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Research Article

Promoting Students' Active Engagement in Online Teacher Education Courses

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Abstract: This paper explores the integration of digital tools in online teacher education courses to enhance active student engagement and support differentiated instruction, particularly for non-traditional teacher candidates. Drawing from the authors' experiences, the study examines how technology tools (e.g. Zoom with Kaltura, simulations, SketchGraph, and AutoDraw), foster personalized learning, accommodate diverse needs, and provide opportunities for deeper engagement. Guided by the SAMR model, the analysis categorizes tools based on their functions in the teaching and learning practices, emphasizing their role in creating dynamic and inclusive learning environments. The findings highlight that digital tools enable active learning by encouraging critical engagement and moving away from traditional, passive modes of instruction. Through teacher modeling and differentiation, these tools empower learners to navigate complex concepts and build autonomy in their learning process. Practical strategies for implementing technology tools, such as modeling their use and providing clear, step-by-step instructions, are also discussed to address the challenges of online learning environments. This study contributes to the growing body of literature on technology integration in teacher education, offering insights into how digital tools can enhance learning experiences and prepare teacher candidates to adopt innovative instructional practices in their future classrooms.

Keywords: online teacher education; technology tools; students' active engagement; SAMR model

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1. Introduction

Online learning has become increasingly prevalent in teacher education programs, particularly for institutions serving a growing population of non-traditional students (Skopek & Schuhmann, 2008). Online courses offer unparalleled flexibility, allowing students to engage with coursework outside of school hours. The nature of online learning accommodates students with diverse backgrounds and various levels of prior knowledge, as it enables students to review complex concepts multiple times and progress quickly through familiar content. This is especially beneficial for non-traditional teacher candidates, such as full-time teachers working with emergency permits, paraprofessionals seeking certification, and other adult learners who must balance work and family commitments. Moreover, an online learning environment enhances reflection and participation by providing more time for students to absorb information and formulate thoughtful responses. This format creates opportunities for deeper reflection on course content and encourages increased participation from students who may feel hesitant to speak up in real-time settings.

While online learning offers numerous advantages, it also presents specific challenges, including issues related to motivation and self-discipline, as well as a lack of immediate interaction and feedback (Kebritchi et al., 2017). To address these concerns, it is crucial to implement strategies that actively engage students with course content through various technology tools. Drawing from our experiences as teacher educators, this paper examines the active uses of technology tools and applications in online courses to benefit non-traditional teacher candidates, with the objectives of sharing our experiences working with online students and offering suggestions for developing effective online courses in teacher education courses.

2. Materials and Methods

To guide educators' effective integration of technology tools in their instruction, various frameworks and models have been developed, including the Community of Inquiry framework (Garrison, 2015), Technological Pedagogical Content Knowledge (TPCK), the Universal Design for Learning framework (CAST, 2024), and the Substitution, Augmentation, Modification and Redefinition (SAMR) model (Puentedura, 2006). Among these, the SAMR model has been popular among practitioners since its introduction in the 2000s (Hamilton et al., 2016). We also adopted this model as a framework to guide our discussion of technology integration practices.

Puentedura (2006) developed the SAMR model to help K-12 teachers select, use, and evaluate their classroom use of technology tools. The model identifies four types of technology use: substitution, augmentation, modification, and redefinition (Figure 1). Substitution involves using technology as "a direct tool substitute, with no functional change" (Puentedura, 2006). For example, paper handouts can be replaced with digital versions. Augmentation also describes the technological substitution of traditional tools but with function improvement. For instance, teachers may supplement textbook readings with videos to explain science concepts to engage auditory learners. Modification and Redefinition represent the "transformation" category of the model, where technology enables redesign (Modification) or creating new tasks (Redefinition) that can be difficult or impossible to accomplish without the technology tools.

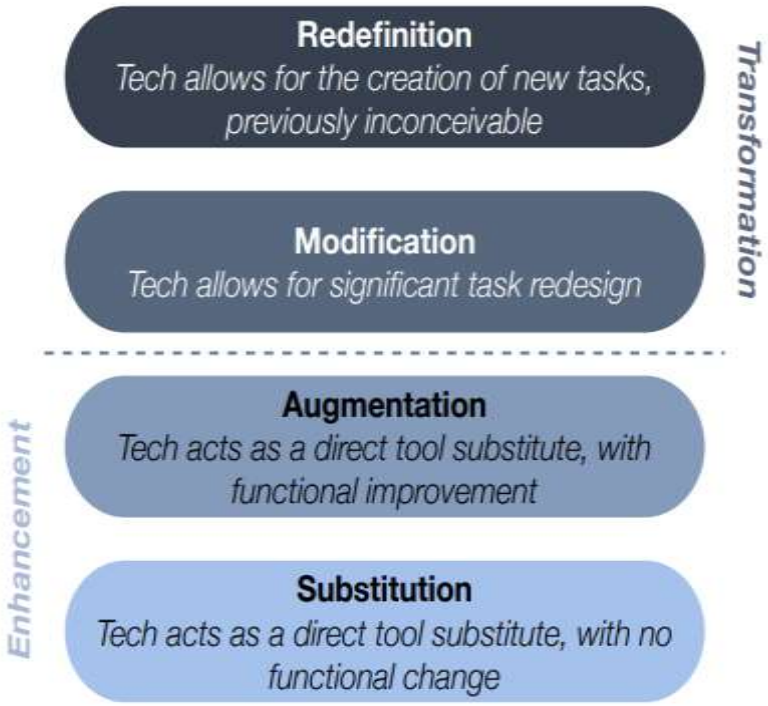

Figure 1. The SAMR model.
Source: Puentedura (2006; 2009).

Since its development, the SAMR model has often been interpreted as a progression, encouraging teachers to move from a "lower" level of substitution up to "higher" levels (Hamilton et al., 2016). However, we used this model to facilitate our discussion of diverse ways technology tools can be used in online courses, with no intention of categorizing technology tools in different levels or indicating that "higher" level integration promotes better student learning outcomes. We agree with Kirkland (2014) and Hilton (2016), both of whom advocate for using the SAMR model as a guide for designing rich, technology-supported tasks rather than as a hierarchical framework aimed at achieving the "highest" levels and that the model should inspire creative task design rather than dictate a linear progression in technology integration.

In addition to categorizing the tools using the SAMR model, we collected student feedback on their experiences with the technology tools used in the courses. The participants are students who enrolled in the courses mentioned below. To analyze the data, we employed

a qualitative approach and included a numerical analysis in which students rated their agreement on a scale from 0 to 5. We then calculated the percentage of students who selected each rating to quantify their responses.

3. Results

3.1. Technology Integration in English Methods Courses

StoryGraph, a digital platform with a mobile application, engages users through its abilities to help readers track their reading progress and choose books, as noted by the company: "We'll help you track your reading and choose your next book based on your mood and your favorite topics and themes." (The StoryGraph Ltd, 2024).

In the asynchronous online course, Methods of Teaching Senior High/Junior High/Middle School English (M452), teacher candidates (TCs) were asked to download StoryGraph, and to specifically track their reading progress of The Scarlet Letter, which we read and eventually pair with a Young Adult (YA) literature novel. To support comprehension, students read in peer buddy groups and took digital notes during four reading periods. StoryGraph allows peer buddy note-taking, emphasizing the importance of reading comprehension. By replacing traditional note-taking with a collaborative digital tool, StoryGraph offers functional improvements, categorizing it as an augmentation tool within the SAMR model. Figure 2 is a screenshot of the peer buddy note-taking assignment with StoryGraph.

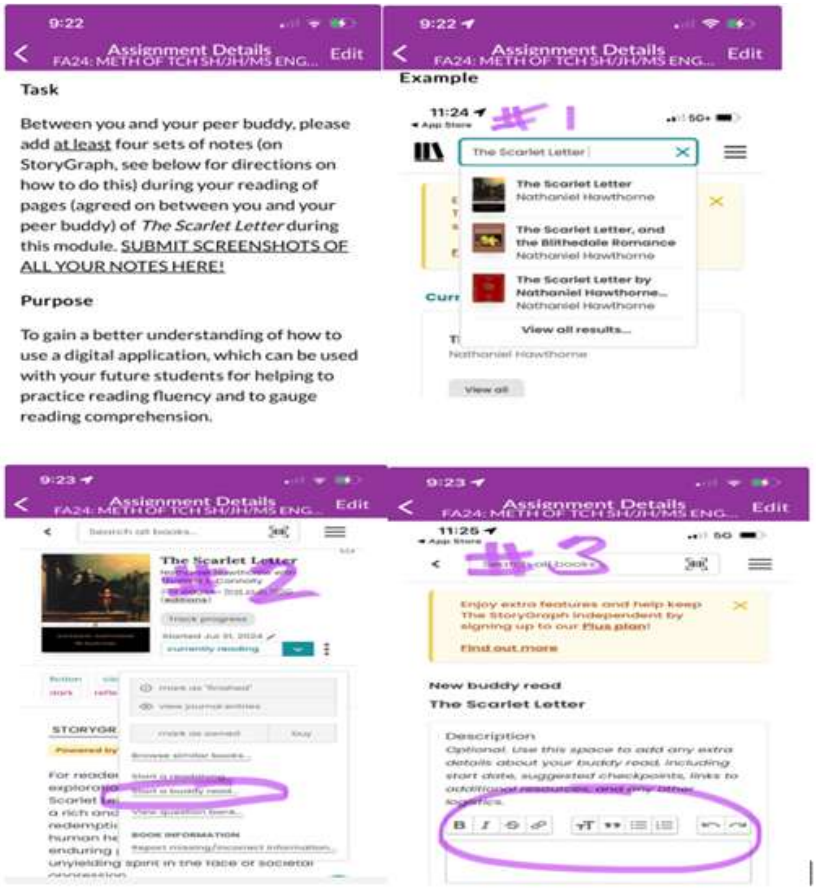

Figure 2. Screenshots of StoryGraph note-taking instructions for students.

3.1.1. Zoom and Kaltura

Zoom enables synchronous digital meetings and supports collaborative recording, while Kaltura serves as a cloud-sharing platform for uploading and publishing recordings. During the COVID-19 pandemic, we used Zoom for weekly synchronous meetings and its recording feature for collaborative projects (Romero-Ivanova et al., 2020).

In M452, the core literacy skill of reading fluency was emphasized. To demonstrate their understanding of fluency and ability to create meaningful activities for their future students,

TCs create repeated readings of selected pages from the YA novel Speak. Working in peer buddy groups, they recorded their readings via Zoom, uploaded the recordings to Kaltura, and submitted the accessible links on Canvas. These features allow for tasks that traditional tools cannot achieve, making Zoom and Kaltura examples of redefinition within the SAMR framework.

3.1.2. Screencasting through Kaltura

In the Teaching English Language Learners BIL/ENL (L442) course, TCs are tasked with creating screen recordings to demonstrate how they plan to engage learners through assessments, activities, and lesson plans. Students select a favorite poem, picture book, or short story they would like to teach and use Kaltura to create a screencast that combines the text with their voiceover. These recordings are uploaded to Kaltura, published, and shared via accessible web links on Canvas, along with supplemental digital resources. This activity enables TCs to showcase their teaching strategies while leveraging technology to engage students effectively. Figure 3 and Figure 4 are examples of two book covers students chose.

Figure 3. Screenshots of "Colorful Leaves".

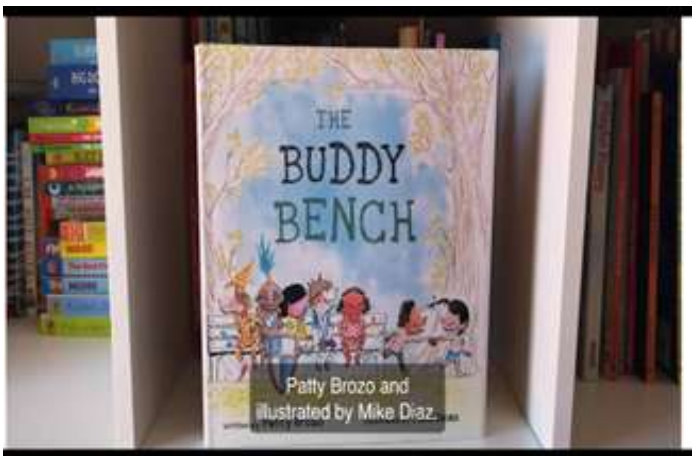

Figure 4. Screencasting of "The Buddy Bench".

3.2. Technology Integration in Science and Math Methods

3.2.1. AutoDraw

In the math methods classes, AutoDraw, a free drawing tool, was used to model math problem-solving strategies. This tool allows the writing and drawing of mathematical models and equations, functioning similarly to a classroom whiteboard. Demonstrations of math problem-solving were recorded and shared with my students on Canvas. The video format enables students to rewatch the content, pause, slow it down, and take notes as needed. This flexibility is especially beneficial for students requiring additional support in math problem-solving.

Using AutoDraw can be categorized as a substitution tool within the SAMR framework, as it serves as a direct replacement for a whiteboard. However, in an online setting, when

combined with video-recording tools, it functions as an augmentation tool. The added capabilities – such as rewatching, pausing, and slowing down the content – offer opportunities beyond what a traditional classroom whiteboard provides. Figure 5 is a screenshot of how one question was explained with AutoDraw.

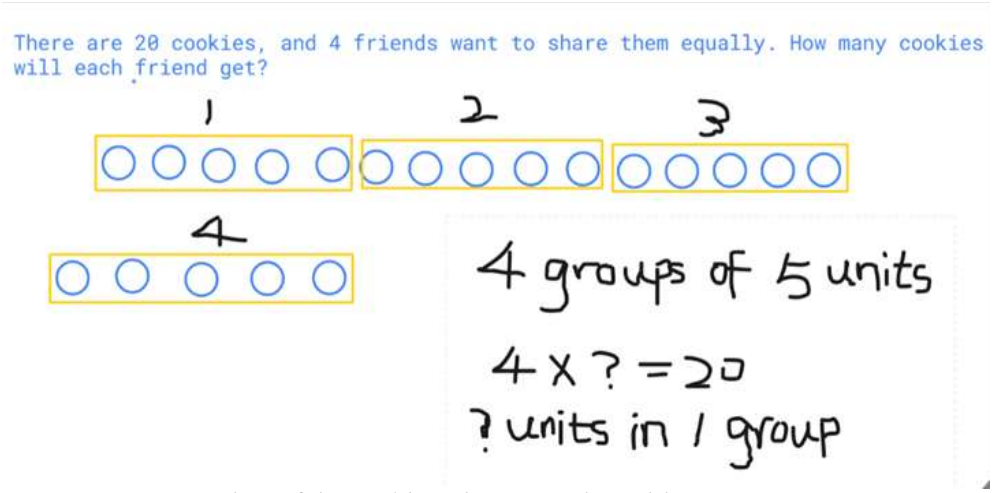

Figure 5. A screenshot of the problem demonstration with AutoDraw.

3.2.2. Simulations

Simulations are popular in K-12 science classes, as they make microscopic phenomena visible and allow students to learn at their own pace as students can run simulations as many times as they want (Wang et al., 2022). In the science methods course, PhET simulations were used to engage students in different science experiments. Conducting experiments is a critical part of science learning. However, in an online course, it can be challenging to implement lab experiences. While some online educators send lab kits to students, this approach raises safety concerns and limits supervision during individual lab work.

PhET simulations cover various science disciplines and enable students to manipulate variables, test hypotheses, and draw evidence-based conclusions. For example, a simulation exploring the dynamics between prey, predators, and environmental factors allows students to experiment with variables and observe their impacts on population trends (Figure 6).

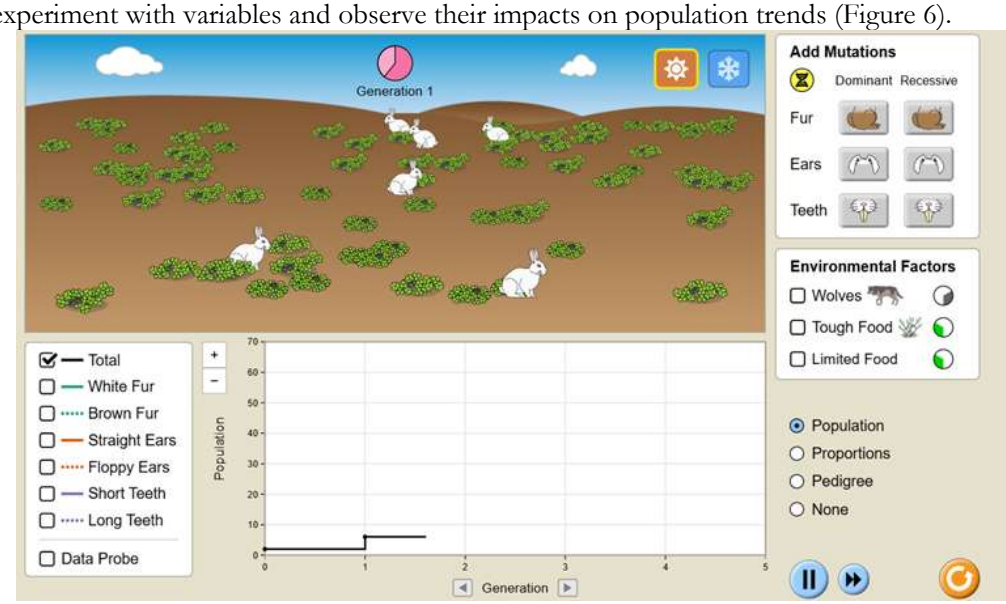

Figure 6. A screenshot of PhET simulation.

Within the SAMR framework, PhET simulations can be categorized as a redefinition tool, as they provide virtual lab experiences that would be otherwise impossible in traditional learning environments.

3.2.3. GeoGebra

GeoGebra is an interactive math platform. The platform enables users to create

mathematical models, visualize concepts, and use manipulatives and simulations to support problem-solving. For instance, when teaching factors, we use visual strips to help students understand how to identify whether a number is a multiple of another. Figure 7 is a question example from GeoGebra.

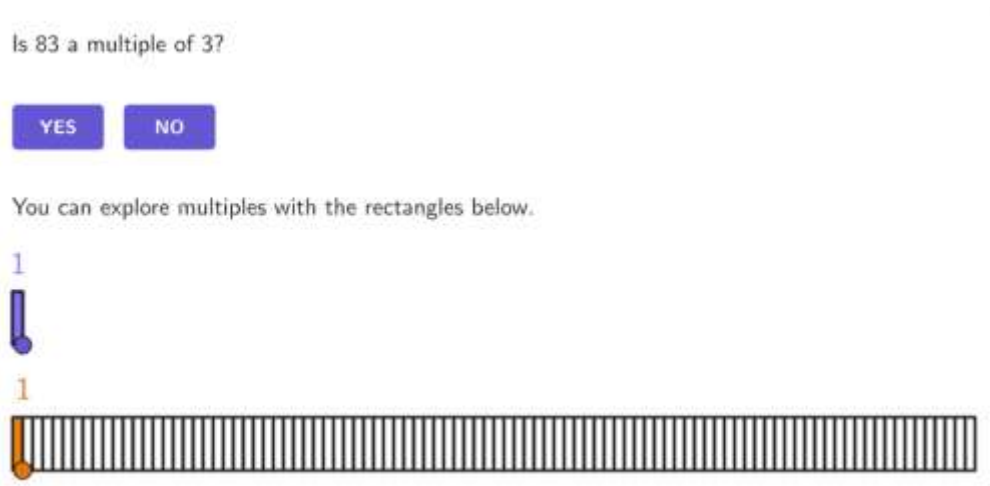

Figure 7. A screenshot of GeoGebra problem example.

GeoGebra is categorized as a redefinition tool under the SAMR framework, as it provides dynamic and interactive opportunities for learning that cannot be achieved through traditional methods, such as visualizing the step-by-step process of solving mathematical problems.

3.3. Students' Data and Analysis

3.3.1. Students' Feedback in the English Methods Courses

We used a Qualtrics survey to explore how students in the English Methods courses perceived the use of digital applications in their learning. Four constructed-response questions were asked in this Qualtrics survey.

1. How do the digital tools shared in this course support your learning?
2. Identify ways that you may use the digital tools you learned in this course in your future classroom. For example, how would you use StoryGraph in your future classroom?
3. How have the digital tools encouraged your thinking about differentiation strategies?
4. What are the benefits of using digital tools, such as StoryGraph and Kaltura?

We employed anecdotal analysis to interpret the collected data, focusing on students' personal experiences and reflections. Below are examples of students' responses that illustrate their experiences with the digital tools.

"This has helped me stay on task and visually expand upon the story itself. It allows me [to] look into the eyes of a student who struggles with reading and writing but can visually and verbally explain their thinking."

This response highlights how digital tools provide alternative means for students who struggle with reading and writing to succeed, emphasizing the value of visual and verbal expression.

"I really like using the screencasting tools. It is a way for me to personalize the stories in the classroom for students to listen to independently."

This comment underscores the role of screencasting tools in fostering independent learning, which the instructor modeled through personalized assignments in the ELL course.

"As a Secondary Education major with an English focus, I am constantly looking for ways I can help my future students who struggle with writing their thoughts on paper. My professor tasked us to read a book called The Scarlet Letter. It is an interesting read, but reading words on paper can be difficult after reading so much."

This response emphasizes the challenges of traditional reading and writing tasks and the need for alternative strategies to support student engagement.

3.3.2. Student Feedback in Science and Math Methods Course

We conducted a survey to gain insights into students' experiences with engagement in

the elementary science and math methods courses, their learning of the technology tools introduced, and their perspectives on using these tools in their future classrooms (Table 1).

Table 1. Students' survey results in the science and math methods courses.

Survey questions	Students' agreement levels (%)					
	5	**4**	**3**	**2**	**1**	**0**
"I was actively engaged in this online course, including participating in discussions, completing activities on time, and connecting with the course content and peers."	75	25				
"This methods course helped me effectively learn and apply technology tools to support teaching and learning."	61.5	15.4	15.4	7.7		
"I can see myself using the technology tools learned in this course in my future classroom."	50	25	12.5	12.5		

The results indicated that 75% of students strongly agreed, and 25% agreed, that the courses effectively fostered engagement by enabling participation in discussions, activities, and interactions with both content and peers. Additionally, over 60% of students strongly agreed that the integration of technology tools supported their learning and application of these tools. Furthermore, 50% of students expressed strong agreement regarding the potential for incorporating these tools into their future teaching practices.

4. Discussion

In this section, we discuss how we used the above digital tools in ways that support students' active engagement.

4.1. Enhancement: Substitution and Augmentation

Several tools utilized in our courses were categorized under the Enhancement level of the SAMR framework, where digital tools replaced traditional in-person resources while maintaining or slightly altering their functionality. For instance, AutoDraw effectively substituted classroom whiteboards, enabling online instructors to visually demonstrate problem-solving processes. This approach preserved the rigor and clarity of learning typically seen in face-to-face instruction. Similarly, GeoGebra replicated the use of physical manipulatives in classrooms by offering digital alternatives, which allowed students to interact with concepts in ways that mimic hands-on experiences. This tool also provided unique opportunities for students to experiment dynamically with mathematical models, supporting conceptual understanding in a flexible, interactive format. StoryGraph offered another example of substitution. This tool replaced in-person group work. Because the course was taught asynchronously online, students were pre-grouped into triads at the beginning of the semester and used these groups to collaborate on assignments.

4.2. Transformation: Modification and Redefinition

The use of tools categorized under the Transformation level provided unique affordances that extended beyond traditional classroom practices. For example, video tools such as Kaltura enabled students to watch instructional videos at their own pace, with embedded questions guiding their focus and reinforcing specific learning objectives. Unlike in-person classrooms, where teachers might pause videos and check for understanding in real time, this tool allowed students to revisit content multiple times and engage with questions at their own pace. This approach proved particularly beneficial for non-traditional students, who often have varying levels of prior knowledge and need flexible learning opportunities. Additionally, Zoom supported non-traditional teacher candidates by facilitating individualized support. Students could schedule meetings at their convenience, enabling a more tailored and responsive learning experience.

Technology tools also offered robust opportunities for differentiation by providing a variety of materials to accommodate diverse learning needs. Students had access to readings,

videos, and hands-on learning experiences. These options allowed students to engage with content in ways that aligned with their individual preferences and strengths. Simulations, for example, removed constraints like material costs, time, and experiment safety, creating a more inclusive and accessible learning environment. By allowing students to begin at a level that felt comfortable to them, these tools supported differentiated practices that promoted autonomy and deeper engagement with the material.

5. Conclusions

The integration of technology tools in online teacher education courses offers important potential to enhance active student engagement, promote differentiated instruction, and support the unique needs of non-traditional learners. By leveraging tools such as Zoom with Kaltura, simulations, and SketchGraph, instructors can create a dynamic learning environment that accommodates diverse learning styles and provides opportunities for personalized engagement. These tools not only bridge the gap between traditional and online learning but also expand the possibilities for rethinking instructional strategies to foster meaningful participation and deeper understanding.

Digital tools inherently require students to engage in active learning, shifting away from the passive model of education where knowledge is simply deposited into learners. This approach aligns with Paulo Freire's critique of the "banking" model of education, emphasizing the im-portance of active, critical engagement in learning processes. By designing tasks that involve exploration, creation, and reflection, educators can cultivate deeper cognitive engagement and foster meaningful learning experiences.

Furthermore, technology can be seamlessly integrated into teacher education courses to achieve dual purposes: representation and differentiation. For example, teacher modeling using digital tools provides a clear framework for students, while differentiated practices, such as interactive simulations, address varied learning needs and preferences. These strategies ensure that technology enhances both the instructional process and the learner's individual experience.

When incorporating digital tools into online courses, it is essential to consider how students will navigate the tools and complete assignments or activities, particularly when they are un-familiar with the technology. Modeling the use of tools through screen recordings or tutorials and providing clear, visual step-by-step instructions are practical strategies to support learners in successfully engaging with the digital environment. Thoughtful implementation of these practices not only ensures accessibility but also empowers students to take ownership of their learning journey.

Future research should continue to explore the impact of specific tools on student outcomes and investigate how the effective integration of technology can prepare teacher candidates to employ similar strategies in their classrooms. By embracing innovative, inclusive, and active learning approaches, educators can reimagine the possibilities of teacher education in online environments.

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