Chapter 13
TeachLivE™ and Teach Well: Simulations in Teacher Education

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13.1 Introduction

Legislation has evolved over the course of several years to mandate opportunities for all students in the USA to have equal access to a robust educational experience. One of the hallmarks of the No Child Left Behind Act (NCLB, 2002) law is the mandate of accountability for educational outcomes among all students to meet challenging state standards in reading and mathematics. Subsequently, the US Department of Education (2010) delineated the expectations of college and career readiness among all high school graduates. In congruence with these federal expectations, the Individuals with Disabilities Education Act (IDEA, 2004) requires the use of classroom practices that have proven effectiveness in improving student outcomes based on evidence-based practices (EBPs, McLeskey & Brownell, 2015).

The legislative implications for teacher and student accountability have parallels directed at universities with teacher preparation programs from accreditors. Expectations from the Council for Accreditation of Educator Preparation (CAEP, 2013) include demonstrable improvement of academic outcomes for all students, including students from low socioeconomic backgrounds and students with disabilities. Leaders in teacher preparation have compelled their colleagues to produce teachers who have the knowledge and skills to do so by focusing on instructional practice (Mcleskey & Brownell, 2015).

Thus, the landscape that teacher candidates navigate during their preparation is complex, dynamic, and highly specialized. Teachers are expected to educate a

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diverse population of children with a wide range of academic needs. Candidates can be required to demonstrate their knowledge and skills across domains developed by both general and special education professional organizations. Teacher preparation programs must prepare educators to be adept at data-based decision-making and proficient in utilizing research-based interventions to improve student outcomes (Garland, Vince Garland, & Vasquez, 2013; Vince Garland, Holden, & Garland, 2016).

In order for educators to successfully teach such a widely diverse group of students to increasingly rigorous standards, teacher candidates need repeated opportunities to learn practices that are essential to promoting improved outcomes if they are to be prepared to use these practices when they enter classrooms (McKleskey et al., 2017). Therefore, more effective pathways and practices are needed for preparing, placing, and supporting beginning teachers and principals (Darling-Hammond, 2010; U.S. Department of Education, 2010). Given such circumstances, institutes of higher education (IHEs) have recommended that teacher preparation programs focus more deliberately on effective instructional practice (Leko, Brownell, Sindelar, & Kiely, 2015). It has also been recommended that programs embed significant time to preparation in clinical settings to systematically support teacher candidates in learning high-leverage practices ([HLPs]; Grossman, Hammerness, & McDonald, 2009). Ideal conditions for preparing teachers to conduct HLPs with fidelity include a safe, controlled environment with immediate feedback and opportunity for frequent, repeated practices (Dieker, Hynes, Hughes, & Smith, 2008; Vince Garland et al., 2016; Vince Garland, Vasquez, & Pearl, 2012).

Clinical field placements provide teacher candidates with access to students in naturalistic settings as well as opportunities to partake in the role of teaching. Extant research reflects that expert practice in any discipline of endeavor typically requires more than a thousand hours of deliberate practice (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2013). However, favorable circumstances for developing skills and a repertoire of instructional strategies to promote learning do not typically lend themselves to such repeated instances.

13.2 Simulation Technology in Teacher Preparation

Through modern technologies, teacher educators and leaders are now enhancing the preparation of the next generation of educators by using simulations and virtual environments. When used in educational contexts, mixed reality clinical simulations provide an effective means by which candidates can master evidence-based pedagogies across a range of academic and behavioral contexts without adversely affecting students. Technology-based simulations allow individuals to have repeated trials without risking the loss of valuable resources such as money, time, and people (Dieker et al., 2013).

Simulation is an industry standard in the fields of aviation, dentistry, medicine, and defense and has rapidly emerged in higher education teacher preparation. When used with fidelity, simulation has proven to be an effective and efficient means by

which teachers obtain mastery-level competency in evidence-based practices (Vince Garland, 2012; Vince Garland et al. 2012, 2016). University faculty use simulated environments to provide teacher candidates with opportunities to hone their skills in ways that do not put actual students at risk. These environments also allow the candidate to repeatedly practice until she or he reaches a level of mastery or target (Vince Garland et al., 2012, 2016).

Another advantage of integrating simulated environments into teacher preparation programs is that permission does not have to be obtained prior to working with actual children. More importantly, actual children are not exposed to errors on the part of novice teachers as they learn to refine their instructional techniques (Judge, Bobzien, Maydosz, Gear, & Katsioloudis, 2013). As a consequence, the use of simulated environments has been touted as a promising means of preparing teacher candidates for their student teaching experience (Dieker et al., 2013). Moreover, simulations have been suggested to be a worthy supplement to classroom practicum settings for developing candidates' individual instructional practices (Wood, Turner, Civil, & Eli, 2016).

13.3 TeachLivE™

One such personalized simulation learning platform is the TeachLivE™ (TLE) simulation laboratory. TeachLivE™ is an immersive mixed reality environment that has been used by over 80 institutes of higher education (IHEs) to enhance traditional didactic instruction and field experiences in teacher preparation programs. The TLE platform is an innovative avenue to providing preservice and novice teachers with means to meet the needs of students from academically, behaviorally, and culturally diverse backgrounds by providing rehearsal opportunities of twenty-first-century skills for use in high-need local education agencies (LEAs). Findings from Spencer et al. (2019) indicated that participants found mixed reality sessions in the TLE simulator significantly more realistic and a more useful practice tool when compared with more traditional role-play simulations.

A key benefit of simulated clinical experiences is the feedback that teacher candidates receive, as feedback encourages reflection and critical analysis of teaching performance (Khalil, Hughes, Gosselin, & Edwards, 2016). As a simulated learning platform, TLE allows faculty to provide meaningful feedback to preservice and novice teachers so that they can refine application of pedagogy to mastery. In addition to its use for pedagogical purposes, researchers have used the TLE simulator to prepare preservice teachers to engage in effective communications during parent-teacher conferences (Kelley & Wenzel, 2019). Furthermore, the TLE simulator provides preservice and novice teachers with the personalized tools to assist them in ascertaining critical skills needed for their success and, most importantly, for the success of students with whom they will teach.

13.4 The TeachLivE™ Space

Since its inception in 2006, TLE has since been used by preservice and in-service teachers throughout the USA (Dieker et al., 2013). In a typical TLE setting, teacher candidates step in front of a large-screen television that displays features of a real classroom with desks, teaching materials, writing boards, and students. A camera, microphone, and Internet connection allow the TLE interactor (digital puppeteer) to see and hear the teacher. Student avatars display personalities that are typical of real-life students. Teacher candidates interact with the student avatars in real time, moving through a nexus that synergizes the prepared lesson or scenario and the organic and reflexive student avatars' reactions to the teacher candidate's behavior while in the teaching session. Users gain a sense of immersion and presence, employing a willing suspension of disbelief that allows them to rehearse high-leverage teaching practices related to student achievement. Like a flight simulator, TLE affords a classroom experience for teacher candidates to plan, practice, reflect, and repeat to proficiency. Following the virtual rehearsal session, the teacher reflects on his or her session. Feedback is also given to the teacher candidate by the professional development facilitator, and this may be conveyed individually or in a small group setting.

13.5 TeachLivE™ Development

Student-avatar characters were developed using the American Academy of Child and Adolescent Psychiatry's description of adolescent development, William Long's classification of adolescent behavior, Rudolf Dreikurs' theory of understanding adolescent maladaptive behavior, and human development theories of, e.g., Piaget, Freud, Kohlberg, Erikson, and Maslow (Dieker et al., 2008). In its nascence, one interactor was the digital puppeteer for all five students simultaneously. The interactor can increase or decrease the level of behavioral responses in a session depending on teacher interaction (Andreasen & Haciomeroglu, 2009).

The original TLE lab virtual classroom space at the University of Central Florida (UCF) was a windowless room with three beige-colored walls and one green wall (see Fig. 13.1). A large projection screen was located slightly left of the center of the room and was roughly 12 feet from the entryway. It is on this screen that the avatar was projected. An additional privacy screen adjoined the projection screen on the left-hand side and provided a divider for an on-site TLE technician to assist in program operations. A webcam was mounted on the top of the projection screen that allowed the interactor to view the participant during sessions. Several microphones were mounted on the ceiling perimeter of the laboratory and enabled the interactor to hear what the participant was saying during sessions. Real-time communications occurred via Skype, allowing the participant and interactor to respond immediately to one another (Vince Garland et al., 2012).

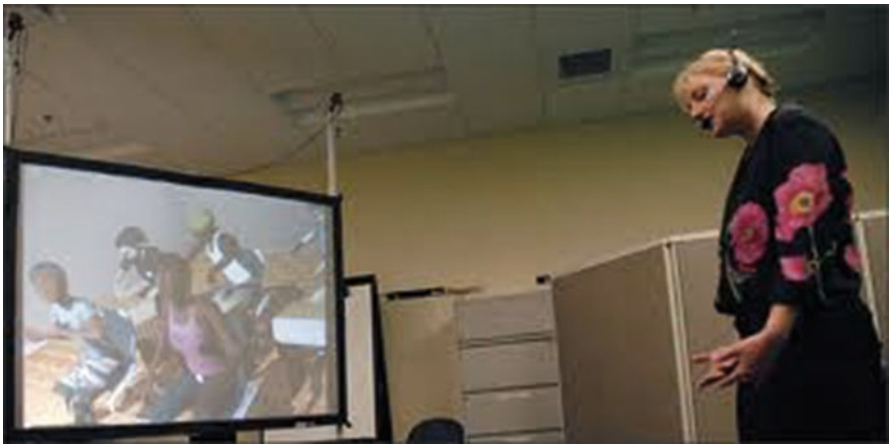

Fig. 13.1 Early iteration stationary laboratory at the University of Central Florida with rear projection unit and requisite participant headpiece, circa 2011

Given the rapidly changing nature of technology, the hardware and logistics associated with using TLE have followed suit. Standardization of the technologies associated with the first TLE laboratory at UCF allowed for replication in other settings. Trainings were provided by experts at the university to colleagues from other universities, and technology specifications were shared. Because communications with interactors were conducted via the Internet, stationary labs were able to be used by teacher educators across the USA (see Fig. 13.2).

The subsequent availability of mobile labs provided increased opportunities demonstrating TLE's potential for developing proficiency and mastery of evidence-based teaching strategies across universities. However, first-generation mobile units were clunky and cumbersome. A large (9 by 7 feet) rear projection screen, video projection unit, external speaker system, wireless microphone, desktop computer with large tower, associated cords, and roll cart for transportation were all required in order to take the platform on the road (see Fig. 13.3).

Additionally, in order to accommodate the size of the equipment, the length of the room needed to be 30–40 feet. Most importantly, and at times, the most challenging requirement was a firewall-free, wired Ethernet connection, which enabled software to communicate between the service provider and end user. Today's TLE mobile units are much more versatile and essentially require a laptop computer with a Wi-Fi connection, web camera, and flat-screen television or projection screen. Most standard classrooms are now equipped with these components. The mobile lab has become, almost literally, a plug and play unit that can fit into a carry-on case to be used globally.

Fig. 13.2 Stationary TLE laboratory setting at SUNY Buffalo State, circa 2016

13.6 Utilizing TLE in Teacher Education Programming

TeachLivE™ provides (a) opportunities for preservice and novice teachers to practice essential skills that will be demonstrated in the practicum and/or internship settings, (b) opportunities to focus on specific teaching skills in need of further development, and (c) additional opportunities for targeted practice for individuals who require more intensive coaching and focused attention in the execution of specific high-stakes skills. Faculty can assess students' baseline levels of teaching skills in the TLE lab at the beginning of their academic careers and use this data to tailor individualized learning opportunities for maximized outcomes. Teacher candidates who demonstrate need for more explicit instructional coaching can work with their mentors in the TLE lab to gain proficiency in targeted sessions.

Candidates can receive multiple sessions with compressed cycles. Avatars don't grow anxious, bored, or fatigued as the candidate develops proficiency (unless prescribed to do so). In the lab space, teacher educators can also provide opportunities for student candidates to receive training on high-stakes but low incidence occurrences (i.e., self-injurious behaviors and medical emergencies). When such

Fig. 13.3 Early rear projection mobile unit, circa 2015

situations actually occur, it is crucial that educators make swift and judicious decisions – there is no room for mistakes.

13.7 Individualized Clinical Coaching and Provision of Feedback

Integrating TLE rehearsal sessions across teacher education coursework provides essential remediative action opportunities for learning and practice among struggling candidates. Targeted experiences in the TLE simulator at increasing levels of intensity can be provided to candidates who are not meeting minimum program requirements until they demonstrate skill mastery. Students early in their academic career may utilize the lab to practice, make mistakes, and try new approaches, thereby gaining a deeper understanding of educational pedagogy. Similarly, current practitioners can rehearse and acquire new pedagogies that will enable them to adapt to increasingly diverse student makeup and support those students to successfully engage in culturally relevant learning.

For colleges of education and local education agencies (LEAs), possible implications of TLE use in preparation programming include reduced attrition rates, high rates of acquisition, mastery, maintenance of research-based practices among educators, and improved academic and behavioral outcomes among students. TeachLivE™ has been used in conjunction with coursework with measurable impact on teacher candidates' abilities to increase effective teaching practices, such as providing explicit, systematic instruction, scaffolding, and increasing opportunities to respond through student engagement (Dawson, Lignugaris/Kraft, 2017; Dieker, Hughes, Hynes, & Straub, 2017; Vince Garland et al., 2016). Providing teacher candidates with multiple opportunities to receive coaching in the TLE simulator is therefore likely to result in an increase in actual student learning and an overall improvement in classroom behavior (Straub, Dieker, Hynes, & Hughes, 2014, 2015).

13.8 Reflective Practice

Of equal importance is the need to emphasize teacher candidate self-reflection. By encouraging teacher candidates to examine their own instructional experiences, they will become practiced at identifying areas in need of improvement and successfully select appropriate teaching strategies that can bridge experience and learning. Effective teacher preparation programs promote preservice teachers' reflective practices to support the development of more sophisticated thinking, moving beyond simplistic views of teaching (Holden, 2016).

A key component in reflective practice involves learning through active participation to gain new insights about one's practice. Immediately after a TLE session, participants should have the opportunity to engage in reflection. This can occur in a written format and does not have to be labor intensive. Examples include a 2-min written or verbal reflection (e.g., what went well, what didn't go well, how could the session be improved next time) or a 2-min free-write reflection. The reflective process encourages teacher candidates to make links from one experience to the next, expanding professional knowledge and action by challenging assumptions of everyday practice and critically evaluating self-responses within the practice space.

Teacher candidates can engage in deeper and more introspective reflection as experience is gained within the lab setting. The experience transitions from reflecting on the immediate action (e.g., reaction) to reflecting about the sustained effects (e.g., longitudinal impact). Refining reflective practices also occurs as teacher candidates progress through sessions in the lab space and ultimately transition into an actual classroom space. Teacher education programs may also choose to engage students in reflecting via written journals or video diaries. The ultimate goal for utilization of TLE was to enhance teacher candidates' academic clinical

experiences by providing a means for personalized, rigorous, and targeted preparation and metrics to evaluate their success. Reflective practice provides an organic counterbalance for the precision-style coaching sessions that can occur in the TLE space.

13.9 Perceived Value

Individuals who have utilized the TLE virtual classroom for practice and coaching have consistently reported that there is a strong perceived value to experiences within the TLE setting (Garland & Vince Garland, 2020; Vince Garland, 2012, 2014; Vince Garland et al., 2012). Sources of impact data include TeachLivE™ Perceptions and Presence Questionnaires, individual after-action reviews, written journal reflections, and focus groups. Information was also collected via email correspondence and personal conversations with cooperating teacher mentors and TLE facilitators (e.g., instructional faculty).

Teacher candidates frequently wrote that they would prefer additional sessions within the TLE virtual classroom and believed future teacher candidates would benefit from using TLE at the beginning of their academic program. Individuals coached in the TLE space reflected that they felt the experience was "worth a large amount." When asked to hypothesize about an acceptable fee schedule, respondents gave a range from $30.00 to $50.00 for a 15-min coaching session. Participants' perceptions of value were consistent with that of the actual cost for lab use of $120 per hour ($30.00 for 15 min).

Individuals commented that they felt a value to the immersive experience of the platform itself and the sense of "presence" that the avatars brought to their practice sessions. Candidates remarked that they felt "immersed" and forgot that they were talking to students on a computer screen. Participants remarked that the avatars needed (behavioral) redirection just like regular students and such immersion was incomparable to that of a typical microteach or traditional role-play simulation. Vince Garland et al. (2016) reported that journal reflections and responses to questionnaires among participants were also positive. Analyses of the questionnaires revealed that over 80% of teacher candidates thought that teaching in the TLE simulator was an effective way to practice new classroom skills. Three quarters of participants felt more prepared to teach and effectively manage the classroom. Likewise, 75% of candidates responded that they had more confidence in their ability to manage undesired behaviors after receiving coaching in the simulator.

Collective feedback from participants who have utilized the lab in coursework has been overwhelmingly positive; participants have reported a high level of engagement and have also suggested that the TLE be further incorporated into academic curricula. Faculty also responded positively; a majority who have facilitated instruction in the TLE space requested future sessions and requested funding from their respective academic departments (Vince Garland, 2014).

13.10 Conditionalities and Considerations

By whatever label attributed to it (augmented, blended, hyper, mixed, or virtual reality), the TeachLivE™ simulator has emerged as one of the more successfully adopted simulated learning platforms in the higher education landscape. Nevertheless, despite the substantive and growing body of evidence of its efficacy for providing robust learning opportunities for rehearsal among teacher candidates, its widespread adoption remains elusive. Nonetheless, expectations for mixed reality in higher education persist, not because of the novelty of the technologies themselves, but because of the teaching opportunities that they provide to instructors. Mixed reality plays into the capability of the human mind to aggregate the physical and the imagined (Alexander et al., 2019). This is where TLE has met expectations.

Considerations to cost of equipment and licensing agreement are also factors in contemplating the integration of TLE sessions into teacher preparation programs. Necessary equipment can typically be purchased for less than $2500. It is important to note that a working agreement with either Mursion (the commercial entity of TeachLivE™) or the Center for Research in Education Simulation Technology at the University of Central Florida is required.

In order for any technology-based learning platform to have the desired impact, the technology needs to be usable across the curriculum and in sufficient numbers to merit institutional investment. Support, training, and professional conferences dedicated solely to TeachLivE™ are readily available to faculty who use the simulation platform. Dawson and Lignugaris/Kraft (2017) recommended controlled comparisons of the effectiveness of TLE with other practice-based learning approaches like microteaching or classroom simulators (Benedict, Holdheide, Brownell, Foley, & CEEDAR, 2016). Prudent collection of such data is necessary to conduct a cost-benefit analysis of utilizing TLE as a core component in teacher preparation programs.

Additionally, perceptions of technical complexity among some faculty may preclude it from being considered as an autonomous platform for campus-wide use. Faculty members who initially use the TLE platform at an IHE can carry its implementation forward to some extent. However, faculty members who plan to integrate its use in their courses must receive training for operating the hardware and software components of the platform and ultimately become self-sufficient at the triangulation between the hardware, software, and correspondence with TLE interactors and maintain a contractual agreement with either Mursion or the University of Central Florida's Center for Research in Education Simulation Technology. Otherwise, the technology will only appear at best in a small segment of a college or university.

Another caveat that teacher educators should consider is the fact that, despite the perceived value and outcomes reported by participants and researchers, several hours of preparation go into session planning with regard to scripting behaviors of the avatars. The lab provides a very realistic simulation of classrooms, students, and teaching scenarios. Ultimately, variability of student behaviors, demographics, classroom layouts, etc. are far less standardized in the real classrooms than in virtual

environments (Dawson & Lignugaris/Kraft, 2017). Nonetheless, given the considerations above, the TLE remains a robust means by which teacher preparation professionals can leverage immersive experiences for their candidates to rehearse and master high-leverage teaching practices across an increasingly diverse educational landscape. Therefore, practice sessions in the TLE should be considered as potent primers to field experiences and not substitutions within teacher preparation programs.

Finally, in order to maximize the preparation of their candidates, teacher educators should strongly consider measuring maintenance and generalization of their students' newly acquired teaching skills once skills training in the TLE has concluded (Dawson & Lignugaris/Kraft, 2017; Vince Garland, 2012; Vince Garland et al., 2016). Restated, TLE is an innovative means of providing preservice and novice teachers with means to meet the needs of students from academically, behaviorally, and culturally diverse backgrounds by providing rehearsal opportunities to acquire and master high-leverage teaching practices. Measuring whether teacher candidates generalize their newly acquired skills and maintaining those skills with their students is the critical benchmark of success.

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