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Jon M. Clausen
Ball State University, jmclaus@bsu.edu

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EdTec Tour of What's Possible: Challenging Concepts of Technology Use in the Classroom Through Breakout EDU

Jon M. Clausen
Ball State University

Abstract

While teacher education candidates and faculty have improved their knowledge and skills with technology, challenges remain regarding their understanding of how to integrate technology effectively within their pedagogical practices. One solution is to provide models of purposeful technology integration within instruction that embeds digital pedagogy throughout the learning process. This paper describes how a teacher education program is addressing the need to engage candidates and faculty around issues of technology integration and adoption. This is done through participation in a Breakout EDU game focused on introducing candidates, and faculty, to what might be possible when integrating technology within their instructional practices. Throughout the paper, I describe how restructured instructional spaces and the Breakout EDU game model technology integration and has initiated change within the teacher preparation program.

Keywords: technology integration, technology infusion, teacher education, Breakout EDU, game-based learning, digital pedagogy

Introduction

There have been numerous calls for greater technology use and adoption in the preparation of teachers. In 2010, AACTE released the *21st Century Knowledge and Skills in Educator Preparation* white paper that called for the development of "a shared vision for 21st century knowledge and skills in educator preparation" and "meaningful dialogue among higher education leaders … about implementing [that] vision in educator preparation" (p. 3). The Educational Technology Policy Brief released in 2016 by the Department of Education Office of Educational Technology (DOE-OET), specifically challenged teacher preparation programs to reflect and act in ways that would ensure that "every new teacher is prepared to meaningfully use technology to support student learning" (p. 5). The policy brief highlighted four guiding principles for teacher education. This included a focus on active technology use to enable learning and teaching; to build sustainable, program-wide systems for professional learning for higher education instructors; to ensure preservice teachers' experiences with technology are program-deep and program-wide; and to align efforts with research-based standards, frameworks, and credentials (DOE-OET, 2016).

This effort to improve how educator preparation programs (EPPs) prepare teachers to use technology was renewed in 2022, with the EPPs for Digital Equity and Transformation Pledge (DOE-OET, 2022). Developed by the U.S. Department of Education Office of Educational Technology and the International Society for Technology in Education (ISTE), along with the Society for Information Technology in Teacher Education (SITE), the American Association of Colleges of Teacher Education (AACTE), the Council for the Accreditation of Educator Preparation (CAEP), and the Association for Advancing Quality in Teacher Education (AAQEP), preparation programs that sign the pledge acknowledged a shared "vision for accelerating change in how we prepare future teachers to be successful in new digital learning environments." Five elements of the pledge are:

1. Prepare teachers to thrive in digital learning environments.
2. Prepare teachers to use technology to pursue ongoing professional learning.
3. Prepare teachers to apply frameworks to accelerate transformative digital learning.
4. Equip all faculty to continuously improve expertise in technology for learning
5. Collaborate with school leaders to identify shared digital teaching competencies. (ISTE, 2022)

These elements emphasize the need for EPPs to support both teacher education candidates and faculty. The elements of the pledge promote ongoing professional learning and modeling of effective technology use for instruction through the use of standards, frameworks, and competencies. In his introduction to the pledge at the launch event in Washington, DC, ISTE CEO Richard Culatta summarized key needs he had heard from school leaders. These needs included:

- The need to teach in virtual environments.
- The need to prepare teachers to use technology beyond academics (e.g., social emotional learning and family communication).
- The need to use technology in ways *other than* presenting information.
- The need for teachers to use technology to support their own ongoing professional learning.

He went on to express that "digital fluency exhibited by teacher education candidates does not equal effective digital pedagogy" (R. Culatta, personal communication, June 7, 2022).

Such calls place pressure on teacher education programs, and educational technology faculty specifically, to challenge common misconceptions about technology use and to create opportunities to model effective digital pedagogy and technology integration for faculty and candidates. Effective technology use in the classroom has been found to shift instruction from a teacher-dominated perspective to more of a student-centered perspective (Pitler et al., 2012). This instructional shift should be modeled in higher education throughout the development of pre-service teachers. Unfortunately, teacher education faculty are rarely provided opportunities to critically examine their own technology use or supported in ways that allow them to take instructional risks. Similar to K-12 instructional contexts, teacher education faculty are often left on their own when making instructional decisions about technology adoption and integration, and often lack the knowledge and skills to model effective digital pedagogies and technology integration for candidates (Clausen et al., 2021; Foulger et al., 2017; Goktas et al., 2009; Tondeur et al., 2012).

Candidate expectations for pedagogical applications of technology within teacher preparation are also limited. In their review of curricula in Norway, Insteford and Munthe (2016) found there was limited documentation of expected learning outcomes for candidates in their pedagogical integration of technology. They concluded; "it becomes the students' own responsibility to convert technology proficiency into pedagogical compatibility" (p. 90).

Many preparation programs are reliant on a required educational technology course. This course may be the only opportunity for candidates to have technology integration modeled for them. A required course, while providing an important foundation of knowledge, falls short in a programmatic view of technology infusion throughout a teacher education program (Foulger, 2020; DOE-OET, 2016). A single course reinforces the misconception that technology integration is an "add-on" to the curriculum rather than an embedded part of the learning and teaching process for teacher candidates. Such isolation can indicate further constraints on meaningful modeling of technological integration throughout a program, and as a result, true integration is not something modeled in candidate coursework or throughout their teacher education experience. Instead, "successful technology integration is achieved when the use of technology is:

- Routine and transparent.
- Accessible and readily available for the task at hand.
- Supporting the curricular goals, and helping the students to effectively reach their goals." (Edutopia, 2007)

As calls for changing teacher preparation programs continue, Ball and Cohen (1999) propose more practice-based teacher education programs that support "a much deeper and more complex learning for their students" (p. 7). They go on to describe a type of pedagogy that can engage learners with its adaptability and flexibility while also collaboratively exploring opportunities to use technology that support the 4Cs (critical thinking, creativity, collaboration, and communication). Unfortunately, students introduced to “powerful conceptual frameworks to help them think about organizing instruction” (p. 9) often do not have the experience or background to analyze this type of information when given opportunities to integrate technology in the content area. To develop teacher education candidates and faculty who enact effective digital pedagogies, they must experience those pedagogies and use technology in ways that support their learning. Using a practice-based model as a guide, educational technology faculty developed a game-based experience that embeds technology throughout the teaching and learning process.

The growth of game-based learning is grounded in calls for educators to move away from traditional transmission and didactic pedagogical approaches to more active, learner-centered practices (New World of Work, 2017; World Economic Forum, 2018). These strategies provide students with transferable knowledge and skills that build resilience, persistence, while supporting creative problem-solving and teamwork (Alexander et al., 2019; Selingo, 2018). Game-based learning is frequently connected to psychological concepts of play (Piaget, 1962) and cognitive development (Vygostsky, 1978). Plass et al. (2015) identify that game-based learning may incorporate a variety of learning theories and propose that, “The learning theory that informed the design of a specific game is reflected in the type of challenge the game provides, the type of responses it facilitates, and the kind of feedback it provides” (p. 262). One kind of game-based learning approach is Breakout EDU.

Breakout EDU was founded in 2015 by James Sanders and Mark Hammons and began as a form of mobile “escape room”. A typical Breakout EDU activity involves a group of people who must work collaboratively to find their way out of a situation or resolve some sort of challenge. To do this, they locate clues and find solutions that lead them to a resolution of the challenge. Breakout EDU is currently a platform designed to bring game-based learning to different PK16 grade levels and content areas. The platform has a variety of games created by teachers and game designers for online or face to face game play. They also provide resources to create your own game.

In this report from the field, I describe the development and design of a Breakout EDU game and how additional experiences provided opportunities to develop pedagogical knowledge of how technology use can support learning. These experiences were designed by educational technology faculty to model and challenge teacher education faculty and candidate understanding of digital pedagogy and technology integration. These experiences took place in a learning space devoted to supporting faculty and teacher education candidates in their use and integration of technology. Participants involved in the tour of what’s possible Breakout EDU game were elementary and secondary candidates in their first teacher education course. Secondary candidates were beginning their teacher education coursework and came from a variety of content areas. Participants also include faculty from the educator preparation program. Teacher education faculty participant so that they can also see how technology may be integrated within instructional practices.

Description of the NESTT Learning Lab

To address the various calls for a renewed effort to improve how candidates are prepared to integrate technology within their instructional practices, the teacher education program restructured spaces previously devoted to development of student portfolios and addressing broken technology equipment. The NESTT Learning Lab stands for New and Emerging Support for Teaching with Technology (NESTT). While the lab spaces are open to anyone from across campus, they are primarily intended for faculty and students in the educator preparation program. The restructured spaces are made up of two rooms. The first is a dedicated classroom for larger group meetings. This space is intended for faculty, candidates, and others to practice and model instructional strategies where technology is integrated within classroom activities. The room has flexible seating and collaborative workspaces along with video displays that allow patrons to screen share from their personal devices. This provides opportunities for collaboration among students, but it can also be use by teachers to model instructional strategies where students share examples of their work. The second space is smaller and is intended for individuals or small groups to plan and work on projects. This space has a variety of technology including 3D printers, paper cutters, robotics, and virtual reality equipment. This space is openly available for anyone to stop by and learn about the equipment.

The space is staffed by undergraduate and graduate student workers. The undergraduate student workers are typically in the teacher education program and the educational technology minor. Graduate student workers are from a variety of academic programs but have expressed interest in learning about different technologies and how they could be used in education. The staff work with educational technology faculty, college technology support personnel, and amongst themselves to learn about the different technologies available in the spaces. The staff also learns about coaching and mentoring models to support their own professional development (ISTE, 2019; Thompson et al., 2007).

Combined, these spaces are designed with the intent to support candidates and faculty to critically examine technology integration for learning and teaching. There are five goals for the spaces. The first goal is to engage faculty and candidates around ideas for the adoption and integration of technology within their instructional practices. The second goal is to provide safe spaces to be curious, creative, and inquisitive with technology. The third goal is to support faculty in the redesign of courses, assignments, and projects to take advantage of how different technologies can support student learning. The fourth goal is to empower both candidates and faculty to utilize and use various technologies themselves instead of being dependent on others. The fifth and final goal is to model pedagogies and practices that support learning.

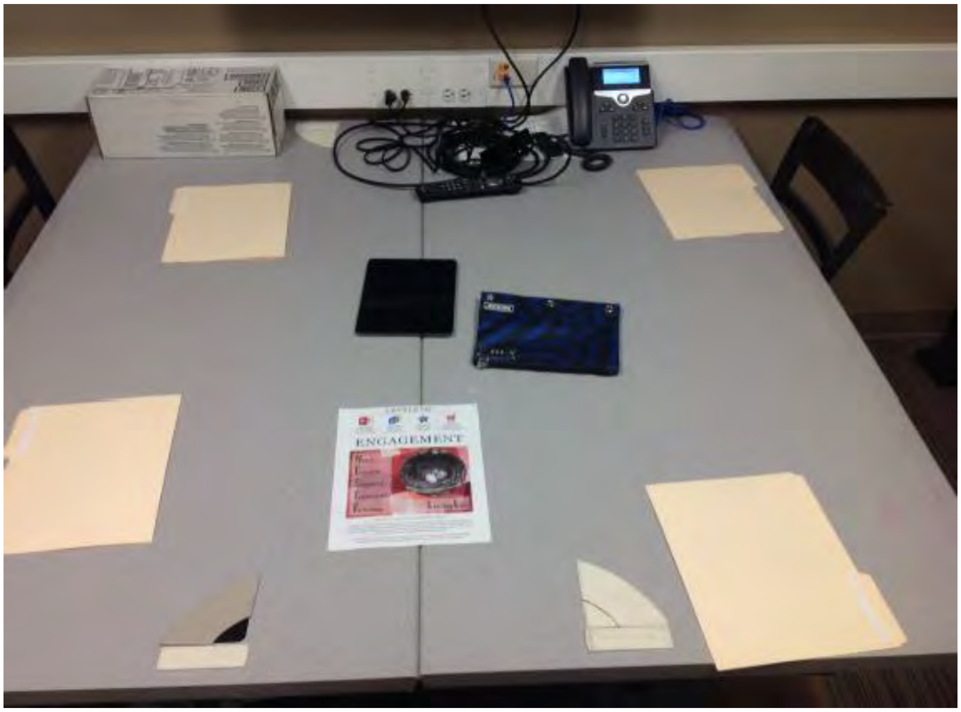
To support these goals, the NESTT has acquired equipment within the lab spaces but has also developed mobile technology kits so that faculty and candidates can take the technology to other classrooms on campus, practicum, or student teaching placements. These kits include several iPads that are in rolling cases, Sphero Power Packs (rolling cases of 12 Sphero robots), Makey Makey classroom packs, virtual reality headsets for virtual expeditions (cases of ten headsets along with wireless router, and a teacher iPad loaded with VR expeditions applications), and Breakout EDU kits. NESTT staff work with anyone checking out the equipment to make sure everything is working properly and that they know how to use it. One example of how faculty or candidates have used this equipment is a candidate who wanted to introduce coding and robotics to an elementary classroom. The candidate checked out a case of 15 iPads that had been configured with several coding applications. They also checked out a Sphero Power Pack of 12 robots. The candidate then used both kits to teach a series of lessons during their student teaching placement. Development of these mobile kits have created opportunities for faculty and candidates to utilize technology within learning contexts where they are and helps to eliminate integration barriers that might exist away from campus.

Description of the Tour of What's Possible

Educational technology faculty and NESTT staff developed a Breakout EDU game to model effective digital pedagogical practices, engage candidates, and introduce what is possible when integrating different technologies within teaching and learning contexts. Prior to the start of the game, staff set up the room so that participants will work in teams of 4-5 individuals and spread posters around the NESTT. Game organizers place an iPad, a locked pencil bag, a folder for each participant that has information about the NESTT and educational technology academic programs, and a piece of paper titled "levels of engagement" on each table (Figure 1).

Figure 1

Table Set Up for Participants



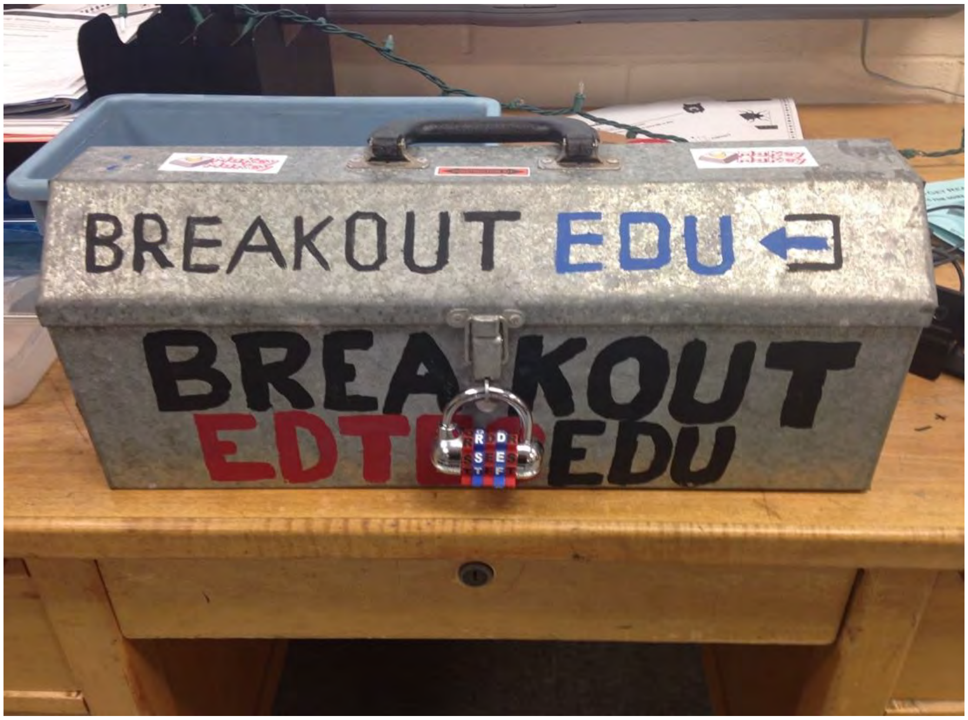
Participants will have 30 minutes to complete the game. The structure of the game involves both physical and digital elements and will require participants to use a variety of technologies as they move through different stages.

Stage One: Introduction to the Game

The session begins with a brief welcome and introduction to the NESTT learning spaces, an overview of existing educational technology courses and programs, an explanation of technology integration models and the 4Cs, a description of Breakout EDU, and finally the guidelines for playing the game. Participants are then challenged to think creatively, and to consider how different technologies may be integrated into PK-12 instructional contexts to support student learning. They are informed that the instructional objective for the game is to learn how educational technology might be integrated into the teaching and learning process. Finally, they are instructed that if the team thinks they have solved the final clue, they must check in with the game master before trying to unlock the Breakout EDU box (Figure 2).

Figure 2

Breakout EDU Game Box



As teams prepare for the start of the game, they are reminded that information shared by the game master, and anything in the rooms might be a clue. The game master and other helpers are not allowed to give teams answers, but they will provide teams with hints if they get stalled on a particular part of the game.

Candidates start the game by visiting several posters spread around the two learning spaces of the NESTT. Participants are then given 30 minutes to complete the challenge. The game begins once questions are answered, and everyone indicates they are ready to start.

Stage Two: Ready, Set, Go!

After the 30-minute countdown is started, participant teams must decide how they will gather information from the posters and share back what they learned. Each poster has a similar construction, identifying a particular technology and how it is used in education (e.g., 3D printing in education). Each poster also has at least two QR codes that link to short video examples of how the different technologies are being used within PK-12 instructional contexts. Participants from each team use their mobile phones, or the provided iPad, to visit each poster and watch each of the videos. As they travel around the rooms and from poster-to-poster participants begin discussing the different technologies and how they might incorporate them within different grade levels and content areas (Figure 3).

Figure 3

Candidates Visiting Posters

Stage Three: Time to Share

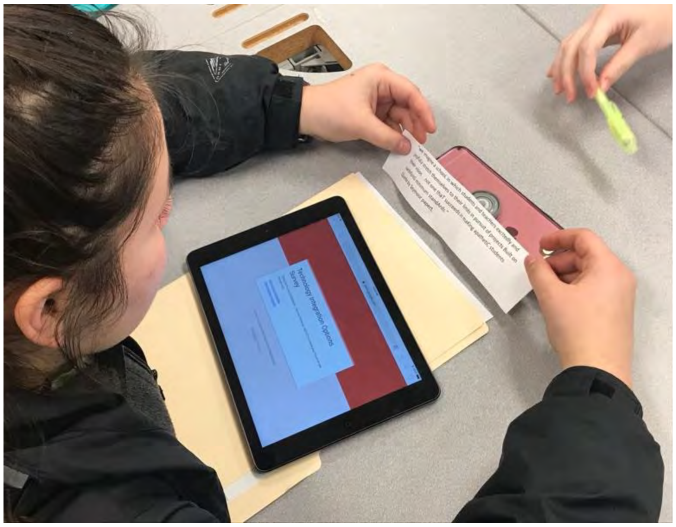
Once team members have visited all the posters, they come back together at their tables and discuss what they saw and their ideas for how the different technologies may be used. The “levels of engagement” paper at the center of each table has another QR code that when scanned will take the team to a Google Form. Within the form, teams are prompted to share team member names, emails, and the instructor's name who brought them to the NESTT. They are then asked to identify three of the technologies that would best fit within their future classroom and provide some examples of how they would incorporate and integrate the tools into future classroom assignments, lesson plans, or projects. They are also encouraged to identify which tools could promote critical thinking, student engagement, enhance the curriculum, and provide PK-12 students with opportunities to demonstrate their knowledge. Once the teams complete the form and submit the results, they receive a message that provides them with a three-digit code. This code is then used to begin the next stage of the challenge.

Stage Four: Say What?

When the teams complete the Google Form and receive the three-digit code, they locate the locked pencil bag, put in the combination, and unlock it. Inside the bag are two items. The first is a piece of paper with a quote from Seymour Papert (Figure 4).

Figure 4

Candidate with Google Form and Quote Clue



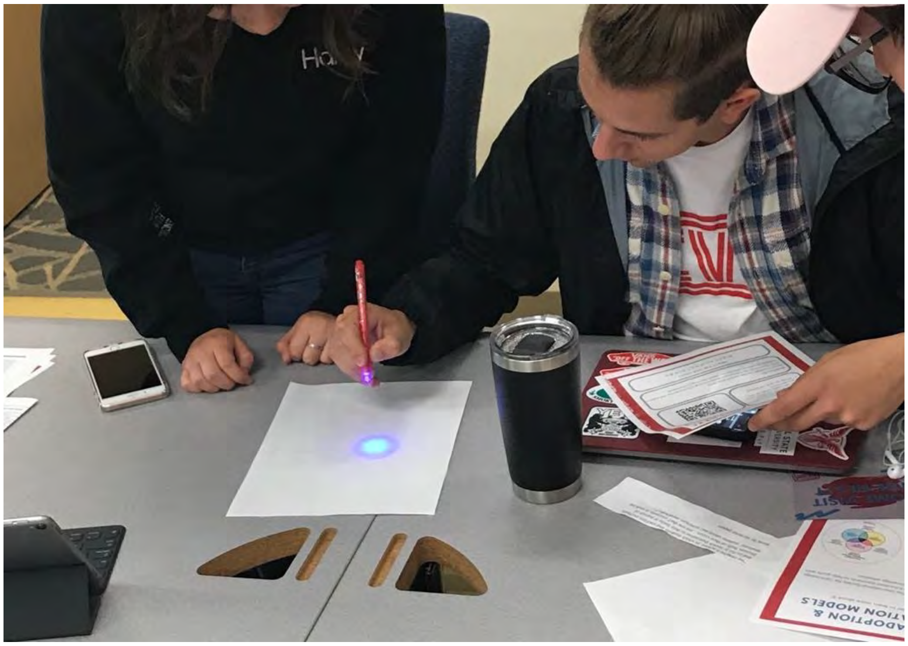
The other item in the bag is an invisible ink marker with an ultraviolet flashlight built into the cap. As participants read the quote, they notice that certain letters within the quote are capitalized. Teams must decide what the letters mean. They must unscramble the letters and come up with a word that will provide them with the next clue. If they unscramble the letters correctly it will spell out the word "blacklight". Once they have the word, they must figure out what they might use the blacklight to uncover.

Stage Five: Reaching a Solution

Participants at this stage of the game must now decide what they should do with the blacklight that was included in the locked bag. Players must think about what they can see using a UVA blacklight. Remembering the directions that anything could be a clue, participants begin shining the light on different items at their tables. The teams ultimately find a letter written in invisible ink on the back of the paper titled, "levels of engagement". At this point, a single letter does not provide much information. As other teams reach the same point in the game, they also find different letters written in invisible ink at their tables. Teams begin to search other tables to locate additional letters (Figure 5).

Figure 5

Candidate Using Blacklight to Search for Clue



This final clue is another jumble of letters. Teams that put the letters together in the right order will have the combination for the padlock on the Breakout EDU box. Teams must think back to the initial presentation by the game master and the discussion about technology integration models. The final solution spells out the acronym for one of the common technology integration models discussed at the beginning of the game, TPACK (Technological Pedagogical and Content Knowledge) (Mishra & Koehler, 2008). The first team that thinks they have the correct combination checks in with the game master. If they have the correct combination, the game master instructs the team to assist other teams that may be struggling. The team members should not give answers to the other players, but instead, think like teachers and guide the other teams to find their own solutions. Once all teams have checked in with the game master, the first team that believes they've found the final solution attempts to unlock the Breakout EDU box (Figure 6). If they succeed, the clock stops, and they open the box to find it filled with affirming signs, candy, and 3D printed tokens as rewards for all participants. Pictures are then taken of the group with their final time behind them.

Figure 6

Team Unlocking the Breakout EDU Box

Stage Six: Putting it All Together

Once pictures are taken, candidates, faculty, and game leaders come back together to reflect and share how the experience enacted concepts discussed at the beginning of the session about meaningful technology integration. The game master leads the conversation and asks candidates to share how the activity enacted the 4Cs. Candidates share that they had to *collaborate* with one another in how they would approach the various tasks and challenges of the game. They had to *communicate* with each other when sharing information from the posters, ideas about technologies they would like to learn more about, and how to solve different challenges. The participants engaged in *critical thinking* and problem solving as they moved through the different stages of the game. They had to use prior knowledge to find solutions, unscramble letters and consider how those words could be used to solve a problem, and look for clues based on the information they gained. Finally, they expressed their *creativity* in how they found solutions to the challenges and their ideas for how the different technologies might be integrated into their instructional practices.

Following the discussion about the 4Cs, the game master asks participants to share their ideas from the Google Form for how they could utilize different technologies within their future classrooms and what technologies they would like to learn more about. Candidates share how the technologies could be integrated within their instructional practices, be included in different classroom projects, or how PK-12 students might use the technology to demonstrate their learning. Some examples include using virtual reality in a social studies classroom to take virtual field trips to locations around the world, using 3D printing within elementary education classrooms to create low-cost manipulatives for math lessons, and applying abstract mathematical concepts to program robots for middle school students.

In the final part of the discussion, the game master asks participants to remember the instructional objective for the activity (to learn how educational technology can be integrated into the teaching and learning process) and to consider how the different elements of the TPACK framework were addressed in the planning and implementation of the lesson. The game master shares that technology integration is much more than hardware, software, and Apps. Instead, it is a complex process of teacher decision-making as they consider the content being taught, the instructional objectives being addressed, the pedagogical practices being incorporated, and which technologies match with those pedagogical practices, and content. He then asks, "How was technology integrated within the teaching and learning process of the Breakout EDU activity we just completed?"

When asked to discuss the content they learned, participants describe that they learned about EdTec programs and the NESTT learning labs from the presentation and word-processed fliers at the beginning of the session. They also expressed that they learned about how different technologies were being used by teachers and students in PK-12 contexts from the different videos they watched while visiting the different posters around the lab. They then shared that from the conversations with teammates, they learned different ideas for how they might use different technologies. Those ideas were then submitted to a Google Form.

Candidates used terms like "active", "student-centered", and "participatory" to describe the pedagogical practices being enacted throughout the game. When asked to explain their responses, candidates shared that they had to get out of their seats and travel from poster to poster, scan each QR code, and watch the videos to gain information about how the different technologies were being used in classrooms. They also interacted with each other throughout the process to share ideas and make decisions about how to solve different challenges. In contrast to more traditional didactic instructional practices, they had to actively engage with the content and each other instead of being passive recipients of the information. When asked to say more, candidates described classes where they just sat and watched instructors go through PowerPoint slides and took quizzes. They then commented that in this lesson they had fun and were engaged while learning something new. When prompted to describe which technologies were used to support this type of pedagogy candidates identified being able to use their own phones, the provided iPad, QR codes, invisible ink pens, ultraviolet flashlight, and the Google Form as tools that supported the learning process.

The participants were then asked to describe how their instructor might assess candidate learning through the playing of the Breakout EDU game. They responded by saying that their instructor could assess them informally by how engaged they were in the process, by asking them questions about what they were learning, and if they were able to get through each stage of the game to ultimately open the Breakout EDU box. They also mentioned that their instructor could look at their responses in the Google Form that was submitted. Teams were prompted to share ideas for how different technologies might be integrated within learning and teaching contexts. The instructor could assign points for the quality of the responses. Candidates also considered that the instructor could use the collected data as a planning tool for future lessons. When asked to say more, candidates explained that they were asked to identify three technologies they would like to learn more about. The instructor could use this information to set up additional visits to the NESTT and focus those sessions on how a specific technology might be incorporated into a specific subject area or grade level. They could then develop lesson plans integrating those technologies.

Conclusion

While experiences during the COVID-19 pandemic forced PK-12 schools, PK-12 teachers, educator preparation programs, and candidates to use technology at a scale like never before. Preparing candidates to use technology in meaningful ways with PK-12 students remains a challenge. As EPPs continue to struggle to prepare candidates to effectively use technology to support student learning, these preservice teachers need to experience instructional practices that model how to integrate technology as an embedded part of the teaching and learning process. For EPPs that seek to infuse technology throughout the experiences of their candidates, initial experiences like the tour of what's possible Breakout EDU can introduce digital pedagogy and technology integration, but also set the stage for additional opportunities for candidates and faculty to use technology later within a course or the preparation program more generally.

Attempts to engage faculty and candidates about technology integration beyond this initial experience have already started to bear fruit. Impact of the Breakout EDU game has been seen through candidates increased use of the lab equipment and checkout of different resources. Teacher education faculty have also scheduled additional times to bring their classes to the lab. Several faculty members have contacted educational technology faculty about creating activities or modifying existing assignments so candidates can integrate different technology within the course. An outcome of the initial experience has been faculty following up on the student responses from the Google Form where candidates identified three technologies they would like to learn more about. Taking the information provided by candidates, faculty have scheduled a second visit to the NESTT to explore different technologies more closely. This has included candidates participating in virtual reality expeditions, exploring 3D printing, or programming sphero robots. Some faculty have even taken the experience further. A social studies methods faculty had her students share something from the NESTT with their cooperating teachers during the observation experiences associated with the class. This led to candidates' 3d printing models of historical landmarks, borrowing VR headsets so middle schoolers could go on a virtual field trip, and designing their own Breakout EDU experience for an economics lesson. In another example, a math methods faculty member followed up by incorporating several technologies into her own course assignments. In turn, her student's used the technologies to demonstrate their understanding of different mathematical concepts. An example includes the students using mathematical principles to design a figure in Google Sketchup and 3D printing the designs.

While teacher education candidates come to their educator preparation program fluent in using technology and social media, teacher educators should not assume candidates know or understand how to integrate technology into effective pedagogical practice. To do so requires teacher education faculty themselves to reflect on their own instruction and to model technology integration practices in ways beyond presenting content. As efforts to improve technology infusion throughout educator preparation and a variety of infusion models emerge (Clausen, 2020), there remains a lot of work to be done. Initial experiences like the EdTec tour of what's possible can help set the stage for candidates and faculty to begin thinking differently about technology integration and developing a digital pedagogy as part of the teaching and learning process.

Jon M. Clausen is an associate professor of educational technology and secondary education at Ball State University Teachers College. He has served as chair of the American Association of Colleges of Teacher Education's (AACTE) Committee on Innovation and Technology, teaches educational technology courses, and is coordinator for the educational technology programs.
Dr. Clausen's areas of research have focused on technology integration and infusion within teacher education. This includes developing instructional contexts that support faculty, PK-12 educators, and candidate technology use. He is also interested in how technology can be used to demonstrate and support student learning. In 2020, his coauthored publication titled "TPACK leadership diagnostic tool: Adoption and implementation by teacher education leaders" received the Outstanding Research Award from the Journal of Digital Learning in Teacher Education.

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