-COVID era. Many of us had no choice but to rapidly pivot to technology-driven clinical practice and supervision models, and for some programs, those changes have been sustained due to the utility, effectiveness, and time and cost-saving nature of video-based remote supervision. The power of time-stamped video analysis is in the ability of PSTs to reflect on their practice while viewing themselves in the moment as captured on video, versus traditional in-person supervision models where reflection of teaching is based on recall (Naffizinger & Fawson, 2014; Nagro, 2020; Rosaen et al., 2008; Van Boxtel, 2017). Again, commercially available platforms like GoReact (2025) and Edthena (2025) are ideal for this purpose as they are designed to enable PSTs to practice emerging pedagogical and classroom management skills through video analysis of their lessons, along with annotated feedback from instructors, peers, and supervisors, as a driver of skill development. Video-based supervision models target all three strands of the TPACK framework in a powerful way.

In our respective programs, we have incorporated video-based remote supervision models for PSTs pursuing multiple subject, single subject, and education specialist credentials. We have used video-based remote supervision for the advanced student teaching phase of clinical practice in both a hybrid model (i.e., half of the classroom observations in person, half of the observations conducted through the platform) as well as fully remote supervision models when PSTs' placements are not geographically conducive to a hybrid model. We integrated the model first by developing loaner supervision kits consisting of hardware such as an iPad mini, tripod, and lanyard for audio capture. However, tools such as SWIVL (2025) enable PSTs to use their smartphones and include wireless lanyards with microphones for audio capture. A fully remote model of video-based supervision is feasible for meeting the needs of high-needs rural districts struggling to recruit diverse teacher PSTs as well as counties deemed as "teacher education deserts" (p. 3) where there is no teacher education program within a 60-mile radius (Matthews et al., 2024). Video-based remote supervision models offer flexibility in clinical practice placements to provide opportunities in more distant communities where PSTs live.

Technology-Driven Collaboration

Technology-driven collaboration during clinical practice offers significant benefits to PSTs by fostering a more connected and reflective learning experience and an integration of the TPACK framework within the authentic classroom context. Platforms for shared document creation, such as Google Docs, OneDrive, or dedicated educational apps, allow for real-time feedback and collaborative lesson planning between the PST, cooperating teacher, and university supervisor - on their own schedules. Cooperating teachers and their PSTs can grade work together online, so that the PST can see the cooperating teacher's methods and rationales and the two teachers can calibrate. Direct and specific feedback can be given to the PST on the collaborative documents as they are creating lesson plans, activities, and unit plans. This is also helpful during coaching sessions with their university supervisor. Digital portfolios and online platforms allow PSTs to curate and reflect on their teaching experiences, enhancing their professional growth. This constant, technology-mediated feedback loop allows for a more comprehensive and nuanced understanding of teaching practices, leading to improved instructional skills and confidence.

Furthermore, technology facilitates the sharing of resources and best practices, expanding the PST's pedagogical toolkit. Faculty can include experiences within coursework where PSTs can utilize platforms and tools commonly used in K-12 classrooms and likely to be encountered during the student teaching experience. For example, faculty can incorporate Google Classroom within methods courses to support PSTs' transition from the student user experience to the classroom teacher user experience, which can also provide practice for PSTs to design authentic collaborative learning and formative assessment activities. Faculty can model positive behavior support principles and techniques by utilizing classroom management tools such as ClassDojo (2025) within foundational or curricular methods courses. Online platforms, such as California Educators Together (2025) provide vetted, curated libraries of lesson plans, teaching strategies, and research articles, accessible to all members of the collaborative team (Darling-Hammond & Bransford, 2005). The Office of Special Education Programs (OSEP) TA&D centers have a wide range of evidence-based resources for PSTs including helpful infographics that can be used for professional development and just-in-time support (OSEP, 2019). Some of our favorites are the IRIS Center (2025), AFIRM (n.d.), CEEDAR Center (2025b), and TIES Center (2025). This access to a wider range of resources and perspectives can individualize and enrich the PST's learning experience and prepare them for the diverse demands of the modern classroom. Additionally, technology can streamline communication and scheduling, ensuring that all stakeholders are aligned and informed, thereby maximizing the effectiveness of the clinical practice experience. Calendaring with technology becomes a simple task when using Outlook, Google, and Apple calendar invites—IEP meetings, grade level meetings, PST observations, etc., are on the collaborative team's calendars instantly. This efficient communication, enabled by technology, helps reduce the feeling of isolation that PSTs may experience, fostering a more supportive and connected learning community (Wei et al, 2009).

E-Portfolio Aligned to Teacher Performance Expectations

Online portfolios offer a powerful tool for PSTs to document their growth and demonstrate competency with the California Teacher Performance Expectations (TPEs) while illustrating their growth over time in *learning technology by design*. We have used Portfolium for this purpose as our university subscribes to this platform for every student, but there are other digital portfolio template options (e.g., LinkedIn Professional, Canva Portfolio Templates, Google Sites Portfolio, or Squarespace). The process of selecting and organizing materials for an e-portfolio aligned to each of the 7 TPEs encourages reflection and self-assessment, allowing PSTs to critically analyze their teaching practices and identify areas for improvement (Barrett, 2007). Our PSTs also include a teaching philosophy statement on the homepage of their portfolio. The portfolio is a reflection of the PST as a new educator and includes accomplishments as well as areas for future planned growth (Cambridge et al., 2009). By showcasing a variety of evidence, such as lesson plans, video clips, photos, and student work samples, PSTs can provide a rich and comprehensive picture of their skills and knowledge in alignment with specific TPEs.

Moreover, e-portfolios can facilitate collaboration and coaching with PSTs, faculty, and university supervisors. The digital format allows for easy sharing and commenting on artifacts, promoting ongoing dialogue and support. Most PSTs add the link to their portfolio to their professional resume. PSTs can use AI tools to enhance their e-portfolios, such as utilizing AI writing assistants for reflective narratives or AI-powered tools to analyze data collected from assessments. Ultimately, the e-portfolio serves as a dynamic and evolving record of a PST's journey toward becoming an effective educator and is often showcased during employment interviews with districts.

Ethical and Legal Considerations

Privacy and Data Sharing

The wealth of technology available for use in our classrooms opens up concerns about not only student privacy and data, but also educator privacy and data. Teacher preparation programs must be sure to preserve teachers' understanding of the Family Educational Rights and Privacy Act (FERPA, 1974) and Children's Online Privacy Protection Rule (COPPA, 1998) requirements when considering how they are using technology in the classroom and for administrative tasks in order to protect student information (U.S. Department of Education [DOE], 2023). In addition, they must have an understanding of their specific district policies regarding student data privacy. FERPA requires teachers to keep student information confidential, both in paper and digital form. Teachers need to be sure that student data is secure and protected when using online tools, such as learning management systems (LMS). Teachers should not be sharing student work with online technology tools such as AI. COPPA requires that the online tools and platforms teachers have students use do not collect information from students without parental consent. This means teachers need to be aware of what information is being collected from students when using third-party apps, platforms, or websites. We also need to be educating our PSTs on protecting their own data online and considering what is being shared when they use online tools themselves. This makes it paramount that ongoing discussions of ethical technology use are occurring regularly among faculty as well as with PSTs.

Ethical Considerations of AI Use in Teacher Preparation and in the TK-12 Classroom

Ethical considerations, hallucinations (errors in output), and algorithmic bias pose significant challenges to the use of AI in education, which is why the technological knowledge of the TPACK framework must not be overlooked when experimenting with new tools. Preparation programs need to teach PSTs that the human component in AI use cannot be discounted, nor bypassed. Examination of all output is critical to protecting students and maintaining quality resources. We teach our PSTs to use the 80/20 rule. Always assume that 80% of output is correct, but 20% will need to be revised for accuracy and possible bias. Bias in informational sources, misinformation, and confabulations must be discussed with PSTs since biased output can perpetuate disparities and inequalities, especially for historically marginalized groups (Buolamwini & Gebru, 2018; Dobusch, 2017; Lalvani & Broderick, 2013). Moreover, balancing personalized recommendations with the need for diverse perspectives and depth of learning is essential to prevent algorithmic reinforcement of existing biases (Barocas & Selbst, 2016). While personalized learning can enhance individualized learning experiences, it is imperative to ensure that: (1) all students have access to AI responses that challenge them to deeper learning, as well as diverse viewpoints and perspectives to foster critical thinking and inclusivity, and (2) no student is left solely working independently with AI tools, discounting the human-centeredness of education.

Digital Divide

When considering AI use in teacher preparation, we also have to be cautious that we are not widening the digital divide. The first digital divide was defined by unequal access to technology globally and in our own communities (Wang, 2015) . The second digital divide defined the difficulty of many marginalized groups to find resources to gain digital skills and knowledge. We are now entering the third digital divide, defined by digital skills that vary according to social class, social status, and power (Ragnedda, 2017). Diliberti et al. (2024) found that teachers working in suburban schools report having more experience with and training for AI use than those in urban or rural schools. It is critical that we prepare high-quality teachers who are able to transform learning experiences using AI for all students, regardless of their perceived status and income. This is also important when we are thinking of our first-generation, disabled, immigrant, and marginalized PSTs. They may have been unwilling participants in the first or second digital divide as K-12 students. We need to be sure that we are closing the gap for these PSTs and preparing them to close the third digital divide in their own classrooms. Personally, we have found that having technology available to PSTs (iPad carts for class use and checkout), hosting tutorials outside of class, and having exploratory time and application activities with online learning tools in seminars helps these PSTs become confident with new technology and digital skills.

Conclusion

The integration of technology throughout teacher preparation coursework and clinical practice through the framework of TPACK and the *learning technology by design approach* (Mishra & Koehler, 2006) holds immense opportunity for positively shaping future educators. Embracing technology during early fieldwork and clinical practice and understanding how it can be used to expand learning possibilities for TK-12 students may help teachers realize they are able to successfully impact teaching and learning, which could lead to greater retention in the profession (Trujillo-Jenks et al., 2024). Our goal in our programs is to prepare PSTs for a rapidly evolving TK-12 environment, where they can be innovators rather than adopters of new technologies. By intentionally embedding the technology we have discussed in this article, we hope to empower our PSTs to not only navigate, but also maximize, the quickly evolving technology landscape. This approach fosters a deeper understanding of the possible pedagogical applications of technology and ultimately equips teachers to create dynamic and inclusive learning environments. As we continue to grow and refine our own technology practices as faculty, while prioritizing ethical and legal considerations, we pave the way for a generation of profession-ready educators who are innovators in their classrooms and leaders transforming teaching and learning. Our greatest challenge as a collective faculty is to become comfortable with rapidly expanding technology tools. We have found our best methods to do this are (lots of) trial and error, talking with colleagues, listening to our PSTs share resources, sharing new resource finds with one another, and definitely staying curious. We challenge all of you to become curious, experiment with the tools we have shared, and imagine what is possible to make your new teachers as innovative as they can be, making learning accessible for all TK-12 students.

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