Advances in Game-Based Learning

Elizabeth Bradley *Editor*

Games and Simulations in Teacher Education

Springer

Advances in Game-Based Learning

Series Editors

Dirk Ifenthaler
Scott Joseph Warren

More information about this series at http://www.springer.com/series/13094

Elizabeth Bradley
Editor

Games and Simulations in Teacher Education

Springer

Editor
Elizabeth Bradley
School for Graduate Studies
SUNY Empire State College
Latham, NY, USA

ISSN 2567-8086 ISSN 2567-8485 (electronic)
Advances in Game-Based Learning
ISBN 978-3-030-44525-6 ISBN 978-3-030-44526-3 (eBook)
https://doi.org/10.1007/978-3-030-44526-3

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Foreword

Teacher education combines a large number of competencies which characterise later experts in education and schooling. Some of these competencies include (a) the design, planning, and evaluation of learning and teaching processes; (b) the motivation of students; (c) the knowledge of developmental, social, and cultural presuppositions of students; (d) the assessment, analysis, and facilitation of a student's stage of development and learning; (e) the ability to conduct counselling interviews; (f) the active cooperation in quality development of a school and school organisation; and many others.

Teacher education programmes focus on these competencies, which teachers require to perform their tasks effectively in the classroom, school, and wider educational arena. Both, the pre-service and in-service teacher education programmes utilise an abundancy of methods and approaches to prepare and advance the teachers' competencies including mentoring, attendance at school, peer networks, supervision, self-reflections, and development portfolios. However, the use of games and simulations in the field of teacher education is very rare.

Computer-supported learning environments such as games and simulations offer effective means for understanding complex processes. As a consequence of this development, games and simulations have become a widely used tool for training and for research on human interaction with complex work and learning environments. In contrast to other media, such as animation, film, etc., games and simulations provide a wide range of capabilities and areas of application for learning and instruction. Accordingly, more and more games and simulations are being implemented for very specific purposes and complex content. For example, training programmes using games and simulations have been successfully applied in the fields of flight training, healthcare education, dental education, command and control training of large incidents, team-based decision making, training of firefighters, and many other domains. Still, comprehensive frameworks linking individual cognitive processes, learning, instruction, and the design of games and simulations are scarce.

In this edited volume, *Games and Simulations in Teacher Education*, Elizabeth Bradley brings together international experts on games and simulations showcasing their latest concepts, methodologies, and empirical findings. The contributions focus on simulation technologies, gamifying trainings, and virtual reality. Chapter authors use empirical research methodologies, including existing, experimental, and emerging conceptual frameworks, from various fields in order to tackle phenomena for preventing adverse childhood experiences; bullying prevention; promoting understanding of students with disabilities and social, emotional, and behavioural concerns; and supporting general and special education preparation.

The synthesis of latest innovations and fresh perspectives on pedagogical constructs makes *Games and Simulations in Teacher Education* a cutting-edge read for researchers and educators in teacher education and beyond. Despite the potential and applications of games and simulations being showcased in this edited volume, it is imperative to note that a meaningful integration of games and simulations in pedagogical scenarios shall have a supporting purpose for learning processes, knowledge construction, and learning outcomes.

Dirk Ifenthaler (http://www.ifenthaler.info) is Professor and Chair of Learning, Design and Technology at the University of Mannheim, Germany, and UNESCO Deputy Chair of Data Science in Higher Education Learning and Teaching at Curtin University, Australia. His previous roles include Professor and Director, Centre for Research in Digital Learning at Deakin University, Australia, Manager of Applied Research and Learning Analytics at Open Universities Australia, and Professor for Applied Teaching and Learning Research at the University of Potsdam, Germany. He was a 2012 Fulbright Scholar-in-Residence at the Jeannine Rainbolt College of Education, University of Oklahoma, USA. Dirk's research focuses on the intersection of cognitive psychology, educational technology, data analytics, and organisational learning. His research outcomes include numerous co-authored books, book series, book chapters, journal articles, and international conference papers, as well as successful grant funding in Australia, Germany, and the USA. He is the Editor-in-Chief of the Springer journal *Technology, Knowledge and Learning* (www.springer.com/10758) and editorial board member of several international journals.

Professor Dirk Ifenthaler
University of Mannheim
Mannheim, Germany
Curtin University
Perth, Australia

Acknowledgements

Thank you to my family – my husband Curtis and our three children, for their encouragement and support of my work – and to my parents for instilling a love of lifelong learning. Thank you to Eileen O'Connor and David Gibson for introducing me to the field of games and simulations. Finally, thank you to the Great I Am, from whom all blessings flow.

Contents

Contributors

Glenn Albright Department of Psychology, Baruch College, City University of New York, New York, NY, USA

Nicolas Boileau University of Michigan, Ann Arbor, MI, USA

Elizabeth Bradley School for Graduate Studies, SUNY Empire State College, Latham, NY, USA

Vu-Minh Chieu University of Michigan, Ann Arbor, MI, USA

Thomas Connolly University of the West of Scotland, Paisley, Scotland, UK

Jelia Domingo School for Graduate Studies, SUNY Empire State College, Latham, NY, USA

Elisabeth Etopio University at Buffalo, The State University of New York, Buffalo, NY, USA

Dennis Garland Niagara University, Lewiston, NY, USA

Krista Vince Garland SUNY Buffalo State, Buffalo, NY, USA

Patricio Herbst University of Michigan, Ann Arbor, MI, USA

Plama Hristova Sofia University, "St. Kliment Ohridski," Sofia, Bulgaria

Nikita Khalid The Graduate Center, City University of New York, New York, NY, USA

Richard Lamb Neurocognition Science Laboratory, East Carolina University, Greenville, NC, USA

Melanie Landon-Hays Western Oregon University, Monmouth, OR, USA

Jeremy McMilan University of Georgia, Athens, GA, USA

Amanda Milewski University of Michigan, Ann Arbor, MI, USA

Eileen O'Connor SUNY Empire State College, Saratoga Springs, NY, USA

Maria B. Peterson-Ahmad College of Professional Education, Texas Woman's University, Denton, TX, USA

Kristen Shockley University of Georgia, Athens, GA, USA

Mollee Shultz University of Michigan, Ann Arbor, MI, USA

Nina Tsvetkova Sofia University, "St. Kliment Ohridski," Sofia, Bulgaria

About the Editor

Dr. Elizabeth Bradley is an Associate Professor in the School for Graduate Studies at SUNY Empire State College. Prior to teaching at Empire State College, she worked as a school psychologist in a city school district in Western Massachusetts. She received her Ph.D. in School Psychology from the University of Massachusetts Amherst, and she is a licensed psychologist and a nationally certified school psychologist. Dr. Bradley has worked with at-risk youth in hospital, residential home, and public school settings and her research intersects psychology and education, with a focus on the use of online simulations in pre-service teacher training.

Chapter 1
Introduction

Elizabeth Bradley

Teacher education has been criticized for a number of gaps in learning. Darling-Hammond (1999) and Ramsey (2000) agree that classroom training experiences are inadequate for pre-service teachers as they usually focus on lesson planning more than student behavior and functioning. Groundwater-Smith, Deer, Sharp, and March (1996), Cambourne, Kiggins, and Ferry (2003) and colleagues have shown that the best way to train pre-service teachers is for them to have unlimited time in the classroom and to be involved in the complex decisions that teachers make every day. However, this is difficult to achieve due to budget and time constraints. Simulation training provides a natural solution to this issue (Wood, Turner, Civil, & Eli, 2016). Computer simulations can provide guided practice for a variety of situations that pre-service teachers would not frequently experience during their teacher education studies (Mason, 2011; Mason, Jeon, Blair, & Glomb, 2011). Training pre-service teachers in a classroom requires patience from the students as a less-than-competent teacher in training makes mistakes. Classroom simulations can help pre-service teachers develop the skills that it takes to properly run a classroom without the high-stakes risk of causing harm to actual students (Matsuda, 2005).

Pre-service teachers use simulations to turn the knowledge they have gained in their coursework into real experience (Office of Postsecondary Education, 2005; Peterson-Ahmad, 2018). Simulations can allow pre-service teachers to see their students from a different perspective and thus gain insight into the best ways to manage their future classroom. Simulations also help pre-service teachers understand how they must feel their way, both cognitively and emotionally, through their decisions each day, and they can provide insight into the direct consequences of the teacher's actions in the classroom (Brookfield, 1995). Correction and feedback are built into

E. Bradley (✉)
School for Graduate Studies, SUNY Empire State College, Latham, NY, USA
e-mail: elizabeth.bradley@esc.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_1

most simulations, allowing learning without real consequence (Ferry et al., 2004; Judge, Bobzien, Maydosz, Gear, & Katsioloudis, 2013).

In active learning, students work together in cooperative groups to engage in experiential, analytical, critical thinking, and problem-solving tasks as opposed to simply reading, taking notes, or listening to course lectures (Zapalska, Brozik, & Rudd, 2012). Simulations provide the opportunity for active and higher order learning through role-playing with students, as users are presented with realistic scenarios, engage in conversations with students, encounter a variety of student responses depending on their actions, and receive feedback for remediation. Computer simulations can help pre-service and new teachers experience active and deeper learning through role-playing without the high-stakes risk of working with real students and potentially causing (or experiencing) harm (Matsuda, 2005).

Across various disciplines, simulations have been used to remove the risks of real-life learning experiences, while allowing the user to gain needed perspective. Computer simulations have been used in many complicated or high-risk situations (Ward, Williams, & Hancock, 2006), such as medical surgery (Haluck et al., 2001), civil law (Rivera & Goldscheid, 2009), and aviation (Allerton, 2000). The business world is one of the most widely developed areas of simulation training. Computer simulation training tools are used in many strategic management courses to help students develop skills in strategy formation, implementation, and team management (Ritchie, Fornaciari, Drew, & Marlin, 2013). Research on the use of computer simulations for management training suggests that simulations are a more favorable choice than the use of case studies, a popular alternative in management training programs, in skill development (Pasin & Giroux, 2011; Wolfe, 1997). Some businesses are using Second Life as alternate offices by which employees can meet and share materials. Companies may use the virtual meeting place to display ads, posters, and other designs live in 3D to clients all around the world and can save thousands of dollars through piloting campaigns in the virtual world, rather than creating expensive, lifelike models (Hof, 2006). Likewise, virtual reality has a number of applications for pedagogy and teacher training (Tondeur, Pareja-Roblin, van Braak, Voogt, & Prestridge, 2017).

Current research on simulations has revealed multiple important factors in determining whether the simulation will be useful. The extent to which the simulation bears resemblance to real life, as well as the method in which it is used in coursework, has a meaningful impact on how effective it is (Ward et al., 2006). Research on the Curry Teacher Simulation has revealed that the more life-like the program is, the more likely it is to translate into practical use (Office of Postsecondary Education, 2005). Kraiger and Jung (1997) determined that the salience of a simulation is not determined by how well the users liked the simulation, but by how much they learned from the simulation and applied it to their jobs. Kirkpatrick (1959, 1996) proposed that trainings need to be evaluated based on reaction, learning, behavior, and results. In addition, design features are a crucial part of the simulation process. Merely participating in a simulation is not enough for meaningful learning to take place. The instructional design features that hold the most weight are performance assessment, task analysis, scenario design, instructional feedback, and participant reflection (Salas, Bowers, & Rhodenizer, 1998).

Teacher simulation training has come a long way over the past few decades. Allen and Ryan developed "microteaching" in the 1960s as a way to help pre-service teachers develop their skills. In the 1980s, Yoshizaki proposed the "Stop Video Method," a technique in which the instructor plays a video of a classroom situation and pauses the video to allow the pre-service teacher the opportunity to respond to the situation in the manner that they see fit. These methods were instrumental in encouraging the next step toward computer simulations but did not provide the real-life feedback that a student would give to the situation (Matsuda, 2005). They were used more as a method of testing and researching teacher behaviors than as a means to educate the teacher. In addition, more recent computer simulations do not require the use of a facilitator, because the simulation does the explaining and guiding on its own.

1.1 Current Teacher Education Simulations

Currently, a number of simulations are available to teacher educators, and they fall into the categories of virtual puppetry simulations, Multi-User Virtual Environments (MUVEs), and single user simulations. Virtual puppetry simulations are synchronous, as the pre-service teacher interacts with actors who comprise the class of students in the virtual environment. Multi-User Virtual Environments allow multiple students to interact synchronously in virtual environments. In single user simulations, the simulation has pre-programmed responses to complex threads of interactions between the pre-service teacher and the simulated student. This book details simulations from each of the above categories. Information on the simulation origins, including theoretical underpinnings, goals, characteristics, relevant research/program evaluation results, discussion of benefits and limitations, as well as dissemination, recommended use, scope of practice, etc. of the game or simulation.

The field of computer simulations is ever changing. Thus, it is impossible to include a fully complete and exhaustive record of all simulations related to teacher training. However, this book includes a large and representative sample of simulation offerings at present time, in the hopes that readers will find several that match their educational needs. When choosing which simulation to integrate into teacher education programs, it may be helpful to request a sample from the creator or publisher. Much like requesting an exam copy of textbooks, publishers are usually happy to give faculty or researchers one copy of the software so they can try it out and see if it may fit their student's needs. Other factors to take into account when choosing the best simulations for students' needs are (1) which gaps may exist in the curriculum, (2) cost, as some may be reduced or free, and (3) whether a simulation has technological issues, as students have reported frustration when experiencing difficulties with technology in the past.

1.2 Conclusions

Computer simulations aren't intended to be a substitute for hands-on classroom experience; rather, they provide specific skill-building lessons to teacher candidates (Sawchuk, 2011). Pre-service teachers can use simulations to turn the knowledge they have gained in their coursework into real experience (Office of Postsecondary Education, 2005). Simulations can allow pre-service teachers to see their students from a different perspective, gain insight into the best ways to manage their classroom, and understand the direct consequences of their actions in the classroom (Ferry et al., 2004). Additional simulations may exist that are yet to be explored or included in this book. The use of computer simulations in teacher education has not yet been widespread, although with the prevalence of online or blended teacher training programs, the use of these effective training tools should increase.

References

Allerton, D. (2000). Flight simulation: Past, present, and future. *Aeronautical Journal, 104*, 651–663.

Brookfield, S. (1995). *Becoming a critically reflective teacher*. San Francisco, CA: Josey-Bass.

Cambourne, B., Kiggins, J., & Ferry, B. (2003). Replacing traditional lectures, tutorials and exams with a knowledge building community (KBC): A constructivist, problem-based approach to pre-service primary teacher education. *English Teaching: Practice and Critique, 2*(3), 7–21. Retrieved from http://www.tmc.waikato.ac.nz/english/ETPC/article/pdf/2003v2n3art1.pdf

Darling-Hammond, L. (1999). Teacher education: Rethinking practice and policy. *Unicorn, 25*(1), 31–48.

Ferry, B., Kervin, L., Cambourne, B., Turbill, J., Puglisi, S., Jonassen, D., & Hedberg, J. (2004, December 5–8). *Online classroom simulation: The 'next wave' for pre-service teacher education?* In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), *Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference* (pp. 294–302). Perth. Retrieved from http://www.ascilite.org.au/conferences/perth04/procs/ferry.html

Groundwater-Smith, S., Deer, C., Sharp, H., & March, P. (1996). The practicum as workplace leaning: A multi-modal approach in teacher education. *Australian Journal of Teacher Education, 22*(2), 21–30.

Haluck, R., Webster, R., Snyder, A., Melkonian, M., Mohler, B., Dise, M., & Lefever, A. (2001). A virtual reality surgical simulator trainer for navigation in laparoscopic surgery. In J. Westwood & H. Hoffman (Eds.), *Medicine meets virtual space* (pp. 171–176). Amsterdam, The Netherlands: IOS Press.

Hof, R. (2006). It's not all fun and games. *BusinessWeek, 3982*, 76–77.

Judge, S., Bobzien, J., Maydosz, A., Gear, S., & Katsioloudis, P. (2013). The use of visual-based simulated environments in teacher preparation. *Journal of Education and Training Studies, 1*(1), 88–97.

Kirkpatrick, D. (1959). Techniques for evaluating training programs. *Journal of the American Society of Training Directors, 13*(3–9), 21–26.

Kirkpatrick, D. L. (1996). Revisiting Kirkpatrick's four-level model. *Training and Development, 50*, 54–59.

Kraiger, K., & Jung, K. (1997). Linking training objectives to evaluation criteria. In M. Quinones & A. Ehrenstein (Eds.), *Training for a rapidly changing workplace* (pp. 151–175). Washington, DC: American Psychological Association.

Mason, L. (2011). *A functional assessment of the use of virtual simulations to train distance pre-service special education teachers to conduct individualized education program team meetings* (All Graduate Theses and Dissertations. Paper 1028). Retrieved from http://digitalcommons.usu.edu/etd/1028

Mason, L., Jeon, K., Blair, P., & Glomb, N. (2011). Virtual tutor training: Learning to teach in a multi-user virtual environment. *International Journal of Gaming and Computer-Mediated Simulation, 3*, 51–67.

Matsuda, T. (2005). Instructional activities game: A tool for teacher training and research into teaching. In S. Rei, K. Arai, & F. Kato (Eds.), *Gaming, simulations, and society: Research scope and perspective*. Tokyo, Japan: Springer-Verlag Tokyo.

Office of Postsecondary Education. (2005, December 09). *Lessons learned from FIPSE Projects I – October 1990: Teacher training through computer simulation*. Retrieved from http://www2.ed.gov/about/offices/list/ope/fipse/lessons1/virginia.html

Pasin, F., & Giroux, H. (2011). The impact of a simulation game on operations management education. *Computers and Education, 57*, 1240–1254.

Peterson-Ahmad, M. B. (2018). Enhancing pre-service special education preparation through combined use of virtual simulation and instructional coaching. *Education Sciences, 8*(10), 1–9. https://doi.org/10.3390/edusci8010010

Ramsey, G. (2000). *Quality matters: Revitalising teaching: Critical times, critical choices. Report of the Review of Teacher Education in NSW*. Sydney, Australia: NSW Department of Education & Training. Retrieved from http://www.det.nsw.edu.au/teachrev/reports/

Ritchie, W., Fornaciari, C., Drew, S., & Marlin, D. (2013). Team culture and business strategy simulation performance. *Journal of Management Education, 37*(5), 601–622.

Rivera, J., & Goldscheid, J. (2009, August). *Making simulations real: Using simulations to teach doctrine, skills and professionalism across the curriculum*. In Paper presented at the 2009 Summer Conference of the Institute for Law Teaching and Learning, New York, NY.

Salas, E., Bowers, C., & Rhodenizer, L. (1998). It is not how much you have but how you use it: Toward a rational use of simulation to support aviation training. *The International Journal of Aviation Psychology, 8*, 197–208.

Sawchuk, S. (2011). Simulations helping novices hone skills. *Education Week, 30*(15), 1–18.

Tondeur, J., Pareja Roblin, N., van Braak, J., Voogt, J., & Prestridge, S. (2017). Preparing beginning teachers for technology integration in education: Ready for take-off? *Technology, Pedagogy and Education, 26*(2), 157–177.

Ward, P., Williams, A., & Hancock, P. (2006). Simulation for performance and training. In K. A. Ericsson, N. Charness, P. Feltovich, & R. Hoffman (Eds.), *The Cambridge handbook of expertise and expert performance* (pp. 243–262). New York, NY: Cambridge University Press.

Wolfe, J. (1997). The effectiveness of business games in strategic management course work. *Simulation and Gaming, 28*, 360–376.

Wood, M. B., Turner, E. E., Civil, M., & Eli, J. A. (Eds.). (2016). *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Tucson, AZ: The University of Arizona.

Zapalska, A., Brozik, D., & Rudd, D. (2012). Development of active learning with simulations and games. *US-China Education Review, 2*, 164–169. Retrieved from http://files.eric.ed.gov/fulltext/ED532179.pdf

Chapter 2
Introduction to PK12 Professional Development Role-Play Simulation Technology

Glenn Albright

2.1 How a Simulation Works

In role-play simulations, the user or "player", or in this case, "an educator," enters a risk-free practice environment, assumes a role of a teacher, administrator, staff member, school nurse, paraprofessional, safety officer, etc., and engages in a conversation with intelligent, fully animated, and emotionally responsive virtual humans that model student or parent behavior.

The virtual humans are coded to possess an individual personality and memory and adapt their behaviors to the decisions of the educators throughout the conversation. Users communicate with the virtual human by selecting from a dynamic menu of dialogue options. Each option represents a specific conversation tactic based on social-cognitive and communication skills that may be more or less effective or ineffective in accomplishing a goal. Once the user chooses a dialogue option, they see the virtual human that represents them "perform" the dialogue and then observe the verbal and non-verbal response of the non-player virtual student or human. A virtual coach provides the educator with on-going personalized feedback and give users an opportunity to revise (or undo) their choice. The relationship between the user's dialogue decision and the response of the emotionally responsive virtual humans are controlled by a set of mathematical behavioral models and algorithms specifically designed to simulate real interactions with student/parent types, for example, that represent particular personality traits or conditions. These algorithms ensure that users are repeatedly exposed to target conversation and behavior patterns as a way to develop skills and knowledge. To successfully complete the conversation, users must apply effective conversation tactics and adapt their decisions

G. Albright (✉)
Department of Psychology, Baruch College, City University of New York,
New York, NY, USA
e-mail: Glenn.Albright@baruch.cuny.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances
in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_2

Fig. 2.1 Screenshot of *At-Risk for High School Educators* where the user assumes the role of an English teacher, Mr. Lyons, to engage in a virtual role-play conversation with Joey, a student he is concerned about

based on the virtual human's behavior. At the end of each conversation, users are provided with summary feedback from the virtual coach and a performance dashboard with detailed feedback on how well they performed on each of the conversation goals (see Fig. 2.1).

2.2 Advantages of Virtual Humans

Learning through live role-play with trained instructors has been widely used in teaching K12 educator's communication skills. However, the cost and logistics of organizing skilled practice and assessment sessions with trained actors, the challenge of standardizing the experience, and the discomfort participants often experience role-playing in a workshop setting are significant barriers to effective adoption. Virtual humans as an alternative to the traditional live role-play methodology provide an opportunity to eliminate many of these barriers. This alternative also provides a highly effective learning experience.

Virtual humans are defined as automated, three-dimensional agents that converse, understand, reason, and exhibit emotions (see Fig. 2.2) Their use has many educational and economic advantages allowing educators to practice how to leverage conversations and drive meaningful change in student behaviors and attitudes. Role-playing with virtual humans decreases the likelihood of negative transference reactions or the user feeling embarrassed or judged, which often happens in live role-plays, especially in the presence of peers (Nestel & Tierney, 2007; Stevenson

Fig. 2.2 Advantages of using virtual humans in role-play are numerous

& Sander, 2002). Both negative emotions in general, and social evaluative threat in particular, are known to impede cognitive performance, learning, and retention (Baumeister, Twenge, & Nuss, 2002; Bolte, Goschke, & Kuhl, 2003; Kuhlmann, Piel, & Wolf, 2005; Lupien et al., 1997; Payne et al., 2006, Payne et al., 2007; Smallwood, Fitzgerald, Miles, & Phillips, 2009). Another advantage is that virtual humans are coded to support high fidelity of the learning experience. This includes consistent delivery of accurate knowledge, realistic and engaging role-plays, and appropriate feedback. Adding to the fidelity is that virtual humans do not fatigue, have a neutral appearance, are not subject to trainer bias, and will continually respond in the most efficacious way to promote skill development. Also, users find it easier to talk to and explore different communication strategies with virtual humans as there is little fear of making mistakes or being judged, especially when practicing in the privacy of one's home or office (McGaghie, Siddall, Mazmanian, & Myers, 2009). Lastly, the appearance and voice/language of the virtual human can be customized to each user and conversation setting to provide a high level of personalization, localization, and cultural appropriateness. These factors make digital simulations appropriate alternatives or supplements to traditional workshops and other non-interactive learning experiences.

2.3 Under the Hood: What Drives the Simulations

The Behavior Change Model includes two parts the instructional design component that draws from the science of education and learning theory and the conversation component that integrates evidence-based communication strategies drawn from models in social cognition and neuroscience.

2.4 *Instructional Design Component:* Simulations Rooted in Learning Theory

There has been widespread agreement, based on extensive research, that skills are best learned when knowledge is actively constructed, rather than through the traditional didactic model where knowledge is presented, and learners passively accept it (Andrade, Bagri, Zaw, Roos, & Ruiz, 2010; Aspegren, 1999; Joyner & Young, 2006; Lane & Rollnick, 2007; Rosenbaum, Ferguson, & Lobas, 2004). In Kognito simulations, learners are afforded multiple opportunities to actively make decisions, thereby creating unique pathways of experience on an individual level. As learners devise their own experience through the simulation, they actively construct knowledge based on the decisions they make (Andrade et al., 2010; Lane & Rollnick, 2007; Rosenbaum et al., 2004).

Research has also demonstrated that skills acquisition and mastery is most likely to occur when active learning strategies (e.g., role-plays) are used. Situated learning (actively participating in the learning experience) gives learners agency and allows the brain to make meaningful connections through physical, embodied experiences that are as authentic as possible related to the context where the learning will be applied (Black, 2010; Driscoll, 2000; Ericsson, Prietula, & Cokely, 2007; Lave & Wenger, 1991; Merriam, 2008). By employing this theory in a virtual space, the role-play simulations provide educators with an opportunity to both learn and practice in a safe, simulated environment that mimics the authenticity of the same real-world contexts. This allows for experimentation with various communication tactics without fear of consequences or judgment.

2.5 Interfering with Leaning: Respecting the Limits of Short-term Memory

According to the Cognitive Load Theory, the processing capabilities of the brain's working or short-term memory are limited in capacity and duration, and in order to allow for as much processing power as possible, information must be presented such that it reduces extraneous cognitive load (Van Merrienboer & Sweller, 2005).

Simulations must encompass several instructional design strategies to reduce extraneous cognitive load in order to increase encoding capabilities in working memory, therefore resulting in deeper and more meaningful learning. This type of learning is ideal, especially when coupled with evidence that show that communication skills change and endure when learning models incorporate deliberate practice, personalized attention, on-going feedback, and provide a connection between the learned content and the current practice (Van de Wiel, Van den Bossche, Janssen, & Jossberger, 2011). The simulations discussed in the chapters that follow are designed in this way and include:

1. Self-pacing, so that learners can reflect on their skills and adjust their strategies at their own pace
2. Continuous analysis and feedback on performance via virtual human verbal and nonverbal reactions to conversation tactics, virtual coaches, and feedback meters (e.g., indicating trust built)
3. Graphics that cue learners to specific content
4. Virtual human inner thoughts or thought bubbles that provide users with context around a perspective and understanding outside of their own

2.5.1 Conversation Component

The simulations also integrate several interrelated communication strategies drawn from social/cognitive models and neuroscience (see Fig. 2.1). These include:

1. *Motivational interviewing* (MI) is a set of communication strategies originally designed by clinical psychologists for use in counseling sessions with problem drinkers (Miller, 1983). MI is a goal-oriented, person-centered counseling approach designed to help people resolve their ambivalence about behavior change. By strategically evoking a student's own thoughts and feelings, the teacher facilitates the exploration of internal conflicts and amplifies the person's existing motivation (Miller & Rollnick, 2012). The simulations discussed in this chapter integrate the four core MI communication skills and the four elements of the MI spirit. The four core MI communication skills are:

   (a) *Ask open-ended questions* to invite the student to share or describe their thoughts while focusing the conversation in a particular direction.
   (b) *Affirm* the student's strengths, values, or efforts. This builds trust and instills the power to change.
   (c) Listen closely and *reflect* the student's statements to selectively emphasize them and confirm understanding.
   (d) *Summarize* what the student has told you to show that you're listening, and link to related information, or transition to a new topic.

The four elements of the MI spirit are:

(a) *Partnership*—the educator respects that the student is the expert on themselves and works *with* them, not "on" them.
(b) *Acceptance* of the *student's perspective*, inherent value, and autonomy.
(c) *Compassion* for the student's needs and welfare. The educator commits to acting in the person's best interest.
(d) *Evocation* of the student's existing expertise and motivation, rather than installing what the counselor thinks is "missing."

2. *Mentalizing* is the ability to recognize and accept that other people (e.g. students) have their own thoughts, beliefs, intentions, and emotions, which may be different from one's own, and that this is OK. The "OK" does not imply necessarily condoning the student's position, but rather understanding it from their viewpoint. Mentalizing requires and promotes a non-judgmental or non-critical stance toward the engaged student, and this is crucial for healthy interaction. While all healthy individuals understand that other beings have independent minds, both the inclination to attend to the minds of others and the ability to accurately assess what others think or know varies among adults and adolescents. Demonstrating mindfulness has been shown to better communication and mental health outcomes (Allen & Fonagy, 2006; Bateman & Fonagy, 2010; Bateman & Fonagy, 2004).
3. *Empathy* is the capacity to feel the emotions of another being, in this case the students (Decety & Jackson, 2004, Stotland, 1969). In most cases, an empathic response is incumbent on mentalizing; a person will be able to feel the emotions of another if they are able to temporarily put aside their own, perhaps different viewpoint (Gallagher & Frith, 2003). In fact, neuroimaging (fMRI) research has shown that mentalizing and empathy rely on overlapping yet distinct brain networks (Völlm et al., 2006). An intact empathic response is important for healthy social and emotional functioning, and research has shown that empathic responsiveness can be enhanced through training, which is one goal of the role-play simulations discussed in later chapters (Pecukonis, 1990; Riess, Kelley, Bailey, Konowitz, & Gray, 2011; Şahin, 2012).
4. *Empathic accuracy*, also sometimes described as "cognitive empathy," is the ability to correctly assess or identify the emotions of others (Ickes, 1993). This skill may be thought of as the ability to "read people" or, in this case, your students. Empathic accuracy and empathy are conceptually distinct. Empathy does not necessarily imply the ability to accurately identify a shared emotion, and empathic accuracy does not necessarily require that one feels the emotions of another. However, research has shown a bidirectional relationship between empathy and empathic accuracy, as long as there is sufficient expression (Zaki, Bolger, & Ochsner, 2008). Empathic accuracy also varies across individuals, and high empathic accuracy is predictive of healthy interpersonal relationships (Lakey & Drew, 1997; Noller & Venardos, 1986). Recent work has shown that it can be improved with training, which, again, is a goal of the simulations discussed in later chapters (Mascaro, Rilling, Tenzin Negi, & Raison, 2012).

5. *Situation modification* is when one attempts to avoid, leave, or modify circumstances that are likely to elicit unwanted emotions. For example, when talking with a student where the educator is motivated to elicit desired emotions (Gross & Thompson, 2007).
6. *Reappraisal strategy* is when one changes the way they interpret the meaning of the interaction they are having with a student. For example, seeing a student's disruptive behavior as a hindrance to the class as opposed to this student having a tumultuous home life (Gross, 1998; Ochsner, Silvers, & Buhle, 2012). Reappraisal is an especially important strategy, as it has been shown to have lasting effects on the way that one responds to conversations that elicit emotions (Erk et al., 2010; Kross & Ayduk, 2008; MacNamara, Ochsner, & Hajcak, 2010; Woud, Holmes, Postma, Dalgleish, & Mackintosh, 2012). The tendency to reappraise is correlated with improved mental health, social functioning, and well-being and is another goal of the simulations discussed in later.

The Kognito Behavior Change Model in the figure below shows the complicated interactivity of the interrelated communication strategies integrated into the authoring of role-play simulations (Fig. 2.3).

In the chapter that follows, the reader will see data from over 300,000 K12 educators who completed one of five simulations. In total, these simulations offer numerous advantages that include:

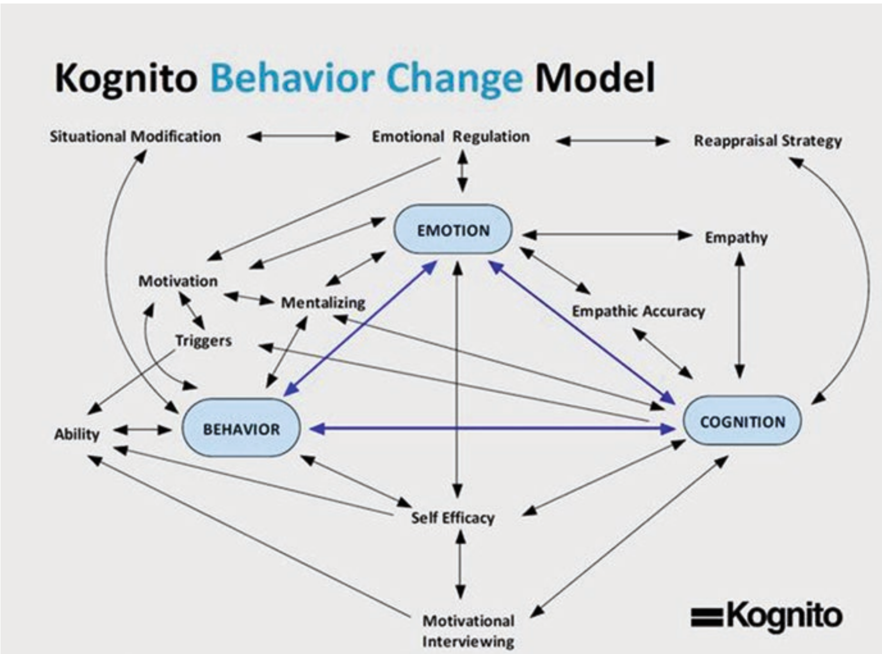

Fig. 2.3 Conversation components of the Kognito Behavior Change Model

(a) *Generalizability*: The simulations are effective in driving sustainable changes in educator's skills, self-efficacy or confidence, and behavior. This generalizability of impact is due in part to the advantage of providing users with the ability to practice in a risk-free environment, thus reducing the anxiety typically present in face-to-face role-plays and the neutrality of the virtual humans, which makes it easier for the user to open up. This is further supported by a recent study demonstrating a significant impact of four simulations with Native American and Alaska Native learners (Bartgis & Albright, 2016).
(b) *Efficiency*: The simulations included in these chapters required 30–45 minutes for the user to complete. The studies show that even such a brief amount of time can result in significant changes which can be further enhanced with additional practice opportunities over time.
(c) *Skill building*: The simulations result in statistically and sustained changes in the level of users' preparedness to effectively manage conversations by using MI with students (and parents).
(d) *Self-efficacy*: Practicing the simulations yielded an increase in educator's self-efficacy or one's perceived ability to manage conversations in real life. Measures of self-efficacy were based on Bandura's integrative framework of personal efficacy: the level of confidence in ability predicts the level of control of behavior (Bandura, 1977). By mastering one's ability, Bandura theorizes that people are more likely to change and improve their behavior in future circumstances (Bandura, 1977). Thus, combining user skill acquisition with increased self-efficacy has yielded a host of self-reported, positive behavioral changes.
(e) *Satisfaction with user experience*: Educators were highly satisfied with the simulations, reporting that the scenarios with the virtual humans were relevant and similar to situations they face in real life, and more than 90% said they would recommend it to their colleagues.
(f) *Engagement*: Important component of assessing educator engagement is the duration of time users spend on the simulation and the frequency of re-playing it. In the two studies that examined these elements, it was shown that users often spent more time in the simulation than required, and a significant portion of them decided to play it more than once. When queried why they spent more time, users stated they were curious about different reactions, were having fun, wanted to explore different approaches, and even see the results of instigating a negative response from the virtual humans in the simulation.

2.6 Conclusion

In a broader sense, the Kognito role-play simulations discussed in this book demonstrate a capability to address overall mental health and wellness at a level that can support public health initiatives where effective conversations are necessary to bring about sustained changes in attitudes and behaviors. Whether online or mobile, there is a research-proven approach to create realistic and risk-free learning environments that are contextually rich and enable users to harness the power of conversations and positively impact the health of others. Innovative use of these types of simulations increases participant engagement so learners not only enjoy the experience but also find themselves transformed from passive receivers to active constructors of the learning experience.

In conclusion, it is a truly exciting time for role-play simulations have the capability of cost-effectively reaching large numbers of geographically dispersed educators to bring about positive changes in their student's lives.

References

Allen, J. G., & Fonagy, P. (Eds.). (2006). *The handbook of mentalization-based treatment*. West Sussex, UK: John Wiley & Sons.

Andrade, A. D., Bagri, A., Zaw, K., Roos, B. A., & Ruiz, J. G. (2010). Avatar-mediated training in the delivery of bad news in a virtual world. *Journal of Palliative Medicine, 13*(12), 1415–1419.

Aspegren, K. (1999). BEME Guide No. 2: Teaching and learning communication skills in medicine: a review with quality grading of articles. *Medical Teacher, 21*(6), 563–570.

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191.

Bartgis, J., & Albright, G. (2016). Online role-play simulations with emotionally responsive avatars for the early detection of native youth psychological distress, including depression and suicidal ideation. *American Indian and Alaska Native Mental Health Research, 23*(2), 1–27.

Bateman, A., & Fonagy, P. (2010). Mentalization-based treatment for borderline personality disorder. *World Psychiatry, 9*(1), 11.

Bateman, A. W., & Fonagy, P. (2004). Mentalization-based treatment of BPD. *Journal of Personality Disorders, 18*(1), 36–51.

Baumeister, R. F., Twenge, J. M., & Nuss, C. K. (2002). Effects of social exclusion on cognitive processes: Anticipated aloneness reduces intelligent thought. *Journal of Personality and Social Psychology, 83*(4), 817.

Black, J. B. (2010). An embodied/grounded cognition perspective on educational technology. In *New science of learning* (pp. 45–52). New York, NY: Springer.

Bolte, A., Goschke, T., & Kuhl, J. (2003). Emotion and intuition: Effects of positive and negative mood on implicit judgments of semantic coherence. *Psychological Science, 14*(5), 416–421.

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews, 3*(2), 71–100.

Driscoll, M. P. (2000). *Psychology of learning*. Boston, MA: Allyn and Bacon.

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). [The making of an expert:] Ericsson, Prietula, and Cokely respond. *Harvard Business Review, 85*(11), 147–147.

Erk, S., Mikschl, A., Stier, S., Ciaramidaro, A., Gapp, V., Weber, B., & Walter, H. (2010). Acute and sustained effects of cognitive emotion regulation in major depression. *Journal of Neuroscience, 30*(47), 15726–15734.

Gallagher, H. L., & Frith, C. D. (2003). Functional imaging of 'theory of mind'. *Trends in Cognitive Sciences, 7*(2), 77–83.

Gross, J. J. (1998). The emerging field of emotion regulation: An integrative review. *Review of General Psychology, 2*(3), 271–299.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In *Handbook of emotion regulation* (pp. 3–24). New York, NY: The Guilford Press.

Ickes, W. (1993). Empathic accuracy. *Journal of Personality, 61*(4), 587–610.

Joyner, B., & Young, L. (2006). Teaching medical students using role play: Twelve tips for successful role plays. *Medical Teacher, 28*(3), 225–229.

Kross, E., & Ayduk, O. (2008). Facilitating adaptive emotional analysis: Distinguishing distanced-analysis of depressive experiences from immersed-analysis and distraction. *Personality and Social Psychology Bulletin, 34*(7), 924–938.

Kuhlmann, S., Piel, M., & Wolf, O. T. (2005). Impaired memory retrieval after psychosocial stress in healthy young men. *Journal of Neuroscience, 25*(11), 2977–2982.

Lakey, B., & Drew, J. B. (1997). A social-cognitive perspective on social support. In *Sourcebook of social support and personality* (pp. 107–140). Boston, MA: Springer.

Lane, C., & Rollnick, S. (2007). The use of simulated patients and role-play in communication skills training: A review of the literature to August 2005. *Patient Education and Counseling, 67*(1–2), 13–20.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, MA/New York, NY: Cambridge University Press.

Lupien, S. J., Gaudreau, S., Tchiteya, B. M., Maheu, F., Sharma, S., Nair, N. P. V., … Meaney, M. J. (1997). Stress-induced declarative memory impairment in healthy elderly subjects: Relationship to cortisol reactivity. *The Journal of Clinical Endocrinology & Metabolism, 82*(7), 2070–2075.

MacNamara, A., Ochsner, K. N., & Hajcak, G. (2010). Previously reappraised: The lasting effect of description type on picture-elicited electrocortical activity. *Social Cognitive and Affective Neuroscience, 6*(3), 348–358.

Mascaro, J. S., Rilling, J. K., Tenzin Negi, L., & Raison, C. L. (2012). Compassion meditation enhances empathic accuracy and related neural activity. *Social Cognitive and Affective Neuroscience, 8*(1), 48–55.

McGaghie, W. C., Siddall, V. J., Mazmanian, P. E., & Myers, J. (2009). Lessons for continuing medical education from simulation research in undergraduate and graduate medical education: Effectiveness of continuing medical education: American College of Chest Physicians Evidence-Based Educational Guidelines. *Chest, 135*(3), 62S–68S.

Merriam, S. B. (2008). Adult learning theory for the twenty-first century. *New Directions for Adult and Continuing Education, 2008*(119), 93–98.

Miller, W. R. (1983). Motivational interviewing with problem drinkers. *Behavioural and Cognitive Psychotherapy, 11*(2), 147–172.

Miller, W. R., & Rollnick, S. (2012). *Motivational interviewing: Helping people change*. New York, NY: Guilford Press.

Nestel, D., & Tierney, T. (2007). Role-play for medical students learning about communication: Guidelines for maximising benefits. *BMC Medical Education, 7*(1), 3.

Noller, P., & Venardos, C. (1986). Communication awareness in married couples. *Journal of Social and Personal Relationships, 3*(1), 31–42.

Ochsner, K. N., Silvers, J. A., & Buhle, J. T. (2012). Functional imaging studies of emotion regulation: A synthetic review and evolving model of the cognitive control of emotion. *Annals of the New York Academy of Sciences, 1251*, E1.

Payne, J., Jackson, E., Ryan, L., Hoscheidt, S., Jacobs, J., & Nadel, L. (2006). The impact of stress on neutral and emotional aspects of episodic memory. *Memory, 14*(1), 1–16.

Payne, J. D., Jackson, E. D., Hoscheidt, S., Ryan, L., Jacobs, W. J., & Nadel, L. (2007). Stress administered prior to encoding impairs neutral but enhances emotional long-term episodic memories. *Learning & Memory, 14*(12), 861–868.

Pecukonis, E. V. (1990). A cognitive/affective empathy training program as a function of ego development in aggressive adolescent females. *Adolescence, 25*(97), 59.

Riess, H., Kelley, J. M., Bailey, R., Konowitz, P. M., & Gray, S. T. (2011). Improving empathy and relational skills in otolaryngology residents: A pilot study. *Otolaryngology--Head and Neck Surgery, 144*(1), 120–122.

Rosenbaum, M. E., Ferguson, K. J., & Lobas, J. G. (2004). Teaching medical students and residents skills for delivering bad news: A review of strategies. *Academic Medicine, 79*(2), 107–117.

Şahin, M. (2012). An investigation into the efficiency of empathy training program on preventing bullying in primary schools. *Children and Youth Services Review, 34*(7), 1325–1330.

Smallwood, J., Fitzgerald, A., Miles, L. K., & Phillips, L. H. (2009). Shifting moods, wandering minds: Negative moods lead the mind to wander. *Emotion, 9*(2), 271.

Stevenson, K., & Sander, P. (2002). Medical students are from Mars; business and psychology students are from Venus; University teachers are from Pluto? *Medical Teacher, 24*(1), 27–31.

Stotland, E. (1969). Exploratory investigations of empathy. In *Advances in experimental social psychology* (Vol. 4, pp. 271–314). New York, NY: Academic Press.

Van de Wiel, M. W., Van den Bossche, P., Janssen, S., & Jossberger, H. (2011). Exploring deliberate practice in medicine: How do physicians learn in the workplace? *Advances in Health Sciences Education, 16*(1), 81–95.

Van Merrienboer, J. J., & Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. *Educational Psychology Review, 17*(2), 147–177.

Völlm, B. A., Taylor, A. N., Richardson, P., Corcoran, R., Stirling, J., McKie, S., … Elliott, R. (2006). Neuronal correlates of theory of mind and empathy: A functional magnetic resonance imaging study in a nonverbal task. *NeuroImage, 29*(1), 90–98.

Woud, M. L., Holmes, E. A., Postma, P., Dalgleish, T., & Mackintosh, B. (2012). Ameliorating intrusive memories of distressing experiences using computerized reappraisal training. *Emotion, 12*(4), 778.

Zaki, J., Bolger, N., & Ochsner, K. (2008). It takes two: The interpersonal nature of empathic accuracy. *Psychological Science, 19*(4), 399–404.

Chapter 3
Swimming Upstream: Preventing Adverse Childhood Experiences in Preparing Students for PK12

Glenn Albright and Nikita Khalid

3.1 Background

Freud once made a statement that 90% of your personality is formed by age six. It's hard to imagine that 90% of who we are, the type of educator we become, the relationships we choose to be in, how we will bring up our children, and the hobbies we select are all influenced by the many subtle unconscious forces created in early childhood—experiences that we have little or no memory of. Freud made an unprovable assumption based on anecdotal clinical experiences, but none-the-less, he was one of the first to focus on the importance of early childhood development, attachment, and parenting.

Today, we know that early childhood experiences dramatically affect attachment and bonding to our primary caretaker(s), which in turn, will have a critical influence on brain development and ultimately how we navigate the educational system. Early childhood development has a direct impact on a student's cognitive, social, emotional, and even physical health. Those parents and educators and school personnel that create an atmosphere where the child feels safe, secure, understood, and loved will have a profound influence that facilitates curiosity, motivation to learn, empathy, emotional regulation, and socialization, which all together result from what is labeled as secure attachment. Secure attachment is the pre-cursor for a child thriving in PK12.

G. Albright (✉)
Department of Psychology, Baruch College, City University of New York, New York, NY, USA
e-mail: Glenn.Albright@baruch.cuny.edu

N. Khalid
The Graduate Center, City University of New York, New York, NY, USA

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_3

3.2 What Are Adverse Childhood Experiences?

Adverse Childhood Experiences (ACE) are events that can produce trauma and occur during childhood and early adolescence. ACEs can be devastating for the PK12 student. They are measured by an ACE questionnaire, which includes 10 questions with yes or no answers that yield an ACE score by adding up the number of yeses. Items vary and include asking about whether a parent or other adult in the household swore at you, insulted you, put you down or humiliated you, or made you afraid that you would be physically hurt, or hit so hard it left marks. Other items address sexual abuse, or a household member being incarcerated, a problem drinker, divorced, mentally ill, or attempted suicide, etc.

For the PK12 students, high ACE scores can create a significant and devastating array of social, emotional, and physical consequences that can rob children of their ability to be successful. This has been demonstrated by dozens of ACE studies that not surprisingly show that high ACE scores can significantly affect a child's developing brain, resulting in their ability to function in school including: (1) executive functioning (e.g., follow directions, problem solving, etc.), (2) memory systems, (3) emotional regulation, (4) concentration/attention, (5) learning disabilities, and (6) social/behavioral problems (Litgen, 2013). One the other side of the coin, educators are on the front line in teaching and managing students who are struggling as the result of high ACE scores. This includes often feeling frustrated and overwhelmed due to lack of adequate support, classroom disruptions, and the time being taken away from other students. This contributes to teacher burnout and turnover.

In general, ACEs are surprisingly prevalent and a risk factor for a number of serious health conditions, even long into adulthood. One study found that 64% of the population reported having at least one ACE and, as the number of ACEs increases, so do the chances of a poor quality of life and a greater number of serious health conditions, such as ischemic heart disease, cancer, and chronic lung disease (Felitti et al., 1998). The process by which ACEs may lead to illness and earlier death in adulthood is still being investigated, but neuroscientists have found that experiencing any of the ACEs can lead to "toxic stress," which is a sustained state of the "flight, fight, or freeze" stress response that is normally activated only briefly in situations of perceived danger. Toxic stress may then cause unhealthy biological changes and impair social, emotional, and cognitive development, which can lead to behaviors that are a risk to health (McEwen, 2008; Shonkoff et al., 2012). Even if a child does not experience an ACE, their environment can cause toxic stress if the child is growing up in extreme poverty (Chen, Cohen, & Miller, 2010). Parenting doesn't have to be abusive to adversely affect a child's level of stress; when a child perceives low acceptance and affection from parents, the child exhibits more anxiety (Wei & Kendall, 2014).

Lastly, the cost of ACEs is staggering. Health-risk behaviors, illnesses, and shortened life spans associated with ACEs cost society years of lost productivity, in addition to costly targeted interventions after child abuse or neglect is reported. According to the Centers for Disease Control and Prevention, "The total lifetime estimated financial costs associated with just 1 year of confirmed cases of child maltreatment (physical abuse, sexual abuse, psychological abuse, and neglect) is approximately $124 billion" (Fang, Brown, Florence, & Mercy, 2012).

3.3 Why Are ACEs Occurring?

Children in PK12 who have high ACE scores are likely to be experiencing physical or emotional child abuse at home. ACEs that are often not intended can result from a loss of impulse control in the parent or caregiver (Pekarsky, 2014). They can also result from the parent or caregiver's frustration and a lack of perceived alternatives. This is particulary true during the COVID-19 pandemic where the stress assicated with social isolation, food insecurity, job loss and assocaited econconomic consequences can expose children to increased ACEs (Sanders, 2020). Physical punishments that parents engage in often have some effectiveness in the short term at producing a desired behavior in a child, which reinforces the parent to continue that type of punishment. But in the long term, it is ineffective and can lead to lower compliance by the child to requests and demands from the parent. The more a parent or ECE (early care educator) uses physical punishment, the more a child becomes aggressive over time, and this aggression from the child might then be punished by further physical punishment (Gershoff, 2002). The cycle often continues for parents, or ECEs become more frustrated and might then escalate the severity of physical punishment until it reaches a clear level of abuse (Gil, 1970; Felzen, 2002), which has a high probability of impacting the child's behavior in the classroom.

Some families also have a cycle of harsh and abusive child-rearing that is perpetuated intergenerationally (Neppl, Conger, Scaramella, & Ontai, 2009). Parenting styles are often learned behaviors from their own experiences as a child, and some parenting techniques can be very unfamiliar to parents if they didn't experience them in their own childhoods.

Lastly, parents may also have limited knowledge about child development and unrealistic expectations for their child. This can lead to parental stress and an escalation of punishments. For example, parents may mistake a toddler's inability to understand instructions for defiance and punish them when it would have been more effective to model the desired behavior or to provide the instructions in a way that a child of that age can understand. Additionally, even if a child understands a rule, it does not mean the child will follow the rule. Focusing on positive behavior, rather than negative behavior, can be more effective in producing desired results.

3.4 Corporal Punishment

Corporal punishment is defined as the use of physical force with the intention of causing a child to experience pain so as to correct their misbehavior (Straus, 2001). Although corporal punishment can longer be used in US military training centers

(Department of Defense Education Activity, 2012), it can still be used in many U.S. schools. Corporal punishment is allowed in 35% of the world's countries (Global Initiative to End All Corporal Punishment of Children, 2016) and is still legal in two *industrialized* countries, which include the United States of America and the outback of Australia (McCarthy, 2005). In the United States, 19 states legally allow public schools to use corporal punishment as a means of correcting students' misbehavior (Center for Effective Discipline, 2015; US Department of Education, 2016). However, these "misbehaviors" are not solely meant to discipline students for serious issues, such as fighting on school grounds, but can include disciplining students for being late to class, using a cell phone, or violating a school policy (North Carolina Department of Public Instruction, 2015). The number of states that are able to use corporal punishment increases to 48 when including policies at private schools, which also do not report their student disciplinary action to the US Department of Education's Office of Civil Rights (Gershoff, 2017). Corporal punishment in schools can range from children being hit with a paddle to standing in painful positions for long periods of time and can legally be used in the select states any time from pre-school to high school graduation (Gershoff, 2017). Some states even have recommended types of paddles that teachers can use to hit their students. For example, in Alabama, the Pickens County Board of Education actually recommends the use of a "wooden paddle approximately 24 inches in length, 3 inches wide and ½ inch thick" (Gershoff & Font, 2016; Pickens County Board of Education, 2015). Most legal corporal punishment is predominantly located in the southern US states and disproportionately affects African American students, boys, and children with disabilities (Gershoff & Font, 2016).

The impact of corporal punishment on children and young adults can result in lower levels of academic performance, poor social competence, and decreased ability, or in other words, decreased self-confidence (Hyman, 1995). Children can develop feelings of inadequacy due to decreased self-efficacy brought on by poor disciplinary policies like corporal punishment. Inadequacy can also grow into feelings of anger or resentment (Hyman & Perone, 1998). Corporal punishment in schools is also not surprisingly related to higher rates of juvenile youth in line to receive capital punishment in the judicial system, more behavioral issues, and more crimes committed by young adults and children (Arcus, 2002; Hyman, 1995; Hyman & Perone, 1998).

3.5 Who Is This Problem Affecting?

Most directly, ACEs and toxic stress in the home are affecting children, which extend into the classroom and possibly long into adulthood in ways that are cutting their lives short. Improved parenting skills can help reduce some ACEs and also strengthen the relationship between parents and children, which is proven to protect children from the effects of toxic stress, possibly even reducing damaging effects on health, learning, and behavior (Toxic Stress, 2015). Thus, reducing ACEs will more successfully prepare a child to easily navigate the educational system.

One last point, poor parenting techniques and ECE capital punishment in schools can also result in unnecessary stress for parents. Some common parenting techniques for instructing and disciplining children are not effective in producing desired behaviors in children. This ineffectiveness, and the continued undesired behavior, can be a source of great stress for parents (Neece, Green, & Baker, 2012), which Pre-K and elementary school educators can clearly detect when having conversations with parents about their children.

3.6 Understanding the Parents

Parents and ECEs sometimes have strong opinions that lie in opposition to some effective discipline techniques. Thus, they may be resistant to learning and practicing those techniques, because they believe that physical punishment is effective in the long term and even necessary for instilling discipline and character in children. This belief may be rooted in cultural norms, personal family history, or religious beliefs. Some studies have concluded that physical punishment can effectively improve behavior (Gershoff, 2002). However, this is not the prevailing view. Below are findings from the "Report on Physical Punishment in the United States: What Research Tells Us About Its Effects on Children," a review of research on physical punishment published in the past century that draws from the fields of psychology, medicine, education, social work, and sociology, among others:

1. "There is little research evidence that physical punishment improves children's behavior in the long term.
2. There is substantial research evidence that physical punishment makes it more, not less, likely that children will be defiant and aggressive in the future.
3. There is clear research evidence that physical punishment puts children at risk for negative outcomes, including increased mental health problems.
4. There is consistent evidence that children who are physically punished are at greater risk of serious injury and physical abuse" (Gershoff, 2008).

The report was endorsed by the American Academy of Pediatrics and the American Medical Association (Smith, 2012).

Parents and ECEs may also object to some effective parenting techniques, such as positive reinforcement of routine behaviors or inadequate behavior, because they believe these techniques will inadvertently reward and encourage less-than-ideal behavior. Parents may also believe that telling a child that a behavior is undesired should be enough for a child to cease that behavior. They may think that children don't deserve positive reinforcement for following the rules or that their children will be “spoiled,” overindulged, and self-centered. With a lot of conflicting parenting advice available, parents may be wary of the reliability of any advice, even if many studies have shown it to be effective.

3.7 Preventing ACEs: Solutions and Results

A number of non-profit organizations are addressing recent findings about ACEs, toxic stress, parenting techniques, and the protective effect of a supportive, responsive relationship with an adult. Such non-profit organizations include Healthy Families America, Family Connections, NJ, and Child First (Lowell, Carter, Godoy, Paulicin, & Briggs-Gowan, 2011). Depending on the specific family-support program, providers receive different types and lengths of training and are required to have appropriate levels of education. However, many family-support programs lack engaging and highly interactive materials about parenting skills to share with client’s families who have low literacy skills; thus, skills development can be compromised. Most mobile applications about parenting skills are largely text-based or are e-books with minimal interactivity that do not allow parents to practice parenting skills in the risk-free space of a computer application.

3.8 The Simulation: *Calm Parents, Healthy Kids*

Calm Parents, Healthy Kids is a virtual human role-play simulation developed by Kognito and designed to help parents to better manage their two to five-year-old child’s misbehaviors to reduce the risk of ACEs and promote attachment. This is accomplished by parents practicing role-playing with emotionally responsive virtual children that possess a personality and memory and will react like real children that are misbehaving. It is though practicing these role-plays, and receiving feedback from a virtual coach, that parents learn how to effectively manage their child’s misbehaviors in a way that prevents ACEs. The overall learning model is described by (Albright, Adam, Serri, Bleeker, & Goldman, 2016) and in the preceeding chapter entitled “Introduction to PK12 Professional Development Role-Play Simulation Technology.”

The general learning objectives involve parents and ECEs learning to:

1. Prepare for situations that are likely to involve parent–child and ECE–child conflict
2. Acknowledge your emotions toward the child to respond appropriately
3. Limit consequences to those that focus on the child’s behavior and their sense of safety or self-esteem
4. De-escalate situations and draw attention to the desired behavior instead of the undesired

3.9 Components of the Simulation

The simulation begins by the parent being introduced to their virtual coach Jessica (seen Fig. 3.1). Jessica has worked with families as a certified parent educator for the past 10 years and has a Bachelor of Science degree in early childhood development. She is a 38-year-old mother, with a 10-year-old son and a 4-year-old daughter. She doesn't expect anyone to be a "perfect" parent and believes every parent should explore what works best for them and for each of their children. She'll note that parents with more than one child have already noticed how each child is different and that what works with one child may not necessarily work with another, but it's worth trying new techniques and trying them more than once.

The learner then chooses from scenarios to play through that include:

1. A child interrupting a parent on the phone
2. Emotion coaching an upset child who hit another child on the playground
3. Reducing the frequency of tantrums by preparing for situations in which they occur
4. Prompting a child to get ready to leave home

These scenarios are common challenges or concerns for parents, and they are opportunities to develop the skills the simulation is targeting.

Each scenario will take 3–5 min each and begin with a backstory explaining events leading up to the interaction, some tips about how to handle such a scenario, and a description of the user's goals in the scenario. Assuming the role of the parent

Fig. 3.1 Virtual coach Jessica

character, learners will choose from a set of more helpful and less helpful conversation options of what to say or do. Then, they will see their choice play out as evidenced by the child's verbal and non-verbal responses before being presented with the next set of options of what to say or do, until the scenario is finished (see the previous chapter entitled "Introduction to PK12 Professional Development Role-Play Simulation Technology" for the learning model).

3.10 Prompting a Child to Get Ready to Leave Home

Four-year-old Sophia has been getting upset and been uncooperative whenever it's time to leave the house (see Fig. 3.2). The parent is frustrated because they need to leave to pick up her sister or they will be late. The coach will point out that children will often be uncooperative or upset during transitions, because they feel like they are happening very suddenly. Young children also don't yet have a sense of time, so they might be surprised that it's time to go even if they have already been told once to get ready to leave after a certain time. Children might not understand (or hear) the first time and will need several warnings and help getting ready to go. If the parent is consistent in preparing the child to transition, the child will learn to transition easier.

Fig. 3.2 Four-year-old Sophia does not want to leave the house

3.11 Temper Tantrums: Reducing the Frequency

Users assume the role of a mother and help prepare her 2-year old Jayden for a grocery trip where he is likely to have a temper tantrum (see Fig. 3.3). Users learn how to handle temper tandems without getting angry or giving in. The simulation starts off with a backstory showing a mother taking her two-year-old child to the supermarket while the coach normalizes tantrums as a part of a child's development. The learner sees a tantrum start when a mother tells the child he cannot get the candy he wants. The coach continues to normalize tantrums: "This is a phase children go through. Toddlers have their own mind and willpower, but not the ability to communicate. This will get better; they'll get through it and learn to talk better. The only way not to have tantrums would be not to have children." The learner can click on the mother's thought bubble to hear how she is "embarrassed" and "wants to shut the child up" or "wants to run away and hide." Then, the coach tells the learner that there isn't much to do but make sure the child is safe and let the tantrum play out.

3.12 Handling a Child Interrupting a Parent on the Phone

This conversation begins with a backstory about a two-year-old Jayden who has been interrupting almost every phone call his mother makes (see Fig. 3.4). The child has not learned to entertain themselves during the mother's phone calls, during

Fig. 3.3 Jayden is going to have a temper tantrum in the grocery store

Fig. 3.4 Jayden is interrupting almost every phone call his mother makes

which he usually makes requests, asks questions, makes noise, or whines loudly. Some of these phone calls are urgent and after the mother has already had a long, stressful day. The user will learn how to prepare the child for calls, and during the call, will have the opportunity to either praise the child for not interrupting or watch the mother's stress level rise as the child does begin to interrupt. These mid-call praises can be small, quick, and non-verbal (thumbs-up, smile, high-five, etc.). If the learner doesn't do a feelings check, the mother's response to the child will be one of anger. If the learner does a feelings check, the mother can respond to the child momentarily and in a calm, controlled manner.

3.13 Hit Another Child on the Playground: Emotional Coaching an Upset Child

Users assume the role of a father and help calm and discipline his 2–3-year-old Jayden, or 4–5-year-old Matthew, who has just hit another boy on the playground and is still upset and angry (see Fig. 3.5). Learners role play practicing talking to a child about the upsetting incident that occurred. The coach will talk about the development of a child's emotional vocabulary and self-regulation and a parent's role in that development. In addition, the coach will point out that a situation like this, though upsetting, is also a great opportunity for emotion coaching. This scenario focuses on techniques for helping toddlers understand and control their feelings.

Fig. 3.5 Jayden has just hit another boy on the playground and is still upset and angry

The simulation *Calm Parents, Healthy Kids* and the pilot study describe below was funded by the Robert Wood Johnson Foundation and is freely available at www.conversationsforhealth.org. To conclude this chapter, the results of a pilot study that examined the impact of *Calm Parents, Healthy Kids* will be presented. This will include a methods section, followed by the results and conclusion.

3.14 Methods

The aim of this study was to measure the impact of the *Calm Parents, Healthy Kids* simulation in teaching parents to: (1) adjust their parenting techniques to match realistic expectations of a child's developmental capabilities, (2) manage parental stress and be able to appropriately respond to a child rather than react emotionally in a way that is confusing to the child or harmful to their relationship, and (3) teach a child (and parent) how to cope with negative feelings (agitation, anger, aggressiveness, etc.) in a healthy and adaptive manner by labeling emotions.

Fourteen parents from Family Connections of New Jersey, a nonprofit organization that offers services to children, adults, and families that comprise low-income minority populations volunteered for this study. To qualify, parents needed to have children between the ages of two and five and be socially or socio-economically disadvantaged: low income, low education, and/or live in an impoverished or otherwise deprived neighborhood. All these risk factors have been shown to increase the likelihood of the use of physical punishment.

Measures included demographics, how satisfied were parents with the learning experience, and validated subscales from the: (1) Parent and Family Adjustment Scale assessing parenting practices and parent/family adjustment, (2) Parent–Child Relationship Inventory assessing parents' attitudes toward parenting and their children, (3) Confidence in Handling Specific Parenting Situations to assess the effect of the simulation on parent's perception of their ability to manage specific situations that are addressed in the simulation, and (4) Confidence in Parenting Skills Inventory, which was developed for this study for there are no known validated measures that tap into a parent's self-efficacy or confidence in their ability to manage their child's misbehaviors.

Participants first completed a baseline survey, then the *Calm Parents, Healthy Kids* simulation, followed by a one-month follow-up survey. The 45–60-minute simulation involves parents engaging in four conversations with intelligent and emotionally responsive virtual children modeling human behaviors that parents often find frustrating and difficult to handle (e.g., temper tantrum in the grocery store, misbehaving at home and on the playground). The virtual children are coded with emotions, personality, and memory and will react exactly like two to five-year-old children who are being punished. It is by practicing these role-plays where learners observe and experience the impact of the strategies they employ to correct the virtual child's misbehaviors, and receiving on-going feedback from a virtual coach, that parents learn to apply best practices and avoid ineffective communication strategies in order to prevent ACEs.

3.15 Results

Overall, parents found the simulation to be very effective, with 86% stating it was very good or excellent and 100% recommending the simulation to other parents. Additionally, there was a significant increase ($p < 0.01$) in parental adjustment, indicating at follow-up that parents were less worried or sad and felt more satisfied with their life and able to cope with the emotional demands of being a parent. Additionally, there was a non-significant decrease ($p < 0.06$) in parents losing their temper with their child, threatening to punish their child, and reporting that their child is out of control much of the time as well as giving in to their child to avoid a tantrum. Lastly, there was a non-significant decrease ($p < 0.08$) in corporal punishment (spanking) and a significant increase ($p < 0.04$) in being consistent in punishment for misbehavior emerged at follow-up.

3.16 Conclusions

To conclude, it is encouraging that, even with small sample size, it appears that the simulation had a positive impact on parents that are socially or socio-economically disadvantaged: low income, low education, and/or live in an impoverished or otherwise deprived neighborhood, which are all known risk factors shown to increase the likelihood of the use of physical punishment. Thus, the implications for this pilot study could be far reaching. First, the use of new role-play simulation technology that has the potential to help mitigate the frequency and/or intensity of ACEs could have a tremendous impact on PK12 youth's physical and mental health. This in turn can have direct consequences on students' academic performance, their ability to form social relationships and "have fun" in PK12. Additionally, the impact on teachers in terms of ameliorating burnout and increasing satisfaction is a reasonable conclusion.

Lastly, ACEs and toxic stress in the home and ECE learning environments can affect children, possibly long into adulthood in ways that compromise the quality of their lives and even cut them short. Improved parenting and ECE's skills can help reduce some ACEs and also strengthen the relationship (attachment) between parents/ECEs and children, which is proven to protect children from the effects of toxic stress, possibly even reducing damaging effects on health, learning, and behavior, including suicide risk. Poor parenting and ECE corrective techniques can also result in unnecessary stress for parents and ECEs. Also, some current parenting techniques for instructing and disciplining children are not effective in producing desired behaviors in children; thus, undesired behaviors continue, which can be a source of great stress for parents.

The advantages of using game-based virtual human role-play simulations are numerous including being online and easily available to geographically dispersed populations 24/7 in the convenience and privacy of one's home. Lastly, role-playing with virtual humans reduces the anxiety that is often experienced in face-to-face role-plays, and users often report feeling safer, less judged, and more willing to open up. Altogether, this holds promise in providing an upstream learning modality in preparing children for a more successful PK12 experience.

References

Albright, G., Adam, C., Serri, D., Bleeker, S., & Goldman, R. (2016). Harnessing the power of conversations with virtual humans to change health behaviors. *mHealth, 2*(11), 1–13. https://doi.org/10.21037/mhealth.2016.11.02

Arcus, D. (2002). School shooting fatalities and school corporal punishment: A look at the states. *Aggressive Behavior: Official Journal of the International Society for Research on Aggression, 28*(3), 173–183.

Center for Effective Discipline. (2015). *Discipline and the law: State laws*. Retrieved from: http://www.gundersenhealth.org/ncptc/center-for-effective-discipline/discipline-and-the-law/state-laws

Chen, E., Cohen, S., & Miller, G. E. (2010). How low socioeconomic status affects 2-year hormonal trajectories in children. *Psychological Science, 21*(1), 31–37.

Department of Defense Education Activity. (2012). *Regulation: Disciplinary rules and procedures*. Retrieved from: https://www.dodea.edu/Offices/PolicyAndLegislation/upload/DoDEA-Regulation-2051_1a.pdf

Fang, X., Brown, D. S., Florence, C. S., & Mercy, J. A. (2012). The economic burden of child maltreatment in the United States and implications for prevention. *Child Abuse & Neglect, 36*(2), 156–165.

Felitti, V. J., Anda, R. F., Nordenberg, D., Williamson, D. F., Spitz, A. M., Edwards, V., … Marks, J. S. (1998). Relationship of childhood abuse and household dysfunction to many of the leading causes of death in adults: The adverse childhood experiences (ACE) study. *American Journal of Preventive Medicine, 14*, 245–258.

Felzen Johnson, C. (2002). Child maltreatment 2002: recognition, reporting and risk. *Pediatrics International, 44*(5), 554–560.

Gershoff, E. T. (2002). Corporal punishment by parents and associated child behaviors and experiences: A meta-analytic and theoretical review. *Psychological Bulletin, 128*(4), 539.

Gershoff, E. T. (2008). *Report on physical punishment in the United States: What research tells us about its effects on children*. Columbus, OH: Center for Effective Discipline.

Gershoff, E. T. (2017). School corporal punishment in global perspective: Prevalence, outcomes, and efforts at intervention. *Psychology, Health & Medicine, 22*(sup1), 224–239.

Gershoff, E. T., & Font, S. A. (2016). Corporal punishment in US public schools: Prevalence, disparities in use, and status in state and federal policy. *Social Policy Report, 30*, 1.

Gil, D. G. (1970). *Violence against children: Physical child abuse in the United States*. Cambridge, MA: Harvard University Press.

Global Initiative to End All Corporal Punishment of Children. (2016). *Global progress towards prohibiting all corporal punishment*. Retrieved from: http://endcorporalpunishment.org/assets/pdfs/legality-tables/Global%20progress%20table%20with%20terrs%20%28alphabetical%29.pdf. [Ref list].

Hyman, I. A. (1995). Corporal punishment, psychological maltreatment, violence, and punitiveness in America: Research, advocacy, and public policy. *Applied and Preventive Psychology, 4*(2), 113–130.

Hyman, I. A., & Perone, D. C. (1998). The other side of school violence: Educator policies and practices that may contribute to student misbehavior. *Journal of School Psychology, 36*(1), 7–27.

Litgen, M. (2013). *Education brief: ACEs for educators and stakeholders (pp. 1–13, issue brief)*. Chicago, IL: Health & Medicine Policy Research Group.

Lowell, D. I., Carter, A. S., Godoy, L., Paulicin, B., & Briggs-Gowan, M. J. (2011). A randomized controlled trial of child first: A comprehensive, home-based intervention translating research into early childhood practice. *Child Development, 82*(1), 193–208.

McCarthy, M. M. (2005). Corporal punishment in public schools: Is the United States out of step? *Educational HORIZONS, 83*(4), 235–240.

McEwen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European Journal of Pharmacology, 583*(2), 174–185.

Neece, C. L., Green, S. A., & Baker, B. L. (2012). Parenting stress and child behavior problems: A transactional relationship across time. *American Journal on Intellectual and Developmental Disabilities, 117*(1), 48–66.

Neppl, T. K., Conger, R. D., Scaramella, L. V., & Ontai, L. L. (2009). Intergenerational continuity in parenting behavior: Mediating pathways and child effects. *Developmental Psychology, 45*(5), 1241.

North Carolina Department of Public Instruction. (2015). *Consolidated data report, 2013–2014*. State Board of Education, Public Schools of North Carolina. Retrieved from: http://www.

ncpublicschools.org/docs/research/discipline/reports/consolidated/2013–14/consolidated-report.pdf

Pekarsky, A. R. (2014). Overview of child maltreatment. *Child Maltreatment*. Merck Manuals. Web. 12 Mar. 2015.

Pickens County Board of Education. (2015). *The Pickens County Board of Education Board policy manual*. Retrieved from: http://www.pickenscountyschools.net/?DivisionID=11923&DepartmentID=12384

Sanders L. M. (2020). Is COVID-19 an adverse childhood experience (ACE): Implications for screening for primary care. *The Journal of Pediatrics, 222*, 4–6. https://doi.org/10.1016/j.jpeds.2020.05.064.

Shonkoff, J. P., Garner, A. S., Siegel, B. S., Dobbins, M. I., Earls, M. F., McGuinn, L., … Wood, D. L. (2012). The lifelong effects of early childhood adversity and toxic stress. *Pediatrics, 129*(1), e232–e246.

Smith, B. L. (2012, April). "The case against spanking." *American Psychological Association*. American Psychological Association, Web. 11 Feb. 2015.

Straus, M. A. (2001). *Beating the devil out of them: Corporal punishment in American families and its effects on children*. New Brunswick, NJ: Transaction Publishers.

Toxic Stress. (2015). *Key concepts: Toxic stress*. Cambridge, MA: Harvard University. Web. 12 Mar. 2015.

U.S. Department of Education. (2016). *Civil rights data collection for the 2013–14 school year.* Retrieved from: www2.ed.gov/about/offices/list/ocr/docs/crdc-2013-14.html

Wei, C., & Kendall, P. C. (2014). Child perceived parenting behavior: Childhood anxiety and related symptoms. *Child & Family Behavior Therapy, 36*(1), 1–18.

Chapter 4
Step In, Speak Up! LGBTQ Youth Bullying Prevention

Elizabeth Bradley, Glenn Albright, Jeremy McMilan, and Kristen Shockley

4.1 Introduction

For students who identify as LGBTQ (Lesbian, Gay, Bisexual, Transgender, or Questioning), school can be a hostile environment where bullying and harassment occur frequently due to students' sexual orientation or gender expression. Roughly 6% of youth identify as LGBTQ, and these students are at high risk for bullying (Human Rights Watch, 2001). Many LGBTQ students are fearful in their learning environment, because of high levels of verbal and physical harassment; 63% of LGBTQ youth report feeling unsafe in school, because of their sexual orientation (Kosciw, Greytak, Bartkiewicz, Boesen, & Palmer, 2012). Roughly 80% of LGBTQ students report being verbally harassed, 38% report being physically harassed, and 18% physically assaulted (punched, kicked, or injured with a weapon) because of their sexual orientation (Kosciw et al., 2012).

Homophobic remarks are frequently used by students and even by teachers or other school staff; roughly 71% of LGBTQ students report hearing homophobic remarks frequently in the school setting, and 56% of all students report hearing those remarks made by teachers or other school staff (GSLEN, 2016a, 2016b; Kosciw et al., 2012). Although homophobic insults are directed at LGBTQ and non-LGBTQ youth alike and the interpretation of homophobic insults is situationally dependent and not always perceived negatively by adolescents, the use of homopho-

E. Bradley (✉)
School for Graduate Studies, SUNY Empire State College, Latham, NY, USA
e-mail: elizabeth.bradley@esc.edu

G. Albright
Department of Psychology, Baruch College, City University of New York,
New York, NY, USA

J. McMilan · K. Shockley
University of Georgia, Athens, GA, USA

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances
in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_4

bic insults can harm LGBTQ youth in a number of ways nonetheless (Hunt et al., 2016). It is important to recognize that students suffer homophobic bullying irrespective of their actual sexual orientation (Hong & Garbarino, 2012; Stonewall, 2017). Often students suffer instances of homophobic bullying or labeling before they have even defined their own sexuality. Roughly 75% of students who are harassed about sexual orientation do not identify as LGBTQ (D'Augelli & Dark, 1994). Thus, LGBTQ bullying affects more than solely youth who identify as LGBTQ. Bullying through the use of anti-homophic labeling can be harmful when the recipient identifies as straight or cisgendered if the victim associates homophobic feelings or negative qualities to the label, fears association of such qualities by others, or finds the labeling of their sexual or gender identity offensive (Slaatten, Hetland, & Anderssen, 2015).

In an international context, research on LGTBQ bullying indicates that, despite broad and extensive policy change, students continue to struggle with bullying and much improvement is required as it relates to cultural inclusivity, student safety, and teacher training. In the United Kingdom, research on LGTBQ student experiences indicates that while anti-LGTBQ bullying and offensive language has decreased across schools from 2012 to 2017, almost half of all LGTB students still face bullying at school for being LGTB (Stonewall, 2017). Research on LGTBQ students and faculty experiences within Australian schools suggests that the culture that exists within educational systems continue to be dominated by heteronormalcy, marginalizing both LGBTQ students and faculty, despite recent policy change (Jones, Gray, & Harris, 2016). Research on the experiences of LGBTQ students in South African schools indicates that the educational system proliferates heteronormativity, promoting gender and sexuality binaries through curriculum and organizational culture and promotes the ideology that all learners conform to a single standard form of gender expression (Francis, 2017).

Bullying is linked to a host of negative outcomes, including suicide and homicide. Children who are bullied by their peers are at greatest risk for suicidal thoughts and behavior, and in the majority of school shootings, the shooters had a history of being bullied (DHHS, 2013). LGBTQ youth are five times more likely to report suicidal ideation, three times more likely to engage in self-harm (Almeida, Johnson, Corliss, Molnar, & Azrael, 2009), and four times as likely to commit suicide than their straight peers (National Youth Association, 2010). Students questioning their sexual orientation report the highest levels of bullying, drug use, truancy, feelings of depression, and suicidality when compared with heterosexual or LGB students (Birkett, Espelage, & Koenig, 2009). Youth who experience bullying based on sexual orientation have lower grade point averages, feel less of a sense of belonging to their school community, and have more discipline issues than other students (Murdock & Bolch, 2005).

A safe and supportive learning environment is essential for promoting student achievement. Positive school climate and a lack of LGBTQ bullying make a difference in student outcomes. LGBTQ youth report that supportive school personnel help them cope and remain resilient in the face of bullying (Marshall, Yarber, Sherwood-Laughlin, Gray, & Estell, 2015). Schools have the ability to improve outcomes for LGBTQ students through creating positive climates, reducing bullying and harassment, and impacting the attitudes of heterosexual students (Birkett et al., 2009; Russell, Kosciw, Horn, & Saewyc, 2010). Teachers are in an ideal position to prevent student harassment, as they spend the majority of the school day in direct contact with students (Rutledge, Rimer, & Scott, 2008). However, teachers do not have adequate training to recognize and intervene when LGBTQ bullying occurs (Szalacha, 2003). Seventy-five percent of LGBTQ students report that when bullying and harassment occurs, teachers do nothing to stop it (EGALE, 2011). In fact, students report that teachers use anti-LGBTQ language or ignore it when their colleagues use it, thereby perpetuating heteronormative biases (GLSEN, 2016a, 2016b).

The majority of teachers are not fully prepared during teacher education programs to address LGBTQ bullying: only 33% of teachers reported receiving training in LGBTQ issues and 24% in transgender issues (GLSEN, 2016a, 2016b). Pre-service teachers report a willingness to serve as an ally to LGBTQ students and address related bullying and harassment; however, they lack an understanding of the issues surrounding LGBTQ bullying, and therefore the knowledge needed to be effective allies (Millburn and Palladino, 2012). In addition, teachers acknowledge the importance of supporting LGBTQ youth; unfortunately, this positive attitude does not consistently translate to action or intervention on LGBTQ students' behalves in the face of bullying behavior (Swanson & Gettinger, 2016).

The growing national awareness of both school bullying and the specific targeting of LGBTQ individuals has placed an increased level of accountability on school systems to ensure that they are not developing or promoting a hostile learning environment (Kimmel, 2016). As a result, school systems are increasingly implementing policy changes and teacher training programs to promote a more inclusive learning climate. Despite changes in policy, teacher training, and Title IX protections there continues to be room for improvement (Kimmel, 2016). Pennell (2017) recommends that rather than focus on inclusion, teacher training should encourage the identification of systematic heterosexism within educational institutions and address underlying issues that create homophobic and transphobic environments. Finally, teacher training should not be done solely as a reaction to anti-homophobic bullying but, rather as a means to supply teachers with actionable ways to improve classroom and school environments (Pennell, 2017).

Among the recommendations for promoting the safety and well-being of LGBTQ youth in schools are anti-bullying policies, teacher training on effective bullying intervention strategies, and school-based support groups (Russell et al., 2010). However, less than half of teachers reported that their school district conducted anti-bullying trainings (Perez, Schanding, & Dao, 2013; Swanson & Gettinger, 2016). Inclusion of bullying prevention strategies and LGBTQ student needs in teacher preparation programs would help teachers to be better trained to intervene when classroom bullying and harassment occurs (Cook & Eby, 2014; Perez et al., 2013).

In addition, teacher preparation programs should provide professional development related to creating safe learning environments and supporting LGBTQ youth (GLSEN, 2016a, 2016b). Kitchen and Bellini (2012) investigated how teacher preparation programs can more effectively implement LGBTQ bullying prevention training into the curricula. They conducted a workshop entitled “Sexual Diversity in Secondary Schools,” and as a result, many teachers identified ways that they could create safe and positive spaces for LGBTQ youth in their own classrooms (Kitchen & Bellini, 2012). Faculty at St. Francis Xavier University conducted a similar training program entitled “Positive Space,” which included two three-hour workshops integrated into two undergraduate teacher preparation courses. The focus of the training program was on becoming an ally to LGBTQ youth, and participants reported an increased understanding of the issues that LGBTQ youth face (Kearns, Kukner, & Tompkins, 2014).

Most LGBTQ teacher professional development is provided by school districts during in-service trainings or workshops (Szalacha, 2004). The *Respect for All* training program for secondary school educators comprised a two-day professional development seminar that included group discussions, presentations, videos, role-playing, and provision of training materials and resources, including activities to use with students and posters to be displayed in the school setting (Greytak & Kosciw, 2010). Participants demonstrated an increase in knowledge related to LGBTQ terms, resources, and issues, improved communication with students and staff regarding LGBTQ issues, and increased engagement in efforts to create safe schools for LGBTQ students (Greytak & Kosciw, 2010).

The Massachusetts Department of Education conducted over 700 workshops across the state (Szalacha, 2004). Attendees reported increased awareness of LGBTQ-related community resources, and students in schools that received the Safe Schools Program training reported feeling supported by teachers. However, the format and duration of the trainings varied considerably across schools, with some trainings lasting a couple of hours and others lasting multiple days (Szalacha, 2004). This lack of consistency across the trainings makes it difficult to effectively analyze the impact of the training and to determine which components should be replicated in other states and school districts.

Current efforts to train teachers on LGBTQ bullying prevention can be very time-consuming and long term, and widespread effectiveness has not been demonstrated. The Gay, Lesbian, and Straight Education Network (GLSEN) recommends that each school have a Safe Space Kit, which includes practical advice on supporting LGBTQ students and making teachers’ classrooms a safe space for students in the publication a *Guide to Being an Ally* (GLSEN, 2016a, 2016b). However, providing reading material for teachers does not ensure that they will read and absorb it nor does it provide discussion or role-playing on how specifically to intervene when bullying and harassment of LGBTQ students occurs. A training that is briefer and involves active learning would be ideal.

4.2 Background

4.2.1 Step In, Speak Up!

Step In, Speak Up! is an online interactive role-play simulation that helps middle and high school educators and staff, as well as youth-serving adults, to understand the challenges that LGBTQ youth face and gives them a chance to practice techniques for creating a safer and more supportive environment, including (1) curtailing instances of harassment and use of homophobic language and (2) connecting with a student who has been the target of harassment. This is accomplished by providing learners with a chance to practice evidence-based conversation strategies for creating a safer and more supportive environment. The simulation is based on a conversation platform that integrates usage of motivational interviewing (MI) skills where participants learn how to employ a set of MI conversation strategies originally designed by clinical psychologists for use in counseling sessions with problem drinkers (Miller, 1983; Miller & Rollnick, 2012). Content for the simulation was based in part on information drawn from critical human rights theory on homophobic bullying (Cornu, 2016; Rivers, 2011; Taylor, 2007). This had an impact on the language used in the simulation as well as communicating the importance of cultural competency and providing an awareness of the barriers experienced by LGBTQ youth.

4.2.2 Hypotheses and Measures

The overall hypothesis is that participants who completed the simulation will increase their participation in bullying prevention activities, including staff education and student referrals, and increase their likelihood to intervene with bullying in the classroom. Below, specific sub-hypotheses and examples are listed.

4.3 Method

4.3.1 Participants and Design

Participants were recruited by contacting school district administrators in urban, suburban, and rural locations throughout the United States. In turn, participants were contacted via email from district superintendent offices, principals, and word of mouth. The Baruch College (City University of New York) Human Protections Program Office determined that *Step In, Speak Up!* is a professional development program and did not meet the definition of human subjects research as defined by the federal regulations 45 CFR 46.102. Participants were provided informed consent and agreed to use their anonymous responses for scientific publication. The final sample consisted of 2904 participants from 809 schools located throughout the United States, including two states in the West, two states from the Northeast, two states from the Mid-Atlantic region, and two states from the Midwest. Participants were largely middle or high school teachers, in line with the primary audience for whom this simulation is designed. Teachers taught a full range of grade levels, from sixth to 12th. Demographic information for participants can be seen in Table 4.1.

As would be expected from the random assignment design, the treatment group and control group did not differ significantly on professional role, previous training on anti-bullying, grade level taught, or initial levels of preparedness to assist a student in psychological distress, likelihood of engaging in helping behaviors, or self-efficacy to engage in such behaviors (all χ^2 and *t*-test significance values were greater than $p = .05$). For a subset of participants located in the Northeastern region of the United States, additional demographic information was collected and demonstrated that the participants were primarily white, female, and in mid-career. The control group and treatment group were not significantly different within this subsample with regard to gender, age, ethnicity, or years spent teaching (all χ^2 significance values were greater than $p = .05$).

4.3.2 Measures

Measures used in this study include: (1) demographics, (2) means efficacy, (3) modified Gatekeeper Behavior Scale, and (4) gatekeeper and supportive behaviors.

Demographic data can be seen in Table 4.1.

Means efficacy is a measure of an individual's belief in the utility of the tools available to perform a job and has been correlated with changes in behavior (Eden, Ganzach, Flumin-Granat, & Zigman, 2010). It was measured by 7 items that were rated on a 5-point Likert response scale that ranged from "not at all to a very little extent" to "to a very great extent" and were administered in the post test (see Table 4.2).

The *Gatekeeper Behavior Scale* (GBS), originally developed by Albright, Davidson, Goldman, Shockley, and Timmons-Mitchell (2016), is an 11-item tool used to determine the impact of online virtual-human gatekeeper simulations and has previously shown good psychometric properties, including a three-factor structure consisting of preparedness, likelihood, and self-efficacy to intervene; a moderately strong relationship with general self-efficacy; and a moderately strong relationship with future intervention behaviors. For the purposes of the present study, the GBS was modified and expanded to address attitudes specifically surrounding LGBTQ students who are being teased, harassed, or bullied. This resulted in three scales of Preparedness (four items; Cronbach's $\alpha = .90$), Likelihood (i.e., behavioral intent; seven items; Cronbach's $\alpha = .93$), and Self-Efficacy (three items; Cronbach's $\alpha = .88$). An additional single item was created specifically to address self-efficacy to manage discriminatory remarks made by students in the classroom.

Table 4.1 Participant demographic information

	N	%
Gender[a]		
Male	102	25.2
Female	303	74.8
Age[a]		
25 or under	18	4.8
26–35	120	32.0
36–45	115	30.7
46–55	73	19.5
Over 55	49	13.1
Race/ethnicity[a]		
Hispanic or Latino[b]	82	22.5
White	227	75.7
Black/African American	55	18.3
Native Hawaiian/Pacific Islander	1	0.3
Asian	16	5.3
American Indian/Alaska Native	1	0.3
Years working in education[a]		
0–2	57	14.5
3–5	48	12.2
6–10	110	28.0
11+	178	45.3
My professional role is:		
Middle/High School Teacher	656	47.2
Staff	160	11.5
Administrator	86	6.2
Psychologist/Social Worker	24	1.7
University Faculty	3	0.2
Other[c]	405	29.1
Missing	56	4.0
Previously received LGBTQ anti-bullying training?		
Yes	566	40.7
No	800	57.6
Missing	24	1.7
Grade level taught (select all that apply; teachers only)		
6th	125	19.1
7th	137	20.9
8th	130	19.8
9th	291	44.4
10th	307	46.8
11th	304	46.3

(continued)

Table 4.1 (continued)

	N	%
12th	298	45.4

[a]Limited subset of sample
[b]Hispanic/Latino was not exclusive of other racial categories, resulting in percentage higher than 100%
[c]Other was comprised mostly of school counselors, paraprofessionals, teacher aids, school nurses, behavioral intervention specialists, and elementary school educators

Table 4.2 Means efficacy items: Percentage of participants who endorsed each option

	Not at all/ very little	A little	Some	Great	Very great
Please indicate to what extent you think that the course is:					
A useful tool	0.4%	1.1%	14.2%	39.7%	44.7%
Well-constructed	0.6%	0.7%	8.6%	41.5%	48.6%
Easy to use	0.4%	0.6%	6.5%	35.2%	57.4%
Likely to help you in supporting LGBTQ students	0.7%	1.1%	11.9%	38.6%	47.6%
Based on scenarios that are relevant to you and your students	1.5%	2.8%	14.4%	36.6%	44.8%
Helpful in getting timely help for a LGBTQ student who has been teased, harassed, or bullied	0.6%	1.1%	13.1%	39.4%	45.9%
Helpful in creating a safer learning environment for LGBTQ students	0.6%	1.3%	10.8%	38.8%	48.5%

Behavioral Data in the treatment group participants were obtained at three-month follow-up where users responded to Likert sale items addressing perceived increases in the number of students they have been concerned about, talked to, and connected to support services, because they were being teased, harassed, or bullied. Users also reported the number of conversations they have had with other adults in their community regarding LGBTQ students (see Tables 4.3 and 4.4).

4.3.3 *Step In, Speak Up!*

Step In, Speak Up! was developed by Kognito Interactive (2013) in partnership with the Trevor Project, a leading national organization providing crisis intervention and suicide prevention services to LGBTQ youth aged 13–24. The simulation was developed with input from nationally recognized scholars and professionals in LGBTQ school mental health and education and numerous end users. The simulation is listed in Sect. III of the SPRC/AFSP Best Practices Registry for Suicide Prevention and approved by various state boards of education for teacher continuing education credits. It takes from 45 to 90 min to complete and is self-paced (users can complete the simulation in multiple sittings) and available to each user online

Table 4.3 Participant behaviors at follow-up: Students

	Strongly disagree	Disagree	Agree	Strongly agree
As a result of taking this course, there has been an increase in the number of students I have:				
Been concerned about their being teased, harassed, or bullied	3.9%	44.1%	42.2%	9.8%
Connected to support services, because they were being teased, harassed, or bullied	4.0%	44.6%	35.6%	15.8%
Talked with after class to check to see if a teased, harassed, or bullied student is OK	3.9%	42.2%	37.3%	16.7%
Talked with after class, because they have used discriminatory language	4.0%	36.6%	40.6%	18.8%
Intervened for the student who revealed they were LGBTQ and being teased, harassed, or bullied	4.0%	43.4%	36.4%	16.2%

Table 4.4 Participant behaviors at follow-up: other adults

	Strongly disagree	Disagree	Agree	Strongly agree
As a result of taking this course, there has been an increase in the number of conversations I have had with other adults in my school community regarding:				
Students I am concerned about because they are being teased, harassed, or bullied	4.0%	37.6%	42.6%	15.8%
The use of discriminatory language in our classrooms	4.0%	31.7%	44.6%	19.8%
How to better support our LGBTQ students	2.0%	20.0%	53.0%	25.0%

24/7. The simulation is built around a series of mini-conversation role-plays where learners interact with intelligent, fully animated, and emotionally responsive virtual students who will react like real students. For example, in the first conversation, learners assume the role of a science teacher who observes two separate incidents where students insult each other using the terms “fag” and “gay.” The goal is for the learner to apply best practices in classroom management techniques to handle the situation. This is accomplished by selecting from a set of dialogue options that represent a variety of effective, neutral, and ineffective tactics. In some cases, a tactic that is ineffective at one point in the conversation may be effective elsewhere. Once learners choose a dialogue option, they see their virtual character “perform” the dialogue and then observe the verbal and nonverbal response of the virtual student. A new set of dialogue options then appear, based on which tactic was selected (see Fig. 4.1).

Throughout the simulation, learners are able to occasionally view students’ private thoughts, which are designed to provide the learner with greater insight, understanding, and empathic communication skills. This role-play is completed once the learner successfully manages the classroom situation. In the second conversation,

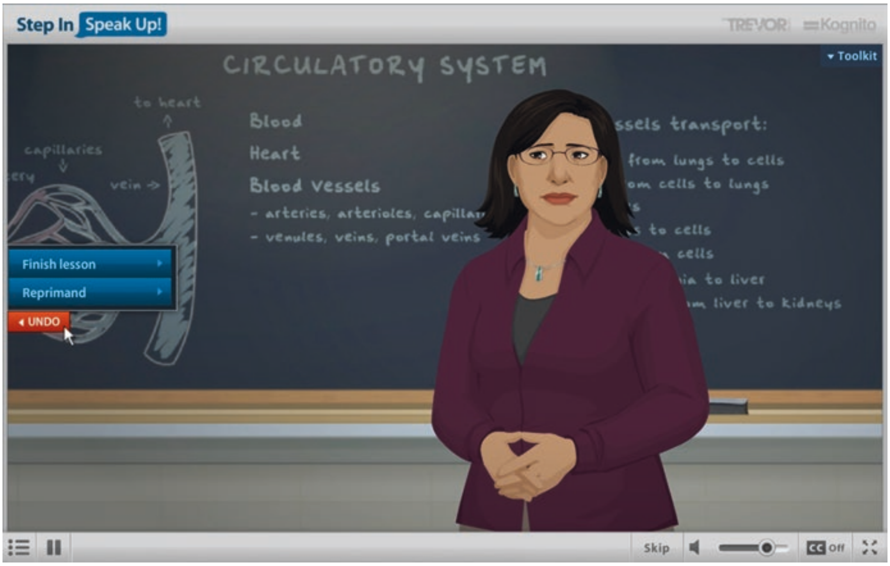

Fig. 4.1 Screenshot of a virtual role-play conversation with Ms. Yazzi in *Step In, Speak Up!*

learners role-play with a student being harassed by another student. The learner has to gain the student's trust; thus, a Trust Meter provides continual feedback based on the choices made by the learner as he or she progresses through the simulation. If the learner selects choices that include being critical, judgmental, or labeling, the Trust Meter will decrease, and learners will find it harder to complete the simulation. The learner also has numerous opportunities to build on their use of MI strategies as they navigate the conversation. To facilitate this, a virtual coach provides real-time positive feedback for correct tactics and suggestions for incorrect tactics or pitfalls. The role-play is complete when the learner has successfully developed a supportive relationship and the student agrees to meet with the school's counselor.

The simulated role-plays described above allow learners to engage in sustained and deliberate practice opportunities in an environment that is visually and mechanically congruous with the setting in which learners will apply their skills (situated learning). Deliberate practice is intended to improve real-world performance (Ericsson, Prietula, & Cokely, 2007) by offering: a challenge to learners' existing skills; a simulated environment that allows users to experiment with various techniques with no fear of the consequences real humans might experience; a protected environment with no fear of judgment or social evaluative threat from observers or students (as opposed to live role-play with peers or standardized students); time for users to reflect on their skills and adjust their strategies; continuous analysis of performance through simulation features (e.g. trust meter) and through individualized and immediate feedback from a virtual coach throughout the simulation. Evidence shows that communication skills improve and endure when learning experiences incorporate deliberate practice, on-going tailored feedback, role-plays, and establish a connection between new skills learned, such as those used in motivational interviewing and their application in live settings (Van De Wiel, Van den Bossche, Janssen, & Jossberger, 2011).

4.3.4 Procedure

Upon giving informed consent, participants were randomly assigned to the treatment or control group. Participants in the treatment group completed a pre-simulation survey (baseline), then completed the simulation, and lastly completed a post-simulation survey. Those in the control group completed the pre-simulation survey for comparison purposes (see Fig. 4.2 for flow chart of progress through the phases of the trial).

Participants who did not complete the post-simulation survey or took more than 4 h were removed ($N = 1514$), thus reducing the sample size to 1390 (716 in the control group, 674 in the treatment group). There were no significant differences between those who completed both surveys and those who did not on initial levels of preparedness to assist a student in psychological distress ($p = .51$), likelihood of engaging in helping behaviors ($p = .17$), or self-efficacy to engage in such behaviors ($p = .21$). Thus, based on the available data, there is tentative support that attrition does not threaten validity. Note that sample size varies slightly for each analysis due to individual missing data.

4.3.5 Fidelity of Simulation and Data Analyses

To better ensure uniformity and fidelity, we only included those participants who took four or less hours to complete the simulation (median completion time was 47.18 min). *Step In, Speak Up!* also addresses fidelity by being computer-delivered; thus, it is not possible to modify content and its delivery. The decision trees incorporated into the conversation platform allow the learning experience to be customized and standardized to each user pending what conversation tactic they select to discuss with how the virtual student responds.

4.3.6 Planned Analyses

Because the outcomes are all expected to be closely associated, a multivariate analysis, Hotelling's T^2, was utilized to assess the impact of the simulation on these outcomes as a whole, thus reducing the likelihood of Type I error when evaluating each individual variable in more detail. Independent samples *t*-tests were then calculated to compare groups on each scale individually, and finally to compare groups on each individual item, thus allowing for fine-grained analyses.

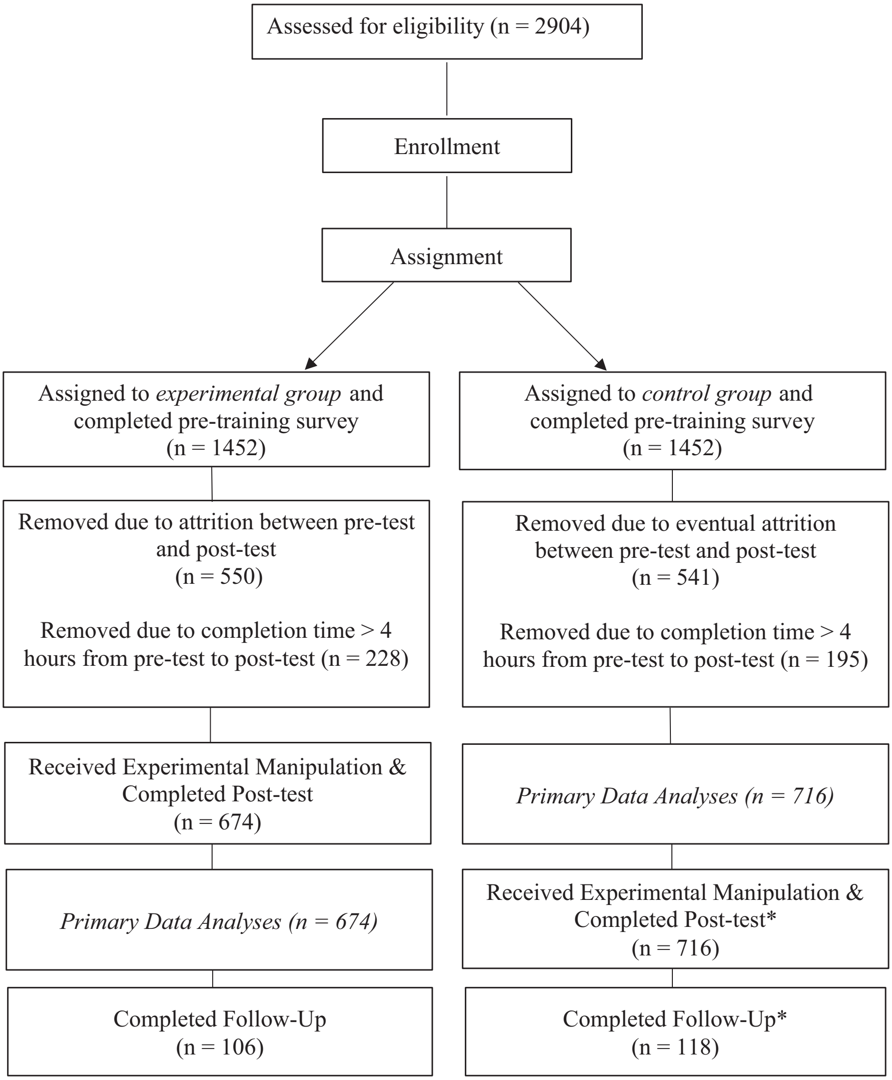

Fig. 4.2 Flow of participants through each stage of the experiment. *Not included in present analyses

4.4 Results

4.4.1 Means Efficacy

Generally, participants in the treatment group were highly satisfied with the simulation, with an average rating of 3.34 on a 4-point scale (49% of participants rated the simulation "excellent," the top point on the scale). In addition, 98.6% of participants agreed or strongly agreed that all staff in their facility should take the course, and 95% indicated that they would recommend the simulation to a colleague. Concerning difficulty of the simulation, about 78% indicated the simulation was at their skill level, 14% below their skill level, and 6% above their skill level. Means efficacy data about treatment group attitudes toward the simulation can be seen in Table 4.2. Results suggest overall that a very large proportion of participants found the simulation to be helpful and effective; thus, hypothesis 1 is supported.

4.4.2 Evaluation of *Step In, Speak Up!*

Results of the Hotelling's T^2 test indicated that the treatment group and control group differed significantly on the three outcome variables of preparedness, likelihood, and self-efficacy, $F(3,1352) = 91.27$, $p < .001$, $\eta^2_{partial} = .17$.

The next statistical analyses consisted of evaluating each of the three primary outcomes individually. Preparedness of the treatment group on the post-simulation survey (M = 4.49, SD = .60) differed significantly from preparedness of the control group in the pre-simulation survey (M = 3.89, SD = .75), $t(1362) = 16.26$, $p < .001$. Likelihood of the treatment group (M = 3.72, SD = .42) differed significantly from likelihood of the control group (M = 3.50, SD = .49), $t(1363) = 8.78$, $p < .001$. Lastly, self-efficacy of the treatment group (M = 3.64, SD = .47) differed significantly from self-efficacy of the control group (M = 3.40, SD = .54), $t(1358) = 8.81$, $p < .001$. However, the two groups did not differ when comparing the pre-simulation surveys on any of the outcomes, highlighting the efficacy of the simulation. Specifically, preparedness of the treatment group at pre-simulation (M = 3.90, SD = .73) was not significantly different from the control group, $t(1363) = .33$, $p = .74$. Likelihood of the treatment group at pre-simulation (M = 3.51, SD = .48) was not significantly different from the control group, $t(1358) = .44$, $p = .66$. Lastly, self-efficacy of the treatment group at pre-simulation (M = 3.41, SD = .52) was not significantly different from the control group, $t(1347) = .13$, $p = .90$. Thus, hypotheses 2, 3, and 4 were supported.

Several additional individual items showed statistically significant increases (see Table 4.5) in comparing the treatment to the control group that included increased: (1) awareness of the need to use gender-based language in the classroom, (2) confidence to manage discriminatory remarks in the classroom, (3) positive perceptions about the role of school staff in supporting LGBTQ students by creating a safer more supportive environment as well as connecting students experiencing teasing, harassment, and bullying to support services or staff, (4) knowledge about the common challenges facing LGBTQ students, and (5) perception in being helped to actively work or create/maintain a safe environment for LGBTQ students (see Table 4.5). Thus, hypotheses 5, 6, and 7 were supported.

Table 4.5 Individual scale item significance testing

	Mean-control (SD)	Mean-treatment post-training (SD)	*t*-value
Preparedness: how would you rate your preparedness to…			
Manage a student in your classroom who has used derogatory language, such as "fag," "gay," "mo," or other	3.76 (.91)	4.47 (.65)	16.54
Discuss with a student your concern about their being teased, harassed, or bullied	3.91 (.86)	4.50 (.65)	14.12
Connect a student who is being teased, harassed, or bullied to support services (such as a counselor or school psychologist)	4.11 (.85)	4.56 (.61)	11.13
Use gender-neutral language in class	3.78 (.95)	4.44 (.68)	14.78
Likelihood: how likely are you to…			
Stop a class every time a student uses discriminatory language, such as "fag," "gay," "mo," and others, to address the issue	3.33 (.70)	3.68 (.50)	10.78
Discuss your concerns with a LGBTQ student who has been teased, harassed, or bullied	3.34 (.67)	3.66 (.51)	9.88
Connect a student who is being teased, harassed, or bullied to support services (such as a counselor or school psychologist)	3.56 (.58)	3.75 (.45)	7.05
After class, check to see if a teased, harassed, or bullied student is OK	3.56 (.58)	3.74 (.46)	6.12
After class, talk with a student who has used discriminatory language	3.62 (.55)	3.77 (.43)	6.42
Intervene if a LGBTQ student tells you that they are being teased, harassed, or bullied	3.59 (.57)	3.73 (.46)	5.29
Communicate to your class(es) that discriminatory language is not allowed	3.62 (.55)	3.77 (.43)	5.51
Self-efficacy: In talking to a student you are concerned about…			
I feel confident in my ability to discuss my concerns with this student	3.29 (.62)	3.61 (.51)	10.23
I feel confident in my ability to help this student seek help if they are having thoughts of suicide	3.40 (.63)	3.62 (.53)	6.90
I feel confident in my ability to connect this student to support services or a supportive staff member	3.51 (.57)	3.70 (.47)	6.52
Additional Items			
I feel confident in my ability to manage discriminatory remarks in the classroom	3.33 (.60)	3.63 (.50)	10.04
Part of the role of faculty, staff, and administrators is to help create a safe and supportive learning environment for LGBTQ students	3.66 (.51)	3.73 (.46)	2.81**
Part of the role of faculty, staff, and administrators is to connect LGBTQ students experiencing teasing, harassment, and bullying to support services or supportive staff	3.64 (.50)	3.73 (.46)	3.24**

(continued)

Table 4.5 (continued)

	Mean-control (SD)	Mean-treatment post-training (SD)	*t*-value
This course will help me actively work to create or maintain a safe environment for our LGBTQ students	3.30 (.63)	3.62 (.52)	10.06
I am aware of the need to use gender-neutral language in the classroom	3.31 (.61)	3.65 (.49)	11.27
I am knowledgeable about the common challenges facing the LGBTQ student population	3.14 (.68)	3.55 (.54)	12.14

Note. All items significant at $p < .001$, unless otherwise indicated
$^{**}p < .01$

4.4.3 Behavior Changes

For 106 participants in the treatment group, one final follow-up survey was completed 3 months after completion of the post-test. The purpose of this data collection was to analyze (1) changes in behavior with regard to discussing LGBTQ issues with other educators and (2) changes in behaviors with regard to assisting LGBTQ students. The data show that roughly half of the participants reported increases in their behaviors interacting with students (see Table 4.3), and a higher percentage reported increases in interactions with other adults (see Table 4.4); thus, hypotheses 8 and 9 were supported.

4.5 Discussion

Regarding the effectiveness of *Step In, Speak Up!* support was evidenced by significant differences between the treatment and control groups on all dependent measures including learners' preparedness, likelihood, or behavioral intent and self-confidence to: (1) manage a student in a classroom who has used derogatory language, (2) discuss with a student concerned about their being teased, harassed, or bullied and, if necessary, (3) connect that student to support services (counselor or school psychologist). In addition, learners reported being more likely to stop a class every time a student uses discriminatory language to address the issue and check to see if a teased, harassed, or bullied student is okay after class. They also reported that they were more confident in their ability to help a student seek support if they seem at risk for suicide and to be more aware and prepared to use gender-neutral language in the classroom.

In terms of the impact on self-reported behaviors, at the three-month follow-up, 52% of participants reported an increase in the number of students teased, harassed, or bullied that they have been concerned about; 51.4% reported an increase in number connected to support services; 54% reported an increase in number talked to after class to see if they were okay; and 52.6% reported an increase in the number of times they intervened for students who being teased, harassed, or bullied by students labeling them as LGBTQ (regardless of whether they self-identified as LGBTQ or not). Lastly, 59.4% of participants reported an increase in the number of students talked to after class, because they used discriminatory language.

At the three-month follow-up, 58.4% of participants also reported an increase in the number of conversations they had with other adults in their school community regarding students they were concerned about, because they are being teased, harassed, or bullied; 64.4% reported an increase in conversations about the use of discriminatory language in their classrooms; and 78% reported an increase in conversations about how to better support LGBTQ students. In total, these self-reported, perceived increases in behavior are modestly promising.

Participants also found the simulation to be useful, realistic, and helpful and highly recommend it to all educators in their school. Finally, participants reported that *Step In, Speak Up!* will help them actively work to create or maintain a safe environment for LGBTQ students and that part of their role as educators is to connect LGBTQ students experiencing teasing, harassment, and bullying to support services or supportive staff. This is encouraging and suggests that, if enough educators and staff complete the simulation, there is the possibility of a shift to a safer and more supportive school culture and climate for LGBTQ students.

Beyond the outcome data from this study, there are important advantages that support utilizing online role-play simulations. First, online virtual role-play simulations offer the user an opportunity to safely explore situations in a risk-free environment in the privacy of one's home or office. Also, role-playing with virtual humans can reduce situational factors that compromise the effectiveness of face-to-face role-plays, such as performing in front of peers, instructors, and other role-players, which can cause embarrassment or social evaluative threat (Nestel & Tierney, 2007). Also, in *Step In, Speak Up!* users are not depending on the skill and experience of the trainers and their knowledge of the population they are training. Users can have an entirely different experience depending on their choice of conversation tactic as they navigate through the role-plays, thus ensuring high fidelity.

Another advantage is that, once a virtual simulation is developed, it is sustainable. There are no costs for training, hiring, and maintaining professional instructors, which can be especially onerous if one is scaling up to implement training on a state or national level. Additionally, this online simulation eliminates the need for travel expenses and the cost of participants being pulled away from their work, especially in rural areas. Lastly, *Step In, Speak Up!* provides participants with an information page with the locations of campus, institutional, and local resources to link students to needed support services.

There are a few limitations of the current study. The first is that the three-month behavioral data collected regarding the perceived impact of the simulation on behaviors was self-reported and there was not a control group comparison. Having access to the schools' support service (counseling) records showing data linking *Step In, Speak Up!* participants to referrals would have been valuable indices of behavioral change. Additionally, those who self-selected to complete the follow-up survey could be more motivated to support LGBTQ students, thus potentially impacting the results. In addition, as this research was conducted in the United States, results may not be generalizable to international populations. Finally, the results of the present study are subject to the general issue of pre-test sensitization, in which a pre-test/post-test design sensitizes participants to the content of both the simulation and the outcome measures, resulting in the possibility of artificially inflated gains between the two time points.

Regarding future research, it would beneficial to more closely examine the individual differences of participants that may theoretically have an impact on the efficacy of the training. In particular for *Step In, Speak Up!* the sexual orientation of teachers and administrators may have an impact on the degree to which they are receptive to and benefit from training. On the other hand, it may be that individuals belonging to a sexual minority already possess a large repertoire of skills related to dealing with issues pertinent to the training due to previous life experiences, and thus would exhibit minimal gains from training. Future examination of these possibilities would be potentially fruitful.

4.6 Conclusion

This study supports the use of *Step In, Speak Up!* as evidenced by significant increases in participants' Preparedness, Likelihood, and Self-Efficacy, to (1) manage a student in a classroom who has used derogatory language, (2) discuss with a student concerned about their being teased, harassed, or bullied and, if necessary, (3) connect that student to support services. Participants also reported being more likely to stop a class every time a student uses discriminatory language to address the issue and check to see if the student who was harassed is okay after class. Lastly, participants reported changes in their behavior that included increases in the number of students they identified as having been teased, harassed, or bullied, as well as those they connected to support services and followed up with after class with students to see if they were okay. These results, coupled with reported increases in the number of conversations about how to support LGBTQ students, suggest that, if enough educators and staff within the community complete the simulation, a school culture shift might ensue, hopefully leading to a safer and more supportive learning environment for LGBTQ students.

References

Albright, G., Davidson, J., Goldman, R., Shockley, K., & Timmons-Mitchell, J. (2016). Development and validation of the gatekeeper behavior scale: A tool to assess suicide prevention gatekeeper trainings. *Crisis: The Journal of Crisis Intervention and Suicide Prevention, 37*(4), 271–280. https://doi.org/10.1027/0227-5910/a000382

Almeida, J., Johnson, R. M., Corliss, H. L., Molnar, B. E., & Azrael, D. (2009). Emotional distress among LGBT youth: The influence of perceived discrimination based on sexual orientation. *Journal of Youth and Adolescence, 38*(7), 1001–1014. https://doi.org/10.1007/s10964-009-9397-9

Birkett, M., Espelage, & Koenig, B. (2009). LGB and questioning students in school: The moderating effect of homophobic bullying and school climate on negative outcomes. *Journal of Youth Adolescence, 38*(7), 989–1000. https://doi.org/10.1007/s10964-008-9389-1

Cook, B. J., & Eby, L. K. (2014). Addressing anti-LGBTQ bullying and harassment. *Communiqué, 42*(6), 35. Retrieved from http://connection.ebscohost.com/c/articles/95718110/addressing-anti-lgbtq-bullying-harassment

Cornu, C. (2016). Preventing and addressing homophobic and transphobic bullying in education: A human rights-based approach using the united nations convention on the rights of the child. *Journal of LGBT Youth, 13*(1–2), 6–17.

D'Augelli, A. R., & Dark, L. J. (1994). Lesbian, gay and bisexual youths. In L. D. Eron, J. H. Gentry, & P. Schlegel (Eds.), *Reason to hope: A psychosocial perspective on violence and youth* (pp. 177–196). Washington, DC: American Psychological Association.

Eden, D., Ganzach, Y., Flumin-Granat, R., & Zigman, T. (2010). Augmenting means efficacy to boost performance: Two field experiments. *Journal of Management, 36*(3), 687–713. https://doi.org/10.1177/0149206308321553

Equality for Gays and Lesbians Everywhere (EGALE). (2011). *Every class in every school: The final report on the first national climate survey on homophobia, biphobia, and transphobia in Canadian schools.* Retrieved April 21, 2012 from: http://www.egale.ca

Ericsson, K. A., Prietula, M. J., & Cokely, E. T. (2007). The making of an expert. *Harvard Business Review, 85*(7/8), 114. Retrieved from https://hbr.org/2007/07/the-making-of-an-expert

Francis, D. A. (2017). Homophobia and sexuality diversity in South African schools: A review. *Journal of LGBT Youth, 14*(4), 359–379. https://doi-org.alumnilibrary.esc.edu/10.1080/19361653.2017.1326868

Gay, Lesbian, and Straight Education Network (GLSEN). (2016a). *Safe space kit*. New York, NY: GLSEN.

Gay, Lesbian, and Straight Education Network (GLSEN). (2016b). *The 2015 National School Climate Survey: Executive summary*. Retrieved from: www.glsen.org

Greytak, E. A., & Kosciw, J. G. (2010). *Year one evaluation of the New York City Department of Education Respect for All training program*. New York, NY: GLSEN.

Hong, J., & Garbarino, J. (2012). Risk and protective factors for homophobic bullying in schools: An application of the social-ecological framework. *Educational Psychology Review, 24*(2), 271–285. https://doi-org.alumnilibrary.esc.edu/10.1007/s10648-012-9194-y

Human Rights Watch. (2001). *Hatred in the hallways: Violence and discrimination against lesbian, gay, bisexual, and transgender students in the U.S*. New York, NY: Human Rights Watch.

Hunt, C. J., Piccolib, V., Carnaghib, A., Di Blasb, L., Bianchic, M., Hvastja-Stefanib, L., … Cavallerob, C. (2016). Adolescents' appraisal of homophobic epithets: The role of individual and situational factors. *Journal of Homosexuality, 63*(10), 1422–1438. https://doi.org/10.1080/00918369.2016.1158000

Jones, T., Gray, E., & Harris, A. (2016). Australian LGBTQ teachers, exclusionary spaces and points of interruption. *Sexualities, 19*(3), 286–303.

Kearns, L.-L., Kukner, J. M., & Tompkins, J. (2014). Building LGBTQ awareness and allies in out teacher education community and beyond. *Collected Essays on Learning and Teaching, 7*, 1–6. Retrieved from http://celt.uwindsor.ca/ojs/leddy/index.php/CELT/article/view/3980/3259

Kimmel, A. P. (2016). Title IX: An imperfect but vital tool to stop bullying of LGBT students. *Yale Law Journal, 125*(7), 2006–2036. Retrieved from http://library.esc.edu/login?url=http://search.ebscohost.com.alumnilibrary.esc.edu/login.aspx?direct=true&db=a2h&AN=115922654&site=ehost-live

Kitchen, J., & Bellini, C. (2012). Addressing lesbian, gay, bisexual, transgender, and queer (LGBTQ) issues in teacher education: Teacher candidates' perceptions. *Alberta Journal of Educational Research, 58*(3), 444–460. Retrieved from http://ajer.journalhosting.ucalgary.ca/index.php/ajer/article/view/1058

Kognito Interactive. (2013). *At-risk for high school educators.* Retrieved from: http://www.kognito.com/products/highschool/research/

Kosciw, J. G., Greytak, E. A., Bartkiewicz, M. J., Boesen, M. J., & Palmer, N. A. (2012). *The 2011 National School Climate Survey: The experiences of lesbian, gay, bisexual, and transgender youth in our nation's schools*. New York, NY: GLSEN.

Marshall, A., Yarber, W. L., Sherwood-Laughlin, C. M., Gray, M. L., & Estell, D. B. (2015). Coping and survival skills: The role school personnel play regarding support for bullied sexual minority-oriented youth. *Journal of School Health, 85*(5), 334–340. https://doi.org/10.1111/josh.12254

Millburn, W., & Palladino, J. (2012). Preservice teachers' knowledge, skills, and dispositions of LGBTQ bullying intervention. *The American Association of Behavioral and Social Sciences Journal, 16*, 86–100. Retrieved from http://eric.ed.gov/?id=ED536041

Miller, W. R. (1983). Motivational interviewing with problem drinkers. *Behavioral Psychotherapy, 11*(2), 147–172. https://doi.org/10.1017/S0141347300006583

Miller, W. R., & Rollnick, S. (2012). *Motivational interviewing: Helping people change*. New York, NY: Guilford Press.

Murdock, T. B., & Bolch, M. B. (2005). Risk and protective factors for poor school adjustment in lesbian, gay, and bisexual (LGB) high school youth: Variable and person-centered analyses. *Psychology in the Schools, 42*(2), 159–172. https://doi.org/10.1002/pits.20054

National Youth Association. (2010). *Gay bullying.* Retrieved on August 22, 2014 from: http://www.nyaamerica.org/2010/11/07/gay-bullyin/

Nestel, D., & Tierney, T. (2007). Role-play for medical students learning about communication: Guidelines for maximizing benefits. *BMC Medical Education, 7*(1), 3. https://doi.org/10.1186/1472-6920-73

Pennell, S. M. (2017). Training secondary teachers to support LGBTQ+ students: Practical applications from theory and research. *High School Journal, 101*(1), 62–72. Retrieved from http://library.esc.edu/login?url=http://search.ebscohost.com.alumnilibrary.esc.edu/login.aspx?direct=true&db=a2h&AN=126036877&site=ehost-live

Perez, E. R., Schanding, G. T., & Dao, T. K. (2013). Educators' perceptions in addressing bullying of LGBTQ/gender nonconforming youth. *Journal of School Violence, 12*, 64–79. https://doi.org/10.1080/15388220.2012.731663

Rivers, I. (2011). *Homophobic bullying: Research and theoretical perspectives*. New York, NY: Oxford University Press.

Russell, S. T., Kosciw, J., Horn, S., & Saewyc, E. (2010). Safe schools policy for LGBTQ students. *Social Policy Report, 24*(4), 1–24. Retrieved from http://files.eric.ed.gov/fulltext/ED519243.pdf

Rutledge, C. M., Rimer, D., & Scott, M. (2008). Vulnerable goth teens: The role of schools in this psychosocial high-risk culture. *Journal of School Health, 78*(9), 459–464. https://doi.org/10.1111/j.1746-1561.2008.00331.x

Slaatten, H., Hetland, J., & Anderssen, N. (2015). Correlates of gay-related name-calling in schools. *Psychology in the Schools, 52*(9), 845–859. https://doi-org.alumnilibrary.esc.edu/10.1002/pits.21864

Stonewall. (2017). *The experiences of lesbian, gay, bi and trans young people in Britain's schools in 2017* (SCHOOL REPORT). Retrieved December 6, 2018, from: https://www.stonewall.org.uk/sites/default/files/the_school_report_2017.pdf

Swanson, K., & Gettinger, M. (2016). Teachers' knowledge, attitudes, and supportive behaviors toward LGBT students: Relationship to Gay-Straight Alliances, antibullying policy, and teacher training. *Journal of LGBT Youth, 13*(4), 326–351.

Szalacha, L. A. (2003). Safer sexual diversity climates: Lessons learned from an evaluation of Massachusetts Safe Schools program for gay and lesbian students. *American Journal of Education, 110*, 58–88. https://doi.org/10.1086/377673

Szalacha, L. A. (2004). Educating teachers on LBTQ issues: A review of research and program evaluations. *Journal of Gay and Lesbian Issues in Education, 1*(4), 67–79. https://doi.org/10.1300/J367v01n04_07

Taylor, C. G. (2007). A human rights approach to stopping homophobic bullying in schools. *Journal of Gay & Lesbian Social Services, 19*(3-4), 157–172. https://doi.org/10.1080/10538720802161672

U.S. Department of Health & Human Services (2013). Facts about Bullying. Retrieved on August 18, 2014 from http://www.stopbullying.gov/news/media/facts/#listing

van de Wiel, M. J., Van den Bossche, P., Janssen, S., & Jossberger, H. (2011). Exploring deliberate practice in medicine: How do physicians learn in the workplace? *Advances in Health Sciences Education, 16*(1), 81–95. https://doi.org/10.1007/s10459-010-9246-3

Chapter 5
Gamifying Teacher Training: Simulated Practice Learning for Future and Practising Teachers Interacting with Vulnerable Learners

Thomas Connolly, Nina Tsvetkova, and Plama Hristova

5.1 Introduction

A key part of the education and social care sectors deals with vulnerable people. In the context of this chapter, we define vulnerable people as 'Groups that experience a higher risk of poverty and social exclusion than the general population. Ethnic minorities, migrants, disabled people, the homeless, those struggling with substance abuse, isolated elderly people and children all often face difficulties that can lead to further social exclusion, such as low levels of education and unemployment or underemployment'.[1] A 2011 report by the Social Protection Committee on the social dimension in the EU2020 strategy states that greater emphasis must be placed on generating an effective and innovative way of developing the human capital of those responsible for improving the quality of life for vulnerable people throughout Europe (European Commission, 2011). Education and training plays a pivotal role in developing those who work with vulnerable people. In many parts of Europe, these sectors have a strong emphasis on learning and assessing skills for job roles in real practice environments (practice learning). Thus, it is important to facilitate skills rehearsal in a risk-free environment which will allow trainees to replay different scenarios many times. On the other hand, it is important for the practice learning environment to provide opportunities for continuous feedback and tutor assessment as well as self-assessment.

[1] SOURCE: Social protection and Social inclusion Glossary. DG Employment, Social Affairs and Inclusion: http://ec.europa.eu/employment_social/spsi/vulnerable_groups_en.htm

T. Connolly (✉)
University of the West of Scotland, Paisley, Scotland, UK

N. Tsvetkova · P. Hristova
Sofia University, "St. Kliment Ohridski," Sofia, Bulgaria

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_5

There are also on-going demands for practice learning with newly qualified professionals and experienced professionals as part of 'in-service'/CPD training. There are clear logistical challenges in arranging practice opportunities where trainees are able to learn the core skills of the job and receive high quality support, supervision, and assessment of their practice from suitably qualified mentors/practice assessors. Furthermore, finding sufficient numbers of such placements has been a challenge for the past 30 years. However, there are also other challenges; for example, risks associated with work-based learning and the safety and well-being of service users in giving trainees access to their lives. Thus, there are vocational skills, mismatches, and shortages around practice learning in this sector. A possible solution to this issue is the introduction of computer games and simulations during the initial preparation or within the forms of continuous education of social workers and teachers. Although research in this field is constantly being updated, it can be maintained that computer games and simulations provide a valuable pedagogical approach, especially when the purpose is to achieve a change in behaviour and attitudes. They are most effective when they support the players in decision making about possible professional scenarios and in experimenting with the desirable and most effective professional actions (Connolly et al., 2016; Tsvetkova, Antonova, & Hristova, 2017).

5.2 Practice Learning

Education for those who interact with vulnerable people aims to prepare students in the relevant professions' fundamental ways of thinking, performing, and acting with integrity (Shulman, 2005). Competence frameworks with a focus on outcomes have been adopted in some countries for professions such as medicine (Frank et al., 2010), nursing (Yanhua and Watson, 2011), psychology (Fouad et al., 2009), and social work (Logie, Bogo, Regehr, & Regehr, 2013). Competence refers to complex practice behaviours reflecting knowledge, skills, values, and attitudes that students should be able to demonstrate on completion of their degree. While education and social work programmes adopt traditional assessment methods to assess learning using, for example, written examinations, essays, student presentations, or portfolios (Crisp & Lister, 2002), the ability of an individual to perform the core functions of the profession in practice situations is of fundamental importance (Finch & Schaub, 2014).

Education and social work practice are complex, and practice learning is an opportunity for students to work directly with service users and to apply and develop their knowledge, skills, values, and ethics and build on their learning within the taught elements of their programme. One approach to experiencing practice learning is through simulation-based education where students engage in an imitation of an activity to learn. This approach is frequently used to develop empathy and empathetic behaviours in medical and health-related students (Bearman, Palermo, Allen, & Williams, 2015). Simulation techniques in health and social work vary and include role-play (Kane, 2003; Moss, 2000); scenarios played out by drama students

(Levitov, Fall, & Jennings, 1999); and use of trained actors (Mole, Scarlett, Campbell, & Themessl-Huber, 2006; Petracchi & Collins, 2006; Robins et al., 2008). This chapter examines gamified simulation-based education through two case studies: Digital_Bridges and Play2Do.

5.3 Simulated Practice Environment

5.3.1 The Cases

Skills development and qualification issues are major features in the EU2020 policy vision. The "Agenda for new skills and jobs" (European Commission, 2010) as well as "Innovation Union" (European Commission, 2013) and "A Digital Agenda for Europe" (European Commission, 2014) clearly underline the importance of skills and knowledge architecture that can be developed within simulated practice learning environments. The two case studies present successful attempts to respond to these requirements through the application of a gamification approach to training specialists who deal with vulnerable people. According to Deterding, Khaled, Nacke, & Dixon (2011, p. 2) "gamification is the use of game design elements in non-game contexts. This differentiates it from serious games and design for playful interactions." In this respect, this chapter considers gamified training of social workers and teachers as professional training employing simulated practice learning as part of its curriculum.

Recently, there has been a move towards inclusive education across EU countries and beyond. The notion of inclusive education is based on the understanding that all individuals, students, and children have the right to education irrespective of any challenges they may have. It also means that they are educated in mainstream settings and enjoy quality instruction together with the special support they need in order to achieve the targets of the curriculum (Bui, Quirk, Almazan, & Valenti, 2010; Alquraini & Gut, 2012). The games discussed below allow for acquiring competences for working in an inclusive educational environment.

The Digital_Bridges project developed an immersive 3D virtual environment, built on gaming architecture and driven by emotional AI, to provide a safe and readily accessible environment where Higher Education and VET students and professionals who deal with young children in a nursery environment can learn by interacting with NPCs (Non-Player Characters) in a simulation of a real-world service. Trainees engage with simulations and are required to navigate their way through choices to arrive at the best resolution. Each simulation can be replayed and evaluated by the trainer/mentor and the trainee can use the same simulation as many times as required. We saw this as offering a measurable, controlled environment where learners can gain a command of the basics of the job role they are training for with minimal resource requirements and zero risk to the public, thus providing a sound basis from which to progress to real work practice placement. Based on the success of Digital_Bridges, the Play2Do project extended this approach to support the education and training of students and professionals who work with students with intellectual and developmental disabilities.

Both games are based on a specially designed pedagogical framework, which accounts for the relationships between the broader social context, the particular educational setting and the learner, the trainer and the vulnerable person and focuses on the learner, being flexible, transparent, and consistent. This allows for following the learning/skills rehearsal model below (Fig. 5.1).

Both games are also compliant with a training curriculum which details the target skills necessary for the effective professional realisation of social workers and teachers dealing with vulnerable individuals in three groups, namely ‘Knowledge and understanding’ (e.g. promoting health, safety and security in the work setting; promoting well-being and resilience; promoting effective communication in the inclusive classroom with colleagues, parents and other stakeholders), ‘Professional and personal skills and attitudes’ (e.g. ability to connect actions to day-to-day practice; ability to deal with behavioural problems; ability to enhance engagement and motivation) and ‘Transversal skills’ (e.g. ability to reflect on and engage in the systematic observation of practice; ability to demonstrate in writing ideas connected to the (future) professional roles; ability to connect own actions in a game-based scenario to day-to-day practice; ability to assess one’s own effectiveness). In the next section, we introduce two simulated practice environments, and in the following section, we discuss their large-scale evaluations.

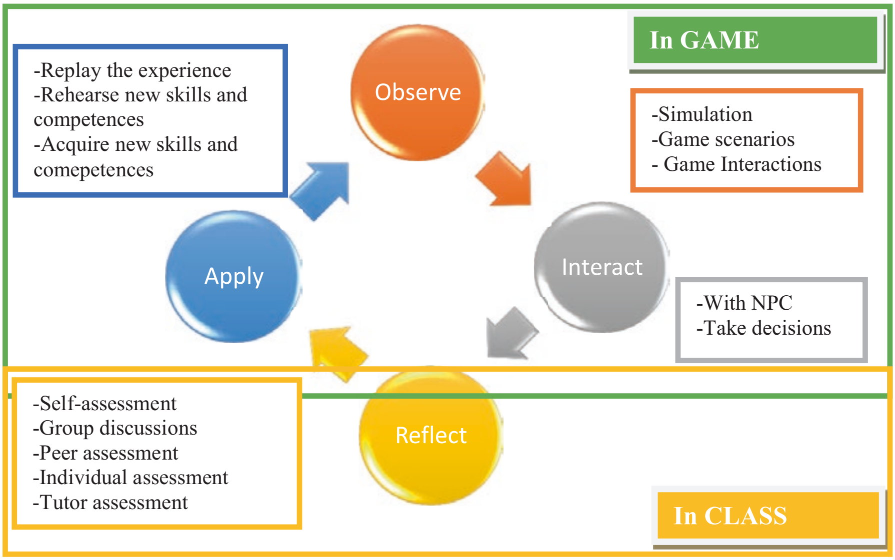

Fig. 5.1 Learning/skills rehearsal model applied in the two case studies

5.3.2 The Tiny Oaks Nursery

For the Digital_Bridges project, the Tiny Oaks simulated practice nursery environment was designed by an advisory group consisting of subject matter experts in childhood practice. A number of general activities was formulated for the 3D practice learning environment, which focuses on a morning session at a nursery from the arrival of children with their parents/carers, through the children participating in various activities until they are collected by their parent/carer. Activities modelled include: painting area – table top painting, painting easel; messy play area – sand tray, water tray; activity table – gluing, modelling, clay and play dough; construction area; home corner; role-play area; reading corner; music area; imaginative play – puppet theatre; investigation area; activity table – board games, jigsaw puzzles, small world play; snack preparation area – plus chairs and tables for children to sit at to eat snack; and a computer area. The environment has been populated with 16 children, one practitioner (maintaining an 8:1 ratio of children to practitioners) and one student practitioner. The two NPC practitioners are there to help the player look after the children during the game.

During the session, different scenarios may arise that the player has to deal with in an appropriate way as shown in Table 5.1.

The gameplay involves the player taking on the role of a childhood practitioner and navigating the 3D nursery environment to deal with one or more scenarios run-

Table 5.1 The Tiny Oaks Nursery: Game scenarios

Scenario	Main aims
Risk assessment mini-game	Review and evaluate the *Tiny Oaks* nursery environment and identify items that potentially could cause harm for children or staff members.
Andrew and Christopher in the Home Corner	Understand how to communicate best with children in situations where there is disagreement and low-level, but developmentally normal, aggression.
Louise slips on water and bangs her elbow	Understand how to communicate with children in situations of accidents and provide appropriate help.
Feedback to Louise's mum after her accident	Understand how to communicate effectively with children and key people when complex or sensitive issues appear.
Cai left out by Zoe and Mollie at nursery	Understand how to communicate with children in situations where there is disagreement and low-level, but developmentally normal, aggression
Alexandra and her new baby sister	Allow learners to consider the well-being and resilience of a child and their family when a child becomes upset when left in the nursery setting
Oscar and his eye patch	Develop an understanding of promoting effective communication within a work setting and develop an understanding of the child's communication preferences and needs
Harry role-playing about a visit to the hospital	Understand the importance of effective communication between adults and children in the nursery and explore the role of the adult in encouraging the child's self-reliance, self-esteem, and resilience.
Child engaging in schematic play	Identify that schematic play is occurring and support the child.

Fig. 5.2 The Tiny Oaks simulated practice nursery environment

ning concurrently to give a realistic representation of what childhood practitioners have to cope with in the nursery environment. Learners are able to replay scenarios and be assessed on the handling of scenarios and the outcomes of those scenarios in a risk-free environment. The game also has a tutorial level that allows players to familiarise themselves with the game controls and game navigation. Figure 5.2 shows an example of the implemented simulated practice game.

In every scenario, a player interacts with the game characters by choosing one of three given options. After a choice is made, one of three colours flashes in the left top corner of the screen: green indicates that the player has made the right choice; orange indicates that the player's choice does not really have an effect on how right/wrong the player is; red shows that the chosen option leads along the wrong path to follow. If a player chooses the 'Badges' icon, feedback on the respective scenario is obtained. Alternatively, the player can choose to receive feedback by email when prompted during the game. As in a real-life setting, players can take notes of different things they observe while playing. These are recorded using the Observation notes available at the nursery desk or through the journal that is always accessible during the game.

The game was implemented in Unity 5 and the animated characters produced in Maya. The game has been built using the cloud-based EngAGe engine for assessment and feedback (Chaudy, Connolly, & Hainey, 2014a, 2014b). EngAGe provides an API and set of web services that supports games developers in adding assessment and feedback into their games. The game is also multi-lingual (currently English, Finnish, Italian, Lithuanian, and Bulgarian languages are supported). The game was available as a download to run on Windows and Mac computers and was also created as a SCORM package to allow the game to be run from a SCORM-compliant LMS (in our case, Moodle).

5.3.3 The Play2Do Simulated Practice Environment

For the Play2Do project, a 3D simulated practice school environment was created with a set of six game scenarios. The scenarios were specially developed by the partners in the Play2Do consortium in consultation with stakeholders – teachers, head teachers, psychologists, parents of special educational needs (SEN), and mainstream students. They create the basis of a simulated practice learning addressing students with intellectual and developmental disabilities and their trainers. The scenarios are implemented in an immersive 3D computer game, and the learning process is supported by further training and assessment materials and tasks. The gameplay involves the player taking on the role of a teacher, who is confronted with a certain situation requiring professional action and decisions. The scenarios briefly described in Table 5.2 are accessed one by one but not necessarily from 1 through

Table 5.2 *Play2Do*: Game scenarios

Scenario	Main aims
Petya loses control after maths class	Include SEN students in the mainstream classroom, identify, and deal with behavioural problems while using values that are consistent with developing pupil-centred, rights-based approaches to working with mainstream and SEN pupils (focus on ADHD), and promote effective communication with colleagues.
Michael hits the dyslexic child in the class	Identify and deal with behaviours that may escalate into a challenging situation, teach tolerance towards the different children in a group and demonstrate ability to cope with mainstream children's negative attitudes (focus on dyslexia).
The shy new classmate	Manage typical problematic behaviour caused by Autistic spectrum disorders, evaluate possible paths for effective management of the critical situations in an integrated classroom, and create and maintain a positive and calm learning environment.
Teenager's impulses affecting classroom dynamics, attention, and communication skills during class	Identify hypersensitivity and obsessive-compulsive triggers and their possible effects, set the rules of and boundaries and cope with stressful situations in an integrated classroom.
Different student needs in a special school classroom setting	Adapt the classroom environment to accommodate varying student needs, identify signs of hypersensitivity and possible causes, and manage challenging and extreme behaviours in a group setting.
Epileptic episode during ICT class	Promote health, safety, and security in the work setting, SEN and mainstream pupils' well-being and resilience, apply rehabilitation work (focus on epilepsy), and promote effective communication with SEN children's parents.

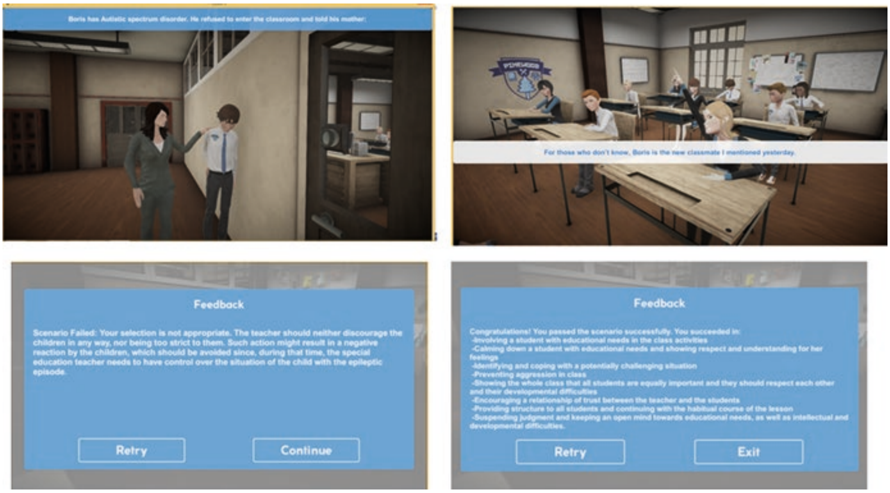

Fig. 5.3 Sample screen from the Play2Do simulated practice environment

to 6. Learners are able to replay scenarios and be assessed on the handling of scenarios and the outcomes of those scenarios in a risk-free environment. Figure 5.3 shows an example of the implemented simulated practice game.

Additionally, learners are provided with background features and case notes, notes on the specific disability of the children, the class, some family backgrounds, the school curriculum, etc. These features help to contextualise the behaviours and the actions of the pupils as well as the actions of the player – trainee teacher. They add richness to the information the player has and helps them make informed choices. They are also resonant with the day-to-day situations a teacher in an inclusive classroom would be expected to deal with. Again, the game was implemented in Unity 5 and the animated characters produced in Maya. As with the Tiny Oaks environment, the game was built using the cloud-based EngAGe engine for assessment and feedback.

5.4 Evaluation Methodology

This section discusses the evaluation of the Digital_Bridges and Play2Do projects with teachers, teacher trainers, and student teachers. In both cases, the methodology selected for the evaluation of the 3D simulated practice game was a pre-test/post-test experimental design, which consisted of the following steps:

- Completion of the pre-test questionnaire
- Explanation of the pedagogy behind the use of the simulated practice environment for teaching and learning
- Playing the in-game tutorial

- Playing the risk assessment mini-game (in the case of the ‘Tiny Oaks nursery’)
- Playing through the scenarios in the simulated nursery environment/integrated classroom environment
- Completion of the post-test questionnaire

The statistical data analysis techniques selected for these two studies were non-parametric statistical tests, given that the data did not adhere to the three pieces of criteria required for the use of parametric tests: normal distribution, homogeneity of variance, and ratio or interval data. The primary statistical analysis technique used to compare the pre- and the post-test groups were Wilcoxon matched pairs signed ranked tests (the non-parametric equivalent of the dependent t-test).

5.4.1 Evaluation of Digital_Bridges

This section discusses the results of the evaluation of the Digital_Bridges project that occurred in early 2016. Participants were asked to complete a pre-test questionnaire before playing the game and a post-test questionnaire on completion of playing the game. One hundred and forty eight participants completed the pre-test questionnaire with 142 of the participants (96%) female and 6 participants (4%) male. The mean age of participants was 42.29 years (SD = 9.50) with a range of 20 to 55 years of age. The mean number of years of experience as a child practitioner was 13.52 (SD = 8.69 with a range of 0–25 years of experience). Participants were then asked a series of questions relating to their experience of using a simulated practice environment and their expectations for the training course. Each question used a seven-point Likert scale: “I strongly disagree” (1), “For the most part I do not agree” (2), “I disagree more than I agree” (3), “I neither disagree nor agree” (4), “I agree more than I disagree” (5), “For the most part I agree” (6) and “I strongly agree” (7). The rankings, means and standard deviations for the answers in the pre-test are shown in Table 5.3. Similar questions were asked in the post-test and the rankings, means and standard deviations are shown in Table 5.4.

The first group of items in the pre-test form referred to the respondents’ experience in simulated practice learning. The statements having the highest means revealed their confidence that they understood the importance of reflection in practice learning (M = 6.13; SD = 1.26), they knew how to use reflection in order to promote learning in a simulated practice environment (M = 6.02; SD = 1.26). The third highest mean was ‘I feel prepared to face working with children in my (future) context’ (M = 5.87; SD = 1.24). Taking into consideration that the sample consists mainly of subjects employed in the childcare sector, it can be assumed the sample is highly qualified already, and thus it is no surprise they feel competent and well prepared to work with children.

The second set of items was related to the training course expectations of the subjects. The most important expectations of the participants concerned their need to gain further competences in working with children (M = 6.82; SD = 1.24), fol-

Table 5.3 Pre-test: Experience of simulated practice learning and course expectations

	Ranking	Mean	SD
Experience in simulated practice learning			
I understand the importance of reflection in practice learning.	1st	6.13	1.26
I know how to use reflection in order to promote learning in a simulated practice environment.	2nd	6.02	1.26
I feel prepared to face working with children in my (future) context.	3rd	5.87	1.24
I know how to provide feedback to trainee nursery workers about their learning processes and progress in a simulated practice environment.	4th	5.78	1.35
Future nursery workers can develop appropriate competences with a simulated practice environment.	5th	5.70	1.69
I understand the process of learning using educational games.	6th	5.49	1.72
I understand what competences can be developed using an immersive educational game.	7th	5.47	1.76
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	8th	5.34	1.81
I can support students/fellow colleagues to gain the required competences for working with children in nursery settings in a simulated environment.	9th	5.29	1.80
I know how to assess learning in a simulated practice environment.	10th	4.80	1.75
Training course expectations			
I expect to gain (further) competences in working with children.	1st	6.82	1.24
I expect the trainers to be competent.	2nd	6.75	0.71
I expect the provided learning activities and materials to be helpful and relevant to the topic.	3rd	6.70	0.74
I expect the chosen teaching methods and techniques are interesting and engaging.	4th	6.67	0.78
I expect to receive help and support when I face questions and uncertainty.	5th	6.66	0.79
I expect to be provided with supplementary learning materials.	6th	6.64	0.76
I expect to feel comfortable to raise a question during the training.	7th	6.59	0.88
I expect the learning atmosphere to be friendly, thought-provoking, and participant-centered.	8th	6.58	0.83
I expect the course to be flexible yet well-structured.	9th	6.48	0.95

lowed by the expectation that the trainers are competent (M = 6.75; SD = 0.71). The third highest mean was observed in the expectation that the learning activities and materials should be helpful and relevant to the topic (M = 6.70; SD = 0.74). These results describe a sample of subjects who are aware they are highly qualified and need only further perfection of their competences, which desire is paired with the expectation to receive training from highly qualified trainers who will provide them with the know-how and current literature on working with vulnerable groups of people.

In the first set of items from the post-test results, experience in simulated practice learning, two of the statements remained with the highest means: 'I understand the importance of reflection in practice learning' (M = 6.44; SD = 1.15) and 'I know

Table 5.4 Post-test: Experience of simulated practice learning and course expectations

	Ranking	Mean	SD
Experience in simulated practice learning			
I understand the importance of reflection in practice learning.	1st	6.44	1.15
I know how to use reflection in order to promote learning in a simulated practice environment.	2nd	6.36	1.10
I know how to provide feedback to trainee nursery workers about their learning processes and progress in a simulated practice environment.	3rd	6.35	1.13
I feel prepared to face working with children in my (future) context.	4th	6.26	1.11
I understand what competences can be developed using an immersive educational game.	5th	6.26	1.11
I understand the process of learning using educational games.	6th	6.18	1.13
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	7th	6.16	1.12
I can support students/fellow colleagues to gain the required competences for working with children in nursery settings in a simulated environment.	8th	6.09	1.10
Future nursery workers can develop appropriate competences with a simulated practice environment.	9th	6.09	1.11
I know how to assess learning in a simulated practice environment.	10th	5.87	1.28
Training course expectations			
I expect to receive help and support when I face questions and uncertainty.	1st	6.60	0.93
I expect the trainers to be competent.	2nd	6.51	0.94
I expect to feel comfortable to raise a question during the training.	3rd	6.50	1.13
I expect the provided learning activities and materials to be helpful and relevant to the topic.	4th	6.39	1.06
I expect the learning atmosphere to be friendly, thought-provoking, and participant-centered.	5th	6.38	1.27
I expect the chosen teaching methods and techniques are interesting and engaging.	6th	6.33	1.18
I expect to be provided with supplementary learning materials.	7th	6.29	1.21
I expect the course to be flexible yet well-structured.	8th	6.11	1.41
I expect to gain (further) competences in working with children.	9th	6.00	1.55

how to use reflection in order to promote learning in a simulated practice environment' (M = 6.36; SD = 1.10), the mean values being slightly higher than the mean values in the pre-test statements. This result demonstrates that the subjects have confirmed for themselves the importance of reflection in their everyday work with vulnerable children. The third most important statement here was different, thus demonstrating the respondents' confidence that they knew how to provide feedback to trainee nursery workers about their learning processes and progress in a simulated practice environment (M = 6.35; SD = 1.13). It is a logical consequence of the game design that enhances this competence (Table 5.4). These results were very encouraging and proved that the simulated practice game had high potential to

Table 5.5 Wilcoxon results from pre-test/post-test questions

Question	Wilcoxon results
Future nursery workers can develop appropriate competences with a simulated practice environment.	Z = −4.766, $p < 0.000$
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	Z = −4.115, $p < 0.000$
I understand what competences can be developed using an immersive educational game.	Z = −3.832, $p < 0.000$
I understand the process of learning using educational games.	Z = −3.174, $p < 0.002$
I can support students/fellow colleagues to gain the required competences for working with children in nursery settings in a simulated environment.	Z = −4.067, $p < 0.000$
I understand the importance of reflection in simulated practice learning.	Z = − 2.056, $p < 0.040$
I know how to use reflection in order to promote learning in a simulated practice environment.	Z = −2.250, $p < 0.024$
I know how to provide feedback to trainee nursery workers about their learning processes and progress in a simulated practice environment.	Z = −4.168, $p < 0.000$
I know how to assess learning in a simulated practice environment.	Z = −5.755, $p < 0.000$
I feel prepared to use a simulated practice environment.	Z = −3.521, $p < 0.000$

respond to the participants' expectations, experience, and attitudes to simulated practice.

Comparison of Pre-test and Post-test

In total, 120 participants completed both the pre-test and the post-test questionnaires. There were a set of question aimed at evaluating the simulated practice environment from the teacher/trainer's perspective. The questions were analysed using Wilcoxon matched pairs signed rank tests as shown in Table 5.5. In each case, the results are significant at the 0.05 level and in most cases at the 0.01 level. While not all of the questions are about the use of the simulated practice environment, the results were encouraging and allowed us to progress to the next stage of evaluation, which was piloting the game with Further Education/Higher Education students and trainee nursery workers.

5.4.2 Evaluation of Play2Do

This section discusses the results of the evaluation of the Play2Do project that occurred in early 2018. Two hundred and fifty five participants completed the pre-test questionnaire with 216 of the participants (84.7%) female and 39 participants

Table 5.6 Pre-test: Experience of simulated practice learning and course expectations

	Ranking	Mean	SD
Experience in simulated practice learning			
I understand the importance of reflection in practice learning.	1st	4.29	0.97
I can use reflection to promote (my own) learning.	2nd	4.04	1.05
I understand the process of learning using educational games in teacher education/training.	3rd	3.95	1.21
I understand what competences can be developed using an immersive educational game.	=4th	3.71	1.29
I feel prepared to face working with students with and without special education needs in my work context.	=4th	3.71	1.16
I understand what an immersive computer game is and how it can be used in teacher education/training.	6th	3.53	1.32
I understand what a simulated practice experience is and how it is addressed to (future) teachers dealing with students with mild intellectual and developmental disabilities.	7th	3.50	1.32
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	8th	3.47	1.33
I can assess learning in a simulated practice environment.	9th	3.38	1.24
Training course expectations			
I expect the chosen teaching methods and techniques to be interesting and engaging.	1st	4.72	0.50
I expect to gain further competences in teaching students with and without SEN in my context.	2nd	4.71	0.53
I expect the provided learning activities and materials to be helpful and relevant to the topic.	3rd	4.69	0.53
I expect the course to be flexible yet well-structured.	=4th	4.65	0.57
I expect to receive help and support when I face questions and uncertainty.	=4th	4.65	0.59
I expect the course to be thought-provoking and participant-centered.	6th	4.64	0.57
I expect to be provided with supplementary learning materials.	7th	4.60	0.65

(15.3%) were male. In terms of age of participants, 17 (6.7%) were 21–30 years of age, 78 (30.6%) were 31–40 years of age, 100 (39.2%) were 41–50 years of age, and 60 (23.5%) were over 50 years of age. In terms of number of years of teaching experience, 44 (17.3%) had 1–5 years of experience, 37 (14.5%) had 6–10 years of experience, 51 (30%) had 11–15 years of experience, 43 (16.9%) had 15–20 years of experience, and 80 (31.4%) had more than 20 years of teaching experience. Participants were then asked a series of questions relating to their experience of using a simulated practice environment and their expectations for the training course. Each question used a five-point Likert scale: ‘Strongly disagree’ (1), ‘Somewhat disagree’ (2), ‘Without an opinion or uncertain’ (3), ‘Somewhat agree’ (4), and ‘Strongly agree’ (5). The rankings, means, and standard deviations for the answers in the pre-test are shown in Table 5.6. Similar questions were asked in the post-test and the rankings, means and standard deviations are shown in Table 5.7.

Table 5.7 Post-test: Experience of simulated practice learning and course reflections

	Ranking	Mean	SD
Experience in simulated practice learning			
I understand the importance of reflection in practice learning.	1st	4.76	0.43
I understand the process of learning using educational games in teacher education/training.	2nd	4.62	0.58
I can use reflection to promote (my own) learning.	3rd	4.60	0.60
I understand what a simulated practice experience is and how it is addressed to (future) teachers dealing with students with mild intellectual and developmental disabilities.	4th	4.57	0.56
I understand what an immersive computer game is and how it can be used in teacher education/training.	5th	4.55	0.61
I understand what competences can be developed using an immersive educational game.	6th	4.53	0.63
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	7th	4.49	0.65
I feel prepared to face working with students with and without special education needs in my work context.	8th	4.45	0.62
I can assess learning in a simulated practice environment.	9th	4.32	0.73
Training course reflections			
The course was flexible yet well-structured.	1st	5.00	0.18
During the course, I received help and support when I faced questions and uncertainty.	2nd	4.98	0.24
The provided learning activities and materials have been helpful and relevant to the topic.	3rd	4.98	0.24
The course was thought-provoking and participant-centered.	4th	4.97	0.24
I have gained further competences in teaching students with and without mild intellectual and developmental disabilities, in my work context.	=5th	4.96	0.20
I was provided with supplementary learning materials.	=5th	4.96	0.26
The chosen teaching methods and techniques were interesting and engaging.	7th	4.94	0.24

The first set of questions in the pre-test questionnaire (See Table 5.6) focused on teachers' experience in simulated practice learning. The three statements with highest mean values were as follows: 'I understand the importance of reflection in practice learning' (M = 4.29; SD = 0.97); 'I can use reflection to promote (my own) learning' (M = 4.04; SD = 1.05); and the third ranking statement was 'I understand what competences can be developed using an immersive educational game' (M = 3.95; SD = 1.21). The participants had at least 1 year of teaching experience, with most of the sample having considerable teaching experience. This length of service could explain the subjects' confidence in their understanding of the importance of reflection and using it in their own process of learning. Understanding the use of educational games in teacher education and training can also be seen as a consequence of professional experience.

The other set of questions revealing the respondents' training course expectations confirmed the subjects' practical orientation and understanding of working with students with and without SEN. The statement with the highest mean was "I expect the chosen teaching methods and techniques to be interesting and engaging" (M = 4.72; SD = 0.50), followed by the statement "I expect to gain further competences in teaching students with and without SEN in my context" (M = 4.71; SD = 0.53). The third highest mean value was found in the statement "I expect the provided learning activities and materials to be helpful and relevant to the topic" (M = 4.69; SD = 0.53), which describes a sample of teachers who know very well what learning activities and information they need for their professional upgrading.

In the post-test questionnaire section, the first three ranking statements were the same as the ones in the pre-test form. Their mean values were slightly higher than the means in the pre-test questionnaire, thus demonstrating that reflection in practice learning and, in particular, in their own professional development is essential. The higher mean value of the statement "I understand the process of learning using educational games in teacher education/training" proves the simulated practice environment has been useful and has broadened the subjects' knowledge of the role of educational games in teacher education and training.

The second set of statements in the post-test questionnaire consisted of the training course reflections similar to the training course expectations. The highest three mean values in this section did not repeat the results from the pre-test form except for the third highest ranking statement, i.e. *"The provided learning activities and materials have been helpful and relevant to the topic*" (M = 4.98; SD = 0.24). The mean was slightly higher than the mean of the same statement in the pre-test form. This result confirmed that the educational game had succeeded in satisfying their need for practical and useful knowledge and skills. The first highest mean value was found in the statement that the course was flexible yet well structured (M = 5.00; SD = 0.18). This proved to be one of the most valuable characteristics of the course – upgrading the traditional form of learning with this more flexible, user-friendly, and stimulating form of practice training. The second highest mean values appeared in the statement "During the course, I received help and support when I faced questions and uncertainty" which demonstrated that the course design provided reliable feedback and help when the participants felt uncertain. This may seem surprising with a view to the pre-test confidence of the participants in their own professional knowledge and skills; however, it proves they were really engaged in the course and worked hard which led to better understanding and learning.

Comparison of Pre-test and Post-test

In total, 186 participants completed both the pre-test and the post-test questionnaires. There were a set of questions aimed at evaluating the simulated practice environment from the teacher/trainer's perspective. The questions were analysed using Wilcoxon matched pairs signed rank tests as shown in Table 5.8. In each case, the results are significant at the 0.01 level. While not all of the questions were about the use of the simulated practice environment, the results are extremely encouraging.

Table 5.8 Wilcoxon results from pre-test/post-test questions

Question	Wilcoxon results
Experience in simulated practice learning	
I understand what an immersive computer game is and how it can be used in teacher education/training.	Z = −8.713, $p < 0.000$
I understand what a simulated practice experience is and how it is addressed to (future) teachers dealing with students with mild intellectual and developmental disabilities.	Z = −9.445, $p < 0.000$
I understand the process of learning using educational games in teacher education/training.	Z = −7.843, $p < 0.000$
I understand what competences can be developed using an immersive educational game.	Z = −8.544, $p < 0.000$
I understand how I can use or integrate an immersive educational game in my own teaching/teacher training practice.	Z = −9.416, $p < 0.000$
I understand the importance of reflection in practice learning.	Z = −7.032, $p < 0.000$
I can use reflection to promote (my own) learning.	Z = − 6.028, $p < 0.000$
I can assess learning in a simulated practice environment.	Z = −8.795, $p < 0.000$
I feel prepared to face working with students with and without special education needs in my work context.	Z = −7.915, $p < 0.000$
Training course reflections	
The course was flexible yet well-structured.	Z = −7.337, $p < 0.000$
The course was thought-provoking and participant-centered.	Z = −7.385, $p < 0.000$
During the course, I received help and support when I faced questions and uncertainty.	Z = −6.424, $p < 0.000$
I was provided with supplementary learning materials.	Z = −7.631, $p < 0.000$
The provided learning activities and materials have been helpful and relevant to the topic.	Z = −6.985, $p < 0.000$
The chosen teaching methods and techniques were interesting and engaging.	Z = −5.723, $p < 0.000$
I have gained further competences in teaching students with and without mild intellectual and developmental disabilities, in my work context.	Z = − 5.536, $p < 0.000$

Summary

The Digital_Bridges and Play2Do projects developed an immersive 3D virtual environment to provide a safe and readily accessible environment where Higher Education and VET students who interact with vulnerable people can learn by interacting with NPCs (Non-Player Characters) in a simulation of a real-world service. The two games were evaluated in various countries across Europe in early 2016 and early 2018, respectively. In each case, there were a set of questions aimed at evaluating the simulated practice environment from the teacher/trainer's perspective and the results showed an increase in knowledge and skills significant at the 0.05 level and in most cases at the 0.01 level for Digital_Bridges and at the 0.01 level for Play2Do, showing that simulation games can be used successfully for practice learning in areas that deal with vulnerable people (nursery children in the case of Digital_Bridges and students with intellectual and developmental disabilities in the case of Play2Do).

5.5 Recommendations and Conclusions

The Europe 2020 flagship initiative 'Europe's Digital Agenda' focuses on exploiting the potential of digital technology in all areas of politics, economics, health, education, and even everyday life. Both the shortage of qualified staff specifically in the ICT field and the need to increase the digital skills that are necessary for a successful professional realisation are considered. The Digital Education Action Plan (2018) outlines three priorities. The first is related to the better use of digital technologies for teaching and learning. The second concerns the development of relevant digital competences and skills for implementing digital transformation, and the third improves education through better data analysis and forecasting (European Commission, 2018, p. 5).

As mentioned at the beginning of the chapter, practice learning is a key component of social worker and teacher training programmes. Based on the evaluation of the two cases under review, we could recommend considering the use of 3D simulation environments for practical training in a number of contexts such as initial and in-service teacher training regarding SEN, inclusive education, training of managerial and administrative school staff, as well as in non-formal settings such as working with parents and local communities. The two simulation games provide successful examples of an innovative learning space that supports learners, focusing on self-reflection and playing action patterns. They both provide new insights into the course of simulation practice training, add a new perspective on transferable competences, and have the potential to influence curriculum development and accreditation within the European Education Area (European Council, 2017).

References

Alquraini, T., & Gut, D. (2012). Critical components of successful inclusion of students with severe disabilities: Literature review. *International journal of special education, 27*(1), 42–59.

Bearman, M., Palermo, C., Allen, L., & Williams, B. (2015). Learning empathy through simulation: A systematic literature review. Simulation in healthcare. *The Journal of the Society for Simulation in Healthcare, 10*(5), 308–319.

Bui, X., Quirk, C., Almazan, S., & Valenti, M. (2010). *Inclusive education research and practice: Inclusion works*. Hanover, MD: Coalition for Inclusive Education.

Chaudy, Y., Connolly, T., & Hainey, T. (2014a). An assessment engine: Educators as editors of their serious games' assessment. In *8th European Conference on Games Based Learning: ECGBL2014* (p. 58). Academic Conferences and Publishing International.

Chaudy, Y., Connolly, T., and Hainey, T. (2014b). Learning analytics in serious games: A review of the literature. In *European Conference in the Applications of Enabling Technologies (ECAET), Glasgow*.

Conolly, T., Farrier, S., Lawrie, J., Wilson, N., Boyle, L., Chaudy, Y., Soflano, M., Fitzpatrick, E., Tsvetkova, N., Motiečienė, R., Junkanaite, D., & Di Consetto, F. (2016). Evaluation of a 3D simulated practice learning environment. In: *Conference proceedings – European Conference on Games Based Learning.* Paisley, United Kingdom, October, 6–7, 2016, pp. 135–143.

Crisp, B. R., & Lister, P. G. (2002). Assessment methods in social work education: A review of the literature. *Social Work Education, 21*(2), 259–269.

Deterding, S., Khaled, R., Nacke, L., & Dixon, D. (2011). *Gamification: A definition*. Retrieved from: http://gamification-research.org/wp-content/uploads/2011/04/02-Deterding-Khaled-Nacke-Dixon.pdf

European Commission. (2010). *An agenda for new skills and jobs: A European contribution towards full employment* (p. 2010). Strasbourg, France: European Commission.

European Commission. (2011). *The social dimension of the Europe 2020 strategy. A report of the social protection committee (2011)*. Luxembourg, Brussels: Publications Office of the European Union.

European Commission. (2013). *Innovation Union – A pocket guide on a Europe 2020 initiative*. Luxembourg, Brussels: Publications Office of the European Union.

European Commission. (2014). *The EU explained: Digital agenda for Europe* (p. 2014). Luxembourg, Brussels: Publications Office of the European Union.

European Commission. (2018). *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the Digital Education Action Plan. COM/2018/022 final*. Brussels, 17.1.2018.

European Council (2017). *European Council Meeting (14 December 2017) – Conclusion* (EUCO19/1/17 REV 1). Luxembourg, Brussels: General Secretariat of the Council.

Finch, J., & Schaub, J. (2014). Projective identification and unconscious defences against anxiety: Social work education. Practice learning and the fear of failure. In *Social defences against anxiety: Explorations in a paradigm*. London, UK: Karnac Books.

Fouad, N. A., Grus, C. L., Hatcher, R. L., Kaslow, N. J., Hutchings, P. S., Madson, M. B., … Crossman, R. E. (2009). Competency benchmarks: A model for understanding and measuring competence in professional psychology across training levels. *Training and Education in Professional Psychology, 3*(4S), S5–S26.

Frank, J. R., Snell, L. S., Cate, O. T., Holmboe, E. S., Carraccio, C., Swing, S. R., … Harden, R. M. (2010). Competency-based medical education: Theory to practice. *Medical Teacher, 32*(8), 638–645. http://gamification-research.org/wp-content/uploads/2011/04/02-Deterding-Khaled-Nacke-Dixon.pdf

Kane, M. (2003). Teaching direct practice techniques for work with elders with Alzheimer's disease: A simulation group experience. *Educational Gerontology, 29*(9), 777–794.

Levitov, J. E., Fall, K. A., & Jennings, M. C. (1999). Counselor clinical training with client-actors. *Counselor Education and Supervision, 38*(4), 249.

Logie, C., Bogo, M., Regehr, C., & Regehr, G. (2013). A critical appraisal of the use of standardized client simulations in social work education. *Journal of Social Work Education, 49*(1), 66–80.

Mole, L., Scarlett, V., Campbell, M., & Themessl-Huber, M. (2006). Using a simulated chaotic home environment for preparing nursing and social work students for interdisciplinary care delivery in a Scottish context. *Journal of Interprofessional Care, 20*(5), 561–563.

Moss, B. (2000). The use of large group role-play techniques in social work education. *Social Work Education, 19*(5), 471–483.

Petracchi, H. E., & Collins, K. S. (2006). Utilizing actors to simulate clients in social work student role plays: Does this approach have a place in social work education? *Journal of Teaching in Social Work, 26*(1–2), 223–233.

Robins, L., Brock, D. M., Gallagher, T., Kartin, D., Lindhorst, T., Odegard, P. S., … Belza, B. (2008). Piloting team simulations to assess interprofessional skills. *Journal of Interprofessional Care, 22*(3), 325–328. https://doi.org/10.1080/13561820801886438

Shulman, L. (2005). Signature pedagogies in the professions. *Daedalus, 134*(3), 52–59.

Tsvetkova, N., Antonova, A., & Hristova, P. (2017). Developing a pedagogical framework for simulated practice learning: How to improve simulated training. In P. Vu (Ed.), *Handbook of research on innovative pedagogies and technologies for online learning in higher education* (pp. 127–150). Hershey, PA: IGI Global.

Yanhua, C., & Watson, R. (2011). A review of clinical competence assessment in nursing. *Nurse Education Today, 31*(8), 832–836.

Chapter 6
Training Special Education Teachers Through Computer Simulations: Promoting Understanding of the Experiences of Students with Disabilities

Jelia Domingo and Elizabeth Bradley

6.1 Introduction

In the twenty-first century, teachers are expected to do it all. K-12 teachers must be well versed in physical, intellectual, and social/emotional child development while being able to effectively instruct typically developing students as well as those who are at-risk and those with a wide range of disabilities; at the same time, they are expected to improve student achievement and utilize culturally responsive instructional techniques (Beare, Marshall, Torgerson, Tracz, & Chiero, 2012; Peterson-Ahmad, 2018). It is imperative for teacher preparation programs to train teachers in how to effectively instruct diverse learners (McDonald, Kazemi, & Kavanagh, 2013). Yet, preservice training and hands-on experience in instructing students with disabilities are limited; many new teachers report a lack of sufficient training in working with diverse students (Kokkinos, Stavropoulos, & Davazoglou, 2016). The demand for special education teachers rises as the number of students diagnosed with disabilities also rises; thus, teacher preparation of special education teachers is of particular importance (Tyler & Brunner, 2014).

An essential part of teacher preparation programs is opportunities for the practice of complex teaching skills that resemble real-life classroom scenarios (Grossman & McDonald, 2008). To successfully prepare preservice teachers to teach increasingly diverse groups of students, teachers must be exposed to frequent and repetitive classroom experiences to practice these skills (McKleskey et al., 2017). However, budget and time constraints make ample opportunities for practice difficult (Bradley

J. Domingo (✉) · E. Bradley
School for Graduate Studies, SUNY Empire State College, Latham, NY, USA
e-mail: Jelia.domingo@esc.edu; elizabeth.bradley@esc.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_6

& Kendall, 2014). Simulations can help provide a solution to this problem. They can provide a safe and controlled environment for teachers to engage in frequent practice and receive immediate feedback (Dieker, Hynes, Hughes, & Smith, 2008; Vince Garland, Holden, & Garland, 2016).

Simulations can be used to help learners acquire a level of understanding and skill that would not otherwise be possible (Colwell, 2013). Within the field of special education, simulations have been utilized to change negative teacher attitudes, which can sabotage efforts to provide a positive and effective learning environment for students (Corkett, 2017). Researchers have utilized simulations to help teachers gain empathy for their students with disabilities. Results indicated that the experiences increased awareness of the negative impact of disabilities on their students and allowed teachers to understand their past assumptions, thereby increasing empathy toward students with disabilities (Colwell, 2013; Corkett, 2017). Simulations have also been useful in helping teachers learn to identify students with learning disabilities (Broadbent & Meehan, 1971).

This article discusses the role that simulations could have in educator training across a number of different disabilities. Although the focus of simulation training is often on preservice and new teachers, paraprofessionals and other educators, as well as school staff, bus drivers, recess monitors, etc., could also benefit. Indeed, paraprofessionals have a gap in knowledge related to effective classroom management and disability-specific symptoms and interventions (Ramos, 2017). Thus, in this article, information on disability prevalence, symptoms, and interventions are discussed as well as simulations that have been developed to provide insight into the particular disability. Recommendations for training and practice are also included.

6.2 Social/Emotional Disorders

Social and emotional disorders are common among middle and high school students. Roughly 20% of adolescents have a diagnosable mental health disorder such as anxiety or depression (Salle et al., 2018). Adolescent suicide has increased roughly 25% over the last 15 years, and suicide is the second leading cause of death among adolescents in the USA (CDC, 2018). Teacher awareness of social and emotional disorders is integral to student safety and success, and, in order to promote effective learning, schools must be a safe place for students.

Teachers are in a position to recognize troubling behaviors in their students as they see them for a significant amount of time each day (Rutledge, Rimer, & Scott, 2008). A positive perception of school climate, which teachers can largely impact, is associated with less suicidal ideation and behaviors (CDC, 2014; Salle, Wang, Parris, & Brown, 2017). The level of connection that students feel with their school impacts the likelihood that they will engage in suicide-related behavior. Students are more likely to connect with teachers if they feel they are empathetic, caring, and supportive (Underwood, Springer, & Scott, 2011). These positive relationships help reduce the negative effects of social and emotional disorders on student success

(Holen, Waaktaar, & Ase, 2018). However, students with social and emotional disorders often experience less supportive teachers; thus, interventions that can improve teacher-student relationships can be helpful (Holen et al., 2018).

Simulations of depression and anxiety can help teachers understand the experiences of their students who have these social and emotional disorders, thereby increasing empathy and leading to a more positive student-teacher relationship. Alessandro Salvati created a simulation entitled Anxiety Attacks, which takes the user through the experience of having a panic attack (Salvati, 2015). A walk in the woods goes from a beautiful sunny day to a dark and cold place with negative thoughts, difficulty breathing, visual disturbances, and fear of dying. The user experiences how negative thoughts can escalate and manifest in physical symptoms until they may feel that they are dying. This simulation is not recommended for youth as the experience of playing it can be frightening. However, it gives an approximation of the frightening experience of a panic attack and how to control it through measured breathing, which is one of the goals or commands of the game (Salvati, 2015). Playing this simulation will help teachers whose students suffer from anxiety disorders to understand how their symptoms can escalate, leading to increased empathy and comprehension of effective de-escalation techniques (Fig. 6.1).

Quinn, Lindsey and Schankler (2013) developed a simulation entitled Depression Quest. The interactive game takes players through different scenarios of a person with depression. The scenarios include those encountered in daily living, such as going to work, spending time with friends and family, and watching TV. It also includes social situations that can be difficult to navigate as well as some sessions during brief treatment with a therapist. Each scenario has a detailed description of the situation and, at its end, several choices about how to respond. At the end of each scenario, there is a reminder of the symptoms of untreated depression (Quinn et al.,

Fig. 6.1 Scene from *Anxiety Attacks* (Salvati, 2015)

2013). The game helps foster an awareness of depression, including signs, symptoms, and treatment options. Teachers who utilize this simulation will gain an increased understanding about their students who struggle with depression. In particular, the lack of motivation those students may have as well as truancy, anxiety, and difficulty with social interactions will become more understandable, resulting in increased empathy for those struggling with depression as a result of playing this game.

6.3 Autism Spectrum Disorder

Autism spectrum disorder (ASD) occurs in about 1 out of every 59 children in the USA and is four times more likely to be identified in boys than girls (Baio et al., 2018). It is known as a spectrum disorder because of the range of symptoms and abilities that occur in those who have been diagnosed (Ryan, Hughes, Katsiyannis, McDaniel, & Sprinkle, 2011). ASD is a developmental disorder characterized by deficits in social communication in addition to restricted, repetitive behaviors and interests, limited eye contact, resistance to change, and high sensitivity to sensory stimuli (Baio et al., 2018; Ryan et al., 2011). Deficits in social communication are caused by the inability to discern social cues such as facial expressions and body language, as well as difficulty processing spoken language (Friedlander, 2009). A highly sensitized central nervous system often makes individuals with ASD overly sensitive to touch, light, taste, or smell (Friedlander, 2009).

Along with a range of deficits, individuals with ASD have a range of intellectual abilities and proficiencies (Ryan et al., 2011). For those considered to have high functioning autism, deficits can be masked by high IQ scores and above-average skill areas, sometimes leading teachers to expect overall higher performance than students are capable of due to the confounding factors related to their masked deficits (Polischuk, 2016). Thus, it is important that teachers have training and understanding regarding the general needs of students with ASD as well as knowledge of the specific strengths and needs of the particular students who may be placed in their classes (Friedlander, 2009). Several studies have found that "even teachers of recognized professional competence often consider themselves less able to deal with [autistic] students than with those with any other form of special needs" (Rodriguez, Saldana, & Moreno, 2011, p. 1). Therefore, trainings that educate teachers regarding the needs of students with ASD and dismantle misconceptions concerning autism are essential for helping teachers gain more knowledge and confidence in meeting the needs of those who may be placed in their classes. To this end, simulations can serve as useful tools to assist teachers in gaining a deeper understanding of how students with autism experience the world and, consequently, how to make the classroom environment more welcoming to students with ASD.

Szczerba (2017) wrote an article that includes text and YouTube videos to help readers understand the experience of autism. The videos included were created by various individuals, many of whom have autism, and simulate the experience of sensory overload. The loudness, repetitiveness, and brightness of auditory and visual stimuli are the general focus of most of the videos. Three of the videos additionally attempt to demonstrate the emotional reactions to these stimuli, which are more difficult to simulate for an observer. The videos help to explain why these stimuli are annoying and frustrating for those with autism. The videos also help demonstrate the chain of events and lack of ability to communicate that can lead a person with autism to become overwhelmed by the fight or flight response.

The autism simulator created by Spoza (2019) uses Oculus software and hardware (headset) to guide users into a more comprehensive virtual experience as their own surroundings are replaced by the sights and sounds they experience through the immersive virtual reality environments presented. Users are guided through the visual and auditory simulations as if they were individuals with autism engaging in mundane tasks such as sitting in a coffee shop, sitting in a desk in school, or waiting for and riding a tram. This simulator can be rented for various lengths of time, and an Oculus Rift (headset) and Oculus-ready computer are also required to utilize the software. This product would be useful for large organizations who wish to train multiple employees or associates. It is less practical for individual teachers to utilize for their own development due to the cost and technology requirement unless the teachers are already engaged in using this type of technology for other activities as well and would therefore have an additional use for the equipment (Fig. 6.2).

These autism simulations can be useful to teachers because they help to contextualize the emotional responses of students with autism. Understanding how seemingly small stimuli are being seen and heard by those with autism can help a teacher design a learning environment with fewer unnecessary distractions and therefore increase an autistic person's time on task through environmental interventions.

Fig. 6.2 Scene from *The autism simulator* (Spoza, 2019)

6.4 Attention-Deficit/Hyperactivity Disorder

Attention-deficit/hyperactivity disorder (ADHD) is a neurodevelopmental disorder characterized by inattention, hyperactivity, and impulsivity that may be the result of genetic, biological, or environmental factors (Kaypakli & Tamam, 2019; Kousha & Kakrodi, 2019; NIMH, 2019). ADHD manifests in a variety of subtypes or hybrid forms; varying degrees of inattention, hyperactivity, and impulsivity cause impairment in cognitive, social, interpersonal, and academic functioning (Kousha & Kakrodi, 2019; Willcutt et al., 2012). Everyday tasks from learning to interacting with people and to driving may be affected by ADHD depending on the particular mix of inattention, hyperactivity, and impulsivity experienced by an individual (Biederman et al., 2007; Kaypakli & Tamam, 2019). These subtypes of ADHD have been identified as predominantly inattentive type, predominantly hyperactive-impulsive type, and comorbid inattentiveness, hyperactivity, and impulsiveness as combined type (Rowland et al., 2008).

In the classroom, ADHD can negatively impact students' abilities to be successful academically and socially. Inattention causes students to miss hearing instructions, misread directions, and have generally poor study skills (Jones & Chronis-Tuscano, 2008). Hyperactivity and impulsivity may cause students to behave disruptively by doing things such as calling out in class, getting out of their seats at inappropriate times, fidgeting in ways that distract others, throwing objects, or doing other similarly distracting activities (Jones & Chronis-Tuscano, 2008). Inattention can impact the ability to learn new information, while hyperactivity and impulsivity often cause people with ADHD to have difficulty communicating effectively, recognizing emotions of others, and responding appropriately in relationships (Kaypakli & Tamam, 2019).

Between 3% and 10% of students have been estimated to meet the criteria for ADHD worldwide (Jones & Chronis-Tuscano, 2008; Kaypakli &Tamam, 2019). This means that teachers, whether designated to work in regular or special education classes, will come across many students with some form of ADHD during the course of their careers and thus require training to successfully educate such students (Jones & Chronis-Tuscano, 2008). Training has traditionally occurred through graduate coursework, in-service trainings, and specialist-teacher consultations and collaborations (Jones & Chronis-Tuscano, 2008). However, simulations are also an option for educators who wish to develop an empathetic understanding of the disorder to better tailor learning environments to the needs of students who have challenges of attention, hyperactivity, or impulsivity.

One such simulation is *Through Your Child's Eyes* by Understood.org (n.d.). In this simulation, visitors can individualize the information they receive by specifying a child's challenges and grade level or select from a previously created profile. After submitting the requested information, the user watches a video of a child who describes their challenges from their own perspective. Then the user plays a simulation in which they experience tasks from the perspective of a student with a particular challenge in reading, writing, attention, math, or organization depending on which

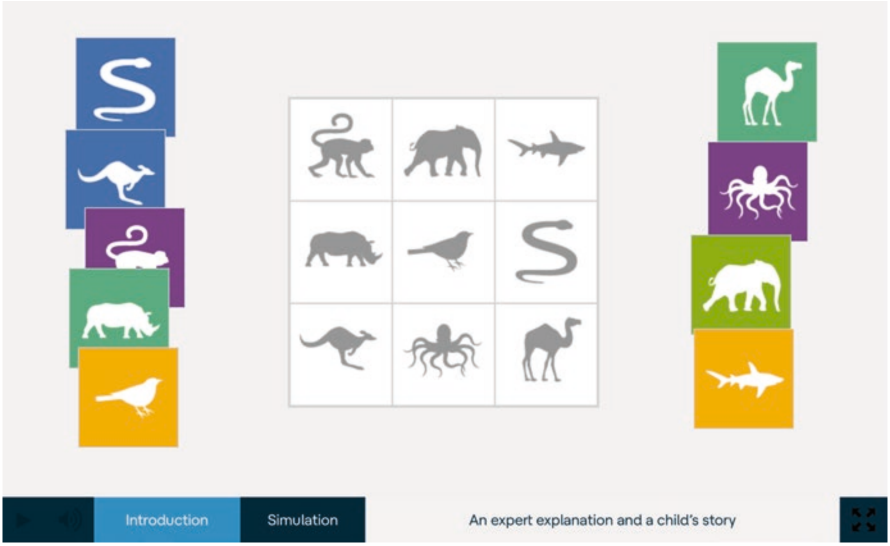

Fig. 6.3 Activity from *Through Your Child's Eyes* (Understood.org, n.d.)

category was previously selected. A teacher assigns a task for the user to complete while competing stimuli are loud and distracting in the background. Finally, an expert explains why the simulation was difficult and how the visitor's experience reflects what students face when working on such tasks. There are a few technical issues with the site that interfere somewhat with the ability to experience the simulation in the sequence it was originally meant to be experienced. However, the simulation still gives insight into the experiences of students with ADHD (Fig. 6.3).

Similarly, a blog by Elaine Taylor-Klaus (2019) links to an ADD/ADHD simulator housed on the YouTube platform. In the simulation, the user is required to read a text which moves in and out of distinct view in the midst of various auditory and visual distractions. After the presentation of the simulation, the user must answer low-level comprehension questions based on the text that was presented. The simulation serves to help the reader understand how difficult it is to keep track of details when a person lacks the ability to screen out distractions to concentrate on one stimulus above all others.

The Piowlski Disability Research website contains links to simulations housed on the PBS website, "Misunderstood Minds" (Johnson, n.d.). There are two simulations which are each dedicated to visual and auditory attention difficulties, respectively. The third link is to an interview between an education specialist and a second-grade student. In the interview, the student explains how he experiences the classroom. The attention simulation gives users the experience of working on a task while distracting competing stimuli are present.

These ADHD simulations are helpful because they support teachers in gaining an understanding of why certain tasks may be difficult for students with ADHD. Seeing how students with ADHD experience environmental stimuli is eye-opening and will help teachers develop strategies to help students with ADHD navigate their challenges in the classroom.

6.5 Dyslexia

Dyslexia is a neurobiological condition that impacts reading fluency and comprehension due to issues with spelling, decoding, and word identification. Many general and special education teachers are not adequately prepared to educate students with dyslexia (Bos, Mather, Dickson, Podhajski, & Chard, 2001). Students with dyslexia can excel in other academic areas; thus, their difficulties with reading and comprehension can come as a surprise to their teachers. Sometimes dyslexia also hides student strengths, particularly if their issues with reading are undiagnosed. A significant proportion of educators have serious misconceptions about dyslexia and don't know how to effectively work with students with dyslexia. In addition to a need for knowledge about dyslexia, teachers need more empathy and understanding concerning the experience of dyslexic students and their daily frustrations and learning difficulties in order to provide effective instruction (Wadlington & Wadlington, 2005).

Multiple face-to-face simulations have been utilized with preservice and in-service teachers to allow participants insight into the experience of having dyslexia. One of these simulations, The Dyslexia Simulation, successfully raised participants' awareness of the limitations and feelings of students with dyslexia. Participants reported increased empathy for students with dyslexia as well as increased the likelihood of effective diagnosis of students with dyslexia (Wadlington, Elliot, & Kirylo, 2008). Likewise, Passig (2011) tested the effectiveness of VR technology on increasing educator knowledge about dyslexia and discovered that simulations were superior to trying to raise awareness through watching a film. However, this and other face-to-face simulations require class time with multiple participants and an instructor. Virtual simulations allow the experience to occur asynchronously and at the click of a button.

One such simulation, created by Victor Widell (2016), mimics the experience of a reader with dyslexia. The simulation shows the Wikipedia definition of dyslexia in movement with letter swapping and reversals. Since the experience of dyslexia differs from one individual to the next, as is the case with most leaning difficulties, this simulation does not ring true for some individuals diagnosed with dyslexia. However, the resulting struggle to read text due to the simulation gives the reader a sense of the difficulty and frustration that dyslexia can lend to reading fluency and comprehension. The sense of confusion and frustration that typical readers will experience while viewing the simulation will aid educators in developing comprehension and empathy for the struggles of students with dyslexia (Fig. 6.4).

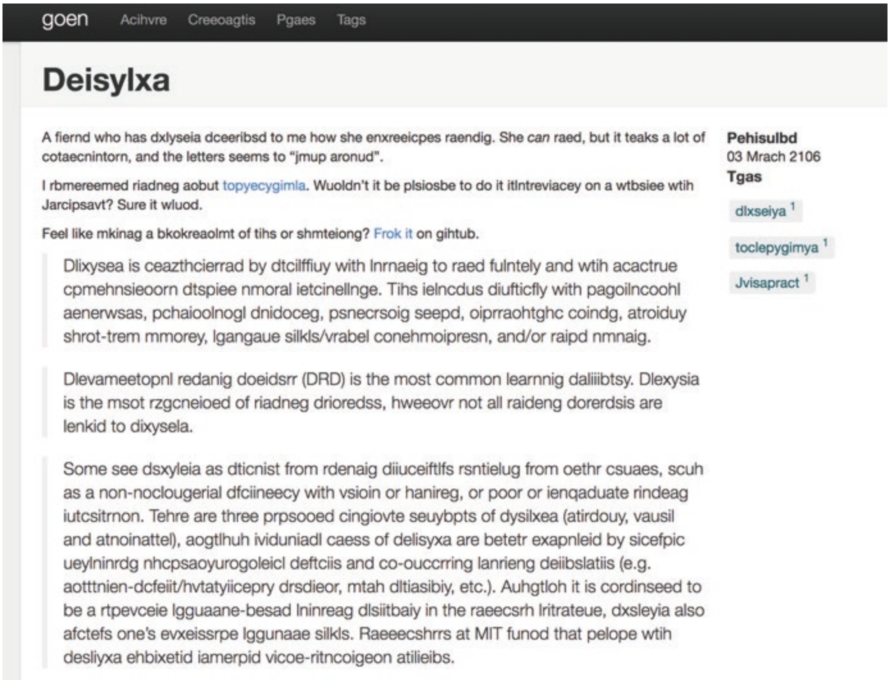

Fig. 6.4 *Dyslexia* (Widell, 2016)

6.6 Visual Impairments

For students with visual impairments, disabilities ranging from low vision to total blindness, the ability to learn incidentally from their environment is limited (Texas Council for Developmental Disabilities, 2013). Roughly 80% of what typically sighted children learn is through visual cues. Touch and hearing do not fully compensate for visual impairments in the classroom environment; thus, without adequate accommodations, social, motor, language, and cognitive development can be negatively impacted. Instructional strategies are integral to student growth, such as consistent organization and structure, fostering independence, and assistive technology including computer adaptations, adaptive devices, and optical devices (Texas Council for Developmental Disabilities, 2013). However, many students with visual impairments don't utilize assistive technology that would be beneficial throughout their school trajectory, largely because of lack of teacher knowledge, confidence, and training about how to utilize the devices (Zhou, Parker, & Smith, 2011).

Low vision simulations have been utilized to help impact the perceptions of sighted people. Boumenir, Kadri, Suire, Mury, and Klinger (2014) had adults search through rooms for targets using low vision simulators, and results indicated that sighted participants learned how difficult it is to perceive and move with limited vision. In addition, Juniat et al. (2019) utilized a simulation-based training to simulate visual impairment and understand its impact on medical patients. Results indicated that students grew in their knowledge of the challenges of being visually impaired and how to adapt their behavior toward these patients. They concluded that low visual simulations can help increase empathy among sighted people for those who are visually impaired.

The use of low vision simulators with special education teachers in the classroom setting has not been well documented. However, Zimmerman (2013) created a low vision simulation kit for this purpose. The low vision simulator kit has been used at ADA sensitivity trainings by numerous organizations, as professional development for occupational therapists and other educators, and with students to help them empathize with their peers (Zimmerman Low Vision Simulation Kit, 2013). Wearing simulation goggles allows users to experience low vision, vision impairments, and legal blindness. Eleven lenses and funnels are included in the kit, which can be used by four people at once. Lenses and funnels can also be combined to create different types of visual impairment including different types of visual acuity, peripheral field loss, macular degeneration, cataract, scotoma, and hemianopsia (Zimmerman, 2013).

These visual simulations can help teachers understand the challenges that students with visual impairments experience daily. Zimmerman's website includes simulation activity ideas to be used with the goggles to help safely amplify the experience and assist the user in developing empathy and planning future modifications for those with visual impairments (Zimmerman, 2013).

6.7 Hearing Impairments

The term "hearing impairment" refers to a spectrum of hearing loss generated from a variety of causes. Depending on the cause as well as the severity of the condition, a person may have partial to complete hearing loss. Terms to describe the various conditions of hearing impairment include "(central) auditory processing disorders, auditory neuropathy, and King Kopetzky syndrome (obscure auditory dysfunction)" (Neumann & Stephens, 2011, p. 44). Practically, terms such as mild, moderate, and severe may be used to communicate to teachers and other lay readers concerning the impact of the hearing impairment under discussion. Hearing-impaired individuals may also be referred to as deaf or hard-of-hearing to further specify the extent of their impairment (Holt, 2019).

As implied above, the range of the severity of hearing impairment may dictate the level of intervention required by students. Deaf and hard-of-hearing students depend more on visual perception than normal-hearing peers (Bratu, Buica-Belciu, & Caraman, 2018). Therefore, while those with mild impairment may sit closer to the teacher to make sure they hear instruction, others may require that instructions and lessons be in some visual form, including written instruction, sign language, or subtitles when watching videos. Still others may require assistive technology such as cochlear implants or a variety of hearing aids with various accessories that may be used in the classroom such as microphones for teacher use and devices which diminish background noise (Holt, 2019). Students may also use residual hearing, lip reading, and sign language to communicate and function within the class setting (Ting & Gilmore, 2012).

Teachers of students with hearing impairments have varying degrees of knowledge on how to best accommodate their students. Teachers of deaf and hard-of-hearing students who are in segregated special education settings often receive specific training in sign language as well as teaching techniques that are specifically known to be effective for hearing-impaired students. However, teachers in inclusive settings who have not targeted their studies on understanding how to teach hearing-impaired students may struggle more to understand the needs of hearing-impaired students learning in the midst of a hearing population (Ntinda, Thwala, & Tfusi, 2019). General education teachers are the target audience for much supplementary training since many have not received such specific training during preservice teaching experiences. Many studies have found that lack of teacher training is a main contributing factor in negative attitudes toward teaching students with disabilities (Colwell, 2013; Uko, 2018).

Simulations have been used to enhance the understanding of deaf and hard-of-hearing individuals by teachers and other hearing stakeholders. The main tactic of these simulations is to help hearing people experience sound as their deaf and hard-of-hearing peers. Some examples of online simulations are found on Success for Kids with Hearing Loss (2016), Hearing Like Me (Phonak, 2013), and Starkey Hearing Loss (n.d.).

The Success for Kids with Hearing Loss (2016) website contains videos and audio clips demonstrating various degrees and types of hearing loss, the results obtained from various hearing types of microphones, wireless devices, and the experiences of individuals in classrooms, stores, and restaurants when they do and do not have the appropriate listening devices available to them. Success for Kids with Hearing Loss (2016) also provides resources specifically useful for classroom teachers.

Hearing Like Me (2013) includes a hearing loss simulator dedicated to helping hearing people understand the experience of hearing loss. Normal, mild, and moderate audio samples are available for a visitor to browse how various types of sounds are heard by people with various levels of hearing ability. These sounds are divided into categories such as speech, environmental, music, and background noise, and there are 48 audio clips on the simulator page.

Starkey Hearing Technologies (n.d.) is a hearing clinic which has a page dedicated to simulating what mild, moderate, and severe hearing loss are like. The audio clips simulate various levels of hearing in a conversation, meeting, listening to music, shopping, talking in a car, crowd, and restaurant.

These hearing loss simulators can be utilized by teachers who would like to be more aware of the way their speech and other classroom sounds are perceived by students. In particular, understanding the ways in which sounds are muffled or change with the movement of a speaker away from a person with a hearing impairment would assist in helping a teacher become more sensitive to their positioning as they speak, as well as the level of clarity and speed with which they speak.

6.8 Conclusion

The simulations discussed in this article are intended to benefit K-12 educators, both in general and special education settings. Although teachers receive some training on these topics, research findings make it clear that this training, whether received in teacher education programs or as school in-service and professional development trainings, is not adequate for skill building, competence, and confidence in effective instructional techniques. Many other school personnel come into contact with students with disabilities and receive much less training than teachers; aides, paraprofessionals, administrative assistants, bus drivers, and lunch and recess monitors are among these individuals. Simulations are a quick, accessible, and salient way to teach educators how to best interact with and instruct students with these disabilities. In addition to the need for educator training in these areas, future research on these topics is also warranted. Although many of these simulations have already been used with educators in the school setting, data were rarely collected as part of these professional development opportunities; thus, clear evidence of positive outcomes is limited. Future research would help clarify the content and parameters of simulations that educators find to be most beneficial.

The simulations in this article cover a wide variety of disabilities that educators could encounter with students in the classroom. These simulations do more than just educate teachers on the signs, symptoms, and experiences of students with these disabilities. They put teachers in the position of those students, helping them to see, hear, and feel what they do. The result is an increased understanding and empathy for students' experiences which, in turn, leads to more positive teacher-student relationships. These more positive relationships help students experience the classroom as a more positive climate, leading to less emotional distress and less of a negative impact from their disabilities (CDC, 2014; Holen et al., 2018; Salle et al., 2017; Underwood et al., 2011). Teachers who have experienced these simulations will also be more aware of the ways that they can accommodate students with disabilities in the classroom through classroom routines and organization, differentiated instruction, assistive technology, peer education, and de-escalation techniques. The result is a classroom that is more conducive to learning for all students, an outcome which benefits disabled and nondisabled students alike.

References

Baio, J., Wiggins, L., Christensen, D. L., Maenner, M. J., Daniels, J., Warren, Z., … Dowling, N. (2018). Morbidity and Mortality Weekly Report (MMWR): Prevalence of autism spectrum disorder among children aged 8 years – Autism and developmental disabilities monitoring network, 11 sites, United States, 2014. *Surveillance Summaries, 67*(6), 1–23. Retrieved from https://www.cdc.gov/mmwr/volumes/67/ss/ss6706a1.htm

Beare, P., Marshall, J., Torgerson, C., Tracz, S., & Chiero, C. (2012). Toward a culture of evidence: Factors affecting survey assessment of teacher preparation. *Teacher Educator Quarterly, 39*, 159–173.

Biederman, J., Fried, R., Monuteaux, M. C., Reimer, B., Coughlin, J. F., Surman, C. B., … Faraone, S. V. (2007). A laboratory driving simulation for assessment of driving behavior in adults with ADHD: A controlled study. *Annals of General Psychiatry, 6*, 4–7.

Bos, C., Mather, N., Dickson, S., Podhajski, B., & Chard, D. (2001). Perceptions and knowledge of educators about early reading instruction. *Annals of Dyslexia, 51*, 97–120.

Boumenir, Y., Kadri, A., Suire, N., Mury, C., & Klinger, E. (2014). Impact of simulated low vision on perception and action. *International Journal of Child Health and Human Development, 7*(4), 441–450.

Bradley, E. G., & Kendall, B. A. (2014). A review of computer simulations in teacher education. *Journal of Educational Technology Systems, 43*, 3–12.

Bratu, M., Buica-Belciu, C., & Caraman, D. (2018). Teachers' perspective on using new pedagogical approaches for students with hearing impairment. *eLearning & Software for Education, 1*, 63–70.

Broadbent, F. W., & Meehan, R. (1971). A learning disability simulation for classroom teachers. *Simulation & Gaming, 2*(4), 489–500.

Center for Disease Control. (2014). *The relationship between bullying and suicide: What we know and what it means for schools.* Retrieved from http://www.cdc.gov/violenceprevention/pdf/bullying-suicide-translation-final-a.pdf

Center for Disease Control. (2018). Suicide Rates rising across the U.S. Retrieved from: https://www.cdc.gov/vitalsigns/pdf/vs-0618-suicide-H.pdf.

Grossman, P., & McDonald, M. (2008). Back to the future: Directions for research in teaching and teacher education. *American Educational Research Journal, 45*(1), 184–205.

Colwell, C. M. (2013). Simulating disabilities as a tool for altering individual perceptions of working with children with special needs. *International Journal of Music Education, 31*(1), 68–77.

Corkett, J. K. (2017). Using simulations to develop pre-service teachers' empathy and understanding of exceptionalities. *Currents in Teaching and Learning, 9*(2), 48–59.

Dieker, L., Hynes, M., Hughes, C., & Smith, E. (2008). Implications of mixed reality and simulation technologies on special education and teacher preparation. *Focus on Exceptional Children, 40*(6), 1–20.

Friedlander, D. (2009). Sam comes to school: Including students with autism in your classroom. *Clearing House, 82*(3), 141–144.

Holen, S., Waaktaar, T., & Ase, S. (2018). A chance lost in the prevention of school dropout? Teacher-student relationships mediate the effect of mental health problems on noncompletion of upper-secondary school. *Scandinavian Journal of Educational Research, 62*(5), 737–753.

Holt, R. F. (2019). Assistive hearing technology for deaf and hard-of-hearing spoken language learners. *Education and Science, 9*(153), 1–22.

Johnson, K. (n.d.). *Simulation activities*. Retrieved from https://piowlskidisabilityresearch.weebly.com/simulation-activity7.html

Jones, H. A., & Chronis-Tuscano, A. (2008). Efficacy of teacher in-service training for attention-deficit/hyperactivity disorder. *Psychology in the Schools, 45*(10), 918–929.

Juniat, V., Bourkiza, R., Das, A., Das-Bhaumik, R., Founti, P., Yeo, C., … Okhravi, N. (2019). Understanding visual impairment and its impact on patients: A simulation-based training in undergraduate medical education. *Journal of Medical Education and Curricular Development, 6*, 1–7. https://doi.org/10.1177/2382120519843854

Kaypaklı, G. Y., & Tamam, L. (2019). Emotional intelligence in attention deficit hyperactivity disorder. *Current Approaches in Psychiatry/Psikiyatride Guncel Yaklasimlar, 11*(1), 112–119.

Kokkinos, C. M., Stavropoulos, G., & Davazoglou, A. (2016). Development of an instrument measuring student teachers' perceived stressors about the practicum. *Teacher Development, 20*(2), 275–293.

Kousha, M. & Kakrodi, M. A. (2019). Can parents improve the quality of life of their children with attention deficit hyperactivity disorder? Iranian Journal of Psychiatry and Clinical Psychology, 14(2),154–159.

McDonald, M., Kazemi, E., & Kavanagh, S. S. (2013). Core practices and pedagogies of teacher education: A call for a common language and collective activity. *Journal of Teacher Education, 64*(5), 378–386.

McLeskey, J., Barringer, M.-D., Billingsley, B., Brownell, M., Jackson, D., Kennedy, M., … Ziegler, D. (2017). *High-leverage practices in special education*. Arlington, VA: Council for Exceptional Children & CEEDAR Center.

National Institute of Mental Health. (2019). *Attention-deficit/hyperactivity disorder.* Retrieved from https://www.nimh.nih.gov/health/topics/attention-deficit-hyperactivity-disorder-adhd/index.shtml

Neumann, K., & Stephens, D. (2011). Definitions of types of hearing impairment: A discussion paper. *Folia Phoniatrica et Logopaedica, 63*(1), 43–48.

Ntinda, K., Thwala, S. K., & Tfusi, B. (2019). Experiences of teachers of deaf and hard-of-hearing students in a special needs school: An exploratory study. *Journal of Education and Training Studies, 7*(7), 79–89.

Passig, D. (2011). The impact of immersive virtual reality on educator's awareness of the cognitive experiences of pupils with dyslexia. *Teachers College Record, 113*(1), 181–204.

Peterson-Ahmad, M. B. (2018). Enhancing pre-service special education preparation through combined use of virtual simulation and instructional coaching. *Education and Science, 8*(10), 1–9. https://doi.org/10.3390/edusci8010010

Phonak. (2013). *Hearing loss simulator: Understanding mild and moderate hearing loss.* Retrieved from https://www.hearinglikeme.com/hearing-loss-simulator/

Polischuk, D. K. (2016). Autism spectrum disorder research. *American Music Teacher, 66*(1), 15–18.

Quinn, Z., Lindsey, P., & Schankler, I. (2013). *Depression quest.* Retrieved from http://www.depressionquest.com/dqfinal.html#

Ramos, M. A. (2017). *Training for paraprofessionals working with special education students*. ProQuest LLC dissertation, California State University, Fresno, CA.

Rodriguez, I. R., Saldana, D. & Moreno, F. J. (2011). Support, inclusion, and special education teachers' attitudes toward the education of students with autism spectrum disorders. *Autism Research and Treatment*, 2012, 1–8.

Rowland, A. S., Skipper, B., Rabiner, D. L., Umbach, D. M., Stallone, L., Campbell, R. A., … Sandler, D. P. (2008). The shifting subtypes of ADHD: Classification depends on how symptom reports are combined. *Journal of Abnormal Child Psychology, 36*(5), 731–743.

Rutledge, C. M., Rimer, D., & Scott, M. (2008). Vulnerable goth teens: The role of schools in this psychosocial high-risk culture. *Journal of School Health, 78*, 459.

Ryan, J. B., Hughes, E. M., Katsiyannis, A., McDaniel, M., & Sprinkle, C. (2011). Research-based educational practices for students with autism spectrum disorders. *Teaching Exceptional Children, 43*(3), 56–64.

Salle, T. L., George, H. P., McCoach, D. B., Polk, T., & Evanovich, L. L. (2018). An examination of school climate, victimization, and mental health problems among middle and high school students self-identifying with emotional and behavioral disorders. *Behavioral Disorders, 43*(3), 383–392.

Salle, T. P., Wang, C., Parris, L., & Brown, J. A. (2017). Associations between school climate, suicidal thoughts, and behaviors and ethnicity among middle and high school students. *Psychology in the Schools, 54*(10), 1294–1301.

Salvati, A. (2015). *Anxiety attacks.* Retrieved from https://neatwolf.itch.io/anxiety-attacks

Sczerba, R. (2017). You can now experience what it feels like to have autism. *The Next Web.* Retrieved from https://thenextweb.com/insider/2016/07/17/can-now-experience-feels-like-autism/#gref

Sposa. (2019). *The autism simulator*. Retrieved from https://theautismsimulator.com/

Starkey Hearing Technologies. (n.d.). *What does hearing loss sound like?* Retrieved from https://www.starkey.com/hearing-loss-simulator#!/hls/page/1

Success for Kids with Hearing Loss. (2016). *Demonstrations: simulated listening with hearing loss & devices*. Retrieved from https://successforkidswithhearingloss.com/for-professionals/demonstrations-simulated-listening-with-hearing-loss-devices/

Taylor-Klaus, E. (2019). *What it's really like in the ADD brain: A video simulation*. Retrieved from https://impactadhd.com/what-its-really-like-in-the-add-brain-a-video-simulation/

Texas Council for Developmental Disabilities. (2013). *Project IDEAL: Informing and designing education for all learners: Visual impairments.* Retrieved from http://www.projectidealonline.org/v/visual-impairments/

Ting, C., & Gilmore, L. (2012). Attitudes of preservice teachers toward teaching deaf and ESL students. *Australian Journal of Teacher Education, 37*(12), 46–56.

Tyler, T. A., & Brunner, C. C. (2014). The case for increasing workplace decision-making: Proposing a model for special educator attrition research. *Teacher Education and Special Education, 37*(4), 283–308.

Uko, F. (2018). Factors associated with negative attitudes of teachers towards inclusive education of children with hearing impairment in UYO, Nigeria. *E-Pedagogium*, (2), 36–51.

Understood. (n.d.). *Through your child's eyes*. Retrieved from https://www.understood.org/en/through-your-childs-eyes

Underwood, M., Springer, J., & Scott, M. (2011). *Lifelines intervention*. Center City, MN: Hazelden Publishing.

Vince Garland, K. M., Holden, K., & Garland, D. P. (2016). Individualized clinical coaching in the TLE TeachLivE™ lab: Enhancing fidelity of implementation of system of least prompts among novice teachers of students with autism. *Teacher Education and Special Education: The Journal of the Teacher Education of the Council for Exceptional Children, 39*(1), 47–59.

Wadlington, E., Elliot, C., & Kirylo, J. (2008). The dyslexia simulation: Impact and implications. *Literacy Research and Instruction, 47*(4), 264–272.

Wadlington, E., & Wadlington, P. (2005). What do educators believe about dyslexia. *Reading Improvement, 42*(1), 16–33.

Widell, V. (2016). *Dyslexia.* Retrieved from https://geon.github.io/programming/2016/03/03/dsxyliea

Willcutt, E. G., Nigg, J. T., Pennington, B. F., Solanto, M. V., Rohde, L. A., Tannock, R., Loo, S.K., Carlson, C. L., McBurnett, K.,&Lahey, B. B. (2012). Validity of DSM-IVattention deficit/hyperactivity disorder symptom dimensions and subtypes. Journal of Abnormal Psychology, 121(4), 991–1010. https://doi.org/10.1037/a0027347

Zhou, L., Parker, A. T., & Smith, D. W. (2011). Assistive technology for students with visual impairments: Challenges and needs in teachers' preparation programs and practice. *Academic Journal of Visual Impairment & Blindness, 105*(4), 197–210.

Zimmerman. (2013). *Low vision simulation kit.* Retrieved from http://www.lowvisionsimulationkit.com/

Chapter 7
What Simulation-Based Mentoring May Afford: Opportunities to Connect Theory and Practice

Patricio Herbst, Nicolas Boileau, Mollee Shultz, Amanda Milewski, and Vu-Minh Chieu

In memoriam Karen King

7.1 Theory and Practice in Learning to Teach

Teaching mathematics in classrooms is complex work. On the one hand, it involves instruction, that is, managing transactions of content with students. On the other hand, it involves using these transactions for a variety of ends, as the work of the teacher has to fulfill obligations to multiple stakeholders (Chazan, Herbst, & Clark, 2016). The latter requires a teacher to make use of a variety of categories of perception and appreciation (Bourdieu, 1998) to relate to classroom events. To support novices in learning to teach mathematics, settings are needed that approximate the complexity of that work, ushering novices into the decisions and actions a teacher needs to make and also enabling them to consider various justifications and liabilities for those decisions and actions. Furthermore, those settings not only need to represent those complexities for novices, enabling them to consider how to act, but also need additional features that can support their development of capacity to decide and act.

Work described in this chapter was done with resources from NSF grant DRL-1420102 (P. Herbst, PI). An earlier version of part of this material was shared at the 2017 NCTM Research Conference, San Antonio, TX.
Vu-Minh Chieu participated of this work when he was an Assistant Research Scientist at the University of Michigan. He is currently a Software Development Engineer at Amazon.com, Inc.

P. Herbst (✉) · N. Boileau · M. Shultz · A. Milewski · V.-M. Chieu
University of Michigan, Ann Arbor, MI, USA
e-mail: pgherbst@umich.edu; nboilea@umich.edu; mollee@umich.edu; amilewsk@umich.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_7

Some development of capacity for teaching happens within teacher education courses, for example, through the study of theories and research on how students learn and the instructional practices that support desired learning. Additionally, the practice of student teaching under a mentor teacher in the real-world setting of a regular school has traditionally been a way in which learning to teach can happen in practice (Fairbanks, Freedman, & Kahn, 2000). Both of these settings for learning to teach rely on some representation of classroom mathematics teaching. In the first case, teaching is represented with a combination of abstract, conceptual language – using expressions like *elicitation*, *student conception*, or *problem-based instruction* – and narrative (written or video recorded) cases of instruction in which those expressions may be instantiated. In the second case, the novice is immersed in actual classroom experiences. In addition to being real experiences, these are also representations of classroom teaching because they are offered to and taken by novices as pedagogical: for the novice, those experiences are tokens that stand for more general aspects of the practice they are learning (see Herbst, Chazan, & Milewski, 2020, p. 231).

While both of those settings are useful, established components of teacher preparation, it seems that neither the teacher education community nor the students of teaching have been satisfied only with those, as they perpetuate a classical divide between theory and practice (Grossman, Hammerness, & McDonald, 2009; see also Francis, 2017). Research and innovation in both the settings and the mentoring needed for capacity development have contributed to mitigate that dissatisfaction and can continue to do so.

7.2 Innovations in the Settings for Learning to Teach

The divide between theory and practice instantiated in the difference between university courses and field placements motivated Dewey (1904/1965) to offer his *laboratory* approach. In a specially designed, laboratory school, students of the teaching profession could use theory as they inquired on practice while practicing. A laboratory school would shelter them from some of the institutional concerns of a regular school setting and provide them with special resources, such as mentors, who were conversant with the theories the novices were learning. Yet the laboratory school would still put them to work in teaching required content to actual students. While laboratory schools have almost vanished from teacher education, variations on the idea have recurred over time, as in the Professional Development Schools movement (Chazan, Callis, & Lehmann, 2009; Holmes, 1990) and in current efforts such as the Michigan Education Teaching School (Michigan Education, 2019; see also Bain & Moje, 2012).

Attempts to bridge the chasm between theory and practice have been the object of intensive work in teacher education programs in the last few decades. Recent efforts have been inspired by the notion that learning to teach should be in, from, and for practice (Lampert, 2010). These have culminated recently with articulations of curricula for practice-based teacher education, including lists of core practices or high-leverage practices (Ball & Forzani, 2011; McDonald, Kazemi, & Kavanagh, 2013). Grossman, Compton, et al. (2009) complemented such developments by identifying a class of pedagogies of practice from the empirical study of programs for the preparation of counselors, ministers, and teachers. Among these pedagogies of practice are what Grossman, Compton, et al. (2009) called *approximations of practice* – where novices are taught through engagement in the act of teaching in settings that approximate, and thus might have less complexity than, regular practice. Novices' practice in Dewey's laboratory school would have qualified as an approximation of practice, and so would other practices that have been used in teacher education over the decades. These have included teaching classes in out-of-school contexts such as camps, clubs, or museums (Anderson, Lawson, & Mayer-Smith, 2006; Kim et al., 2015), tutoring individuals (Shin, 2006), microteaching (Fernandez, 2010), rehearsals (Lampert et al., 2013), scripting and storyboarding classroom dialogue (Crespo, Oslund, & Parks, 2011; Earnest & Amador, 2019; Rougée & Herbst, 2018; Zazkis, Liljedahal, & Sinclair, 2009), and actual practice with actors who simulate being students or parents (Khasnabis, Goldin, & Ronfeldt, 2018; Shaughnessy & Boerst, 2018).

Technology has been used in different ways to create simulations for novices. These simulations make different kinds of demands on technology: Some use technology to mediate interactions between live humans (e.g., Dieker, Straub, Hughes, Hynes, & Hardin, 2014; Thompson et al., 2019), and others use programmed responses or artificial intelligence to provide a counterpoint to what the person playing the role of teacher chooses to do (e.g., Chieu & Herbst, 2011; Tyler-Wood, Estes, Christensen, Knezek, & Gibson, 2015). Our contribution uses a basic case of the latter simulation, as it makes use of technology to represent the classroom environment and possible courses of action and enables the player to make teaching decisions and experience some of the consequences of those decisions, programmed in advance. While a detailed review of the literature on technology-mediated simulations in teacher education is outside of the scope of this chapter (but see Bradley & Kendall, 2014), in the next section we provide a conceptual framework to describe our simulation more precisely.

Like other approximations of practice, a central use of our simulations is by novices playing the role of the teacher and receiving feedback from the system in the form of student reactions. Yet this is not the only possible use. We propose that another use, closer to the opportunities that novices have to observe their mentors teach before teaching themselves, could involve the mentor engaging in the simulation and describing their thinking to the novice. In this chapter, we examine what the novice could learn from such exchanges. To more fully elaborate on the research questions, it is therefore important to consider what we know and could use learning more about mentoring.

7.3 Innovations in Mentoring Are Needed

The role of more experienced teachers as mentors of novices in their teacher development is a usual component of some approximations of practice, such as student teaching or field experiences, when novices are placed in actual classrooms with a more experienced teacher. To think of this more experienced teacher as a *mentor* is a departure from older labels such as *critic teacher*, which emphasized their role as evaluators or gatekeepers of the profession (Feiman-Nemser, 1996). Conceptually, *mentor* emphasizes less the role of evaluator and more the role of a guide, even an inquiry partner. While mentors still are expected to assess their mentees at some point, the concept of mentoring entails providing opportunities for novices to learn to teach from experienced teachers by observing their teaching, asking questions about it, and receiving feedback from the mentor on their own teaching (Jaworski & Watson, 2014). Based on their review of the empirical research on mentoring, Butler and Cuenca (2012) suggest that mentors tend to have one of the following three conceptions of their role as mentors: (1) instructional coach, (2) emotional support system, and (3) socializing agent. Those authors argue that such conceptualizations are useful because they can be used to negotiate "the kinds of mentoring practices necessary to further individual program aims and expectations" (ibid., p. 303) and, more generally, open communication between mentors and teacher educators, which the authors suggest is one of the reasons for the divide between theory and practice that we mentioned in the previous section. In particular, promoting the integration of those three different types of mentoring seems useful.

We believe that mentor-mentee interactions about simulations can afford opportunities for mentors to coach mentees on issues of instruction, particularly examining alternative courses of action, while also socializing them into the demands of the profession. Simulations may afford that without adding more stress to the observation and evaluation of the actual teaching of mentor or mentee. We suggest this because Feiman-Nemser (1996) notes that "teachers work alone, in the privacy of their classroom, protected by norms of autonomy and noninterference" (p. 3); hence, it can take some time for mentees to develop the rapport needed to really inquire on the actions and decisions their mentors took and the rationality behind those. It can be difficult for the novice teacher and the mentor to dissect, discuss, and reflect on alternative actions of teaching when all they can refer to are lessons they taught (van Ginkel, Oolbekkink, Meijer, & Verloop, 2016).

A technology-mediated teaching simulation can help alleviate the above limitations, if and when they engage novice teachers with a virtual representation of a classroom and require them to manage instruction with virtual students. In general, teaching simulations can promote practice-based learning by enabling novices to examine teaching practice from a first-person perspective (Chieu & Herbst, 2011; Dieker, Rodriguez, Lignugaris, Hynes, & Hughes, 2013; Ferry & Kervin, 2007; Gibson, Aldrich, & Prensky, 2006; Girod & Girod, 2008). Furthermore, there are few empirical studies on the affordances of simulations for mentoring or on any feedback beyond the immediate consequences of their actions that novices could receive based on their choices in the simulation (e.g., justifications for the appropriateness, or lack thereof, of a teaching action at a given moment). The main goal of this empirical study is to understand what kinds of affordances a simulation of a lesson might provide for a novice teacher to learn from observing a mentor navigate the choices offered by the simulation. What learning opportunities might a simulation of a lesson afford to a novice as they use the simulation to interrogate the actions of the mentor?

7.4 Theoretical Framework

Our framework is composed of two complementary pieces. The first is a conceptual framework that proposes how to organize the space of simulations of teaching. We use this framework to make more precise the design goals of our simulation, which have a bearing on its specific technology realization and the differences between it and other simulations. The second is a theoretical framework that helps describe the specific design features of our simulated lesson.

7.5 Technology-Mediated Simulations of Teaching: A Conceptual Framework

An important contribution of Piagetian epistemology (Piaget, 1985) is the notion that learning can be modeled as the adaptation of prior knowledge to the feedback provided by the environment in response to the actions of the learner. Building on this view of learning as adaptation, Brousseau (1997) conceptualized the notion of the *milieu* as a key component of instructional design (i.e., of the design of interventions that seek a particular learning goal or knowledge at stake). The milieu, in Brousseau's sense, is the set of elements of the environment related to the knowledge at stake that receive the actions of the learner and provide feedback that may inform the learner's future actions (see Fig. 7.1). Brousseau (1997) has explicated this concept in relation to mathematics instruction; Balacheff (1994; Balacheff & Gaudin, 2010) and his collaborators have adapted the notion of milieu for the design of digital environments for human learning, including simulations for the learning of medical skills (Chieu, Luengo, Vadcard, & Tonetti, 2010; Vadcard, 2013).

The notion of milieu supports thinking of a teaching simulator in the following way: The user interacts with the teaching simulator by modifying some aspects of the milieu, inscribing a trace of those actions in the milieu. These inscriptions are done in a region of the milieu that is ordinarily called the *user interface*. Those inscriptions in the user interface are interpretable by another region of the milieu, let's call it the *engine*, which can process them, or compute with them, and then display its outcomes through the user interface. This display is, usually, a contingency for the user, that is, it is something that the user cannot control. As this con-

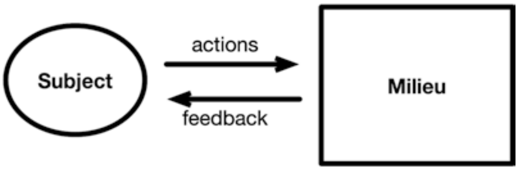

Fig. 7.1 The milieu (adapted from Brousseau, 1997, p. 9)

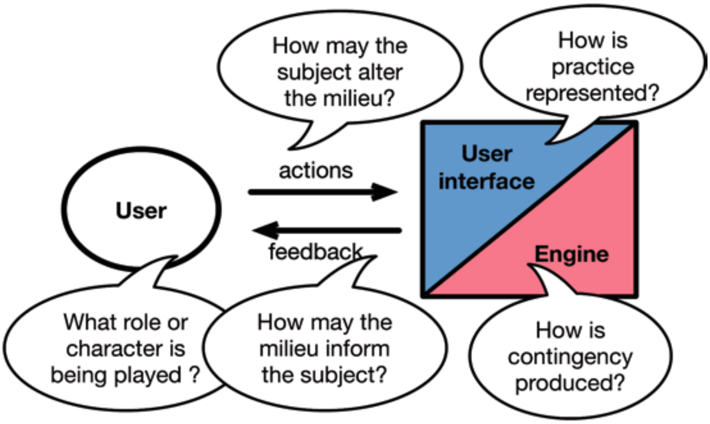

Fig. 7.2 The milieu of a teaching simulator (© 2019, The Regents of the University of Michigan, used with permission)

tingency is read by the user, it feeds back on their original actions, for example, prompting an association of a feeling (say, of happiness) or a value (e.g., success) to those actions. Figure 7.2 shows how this application of the notion of milieu applies to a teaching simulator. Figure 7.2 also includes some questions, in the form of callouts, that explicate the components of the diagram and suggest that teaching simulators can be realized in many different ways. We assume for the time being that the user is somebody playing the role of teacher and that the user interface presents the class the teacher is teaching. How this class is presented and how their actions are produced is what we explicate below, using the notion of milieu, conceptualized as the union of a user interface and an engine.

7.5.1 The User Interface: Modality and Individuality

The user interface responds to the question of how practice is represented. This question can be unpacked into two further, related questions: What distinctions within practice are represented and how the representation of practice is communicated to the user? The latter alludes to the communication modality, which could include print, graphics, audio, holograms, live action, etc. The former can be contained in the distinctions that Herbst, Chazan, Chen, Chieu and Weiss (2011) included as the *individuality* dimension of a representation of practice: the extent to which people and settings are represented as unique. As a basic example, consider a chat room in which role- or character-play is happening (e.g., Vincent & Shepard, 1998). The modality includes print text displayed on a screen, while individuality may be signaled by names or pseudonyms used to identify the characters speaking each line. Further, individuality also includes that individuals are reduced to what they say (as the chat room does not allow for the modality of facial expression, etc.), and the specific settings in which those characters are may be reduced to some textual description of the scene.

A completely different case of modality and individuality is offered by the TeachLive system (Dieker et al., 2013). In this case, modality includes audio and visual (digital screen) displays of students that respond to the closeness of the teacher by zooming in. Individuality includes 3D cartoon representation of students using human models that afford them a range of humanlike motions and expressions and who differ from each other physiognomically, aurally, and locationally. Further, individuality includes some specificity of the room, including seats and desks and a given number of students visible. Below we use modality and individuality to describe our SimTeach animation, but we surmise that these elements can be used to describe and differentiate other simulations.

7.5.2 The Engine of a Simulation

The engine of a simulation responds to the question of how contingency is produced. These contingent actions respond to the user and create contexts for the user's following actions. In the case of an Internet chat room used to role-play teacher and students, this engine is composed of the aggregate of actual individuals authoring the lines purportedly spoken by students – their cognitive and linguistic capacities and limitations and their knowledge of children and classroom language are part of that aggregate. The question of how contingency is produced can be unpacked into the questions of who produces the contingency and by what mechanisms they do it. In the case of the Internet chat room role-play, the who is several individuals, and the how can be synchronously and improvised or perhaps asynchronously and informed by ad hoc reading. In the case of SimSchool (Gibson, Christensen, Tyler-Wood, & Knezek, 2011; see also Christensen, Knezek, Tyler-Wood, & Gibson, 2011), contingency is produced by a programming team and executed by a web-based software and game engine, programmed to calculate classroom responses to the choices of the user.

7.5.3 Interacting with the Milieu in a Simulation of Teaching

Figure 7.2 also employs arrows to represent the actions of the user on the milieu and the feedback from the milieu to the user. The first arrow represents the question of how the user may alter the milieu. In the case of an Internet chat room, the user enters text to represent when they want to speak and what they want to say. In SimSchool, there are menus of actions and dials that the user can control. This comparison highlights not only the different technology functionalities used (e.g., typing vs. choosing) but also the fact that the meaning potential the user can convey to the milieu can be more or less restricted: A chat room line accommodates freely the meaning potential of written English, while the menus and choices from SimSchool contain some selected tokens with assigned meanings that may have a limited specificity (e.g., the choice to *assign an academic task* has a specific meaning for the software even if it appears as having a rather broad meaning potential as an English phrase).

The second arrow, from the milieu to the user, represents the question of how the milieu provides its feedback to the user, which includes how the user interprets that information. In the case of an Internet chat room, the user's knowledge of reading, language, and conversation norms would assist. In the case of TeachLive, because the user interface shows humanlike characters who speak and emote, one might add knowledge of reading body language and facial expressions and how to listen for affect in speech. Some of the responses from the milieu may be encoded in some simulation-specific jargon, much in the same way as games will give bonus points or report that the user has no lives left, while in other cases there may be all the ambiguity and choice of a multimodal language.

7.5.4 A Teaching Simulator as Support of a Mentor-Mentee Relationship

The interaction between the user and the teaching simulator that interests us needs to be seen in the larger context of an activity structure for teacher learning. Specifically, we could use the instructional triangle (Cohen, Raudenbush, & Ball, 2003) to consider the mentor-mentee-practice relationship in which the knowledge at stake is knowledge of practice, and the simulator is a representation of this knowledge at stake. In Fig. 7.3 below we adapt the professional development triangle (i.e., an instructional triangle of professional development that puts practice as the content of instruction; Carroll & Mumme, 2007, p. 11) for the case in which practice is represented by using a teaching simulator. We note in the diagram that the simulator use needs to be put in relation with some knowledge of practice at stake because, as the meaning potentials of the user interfaces and the computing capacity and knowledge bases of the engines vary across different simulators, one can expect that considerations of what knowledge of practice is at stake in a given simulator will matter in what opportunity to learn it creates for novices. This is key in justifying the present study: seeing a mentor interact with a simulated lesson can be more or less productive for teacher learning depending on what knowledge of practice is afforded – seeing the simulated lesson is not enough by itself.

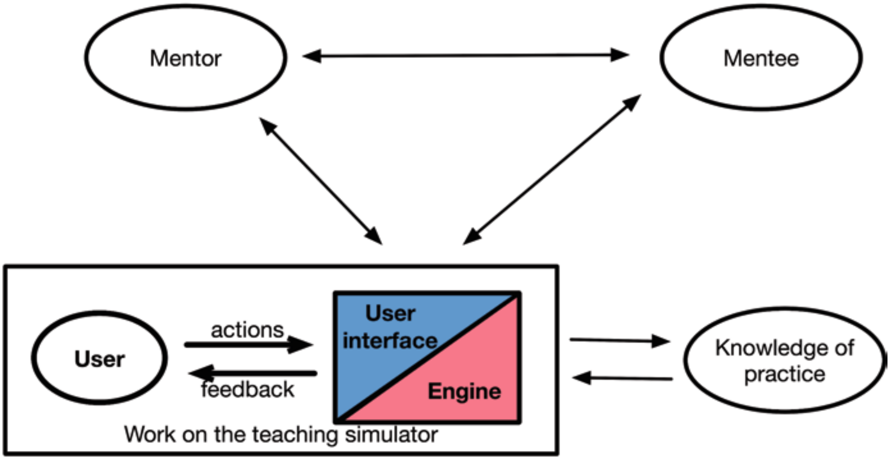

Fig. 7.3 A teaching simulator in the context of teacher education (© 2019, The Regents of the University of Michigan, used with permission)

The triangle in Fig. 7.3 helps us anticipate two possible uses of the simulator in the context of a mentor-mentee relationship. One is that the mentor assigns the mentee to play the role of the user of the simulation (i.e., the role of the teacher in the represented lesson), possibly bringing back to their conversations observations from their experience playing the teacher in the simulation. A second one is that the mentor takes themselves the role of user of the simulation, making their virtual practice of teaching with the simulator visible for the mentee, who can possibly ask questions about the mentor's virtual practice. The latter is the case of the data we analyze in this chapter. But before going into that data, it is necessary for us to describe the theory of teaching used in designing the SimTeach simulation.

7.6 Practical Rationality: The Theory of Teaching Behind the Design of SimTeach

A characteristic of our teaching simulation is that it seeks to simulate the decision-making of a mathematics teacher in a given lesson. In making those decisions, a teacher needs to attend not only to managing instruction but also to other demands on their teaching work (Chazan et al., 2016, p. 1051). Instruction, the transaction of content with students, is a central activity in the work of teachers, but not the only one they do – teachers also mentor and motivate students, communicate school policies, teach students how to talk to each other, etc. While in real classrooms many of those other activities happen at the same time as instruction, for the sake of constructing a simulation of practice, it helps to define instruction more narrowly first. Our simulations seek to represent the management of decisions that happen in the context of instructional practice – where the work being done has for its end to transact specific (mathematical) content. Practical rationality considers other legitimate activities of teaching as presenting alternatives for action, justified by the need to attend to expectations from multiple stakeholders.

7.6.1 Mathematics Instruction

(Mathematics) instruction is the transaction of (mathematical) content between students and teacher. A fundamental assumption for understanding instruction is that it stages an exchange between two different representations of knowledge (see Brousseau, 1997, p. 21–23). On the one hand, knowledge is represented in the set of instructional goals or contents at stake in a course of studies. On the other hand, knowledge is also represented in the work students are asked to do on behalf of the knowledge at stake. Students do that work over time using resources like language, their bodies, inscriptions, and social interactions. The teacher's instructional work includes enabling that student's work to happen. For a teacher to manage instruction means that they manage getting students to work on such tasks as well as interpreting what students do in those tasks on behalf of the knowledge at stake.

Practical rationality aims to describe the rational basis behind the actions and decisions teachers make when managing the production of student work that might be exchangeable for the knowledge at stake. But because more than instruction is at play, teachers need to make decisions that may be justifiable on a variety of reasons. Practical rationality attempts to identify those possible reasons. Some of those reasons are regulations of instruction, and others come from stakeholders of the work of teaching.

Two sources of regulation of instruction that support the development of simulators of instruction are the didactical contract and instructional situations. *Didactical contract* alludes to a set of tacit norms that regulate classroom mathematics instruction in general, for example, the norm that teachers have the right to ask students to do problems or that teachers are expected to respond to students' work. *Instructional situation* refers to regulations more specific to the nature of the mathematical work being done (Herbst, 2006; Herbst & Chazan, 2011, 2012). An *instructional situation* is a recurrent type of instructional exchange – a type of task that is recurrently used to support the claiming of a particular item of knowledge. Examples in mathematics abound: comparing numbers, solving equations, and the one we use here, doing geometric proofs. While not all mathematics instruction reduces to managing instructional situations, as there also are novel problems that can be used for instructional purposes, and while not all instructional situations need to be studied in teacher preparation, some instructional situations are useful inasmuch as they provide context for learning not only how to manage that situation but also broader issues about practice.

Instructional situations are governed, and can be modeled, by a local contract or system of *norms* (i.e., routine and tacitly expected behaviors) that regulate "a type of encounter where an exchange can happen between (1) specific mathematical work done by students and their teacher in moment-to-moment interaction and (2) a claim on students' knowing of a specific item of knowledge at stake" (Herbst & Chazan, 2011, p. 412). According to Herbst and Chazan (2012), teachers' instructional decisions are not only "a function of their knowledge and resources, goals, and beliefs and orientations" (Schoenfeld, 2015, p. 231) but also a response to instructional norms (e.g., norms of the didactical contract and instructional situations relevant to the work at hand) and to teachers' professional obligations.

7.6.2 The Professional Obligations of Mathematics Teaching

As noted above, mathematics teaching as a profession is responsible for more than mathematics instruction, though these added responsibilities often manifest themselves practically in and through mathematics instruction. Chazan et al. (2016) name four stakeholders of the position of mathematics teacher: knowledge, the client, society, and organization. Chazan et al. (2016) describe four obligations that tie mathematics teachers to those stakeholders. An obligation to the discipline of mathematics alludes to, more than the content of instruction, the obligation that mathematics teachers have to represent mathematical knowledge and practice in ways that are true to the mathematics discipline. An obligation to individual clients (children, youth, adults) alludes to, more than the student of mathematics, the obligation that mathematics teachers have to attend to their clients as whole persons (emotional, physical, etc.). An obligation to the class as an interpersonal collective alludes to, more than having many students of mathematics together, the obligation that mathematics teachers have to attend to their classes as members of society, with resources to share, values to develop, and skills to hone. Finally, an obligation to the institutions of schooling (the mathematics department, the school, the district, the national system) alludes to, more than the isolated study of content, the organized study of this content within regimes that specify time, coverage, control, and so on within various institutional and legal policies. Below, we explain how the specification and modeling of instructional situations helped us design a teaching simulation in which mentors could both follow normative choices and also, at times, deviate from those on account of professional obligations.

7.7 The SimTeach Simulation

We used cartoon storyboards to represent (part of) a lesson in which a high school geometry class was doing a proof. Herbst et al. (2009) have identified a number of norms of the situation of doing proofs in geometry, including how geometric objects are referred to, the order in which different types of contributions to a proof are made, and so on. We started with a scenario that we hypothesized to be normative,

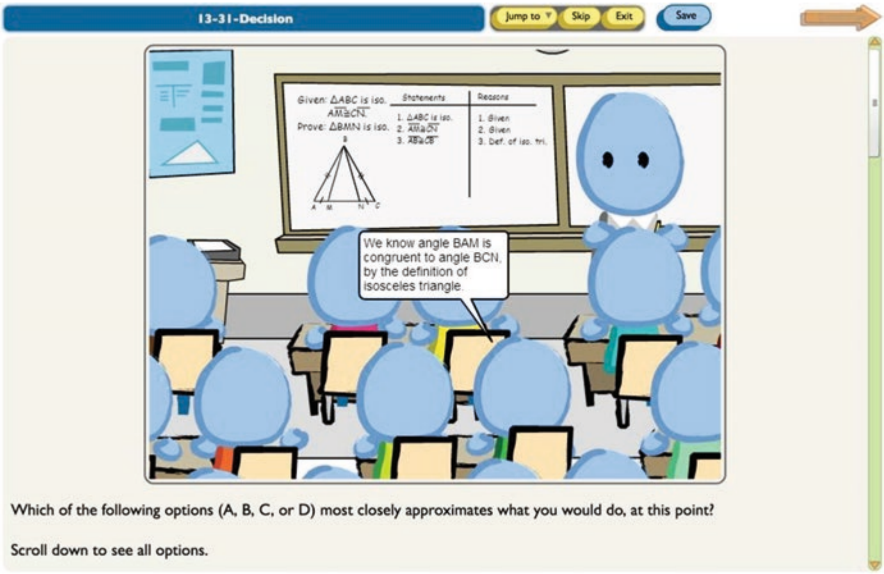

Fig. 7.4 A decision point of the simulation (© 2019, The Regents of the University of Michigan, used with permission)

that is, an instance of the situation of doing proofs where all norms would be complied with. Then, we identified a number of moments in the scenario where we could create *decision points* – a moment in a classroom episode where the teacher user is prompted to make an instructional decision. In general, moments when a norm of the contract or of the situation would be at issue (e.g., when a student makes an error) were candidates for decision points. For example, Fig. 7.4 shows a decision point where a student makes a correct statement ("We know angle *BAM* is congruent to angle *BCN*") but provides an incorrect reason (the reason is incorrect because those angles are congruent by "base angles theorem," not by the definition of isosceles triangle).

At each of those decision points, the simulation presented four close-ended options to users and asked them to choose which best approximated what they would do next: two of those options were ones we conjectured novice teachers would be more likely to choose (e.g., for the teacher to say "Actually, that's not the right reason"), and two options were ones that we conjectured expert teachers would be more likely to choose (e.g., for the teacher to ask "What do others think of Green's contribution?"). We designed each option in ways that either complied with the norm that motivated the design of that decision point or departed from that norm in ways that could be considered justifiable on account of a professional obligation. For example, the novice option described above complies with the norm that teachers are expected to provide students with feedback on their thinking (Brousseau, 1997), while the expert option departs slightly from that norm, by instead involving other students in evaluating the contribution, thereby promoting collaborative work on the proof and, in that way, satisfying the teacher's interpersonal obligation. The

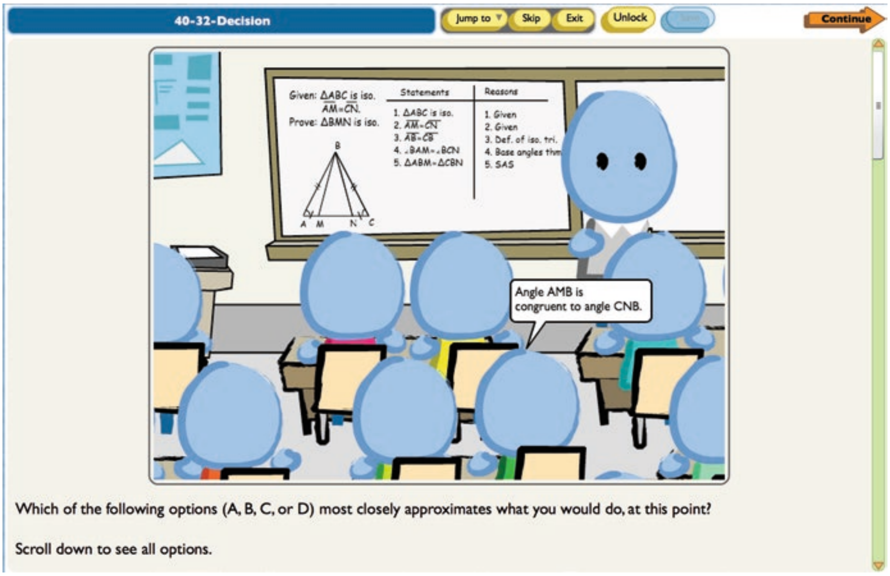

Fig. 7.5 Another decision point (© 2019, The Regents of the University of Michigan, used with permission)

design of decision options was grounded in the theory of practical rationality to allow for diagnosis of each user's recognition of targeted norms and their professional obligations. The scenario branches based on a user's choices at each decision point. Figures 7.5 and 7.6 provide another example, later in the lesson.

In Fig. 7.5 the user sees a student offering a statement for the proof. The statement is warranted by the series of statements that had been deduced from the givens to that point (and that, hence, were mathematically correct). The situational norm would indicate the next intervention should be a reason for that statement (Herbst et al., 2009). However, mathematically, the statement made is not the most strategic one toward the end of proving that triangle *BMN* is isosceles: Rather than show that angles *ABM* and *CBN* are congruent, then that angles *NMB* and *MNB* are congruent, then that triangle *BMN* is isosceles, one could directly say that $\overline{BM}$ is congruent to $\overline{BN}$, then that triangle *BMN* is isosceles. What would a teacher do? Figure 7.6 offers the four choices provided.

Note that Fig. 7.6d (lower right) includes a positive evaluation of the student's comment. In choosing this option, the teacher would comply with the didactical contract (providing the student with feedback on his statement). In Fig. 7.6c (lower left), there is instead somewhat of an affirmation of the student's response while also requesting a reason, which would be normative for the situation of doing proofs. The less normative options are the ones on the top of Fig. 7.6. The top right is a question that suggests that the statement offered might not be the only or the best one to make; it might be construed as suggesting a negative evaluation on the student who offered it, and it also opens up participation to others. One could

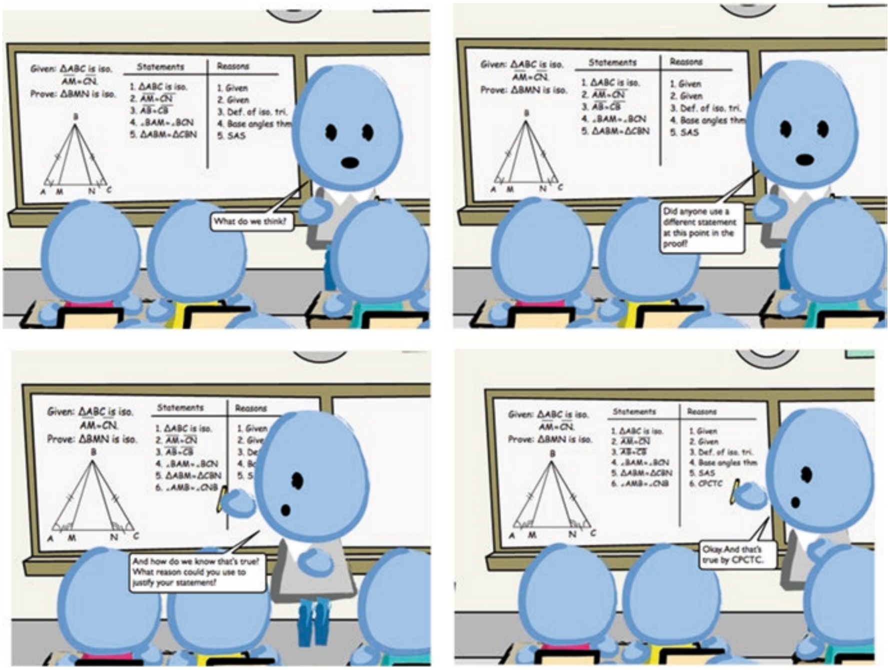

Fig. 7.6 Options offered for the teacher after the student intervention in Fig. 7.5 (© 2019, The Regents of the University of Michigan, used with permission)

describe this option as a mild breach of the contractual norm while attending to the interpersonal obligation (as other students might have opinions to share). The top left is also a question "what do we think?" asked before sanctioning the statement made; it neither suggests a negative evaluation nor it requests a specific type of follow-up, but it plainly asks students to think. It seems minimalistic, yet it might be the best one to choose at this moment if one were interested in giving students the opportunity to find an elegant proof, as opposed to merely a correct one: If students considered for a moment the statement offered, they could notice that, for the same reason (CPCTC[1]), they could just assert that sides $\overline{MB}$ and $\overline{NB}$ are congruent, which would get to the conclusion sought more efficiently than by using the statement made by the student in Fig. 7.5. We offer this to illustrate how decision points could elicit some thinking around the different sources for justification of action.

Thus, norms of the contract and of the situation served us to identify decision points and to come up with default decisions when we were designing the simulation. But normative responses were not assumed to always be the correct ones – as a teacher has obligations to a variety of stakeholders, other options might be feasible

[1] CPCTC stands for corresponding parts of congruent triangles are congruent.

that could handle the circumstance in ways that might not be entirely normative but that might still move the class toward the instructional goal while attending to one or more of the professional obligations.

The simulation was therefore realized as a branching scenario in the sense that the experience of the user would include navigating the frames of the storyboard linearly until a decision was required. At the decision point, four alternative actions would be presented. After each choice, a branch of the scenario would spring out. The result of this was a treelike structure, which, in its totality, represented a lesson as a region in the multiverse: Each sequence of decisions made constituted one possible universe, in which some events would happen and others would not (Herbst & Milewski, 2020).

7.7.1 The Milieu in the SimTeach Simulation

In terms of the conceptual framework presented above for the description of technology-mediated simulations, the milieu of the SimTeach simulation can be described using the notions of user interface and engine as follows. The user interface has a visual and print modality – users see the students in the classroom and read what they avowedly say in speech balloons. To do the latter, particularly to discern the order in which speech balloons on the same frame need to be read, they need to be capable of reading comics, though our panels rarely have more than two speech bubbles and ordinarily just one, so this demand is low. In terms of individuality, Fig. 7.4 shows that students are distinguished by their physical location, their facial expressions, their shirt color, and what they say and do. Other possible markers of individuality are not available (e.g., their mathematics background or interests, family situation, physical and demographic characteristics, etc.). The user interacts with the user interface by navigating the story forward and by choosing from a set of alternatives when these are offered. In both cases, the user chooses when to navigate the story forward or make a selection – thus, the user controls the passing of time (or *temporality*; Herbst et al., 2011) in the representation.

The engine is the theory of practical rationality, interpreted by us as designers for the context of this lesson, and simplified by the decision to offer only four options at each decision point: While not all possible branches of the simulation are anticipated, designers chose decision points identified by the theory and designed decision choices using the theory described above. These choices might be normative according to the contract or the situation, or could deviate from those norms. Those deviations from norms might be justifiable on account of an obligation. All those choices were pursued with branches of the lesson. Choices that were not normative might elicit responses from students that noted that lack of normativity. In general, the user would receive feedback from the milieu by the simulator's choice of a response from students to the choice made by the user. Because in this simulator that response was unique for each choice, the engine did not do any sophisticated computing other than what was needed to retrieve the graphics for the programmed response.

The user received this feedback as noted above, by reading the comic frame. In some cases, the only option the user would have was to read and move forward: The engine would offer either a single screen with an arrow to move forward or a set of four possible screens with buttons to choose one and then move forward. Thus, the engine provided the decision points chosen by the designers. In the context of this very simple simulated lesson, we were interested in understanding what opportunities this simulation could offer for a novice to learn from her mentors.

7.8 Method

7.8.1 Procedure

We selected four experienced geometry teachers who were teaching in different local high schools and who had been mentors for student teachers in a teacher education program. We recruited a novice teacher (Céline[1]), a recent graduate from a secondary mathematics teacher education program. Céline interviewed of each of the four experienced teachers as they went through the simulation. We trained Céline on an interview protocol that consisted of possible prompts that she could use to encourage the experts to explain and justify what they would do next and why, if they did not do so naturally, explain whether and why they might consider some of the other options presented, as well as reveal more about their decision making process (e.g., what they think would happen if they chose to do what was depicted in one of the response options). While we expected that the expert teachers might provide a wide range of justifications, we expected that both the design of the decision options – options to follow and breach norms – and having Céline ask them to justify their decisions might, in particular, provide opportunities for her to connect norms of instruction with professional obligations of mathematics teaching. We asked each expert teacher to complete at least two different branching scenarios of the simulation.

At the end of each session, we interviewed Céline to learn what she felt she learned from these sessions. As the protocol that we asked her to use to learn more about the expert teachers' decisions included questions about their reasons for making certain decisions, what they thought of possible actions that the simulation suggested they could have taken but that they chose not to, and the potential consequences of some actions, we asked Céline what she learned about each of these things. In addition, given our familiarity with the literature on teacher noticing (e.g., van Es, Tunney, Goldsmith, & Seago, 2014) – which suggests that experts notice things that novices often miss, interpret them differently than novices, and consequently make different types of decisions – and that what they notice, how they interpret them, and how they react might be influenced by their familiarity with instructional norms, we also asked Céline what she learned about the features of classroom interactions that experienced teachers notice and attend to. Last, we asked a couple of more-general questions to capture learnings that we did not anticipate, such as “Were there any decisions that the [mentor] made that surprised you?” and “Is there anything else that you want to share with us in terms of what you learned about teaching and decision-making from this experience?” At the end of the study, after Céline had interviewed all four expert teachers, we also asked her to compare her simulation-based apprenticeship experiences with her traditional apprenticeship experiences (e.g., debriefing with her student teaching mentor after either of them taught).

7.8.2 Data Sources and Data Analysis

We used a constant comparative method (Glaser & Strauss, 1967) to analyze video records and screencasts that captured the interaction between each expert and the simulation and the novice and videos of the interviews. That is, we used an iterative and inductive process of reducing and constantly comparing incidents (i.e., interactions between the expert teacher and Céline at each decision point, interviews of Céline) to look for similarities and differences of patterns of learning opportunities that the novice experienced from the apprenticeship sessions. This process helped us find a core category, *connections*, in Céline’s responses to our questions, as follows.

7.9 Results

From Céline’s accounts of what she learned from each of the sessions, we found a core category that we named *connections* and that alludes to the gap between theory and practice noted in the introduction: Céline found opportunities to connect (or ground) some of the abstract concepts that she had learned about in her teacher education classes with (or in) a wide range of concrete examples depicted in the simulation and discussed by the expert teachers. Below, we provide examples of these connections, through examples of what she learned about which features of classroom interactions expert teachers notice and attend to (hereafter, noticing), how they evaluate various possible actions that they could take (hereafter, alternativity), and justifications of various types of teaching decisions, in particular decisions to breach or follow norms (hereafter, justification). Through our open coding of the data, we also noticed that novices also learned about what we now call *situative flexibility* – the ability to consider whether framing the lesson in a different way (e.g., as an instance of another situation or as an opportunity to attend to one of the obligations) may be more productive than continuing to frame it using the given situation.

7.9.1 Connections Made About Noticing

Céline noticed that teachers were attentive to specific conventions used in high school geometry (e.g., that line segments are notated with a bar over the letters that label their extremes). Céline also saw her mentors taking cues from students as indicators of how students really felt about an idea, and she saw her mentors making different interpretations of students' errors. Thus, as regards noticing students and their thinking, she could see mentors being aware of more than the normative responses on the part of students.

7.9.2 Connections Made About Alternativity

The abstract concepts that Céline connected with concrete examples regarding *alternativity* included asking "good questions," which she learned could require a teacher to consider asking "what questions do you have?" as an alternative to "do you have questions?" as the former is more welcoming, while the latter may make "students… feel they are dumb if they answer." While Céline was aware that students study in an interpersonal environment where they are often judged by their peers, the simulation allowed her to connect that awareness to how to ask questions in the context of instruction. Another example was "differentiating instruction." Céline learned that, when some students are finished with a task before others, a teacher could consider alternatives to expecting them to be patient while others finish the task; the teacher could assign those students to do other problems or additional questions about the initial task. Toward the goal of having students refine their contributions, Céline appreciated seeing an alternative to having the student clarify what they are saying in the suggestion to have the student dictate to the teacher what to write on the board. In regard to promoting discussion, she appreciated an alternative to responding to students when she saw teachers asking other students to comment on what a student had said. Also, in regard to the need to respond to students when they make unexpected contributions, she saw as alternatives the possibility to say "I will get back to you" or ask "where are you going with that?" In these examples we also see some concrete attempts to attend to the obligation to students as individuals while managing instruction.

7.9.3 Connections About Justification

Céline connected actions in the simulation with justifications that included considerations of consequences for students as individuals who have needs that have to be attended both in the short term and long term. For example, in regard to justifying whether and how to insist on precision in language, Céline reflected on the possible short-term consequences negatively affecting students' feeling of comfort in the classroom and on the possible long-term consequence of discouraging students from willing to share their ideas. She reflected on the importance of knowing who the students are so as to be able to understand their mood and levels of engagement. And she reflected on the obligation a teacher has toward their students as individuals, for example, in making them feel comfortable in class and in appreciating their contributions even if they are not entirely correct.

7.9.4 Connections About Situative Flexibility

By situative flexibility, we mean, in particular, whether Céline was able to see connections between broader responsibilities of a teacher and the extent to which the mentors were flexible in deciding to enforce or relax the norms of the situation, possibly even reframe the interaction in terms of a different situation or otherwise renegotiate how they would interact with students about knowledge. One of those connections was with attending to time, particularly the time left in a lesson, which ties to the institutional obligation insofar as teachers have to respect the school's bell schedule. All the expert teachers discussed the idea that they could make room for students offering alternative responses to the same proof problem or to switch from producing the proof to an open discussions about a solution but made that dependent on whether there is sufficient time in class for that. Another connection to situative flexibility had to do with the instructional goal of the situation of doing proofs – while the goal of doing proofs is for students to learn what is a proof and to develop skills of deductive reasoning, Céline observed teachers' flexibility in regard to pursuing that goal depending on students' past experiences with specific disciplinary values that could be used to describe a specific proof, such as efficiency or elegance. If the students' experiences had not yet included developing appreciation for efficiency or elegance, teachers might look more flexibly at the opportunity to do a proof and nudge students toward achieving an efficient or elegant proof. While these characteristics of proofs are not among the instructional goals of the geometry course, they are mathematical values, and teachers' attention to them evinces recognition of an obligation to the discipline.

7.10 Discussion and Conclusion

The examples above gave evidence that the simulation-based apprenticeship experiences helped Céline develop awareness of a wide range of possible teaching actions and the justifications for and against those actions, with many concrete, practical examples. The main category of connecting theory and practice became most evident to us in her final reflection on the four sessions, when she shared that she would attribute many of the insights that she gained to the discussions that she and the expert teachers had about reasons *not to choose* some of the provided decision options. She noted that, in her previous apprenticeship experiences, as an intern in field experiences or as a student teacher, she had not had such opportunities to discuss possible actions that either she or her mentor had not taken. These observations suggest that simulations like the one Céline and her mentors discussed might have a place in learning to teach.

As noted in the introduction, the field of teacher education has been looking for a variety of ways to connect theory and practice. In teacher education courses, it is usually the more abstract, theoretical ideas, the ones used to organize learning, and connections to practice can be made in the form of discussions of examples and nonexamples, even using pedagogies of practice. But the complex struggle between those issues, the dilemmas that show up in actual practice (Lampert, 1985), may not be so apparent. Student teaching and the teaching of isolated lessons during field experiences offer opportunities to contend with those dilemmas, yet within a space of high consequence and where neither much time for analysis is available nor taking all sorts of risks in the name of inquiry is advisable. The simulation seems to offer a third activity type: one where the instructional situation and the lesson that instantiates it provide important anchors in practice but other features support inquiry and the making of connections to more abstract educational ideas. As Céline noted, many of those connections came up because of her discussions with the mentors about the paths not taken and the reasons not to take them. This type of discussion may happen about very particular decisions when debriefing about lessons in student teaching – a simulation of a lesson, like the one Céline and her mentors inquired on, offers an opportunity to explore decisions more systematically.

The opportunity to systematically explore decisions in a lesson, offered by the simulation, brings us to the value of the theory used to develop the simulation. Clearly, at any moment in teaching, whatever happens next is a contingency – it is not determined as if it were a mechanical process. Yet, the simulation afforded some moments as ones in which to make decisions and left other moments as if the actions taken were unproblematic. In the same way that the notion of instructional situation served to anchor the simulation to the practice of teaching a lesson, the notion of instructional norm (either norm of the contract or norm of the situation) was useful to choose decisions where to focus the inquiry and the discussions thereafter. Interestingly, the places where norms apply might be the ones the least problematic to figure out, but the nature of the simulation and the protocol Céline used for her mentoring sessions made them matters of inquiry: Mentors had to consider given alternatives even if they would have chosen a normative one, and Céline asked them to usher her into their thoughts as to why to or not to take each choice. As a result of those considerations, a variety of issues came out, some of which served to justify the normative choices, but the discussion of other choices brought up conditions that would make those choices also reasonable.

The alternatives offered next to the normative choices came from the application of the theory. In particular, the recognition that when managing instruction a teacher is accountable to multiple stakeholders was a general resource to produce those alternatives. As society is one of those stakeholders, with its social resources, values, mores, and aspirations, the professional obligation to the class as a social group was one source of alternatives. As rational dialogue and doing work through social interaction are among those social values, it is understandable that teachers be asked to promote classroom discussions, even if a narrow conception of instruction would not require it. Anchoring alternative ways of responding to students, so that normative evaluations of student contributions (which close opportunities for discussion) could be seen next to questions that ask the class to comment on a student contribution (which open opportunities for discussion), made it possible to inquire into the complexity of doing these different activities (instruction and promoting discussion) at the same time. Likewise, other obligations offered alternatives at various moments. While it is clear that this use of the simulation does not approximate practice in the sense of requiring the making of decisions within a complex environment and under time constraints, some of this complexity is maintained by providing alternatives to the instructional norm. By deliberately asking the consideration of specific alternatives, the multiple activities of teaching that make teaching practice more complex than mere instruction are represented as integrated with the work of managing instruction. In that context, novice and mentors can discuss what can be done and ponder its costs and benefits.

We have presented the SimTeach simulation Céline used with her mentors as a case of technology-mediated simulation of teaching. In that context, SimTeach makes minimal demands on computing capabilities, yet the user interface supports conceptualizing what a lesson is. Albeit simplified to merely the enactment of an instructional situation, the simulation offers an image of a lesson as a treelike structure where the same content at stake may be represented through interactive work in a variety of ways. While some of those ways may seem normative, others may be less so and yet be justifiable on the basis of professional obligations. The whole SimTeach simulation can be offered as a representation of a lesson, not as a single story but as a multiplicity of related stories, a region of the multiverse.

References

Anderson, D., Lawson, B., & Mayer-Smith, J. (2006). Investigating the impact of a practicum experience in an aquarium on pre-service teachers. *Teaching Education, 17*(4), 341–353.

Bain, R., & Moje, E. (2012). Mapping the teacher education terrain for novices. *Phi Delta Kappan, 93*(5), 62–65.
Balacheff, N. (1994). Didactique et intelligence artificielle. *Recherches en Didactique des Mathematiques, 14*, 9–42.
Balacheff, N., & Gaudin, N. (2010). Modeling students' conceptions: The case of function. *CBMS Issues in Mathematics Education, 16*, 207–234.
Ball, D., & Forzani, F. (2011). Building a common core for learning to teach and connecting professional learning to practice. *American Educator, 35*(2), 17–21, 38–39.
Bourdieu, P. (1998). *Practical reason: On the theory of action*. Palo Alto, CA: Stanford University Press.
Bradley, E. G., & Kendall, B. (2014). A review of computer simulations in teacher education. *Journal of Educational Technology Systems, 43*(1), 3–12.
Brousseau, G. (1997). *Theory of didactical situations in mathematics: Didactique des Mathématiques 1970–1990*. Dordrecht, The Netherlands: Kluwer.
Butler, B. M., & Cuenca, A. (2012). Conceptualizing the roles of mentor teachers during student teaching. *Action in Teacher Education, 34*(4), 296–308.
Carroll, C., & Mumme, J. (2007). *Learning to lead mathematics professional development*. Thousand Oaks, CA: Corwin Press.
Chazan, D., Callis, S., & Lehman, M. (2009). *Embracing reason: Egalitarian ideals and the teaching of high school mathematics*. New York, NY: Routledge.
Chazan, D., Herbst, P., & Clark, L. (2016). Research on the teaching of mathematics: A call to theorize the role of society and schooling in mathematics. In D. Gitomer & C. Bell (Eds.), *Handbook of research on teaching* (5th ed., pp. 1039–1097). Washington, DC: AERA.
Chieu, V. M., & Herbst, P. (2011). Designing an intelligent teaching simulator for learning to teach by practicing. *ZDM Mathematics Education, 43*(1), 105–117.
Chieu, V. M., Luengo, V., Vadcard, L., & Tonetti, J. (2010). Student modeling in orthopedic surgery training: Exploiting symbiosis between temporal Bayesian networks and fine-grained didactic analysis. *International Journal of Artificial Intelligence in Education, 20*(3), 269–301.
Christensen, R., Knezek, G., Tyler-Wood, T., & Gibson, D. (2011). simSchool: An online dynamic simulator for enhancing teacher preparation. *International Journal of Learning Technology, 6*(2), 201–220.
Cohen, D. K., Raudenbush, S. W., & Ball, D. L. (2003). Resources, instruction, and research. *Educational Evaluation and Policy Analysis, 25*(2), 119–142.
Crespo, S., Oslund, J. A., & Parks, A. N. (2011). Imagining mathematics teaching practice: Prospective teachers generate representations of a class discussion. *ZDM Mathematics Education, 43*(1), 119–131.
Dewey, J. (1965). The relation of theory to practice in education. In M. Borrowman (Ed.), *Teacher education in America: A documentary history* (pp. 140–171). New York, NY: Teachers College Press. (Original work published 1904).
Dieker, L. A., Rodriguez, J. A., Lignugaris, B., Hynes, M. C., & Hughes, C. E. (2013). The potential of simulated environments in teacher education: Current and future possibilities. *Teacher Education and Special Education, 37*(1), 21–33.
Dieker, L. A., Straub, C. L., Hughes, C. E., Hynes, M. C., & Hardin, S. (2014). Learning from virtual students. *Educational Leadership, 71*(8), 54–58.
Earnest, D., & Amador, J. M. (2019). Lesson planimation: Prospective elementary teachers' interactions with mathematics curricula. *Journal of Mathematics Teacher Education, 22*(1), 37–68.
Fairbanks, C. M., Freedman, D., & Kahn, C. (2000). The role of effective mentors in learning to teach. *Journal of Teacher Education, 51*(2), 102–112.
FeimanNemser, S. (1996). Teacher mentoring: A critical review. *ERIC Digest, 95*, 2.
Fernandez, M. L. (2010). Investigating how and what prospective teachers learn through microteaching lesson study. *Teaching and Teacher Education, 26*(2), 351–362.
Ferry, B., & Kervin, L. (2007). Developing an online classroom simulation to support a preservice teacher education program. In D. Gibson, C. Aldrich, & M. Prensky (Eds.), *Games and simulations in online learning* (pp. 189–205). Hershey, PA: Information Science.

Francis, A. T. (2017). Reforming only half: A study of practice-based teacher education in traditional field placements. *Mid-Western Educational Researcher, 29*(3), 235–260.

Gibson, D., Aldrich, C., & Prensky, M. (Eds.). (2006). *Games and simulations in online learning*. Hershey, PA: Information Science.

Gibson, D., Christensen, R., Tyler-Wood, T., & Knezek, G. (2011, March). SimSchool: Enhancing teacher preparation through simulated classrooms. In *Society for information technology & teacher education international conference* (pp. 1504–1510). Association for the Advancement of Computing in Education (AACE).

Girod, M., & Girod, G. R. (2008). Simulation and the need for practice in teacher preparation. *Journal of Technology and Teacher Education, 16*(3), 307–337.

Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. New York, NY: Aldine Publishing Company.

Grossman, P., Compton, C., Igra, D., Ronfeldt, M., Shahan, E., & Williamson, P. (2009). Teaching practice: A cross-professional perspective. *Teachers College Record, 111*(9), 2055–2100.

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching, re-imagining teacher education. *Teachers and Teaching: Theory and Practice, 15*(2), 273–289.

Herbst, P. (2006). Teaching geometry with problems: Negotiating instructional situations and mathematical tasks. *Journal for Research in Mathematics Education, 37*, 313–347.

Herbst, P., & Chazan, D. (2011). Research on practical rationality: Studying the justification of actions in mathematics teaching. *The Mathematics Enthusiast, 8*(3), 405–462.

Herbst, P., & Chazan, D. (2012). On the instructional triangle and sources of justification for actions in mathematics teaching. *ZDM Mathematics Education, 44*(5), 601–612.

Herbst, P., Chazan, D., Chen, C., Chieu, V. M., & Weiss, M. (2011). Using comics-based representations of teaching, and technology, to bring practice to teacher education courses. *ZDM Mathematics Education, 43*(1), 91–103.

Herbst, P., Chazan, D., & Milewski, A. (2020). Technology tools for mathematics teacher learning: How might they support the development of capacity for specific teaching assignments? In O. Chapman & S. Llinares (Eds.), *Handbook of research in mathematics teacher education* (pp. 223–251). Dordrecht, The Netherlands: Brill-Sense.

Herbst, P., Chen, C., Weiss, M., Gonzalez, G., Nachlieli, T., Hamlin, M., & Brach, C. (2009). "Doing proofs" in geometry classrooms. In M. Blanton, D. Stylianou, & E. Knuth (Eds.), *The teaching and learning of proof across the grades: A K-16 perspective* (pp. 250–268). New York, NY: Routledge.

Herbst, P., & Chieu, V. M. (2014). *SIMTEACH: What can practical knowledge modeled in a teaching simulator contribute to support mathematics teacher learning?* Proposal to the National Science Foundation, EHR, DRL-1420102.

Herbst, P., & Milewski, A. (2020, February). Using story *Circles* to inquire into the social and representational infrastructure of lesson-centered teacher collaboration. In H. Borko & D. Potari (Eds.), *Teachers of mathematics working and learning in collaborative groups: Proceedings from ICMI Study 25* (pp. 629–636). Lisbon, Portugal: University of Lisbon.

Holmes Group. (1990). *Tomorrow's schools: Principles for the design of professional development schools*. East Lansing, MI: Holmes Group.

Jaworski, B., & Watson, A. (Eds.). (2014). *Mentoring in mathematics teaching*. London, UK: Routledge.

Khasnabis, D., Goldin, S., & Ronfeldt, M. (2018). The practice of partnering: Simulated parent–teacher conferences as a tool for teacher education. *Action in Teacher Education, 40*(1), 77–95.

Kim, C., Kim, D., Yuan, J., Hill, R. B., Doshi, P., & Thai, C. N. (2015). Robotics to promote elementary education pre-service teachers' STEM engagement, learning, and teaching. *Computers & Education, 91*, 14–31.

Lampert, M. (1985). How do teachers manage to teach? Perspectives on problems in practice. *Harvard Educational Review, 55*(178–194), 1985.

Lampert, M. (2010). Learning teaching in, from, and for practice: What do we mean? *Journal of Teacher Education, 61*(1–2), 21–34.

Lampert, M., Franke, M. L., Kazemi, E., Ghousseini, H., Turrou, A. C., Beasley, H., … Crowe, K. (2013). Keeping it complex: Using rehearsals to support novice teacher learning of ambitious teaching. *Journal of Teacher Education, 64*(3), 226–243.

McDonald, M., Kazemi, E., & Kavanagh, S. S. (2013). Core practices and pedagogies of teacher education: A call for a common language and collective activity. *Journal of Teacher Education, 64*(5), 378–386.

Michigan Education. (2019). Designing the future of STEM education… and educators. *Michigan Education Magazine*, Fall issue, 21–23.

Piaget, J. (1985). *The equilibration of cognitive structures: The central problem of intellectual development*. Chicago: University of Chicago Press.

Rougée, A. and Herbst, P. (2018). Does the medium matter? A comparison of secondary mathematics preservice teachers' representations of practice created in text and storyboarding media. In R. Zazkis and P. Herbst (Eds.), *Scripting approaches in mathematics education: Mathematical dialogues in research and practice* (pp. 265–292). Cham, Switzerland: Springer.

Schoenfeld, A. H. (2015). How we think: A theory of human decision making, with a focus on teaching. In S. H. Cho (Ed.), *The proceedings of the 12th international congress on mathematical education* (pp. 229–2243). Cham, Switzerland: Springer International Publishing.

Shaughnessy, M., & Boerst, T. A. (2018). Uncovering the skills that preservice teachers bring to teacher education: The practice of eliciting a student's thinking. *Journal of Teacher Education, 69*(1), 40–55.

Shin, S. J. (2006). Learning to teach writing through tutoring and journal writing. *Teachers and Teaching: Theory and Practice, 12*(3), 325–345.

Thompson, M., Owho-Ovuakporie, K., Robinson, K., Kim, Y. J., Slama, R., & Reich, J. (2019). Teacher moments: A digital simulation for preservice teachers to approximate parent–teacher conversations. *Journal of Digital Learning in Teacher Education, 35*(3), 144–164.

Tyler-Wood, T., Estes, M., Christensen, R., Knezek, G., & Gibson, D. (2015). SimSchool: An opportunity for using serious gaming for training teachers in rural areas. *Rural Special Education Quarterly, 34*(3), 17–20.

Vadcard, L. (2013). Étude didactique de la dialectique du travail et de la formation au bloc opératoire. *Éducation et Didactique, 7*(1), 117–146.

van Es, E. A., Tunney, J., Goldsmith, L. T., & Seago, N. (2014). A framework for the facilitation of teachers' analysis of video. *Journal of Teacher Education, 65*(4), 340–356.

van Ginkel, G., Oolbekkink, H., Meijer, P. C., & Verloop, N. (2016). Adapting mentoring to individual differences in novice teacher learning: The mentor's viewpoint. *Teachers and Teaching: Theory and Practice, 22*(2), 198–218.

Vincent, A., & Shepherd, J. (1998). Experiences in teaching Middle East politics via internet-based role-play simulation. *Journal of Interactive Media in Education, 98*(11), 1–35.

Zazkis, R., Liljedahl, P., & Sinclair, N. (2009). Lesson plays: Planning teaching versus teaching planning. *For the Learning of Mathematics, 29*(1), 40–47.

Chapter 8
Professional Development Simulations for K12 Educators to Address Social, Emotional, and Behavioral Concerns in the School Setting

Nikita Khalid

8.1 Using Virtual Classrooms to Help Real Students

Imagine yourself stepping into your classroom on a Monday morning. Your students are on their way in; you greet them and, in a few minutes, begin teaching the topic of the day. However, during your lesson, you notice one of your students, Avery, seems withdrawn and isolated. You find this especially apparent because the lesson today includes a hands-on activity where the students create their own short story and illustrations to go along with it. Avery usually loves to draw and frequently asks you about art. This is Avery's first day back in class after a few absences. You notice that Avery avoids speaking to classmates, and when you approach Avery to see how the assignment is going, you see a blank page. Avery looks exhausted and seems to be having a difficult time concentrating. You decide to set up a time to connect with the parents, speak about what you've noticed, and discuss whether there is anything you can do to help.

According to the 2016 Children's Mental Health Report conducted by the Child Mind Institute, mental health disorders are the most common health issues faced by US school-aged children. One in five school-aged children have a learning disorder, such as ADHD or dyslexia, and 80% of chronic mental health disorders begin in childhood. Merikangas et al. (2010) reports that 22% of American youth will have a diagnosable mental illness with serious impairment before they reach the age of 18. The most commonly diagnosed mental disorders in children and youth ages 2–17 are anxiety (7.1%), depression (3.2%), ADHD (9.4%), and behavior problems (7.4%) (Danielson et al., 2018; Ghandour et al., 2018). For educators of students in prekindergarten and elementary school, it is especially important to be aware of warning signs of mental, behavioral, or developmental disorders (MBDD) and to be able to

N. Khalid (✉)
The Graduate Center, City University of New York, New York, NY, USA

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_8

effectively communicate with children who have these types of disorders. One in six children from 2 to 8 years old have a MBDD (Cree et al., 2018). Rates of mental health disorders also alter with age, with depression and anxiety being at the highest rate in adolescents ages 12–17 (Ghandour et al., 2018). The studies cited above were based on diagnosed disorders, whereas we can only imagine the number of non-diagnosed disorders that children and adolescents suffer from and don't receive necessary mental health treatment for. The number of school-aged youth considering suicide in the last 10 years has, on average, increased 25%, with differences by gender and racial identity (Pane, 2018). This increase persists not because youth are less resilient or less capable, but because of factors such as ineffective program implementation or lack of emphasis on the impact that poor mental and behavioral health can have on student success inside and outside of school. One of the advantages of the simulations discussed in this chapter is the ease of program implementation and the ability of simulation technology to reach geographically dispersed communities.

Educators spend a large portion of time with students during their crucial developmental years. They are usually the first to notice warning signs of mental health disorders or whether students need additional support. Due to the prevalence of mental health concerns in children and adolescents, it is vital that educators have training to aid in the early identification of the signs of mental health disorders and feel confident in their ability to talk with students, as well as with parents, about their concerns regarding students' mental health.

8.2 Effects of Mental Disorders on Student Achievement

Mental health disorders in children and adolescents can impact how well students perform in school. This includes difficulty socializing, lack of participation in extracurricular activities, and falling behind academically. Some disorders are so debilitating that they cause students to drop out of school, which can further impact their sense of self-worth. Failing grades, increases in absenteeism, visible mood swings, and isolation can be warning signs of mental health disorders. Both depression and anxiety make it difficult for youth to sustain friendships, which are part of a crucial support network, along with family. Maintaining grades and participating in school activities is overwhelming for some students, and when these students begin to develop mental health disorders, there may be a precipitous negative impact on their attitude and behavior without the appropriate emotional and academic support.

8.3 Impact of Student Mental Health on Educator Fatigue, Burnout, and Turnover

Teachers, paraprofessionals, school nurses, and staff all play a crucial role in the lives of our children. Without the proper assistance and resources, both within a school and within the local community, there is an overwhelming amount of pressure that school personnel face, especially due to ambiguity surrounding who is responsible for taking action to address the mental health of a student. Teachers' schedules are increasingly constrained, revolving around meeting state standards, lesson planning, classroom management, grading, professional development requirements, meeting with students and parents, and after-school activities. With the culmination of teaching students that either suffer from mental health or behavioral disorders, along with demanding work schedules and lack of a work-life balance, teaching becomes less of a job with concrete hours and more of a lifestyle with sacrifices that sometimes go unacknowledged. Oftentimes we see teachers sacrifice their own mental health to continue the balancing act that is teaching.

People in teaching professions interact with students within or across various school communities; thus, it is common for school personnel to come in contact with many situations that can involve students that are in traumatic or psychologically distressing circumstances. Teachers can experience something called vicarious trauma, also known as compassion fatigue, which occurs when people have repeated exposure to individuals in distress or those that have experienced trauma. Compassion fatigue is a substantial concern for teachers because of their consistent interaction with students and adds to the overall feeling of burnout among educators. Compassion fatigue and burnout share many symptoms such as feelings of physical and emotional exhaustion, irritability, weight loss, headaches, difficulty sleeping, and poor job satisfaction that is reflected in feelings of cynicism and resentment toward a job. According to a 2018 report by the National Association of Elementary School Principals, an increase in the number of students experiencing trauma correlated directly with an increase in the amount of teachers and administrators at risk for developing compassion fatigue (Elliot et al., 2018). Due to heavy workloads and hectic schedules, it is not uncommon that teachers are subject to developing mental health concerns that contribute to teacher attrition.

Of 22,730 teachers who left the profession in 2013, the categories in which they rated their current occupation as better compared to when they were teaching were (1) recognition and support from managers, (2) social relationships with colleagues, (3) safety of their work environment, (4) influence over workplace policies or practices, (5) control over their own work, (6) manageability of workload, (7) ability to balance personal life and work, and (8) having a sense of personal accomplishment (U.S. Department of Education, National Center for Education Statistics, 2014). A recent survey conducted by the American Federation of Teachers that surveyed 5,000 educators found that 61% of educators indicate that they find work "always" or "often" stressful (American Federation of Teachers, 2017). Teachers also indicated that they feel either bullied, harassed, or threatened on the job, with 35% identifying a principal, administrator, or supervisor as a bully and 50% indicating that the bully was a student. Teachers have less influence in school-wide or district-wide decisions that directly impact their day-to-day activities in their classrooms. Most teachers have little to no influence over budget decisions, and almost half of teachers state that they have little to no opportunity to share their input when school districts determine professional development content.

Managing stress and participating in self-care is essential for teachers to minimize feeling burnt out and helps to improve mental health. If teachers can better identify, talk to, and, if necessary, refer students in psychological distress to support services, then teachers themselves will be better equipped to manage their own stress associated with classroom management. One of the goals of the pre-K12 simulation suite is for teachers to practice evidence-based communication strategies, such as emotional self-regulation and mentalizing, which will help them to ameliorate the effects of having distressed or traumatized students in their classrooms. Strategies for self-care include making sure to get enough sleep, meditating regularly, trying to exercise, and expressing your emotions about stress or anxiety with someone you feel comfortable with. It is especially important to incorporate these seemingly small self-empowerment strategies into our daily schedules now because of the Coronavirus pandemic, a global health crisis that has caused educational disruptions for 1.6 billion learners in over 190 countries (United Nations, 2020). Engaging in postive mental and physical health activities is crucial for teachers to create a balance between teaching and personal life, which can grow blurrier due to the demanding shift to online learning. For those fortune enough to be able to teach and learn remotely, this comes with it's own hardships, one of which can be feeling detached from students and work, and could lead to higher levels of educator burnout, however more research is needed to understand the lasting impact of the pandemic.

8.4 Teacher Mental Health and Its Impact on Student Achievement

The importance of teacher mental health cannot be underscored. As evidenced by a 2016 report on teacher stress and health by the Robert Wood Johnson Foundation and Penn State University, teacher stress is associated with high turnover, which can result in lower achievement for students and higher costs for school districts. In a survey of over 78,000 students in 160 schools, high teacher engagement was correlated with higher levels of student engagement and better achievement (International Board of Credentialing and Continuing Education Standards, 2019). Students have lower test scores and difficulty adjusting socially when their teachers are overwhelmed and feel disengaged from their job because they have no alternative way to cope with their stress.

Adverse effects of poor mental health for teachers and students impact entire school communities. As students continue to face mental health issues, teachers continue to have increased difficulty managing behavioral problems in their classrooms, which are exacerbated when not all schools have the funding to provide their teachers with the resources they need to support their students, themselves, and their colleagues. By advocating for role-play simulations as professional development tools, such as those described in previous chapters, entire school communities will benefit from the early identification of students in distress and their referral to treatment, and we can help to decrease teacher turnover, lessen student and teacher absenteeism, and improve school environments for teachers and students alike.

8.5 Mental Health Culture in Schools

School climate is a combination of the educational environment, feelings of school safety, and connectedness between parents, teachers, and peers. Research shows that overall school climate is positively associated with literacy about depression and negatively associated with stigma (Townsend et al., 2017). This means that the more people know and understand about mental health, namely, risk factors and symptoms of depression, and the less stigma that people have about mental health, the more positive the school climate tends to be. Depression literacy and positive peer relationships foster an environment that helps encourage treatment-seeking and instills better communication practices. The notion of positive school climate is supported by the CDC's Whole School, Whole Community, Whole Child (WSCC) model. This model emphasizes how important it is for school communities and parents to be heavily involved in their children's health behaviors and development (Centers for Disease Control and Prevention, 2019). School communities play a vital role in the promotion of children and adolescent health and safety and are critical in helping students establish healthy behaviors that will support their future education, professional careers, and families. As more people become literate about student mental health and more confident in gatekeeping behaviors, the culture within the school system will begin to shift to better support student mental health and wellness.

8.6 Influence of Stigma and Culture in Help-Seeking Behaviors

Resistance to help-seeking can stem from stigma against mental health support. There are certain stigmas about mental health disorders and treatments that can be higher or lower depending on cultural identity (Biswas et al., 2016). Stigma serves as one of the major barriers to accessing support. It can also play a role in the length to which students can go to hide their mental illness or psychological distress. Cultural differences in upbringing also influence how parents and students that identify with various ethnic and social backgrounds perceive mental health conditions, whether or not they want to seek help, what type of coping strategies they choose to use, and what types of treatment options work best for them. Cultural differences can influence how effective a mental health resource is and how well gatekeepers can identify, talk to, and motivate students to seek help. Cultural competency is an important aspect of a good mental health resource because culture influences how symptoms manifest and how effective a specific resource option can be. There is a relatively monocultural understanding of mental health because mental health theory and practice stem from Western cultural traditions and understandings of the human mind (Gopalkrishnan, 2018). Thus, it can be hard to try to explain mental health concepts and treatment options to someone who identifies with a non-Westernized culture. For example, many non-Western cultures are collectivistic and based on traditions that focus on family, while Western cultures are individualistic. Cultural differences dictate how comfortable someone is with emotional expression and how it relates to feelings of shame. As there are various interpretations of mental health that exist across cultures, when you ask your students questions about how they feel or try and interpret their behaviors, it helps to be cognizant of how cultural backgrounds (e.g., religious or ethnic) affect the way some students express their distress. For example, some may not be as willing to open up and talk about their emotions, while others could have been raised in households that do not accept having mental health disorders. Kognito's online role-play simulations provide realistic role-plays to support motivational interviewing (MI) skills building that teaches educators to be effective cross-culturally because of the nature of this evidence-based communication strategy. In addition, the neutrality of physical appearance of a virtual human has been shown to be effective across different races and ethnicities in training gatekeeping skills.

8.7 Cost and Availability of Mental Health Care

One of the major advantages of online simulations is that they can reach large numbers of geographically dispersed teachers in a cost-effective manner. This is particularly important in today's school climate as cost and availability of mental health care are crucial aspects when individuals make the decision to pursue therapy and counseling services. Funding to low-income Title I schools has decreased since 2010, and a number of states have cut pre-K educational per student funding in recent years, and many have had to reduce enrollment numbers (Litvinov & Flannery, 2017). Student enrollment in primary and secondary education has increased by over one million students in the last decade, but school funding has remained at what it was during the Recession in 2008 (McFarland et al., 2019). The growing rate of child and adolescent mental health disorders warrants drastic changes in how schools implement programs to increase school mental health literacy. There is also an unprecedented need for referrals to therapy and in-school counseling services. How can we close the achievement gap that exists throughout K12 education? We can start by involving our school communities in proactive professional development that is helpful for both educators and their students as evidenced by implementing role-play simulations, like Kognito's, nationally. Partnering with members of the school community and fostering a growth mindset across the community is an avenue that can lead to better learning outcomes and happier, safer, and better supported students.

8.8 Kognito K12 Simulations: Educators Becoming Gatekeepers

Below we describe three K12 role-play simulations developed by Kognito that have trained over 420,000 educators and school staff members. Each simulation provides users practice with using evidence-based communication tactics, such as motivational interviewing (MI), which are a part of Kognito's learning methodology and instructional design process and are applicable to various situations that do not always deal with discussing mental health. Motivational interviewing techniques such as using reflective statements, open-ended questions, affirmations, and summarizing what someone has said can help engage students in conversations about their schoolwork or interests and can even be applied as strategies to improve communication with colleagues and family members. Kognito's simulations are designed to teach individuals how to effectively lead conversations to drive positive social, emotional, and physical health behaviors (Albright et al., 2016). Having the ability to practice through virtual role-plays helps people build the confidence that they need to implement these conversation tactics in real-life conversations. Hands-on activities, similar to those that educators use in their teaching strategies with students, have proven to reinforce learning and help with retention of information. Kognito simulations first provide information about the topic area (e.g., mental health) and then guide learners through conversations by letting them experiment with various dialogue options. This is similar to the way that educators guide their students through exercises and prompt them to try different things to engage their brains in executive functioning and encourage students to participate in active decision-making.

8.9 At-Risk for Elementary School Educators (Fig. 8.1)

At-Risk for Elementary School Educators is a virtual role-play simulation that builds awareness, knowledge, and skills about mental health and prepares teachers and school staff to lead real-life conversations with students, parents, and caregivers about any concerns that they have about students. The two conversations in the *At-Risk for Elementary School Educators* simulation are with Lucas, a third grader who you noticed has recently been very tired, withdrawn, and irritable in class, and Sandra, a caregiver of a fifth-grade student in your class that has become increasingly aggressive and disruptive in class. Goals for both conversations are to build rapport with the virtual human and bring up any concerns. The parent/caregiver

Fig. 8.1 *At-Risk for Elementary School Educators* simulation screenshot with a virtual educator speaking to their student Derrick

conversation encourages you to share information about what is going on at school and suggest resources that would be helpful to the caregiver and their child. A study conducted with 18,896 educators across 10 states who took the *At-Risk for Elementary School Educators* simulation shows that users were more confident and more prepared to identify warning signs in elementary school-aged children, have discussions with students to gather more information, and initiate discussions with parents of those students to encourage them to stay informed about mental health support services. Changes in student identification and approach rates increased by 36% and 16%. Educators also approached 70% more parents/caregivers to talk about their child. There were 72% more discussions about mental health support services available to a child exhibiting signs of psychological distress (Long et al., 2018). Figure 8.2 shows both behavioral and attitudinal changes previously discussed in this section. "Total Mental Health Skills" refer to the attitudinal constructs of preparedness and self-efficacy.

8.10 At-Risk for Middle School Educators (Fig. 8.3)

The conversations in *At-Risk for Middle School Educators* use similar conversation strategies; however, the stories behind these virtual students are relevant to preadolescents. Mariah, Jen, and Michael are all middle school students who are experiencing noticeable changes in demeanor, and your role is to build resilience, strengthen their relationships within the school community, and connect them with support services. Mariah, a new student at school, is being teased by a group of

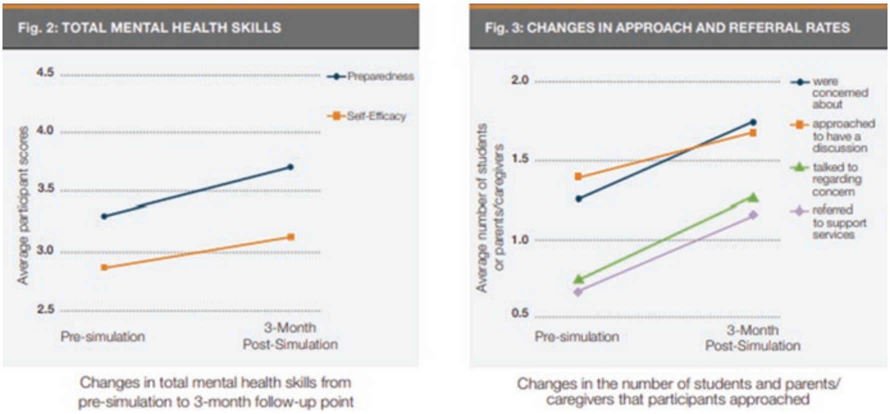

Fig. 8.2 Screenshot from Kognito data summary for *At-Risk for Elementary School Educators*

Fig. 8.3 *At-Risk for Middle School Educators* simulation screenshot of a virtual educator talking with his student Jen

popular girls and has become withdrawn in class. Jen is a part of the group of eighth graders that could be bullying Mariah, and you're tasked with implementing effective techniques for broaching sensitive topics about school bullying and cyberbullying. Michael has been writing concerning entries in his class journal about a sick family member, and you practice approaching Michael, asking about thoughts of suicide and discussing a referral. A study that included 12,535 middle school educators across 34 states showed significant increases in gatekeeping attitudes, including preparedness and self-efficacy to recognize signs of distress and talk about those signs with at-risk students (Timmons-Mitchell et al., 2019). There was a 34% increase in identification, a 66% increase in conversations with students, and a 30%

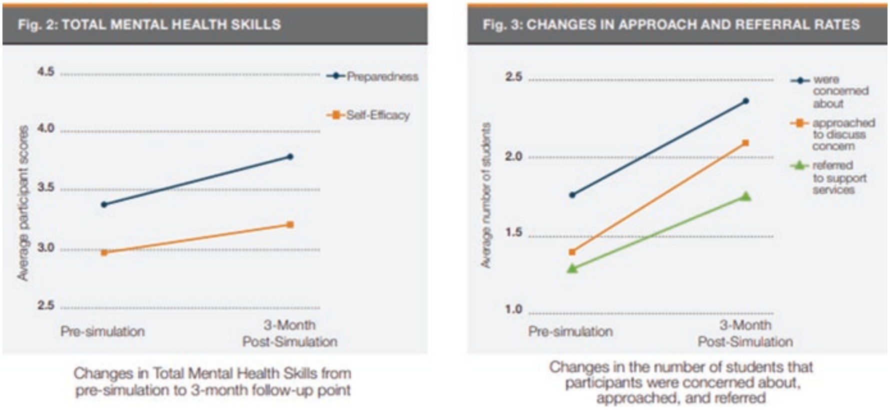

Fig. 8.4 Screenshot from Kognito data summary for *At-Risk for Middle School Educators*

increase in students who were referred to additional support. See below for the attitudinal and behavioral results for *At-Risk for Middle School Educators*. The results reflected in Fig. 8.4 are similar to those seen in the *At-Risk for High School Educators* simulation. For exact percentages reference the section titled *At-Risk for High School Educators*.

8.11 At-Risk for High School Educators (Fig. 8.5)

At-Risk for High School Educators also includes three conversations that have similar goals as the *At-Risk for Middle School Educators* simulation, which are building resiliency, strengthening relationships, and connecting at-risk students with support. The first conversation is with Rene, a senior that is showing signs of anxiety and self-harm. The second is with Joey, a freshman that lost his father and is showing signs of depression and suicidal ideation. The final conversation is with Rob, a junior with low grades, poor attendance, and disciplinary issues. Throughout these conversations you are tasked with broaching sensitive topics with the help of motivational interviewing tactics and ultimately establishing rapport with the virtual students so they can receive the support that they need. Another study that included 23,132 high school teachers and personnel across 43 states similarly showed that, after completing this simulation, there were significant increases in how prepared and self-confident users felt they were to identify warning signs of distress in students, begin a conversation about their concerns, and build enough of a relationship to suggest a referral to support services. In this study there was a 23% increase in identification, a 27% increase in conversations with students, and a 16% increase in students who were referred to additional support (Albright et al., 2019).

Fig. 8.5 At-Risk for High School Educators simulation screenshot of a virtual educator talking to his student Joey

8.12 Conclusion

Young people are our future. Many people decide to enter the teaching profession in the hopes of inspiring young people, supporting the future of our communities and the future of this planet. It is not just the philanthropists or public servants who can make change. If it were not for teachers, we would not have researchers, scientists, lawyers, medical professionals, or economists. We wouldn't have the courage to speak up, nor would we have the curiosity to ask why. We would not have the tenacity to say "there is a better way" or be daring enough to disagree. It is because of teachers that children become inspired, and it is because of the sacrifices that teachers make for their students that each generation is able to blossom. Our childhood teachers taught us to be inquisitive and showed us how much each of us has to offer. If it weren't for my sixth grade homeroom teacher, Mr. Edelman, who showed me how to persevere and told me that it was okay to make mistakes and try as many times as I needed to, I wouldn't be writing this sentence in this book. We owe it to our educators and to our youth to support them in any way we can, including addressing mental health stigma, mental health culture in our schools, and providing resources to support positive health behaviors.

References

Albright, G., Adam, C., Serri, D., Bleeker, S., & Goldman, R. (2016). Harnessing the power of conversations with virtual humans to change health behaviors. *Mhealth, 2*, 44.

Albright, G., Fazel, M., McMillan, J., Shockley, K., Khalid, N., & Joshi, S. (2019). *The impact of a brief online professional development program for high school educators to address social, emotional and behavioral concerns in the school setting*. Manuscript submitted for publication.

American Federation of Teachers. (2017). *2017 educator quality of life survey*. https://www.aft.org/2017-educator-quality-life-survey

Biswas, J., Gangadhar, B. N., & Keshavan, M. (2016). Cross cultural variations in psychiatrists' perception of mental illness: A tool for teaching culture in psychiatry. *Asian Journal of Psychiatry, 23*, 1–7.

Centers for Disease Control and Prevention. (2019). Whole School, Whole Community, Whole Child (WSCC). https://www.cdc.gov/healthyschools/wscc/index.htm

Cree, R. A., Bitsko, R. H., Robinson, L. R., Holbrook, J. R., Danielson, M. L., Smith, D. S., … Peacock, G. (2018). Health care, family, and community factors associated with mental, behavioral, and developmental disorders and poverty among children aged 2–8 years — United States, 2016. *MMWR, 67*(5), 1377–1383.

Danielson, M. L., Bitsko, R. H., Ghandour, R. M., Holbrook, J. R., & Blumberg, S. J. (2018). Prevalence of parent-reported ADHD diagnosis and associated treatment among U.S. children and adolescents, 2016. *Journal of Clinical Child and Adolescent Psychology, 47*(2), 199–212.

Elliot, K. W., Elliot, J. K., & Spears, S. G. (2018). *Teaching on empty: As more students suffer from trauma, compassion fatigue is becoming a problem for teachers and administrators alike.* National Association of Elementary School Principals: NAESP.

Ghandour, R. M., Sherma, N. L. J., Vladutiu, C. J., Ali, M. M., Lynch, S. E., Bitsko, R. H., & Blumberg, S. J. (2018). Prevalence and treatment of depression, anxiety, and conduct problems in U.S. children. *The Journal of Pediatrics, 206*, 256–267.e3.

Gopalkrishnan, N. (2018). Cultural diversity and mental health: Considerations for policy and practice. *Frontiers in Public Health, 6*, 179.

Litvinov, A., & Flannery, M. E. (2017). *Poverty and school funding: Why low-income students often suffer.* https://www.theedadvocate.org/poverty-and-school-funding-why-low-income-students-often-suffer/

Long, M. W., Albright, G., McMillan, J., Shockley, K. M., & Price, O. A. (2018). Enhancing educator engagement in school mental health care through digital simulation professional development. *Journal of School Health, 88*(9), 651–659.

International Board of Credentialing and Continuing Education Standards. (2019). *Record Teacher Turnover Tied to Lack of Mental Health Training*. https://ibcces.org/blog/2019/03/27/teacher-turnover-lack-mental-health-training/

McFarland, J., Hussar, B., Zhang, J., Wang, X., Wang, K., Hein, S., ... & Barmer, A. (2019). The Condition of Education 2019. NCES 2019–144. National Center for Education Statistics.

Merikangas, K. R., He, J. P., Burstein, M., Swanson, S. A., Avenevoli, S., Cui, L., ... & Swendsen, J. (2010). Lifetime prevalence of mental disorders in US adolescents: results from the National Comorbidity Survey Replication–Adolescent Supplement (NCS-A). *Journal of the American Academy of Child & Adolescent Psychiatry, 49*(10), 980–989.

Pane, N. (2018). The rate of high school-aged youth considering and committing suicide continues to rise, particularly among female students. Child Trends. https://www.childtrends.org/blog/high-school-aged-youth-considering-and-committing-suicide-among-female-students

Timmons-Mitchell, J., Albright, G., McMillan, J., Shockley, K., & Cho, S. (2019). Virtual role-play: Middle school educators addressing student mental health. *Health, Behavior and Policy Review., 6*(6), 546–557. https://doi.org/10.14485/HBPR.6.6.1

Townsend, L., Musci, R., Stuart, E., Ruble, A., Beaudry, M. B., Schweizer, B., … Wilcox, H. (2017). The association of school climate, depression literacy, and mental health stigma among high school students. *Journal of School Health, 87*(8), 567–574.

United Nations. (2020). Policy Brief: Education during COVID-19 and beyond. http://www.un.org/development/desa/dspd/wp-content/uploads/sites/22/2020/08/sg_policy_brief_covid-19_and_education_august_2020.pdf

U.S. Department of Education, National Center for Education Statistics. (2014). *Teacher attrition and mobility: Results from the 2012–13 teacher follow-up survey* (NCES 2014–077).

Chapter 9
Trauma-Informed Practices for K12 Schools

Nikita Khalid and Glenn Albright

9.1 Introduction

In August 2017, Hurricane Harvey devastated the Houston area just as schools were starting back. Anticipating the needs of schools to support over 250,000 children affected by the storm, Mental Health of America of Greater Houston and UNICEF USA worked with Kognito to create a simulation entitled *Trauma-Informed Practices for K12 Schools* to introduce the concepts of trauma-informed practice to help educators build the skills to support students affected by trauma and other acute or chronic adverse experiences.

This training could not have come at a better time, for across the globe, young people are experiencing extremely challenging situations. Some students grow up facing violence, abuse, or neglect at home; others struggle in the wake of natural disasters, war, famine, loss of a loved one and poverty (Chen, Cohen, & Miller, 2010; U.S. Administration for Children, & Families, Child Maltreatment, 2014). In many ways the COVID-19 pandemic mirrors a natural disaster, as students face unprecedented obstacles such as higher instances of physical and mental abuse, neglect, grief, loss and social isolation, all of which can affect mental health (Aber et al., 2011; Copeland et al., 2007; Cullen et al., 2020; Miller, 2020; Reger et al., 2020; Salerno et al., 2020). Additionally, as the pandemic disproportionately affects black and brown communities and those with low socioeconomic status, it is clear

N. Khalid (✉)
The Graduate Center, City University of New York, New York, NY, USA

G. Albright
Department of Psychology, Baruch College, City University of New York, New York, NY, USA
e-mail: Glenn.Albright@baruch.cuny.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_9

that the impact extends across education and health disparities (Chappell, 2020; Dunn et al., 2020; Phelps & Sperry, 2020). The list can seem endless and, for our students, may lead to a long-term impact on their cognitive abilities, emotional processing, and physical health. Thus, a student who is in distress or has been traumatized can easily feel overwhelmed, unable to cope, unsafe, and will not thrive in a classroom environment, virtual or in-person.

The statistics from both natural disasters like Hurricane Harvey and human-made disasters such as school shootings, child abuse, sexual assault, violence within the household, loss due to death, or witnessing a traumatic event are numbing. According to the 2016 National Survey of Children's Health, nearly 35 million children and teens in the United States have experienced at least one type of serious childhood trauma (Carroll, 2015; Sack & Murphey, 2018). According to the CDC (2019), up to two-thirds of US children have experienced at least one type of serious childhood trauma, such as abuse, neglect, natural disaster, or experiencing or witnessing violence. These statistics are undoubtedly higher due to COVID-19. Trauma is possibly the largest public health issue facing our children today. Childhood and adolescent psychological trauma, including those who have high adverse childhood experience scores, often have profound long-term consequences on psychological and physical well-being, including neurophysiological brain development (McEwen, 2008; Shonkoff et al., 2012). We know that early detection and intervention of trauma increases the likelihood of recovery; thus, K12 educators and staff are well-positioned to become effective gatekeepers by implementing trauma-informed practices in their teaching.

In an effort to support educators and school personnel and address their need to be better informed in trauma-informed teaching practices, Kognito developed the *Trauma-Informed Practices for K12 Schools* simulation. The process of creating the simulation involves a multi-disciplinary mode, also developed by Kognito (Albright et al., 2016) and includes the following:

Phase One: Design: This design phase begins with a comprehensive needs and user analysis. This interactive process draws upon secondary research from journals, interviews with nationally renowned subject-matter experts (SMEs), and end-user focus groups to develop a blueprint for the simulation. The key deliverables include the instructional design plan, simulation design document, content analysis, behavior change model that includes the integration of evidenced communication strategies mentioned in a previous chapter, virtual human profile(s), and user stories.

Phase Two: Development: This phase includes scripting of all simulation content, narration by professional voice actors, creating 3-D virtual humans to operate in dynamic and life-like virtual environments, and design and testing of simulation analytics. Throughout this iterative phase, Kognito collaborates with SMEs and conducts focus groups to ensure authenticity and accuracy of the learning experience. At the end of development, beta testing with SMEs and end-users allows for any final refinements.

Phase Three: Analytics: Tracking and analytics are integrated into the simulation engine, which allows for the utilization of a variety of data sets to assess learner outcomes. These include users' actual decisions/behavior in the simulation as well as their self-reported data. The simulation is connected to an online data portal that provides clients and research partners with access to real-time usage tracking, a series of dashboards and analytics to gain insights into behavior change, and direct access to the actual data for analysis.

Phase Four: Delivery: Phase four includes making the simulation available to users and providing users' organizations with ongoing technical assistance, maintenance, roll-out support, and implementation strategies. The simulation can be delivered via Kognito's Learning Management System or integrated with the organization's own system or website.

9.2 Background to the Learning Experience

Statistically speaking, there is probably at least one student in every classroom who has been traumatized. Their experiences drive the way they act and making *small* adjustments involving the classroom, school cafeteria, gym, and playground, etc., can make a *big* difference for them.

In the simulation, the learner hears about a student named Casey who liked being the center of attention in class. One time he was asked to stop talking while the teacher was in the middle of a lesson, and he pushed over a desk and yelled, "this class is total BS!" and then stormed out of the room. The whole class was stunned, and no one could focus afterward.

Now take a second and ask yourself:

- How would you react if this happened in your classroom?
- How would you explain Casey's actions?
- What would you want to say to a student?

Understandably, many educators would take this personally, get upset, maybe lose their cool, yell, and seek disciplinary measures. However, by shifting to a trauma-informed approach (Walkley & Cox, 2013), which can be very challenging, one has an opportunity to retrain themselves to see students differently. Of course, not all disruptive behavior in the classroom is due to distress or trauma, but instead of seeing this as something that needs to be managed and discouraged, it might be a sign of distress or trauma and an opportunity to approach the student using trauma-informed communication strategies. For Casey, it turns out his dad drank a lot of alcohol and Casey never knew what to expect. His father could fly into a rage at any moment—throwing things, breaking furniture, and screaming at him and his mom. When his dad was calm, any little thing could set him off, so Casey lived in constant fear and was always hypervigilant. People at school who were trying to help Casey through the years focused on his challenges around paying attention in class, but they missed the root cause of these behaviors—his chaotic home life. Thus, Casey felt like no one was trying to help, no one could figure him out, and he was on his own. His feelings of fear, anger, despair, and powerlessness over his situation changed the way he viewed and responded to the people around him. Giving students like Casey detentions or low grades doesn't make them feel safer or less overwhelmed, so it doesn't change their behavior in the classroom. However, recognizing Casey's disruptive behavior and that wanting attention was a cry for help makes it easier not to take a student's behavior personally and provides an opportunity to help him.

Students like Casey and others can show signs of distress and trauma in a number of different ways depending on whether the student is in elementary, middle, or high school. A comprehensive list of what you might observe in students who have been traumatized, as well as trauma facts and suggestions for educators can be found on the National Child Traumatic Stress Network (2008). Specifically, the simulation overviews:

- Inattention, social withdrawal, extreme fatigue, distractibility, hyperactivity, aggression, being prone to angry outbursts, general disengagement, headaches, and stomach cramps.
- Gender differences that involve boys being more likely to externalize their emotions or act out whereas girls are more likely to internalize their emotions or withdraw.
- Age differences that result in younger students usually showing how they are feeling more, whereas older students often don't want to be noticed or seen as "weak" and hide how they are feeling more; they can also cope with distress by doing dangerous things like driving too fast, using drugs, or getting into fights.

Not all students who exhibit these warning signs have experienced trauma and not all students who have experienced trauma will exhibit warning signs. No one expects teachers to diagnose students, but if you are an educator, staff member or administrator who aims to be trauma-informed, you can start by recognizing the warning signs, reaching out to struggling students to let them know you care, and helping them find more constructive ways to cope and succeed in case they actually *do* need support. So, if one notices that a student regularly seems anxious, depressed, socially isolated, or agitated, or observes indicators that they might be engaging in risky behavior, in addition to approaching them with compassion, one should strongly consider referring them to a mental health professional in the school or community. The interactive role-play simulation provides practice in managing such conversations.

9.3 Adverse Childhood Experiences

In a previous chapter, we reviewed what adverse childhood experiences (ACEs) are, their impact, and how parents of young children and early childhood educators can prevent ACEs when they are correcting children's misbehaviors.

Since it's important, let's briefly review. Some ACEs are single events–like a natural disaster, a violent attack, or the death of a loved one. Others, like abuse in the home, may be ongoing. Some of our students experience a mix of one-time and ongoing ACEs. No matter the specifics, all ACEs can significantly impact a child's ability to learn. Think about if any students you know might have experienced ACEs as you look at this list:

Lived with a parent or guardian who:

1. Got divorced or separated
2. Served time in jail or prison
3. Was mentally ill, attempted suicide, or was depressed
4. Behaved violently
5. Had a problem with alcohol or drugs

Have experienced:

6. A parent or other adult in the household often pushing, grabbing, slapping or throwing something at them, or ever hit so hard that it left marks or resulted in an injury
7. Not having enough to eat, having to wear dirty clothes, and/or no one to protect them
8. No one in the family loved them or thought they were important or special
9. An adult touching or fondling them in a sexual way

About three in every five children in the United States experience one ACE by the time they turn 18 and as many as one in three children experience *two or more* ACEs before the age of 18 (Bethell et al., 2017; Sack & Murphey, 2018). We now know that students from under-resourced communities are even more likely to experience multiple ACEs but, in general, ACEs can happen to students of all backgrounds, of all ages, and from all parts of the world with significant consequences on physical and mental health as described in a previous chapter.

Students can also experience distress or trauma which is a community-wide incident like a violent attack, hurricane (like Hurricane Harvey), earthquake, suicide, death of an important community member, and especially now, instances of prolonged trauma due to COVID-19. Many students will be affected and some will need long-term attention and support to recover. It's important to support each other after events like these and, thankfully, school can actually be a source of strength for students whose lives have been disrupted.

9.4 Trauma and Learning

A person's brain is in learning mode when they feel safe. They can predict what will happen in their environment and they have all their basic needs met. All of this really helps them to recognize and control their emotions and focus on learning. But when a person, especially a child, has experiences of an unsafe environment or intense danger, their brains are rewired to always be on guard for *more* harm or neglect. This ongoing vigilance makes the world (and school) feel unsafe and non-nurturing. In other words, it can be a *terrifying* place. Thus, when a child feels threatened or overwhelmed, or when something reminds them of a traumatic event, their brains quickly go into a reactive mode (Herman, 2015). Their body is getting ready to respond in one of three ways: fight, flee, or freeze. Fighting means becoming physically or verbally hostile, like Casey, or maybe becoming the school bully. Fleeing can mean getting out of a physical or social situation, or avoiding it in the first place (again, like Casey). Freezing means becoming silent, unresponsive, or in a daze. Our brains have these evolutionarily driven instincts for a reason; they're a good way to respond to real danger, but are not practical in the K12 learning environment.

Because it is a quick, almost reflexive response, a student might not even realize what's happening or why they are fighting, fleeing, or freezing. So, it's important to try not to take those behaviors too personally, such as when a student refuses to do any work, won't stop talking to a friend, insults you or a classmate, makes fun of something you said, won't lift their head off the desk or even spits on your shoe, etc. This can be hard and requires one to step back, evaluate the situation, and if it's an opportunity to engage in trauma-informed teaching practices, be understanding, show compassion, and follow-up on an invitation to talk in a safe space. The word "safe" cannot be over-emphasized, for if the student feels judged, threatened with discipline, or not accepted, they might very well be triggered to activate the primitive and non-effective defenses they have relied upon in their past for their survival. Students must feel safe and supported before you can help them. One last thing, implementing trauma-informed practices does not mean changing the feelings that come up in dealing with difficult situations in the classroom. Instead, observe those feelings (such as anger, frustration, hopelessness, etc.), and at the same time, engage in trauma-informed practices. This will take practice, which is exactly what the role-play simulation will provide.

9.5 Teacher Burnout

The impact of distressed or traumatized students on teachers can be profound for there is only so much that teachers can do to keep themselves afloat. Teachers are struggling to balance overwhelming workloads and often do not feel that they are active participants in professional decisions that impact their daily lives. Unaddressed educator mental health isn't just a major public health concern for our teachers – it can also impact the quality of education that students receive from their teachers.

The National Commission on Teaching & America's Future found that high teacher turnover costs US schools about $7.3 billion in losses annually (Carroll, 2015). Teacher turnover also tends to be higher in low-income neighborhoods, which already have limited resources due to poor funding and are more likely to have poorer academic performance that exacerbates issues such as generational poverty, which these communities are working so hard to resolve. Additionally, students in low-income neighborhoods have a variety of additional stressors that heavily influence mental health and student achievement (Evans & English, 2002; Morgan & Amerikaner, 2018; Ringel & Sturm, 2001).

Since teachers are already pushed to their limit, asking them to learn how to use trauma-informed practices in the classroom seems like adding another onerous layer of responsibility to what is already a job that is difficult to manage. Although teachers are not solely responsible for the mental health of their students, they are an important part of students' developmental years and can advocate for both emotional and academic student success. Teachers can and are an important part of mental health advocacy, just as parents, school counselors, the school administration, and the local community are. And, once learned, employing trauma-informed practices in the classroom provides the teacher with additional tools to help reduce the stress and frustration that comes with dealing with the consequences of distressed and traumatized students.

9.6 The Simulation

The learning objectives of *Trauma-Informed Practices for K12 Schools* include: (1) increasing knowledge and awareness about the types of experiences that can cause distress or trauma and how these relate to brain development, (2) recognizing when a student's behavior might be the result of trauma or distress, (3) talking with a student about how they might be feeling, (4) talking with a parent regarding your concern about their child, (5) problem-solving ways to adapt the classroom so that it can become a more comfortable place for students who have experienced trauma, (6) assessing the need for referral and motivating students to seek help when needed, and (7) considering educators' own needs for self-care.

The components of the *Trauma-Informed Practices for K12 Schools* simulation include:

1. Introduction: When users first enter the simulation, they meet their virtual coach, Jackie Torres, and begin to learn how to use trauma-informed practices to support their students. Ms. Torres provides an overview of conversation challenges: spotting warning signs, talking with a struggling student to improve their experience in class, and referring a student who is experiencing psychological distress or trauma.
2. Virtual role plays: The introduction is followed by three role-play challenges, one for either elementary, middle, or high school educators. These include conversations with:

    (a) Noah, who is a junior in high school. Recently his grades have dropped, and he has been getting into some heated exchanges with other students. Noah has been checking in frequently to see if his papers or tests have been graded and if he can do anything to bring up his grades. Lately, he's seemed really tired and has been falling asleep in class. During class, he has been biting his nails, sometimes so much that his fingers bleed. Noah's brother, who was a highly recognized star athlete in school who Noah idolized, became a marine and was killed in action overseas. The learner is tasked with building trust

Fig. 9.1 Role-play conversation with Noah

and encouraging him to share, brainstorming solutions to any problems he identifies, and determining if he needs a referral to the school counselor (see Fig. 9.1).

(b) Charlie, who is in the seventh grade, recently stopped participating in class discussions, sometimes not responding to her teacher or peers at all. Occasionally when called on, Charlie had no idea what the class had been discussing. She cried when asked about a recent drop in her participation grade and pleaded to be able to stay in "honors" the following year. There were multiple times when she was little that her dad abused the family dog and it is unclear if she may have been abused. Charlie got triggered when reading an assigned book about a dog that got hurt. Your first goal is to check in with Charlie. There's a lot you don't know, like why she's spacing out. The learner will need to build trust and encourage her to share by asking open-ended questions, expressing empathy, and making specific observations (see Fig. 9.2.)

(c) Lucas, a third-grader who seems tired and distracted, has been increasingly absent from school since a fire damaged his home and he has to live with extended family across town. Because of the loud noises in the house, he can't sleep, and it now takes 1½ h to get to and from school. The learner needs to talk with Lucas using open-ended questions and reflections to encourage him to open-up about his situation (see Fig. 9.3).

Fig. 9.2 Role-play conversation with Charlie

3. At the end of each conversation challenge, users view a Performance Dashboard which contains a detailed analysis of their performance and how well they did in achieving their goals.
4. Student self-regulation exercises, which include class activities that help students learn to better manage their feelings. This can include breathing and being still exercises, observing thoughts and feelings, etc.
5. Conclusion: The virtual coach explores ways to support students who are not exhibiting warning signs. She summarizes learning objectives and reiterates how using a trauma-informed approach can improve self-esteem, confidence, resilience, and achievement for students and the user themselves.
6. Customized html page that provides school-specific referral information and other relevant resources.

9.7 The Study

Method: A total of 773 participants from Texas completed one of three *Trauma-Informed Practices for K12 Schools* simulations that contained a role-play trauma conversation for either an elementary, middle, or high school educator. To review the learning experience, participants role-played with emotionally responsive

Fig. 9.3 Role-play conversation with Lucas

virtual students that have memory and personality and react like real students who are experiencing psychological distress or trauma. It is by practicing these role-plays, and receiving ongoing feedback from the virtual coach, that participants learn how to use evidenced-based communications strategies such as motivational interviewing to approach, talk to and, if necessary, refer a student who is in distress or has been traumatized. All participants completed a pre-survey (baseline), then the simulation followed by a post-survey, and 2 months later, a follow-up survey.

9.8 Results

9.8.1 Demographics

- 80% of participants were female, 19% male and 1% other.
- Race/ethnicity data show that 47% were White, 28% Black, 3% American Indian, 1% Hawaiian/Pacific Islander, 5% Asian, and 15% Hispanic.
- Roles included 65% teachers, 4% administrators, 5% health/mental health specialists, 6% staff, 1% school resource officers, and 19% other.
- Average age was 45.

- Average years of experience in education was 14 years.
- 80% reported that they have a mental health professional at their school.
- 41% did not know whether that mental health professional was being adequately used.

9.8.2 Satisfaction

- 92% of participants rated the simulation good to excellent.
- 94% would recommend it to their colleagues.
- 95% said that the simulation had scenarios that were relevant to their daily interactions with students.

9.8.3 Knowledge and Ability

When comparing the pre-survey (baseline) to post-simulation survey responses, all items that measured knowledge and perceived ability significantly increased ($p < 0.01$) for educators and school personnel (see Fig. 9.4). This includes participants learning:

- How to recognize warning signs of psychological distress or trauma in students.
- Communication strategies to help a distressed student feel safe.
- How to talk with a distressed student about mental health support services (for middle and high school only).
- How to teach students activities to manage their stress and emotions.

Participants also reported a significant increase ($p < 0.01$) in understanding trauma-informed approaches in teaching.

Elementary educators reported significant increases ($p < 0.01$) in:

- Knowing communication strategies to use in discussions with parents.
- Ability to discuss concerns about a student's possible distress or trauma with their parents.
- Ability to inform parents about the availability of mental health support services for their child.
- Knowing where to take a student if they have been traumatized.

9.9 Beliefs Regarding Disruptive Students

An aspect of teaching that does not go unnoticed is the impact of students on their teachers. It can be difficult to teach students who act impulsively or are disruptive due to psychological distress or trauma. After taking the simulation, educators

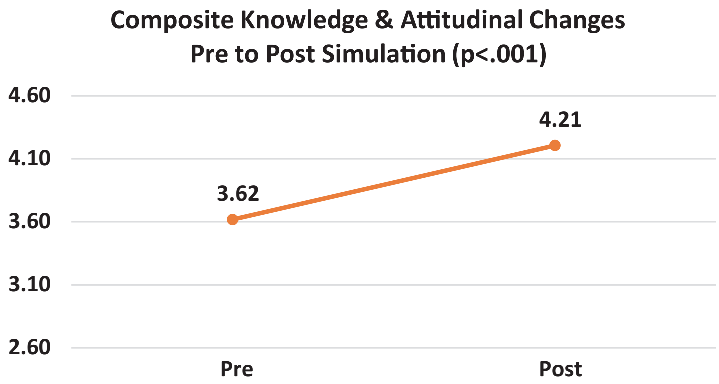

Fig. 9.4 Composite scores for the four knowledge and attitudinal changes as a result of the simulation. (Based on a five-point Likert scale)

showed significant increases ($p < 0.05$) in not taking it personally when a student makes a disparaging remark toward them. They also collectively decreased in their belief that students who disrupt their class do not care about learning. This type of attitude change is crucial for educators to better support students with mental illness or trauma as a way to step into their students' shoes, rather than instinctively reacting to correct disruptive behavior. It may also have an impact on teacher self-care, for they are not taking disruptive behavior as personally.

9.10 Impact on Behavior

Lastly, 2 months after completing the simulation, elementary, middle, and high school participants either agreed or strongly agreed that, as a result of the simulation, there have been increases in the number of:

- Students identified who might have been traumatized – 35%
- Students talked to regarding concerns that they may have been traumatized – 36%
- Students who were either referred or discussed a referral to support services – 30%
- Parents talked to regarding signs their child may have been traumatized (elementary educators only) – 25%
- Conversation with other teachers/staff about trauma-informed teaching – 46%

9.11 Discussion and Conclusion

The results show that the *Trauma-Informed Practices for K12 Schools* simulation had a positive impact on knowledge, and perceived ability to identify, talk to, and refer students who are experiencing distress or trauma. Additionally, there was an increased understanding of what trauma-informed practices are and how to implement them. Lastly, as a result of the simulation, participants reported increases in the number of students identified, talked to, and referred for the middle and high school settings and an increase in the number of parents talked to regarding concerns that their child is manifesting signs of distress or trauma.

The use of virtual human simulations to teach K12 educators, staff, and administrators to engage in trauma-informed practices holds tremendous potential in helping the significant number of students experiencing psychological distress or trauma. Recent advances in simulation and gaming technology offer unique advantages to the learner, many of which are discussed in previous chapters. It's important to reiterate that when learners role-play with virtual humans, they often report feeling less judged, safer, and more likely to be themselves, as opposed to face-to-face role-play conversations of a similar nature. Lastly, these types of online simulations also have the advantage of cost-effectively reaching geographically diverse populations in the privacy of their homes or offices 24/7.

To conclude, in this study, 46% of participants reported increases in conversations they had with other teachers/staff/administrators about trauma-informed teaching due to what they learned in the simulation. Therefore, as the number of K12 educators trained in trauma-informed practices increases, so will discussions with colleagues. This holds great promise for supporting public health initiatives aimed at shifting the mental health culture within schools, communities, and districts to increase support for recognizing, understanding, and referring students who are struggling with psychological distress, trauma, and other mental health issues.

References

Aber, L., Brown, J. L., Jones, S. M., Berg, J., & Torrente, C. (2011). School-based strategies to prevent violence, trauma, and psychopathology: The challenges of going to scale. *Development and Psychopathology, 23*, 411–421. https://doi.org/10.1017/S0954579411000149.

Albright, G., Adam, C., Serri, D., Bleeker, S., & Goldman, R. (2016). Harnessing the power of conversations with virtual humans to change health behaviors. *mHealth, 2*(11), 1–13. https://doi.org/10.21037/mhealth.2016.11.02

Bethell, C. D., Davis, M. B., Gombojav, N., Stumbo, S., & Powers, K. (2017). *Issue brief: Adverse childhood experiences among US children. Child and adolescent health measurement initiative*. Johns Hopkins Bloomberg School of Public Health.

Carroll, T. G. (2015). *National commission on teaching and America's future: The high cost of teacher turnover.* http://nieer.org/wp-content/uploads/2015/06/NCTAFCostofTeacherTurnoverpolicybrief.pdf

Centers of Disease Control and Prevention (CDC). (2019). *Adverse childhood experiences*. www.cdc.gov/violenceprevention/childabuseandneglect/acestudy/index.html

Chappell, B. (2020). Fauci says U.S. coronavirus deaths may be 'more like 60,000'; antibody tests on way. NPR. https://www.npr.org/2020/04/09/830664814/fauci-says-u-s-coronavirus-deaths-may-be-more-like-60-000-antibody-tests-on-way.

Chen, E., Cohen, S., & Miller, G. E. (2010). How low socioeconomic status affects 2-year hormonal trajectories in children. *Psychological Science, 21*(1), 31–37.

Copeland, W. E., Keeler, G., Angold, A., & Costello, E. J. (2007). Traumatic events and posttraumatic stress in childhood. *Archives of General Psychiatry, 64*, 577–584.

Cullen, W., Gulati, G., & Kelly, B. D. (2020). Mental health in the Covid-19 pandemic. *QJM: An International Journal of Medicine, 113*(5), 311-312.

Dunn, C. G., Kenney, E., Fleischhacker, S. E., & Bleich, S. N. (2020). Feeding low-income children during the Covid-19 pandemic. *New England Journal of Medicine, 382*(18), e40.

Evans, G. W., & English, K. (2002). The environment of poverty: Multiple stressor exposure, psychophysiological stress, and socioemotional adjustment. *Child Development, 73*(4), 1238–1248.

Herman, J. L. (2015). *Trauma and recovery: The aftermath of violence–from domestic abuse to political terror*. London, UK: Hachette UK.

McEwen, B. S. (2008). Central effects of stress hormones in health and disease: Understanding the protective and damaging effects of stress and stress mediators. *European Journal of Pharmacology, 583*(2), 174–185.

Miller, E. D. (2020). The COVID-19 Pandemic Crisis: The Loss and Trauma Event of Our Time. *Journal of Loss and Trauma*, 1–13.

Morgan, I., & Amerikaner, A. (2018). *Funding gaps 2018.* https://edtrust.org/resource/funding-gaps-2018/

National Child Traumatic Stress Network (NCTSN). (2008). *Child trauma toolkit for educators*. https://wmich.edu/sites/default/files/attachments/u57/2013/child-trauma-toolkit.pdf

Phelps, C., & Sperry, L. L. (2020). Children and the COVID-19 pandemic. *Psychological Trauma: Theory, Research, Practice, and Policy, 12*(S1), S73–S75. http://dx.doi.org/10.1037/tra0000861

Reger, M. A., Stanley, I. H., & Joiner, T. E. (2020). Suicide mortality and coronavirus disease 2019—A perfect storm? JAMA Psychiatry, E1–E2. https://doi.org/10.1001/jamapsychiatry.2020.1060

Ringel, J. S., & Sturm, R. (2001). National estimates of mental health utilization and expenditures for children in 1998. *Journal of Behavioral Health Services & Research, 28*(3), 319–333.

Sack, V., & Murphey, D. (2018). The prevalence of adverse childhood experiences, nationally, by state, and by race or ethnicity. *Child trends*. https://www.childtrends.org/publications/prevalence-adverse-childhood-experiences-nationally-state-race-ethnicity

Salerno, J. P., Williams, N. D., & Gattamorta, K. A. (2020). LGBTQ populations: Psychologically vulnerable communities in the COVID-19 pandemic. Psychological Trauma: Theory, Research, Practice, and Policy.

Shonkoff, J. P., Garner, A. S., Siegel, B. S., Dobbins, M. I., Earls, M. F., McGuinn, L., … Wood, D. L. (2012). The lifelong effects of early childhood adversity and toxic stress. *Pediatrics, 129*(1), e232–e246.

U.S. Administration for Children & Families, Child Maltreatment. (2014). https://www.acf.hhs.gov/cb/resource/child-maltreatment-2014

Walkley, M., & Cox, T. L. (2013). Building trauma-informed schools and communities. *Children & Schools, 35*(2), 123–126. Retrieved from https://www.researchgate.net/publication/270531435_Building_Trauma-Informed_Schools_and_Communities

Chapter 10
Virtual Reality to Train Preservice Teachers

Richard Lamb and Elisabeth Etopio

10.1 Introduction

With the rapid pace and increased expectations for learning, students can ill afford ineffective teachers. Beginning teachers are faced with many challenges; in addition to understanding content and effective instructional practices, teachers are called upon to create learning environments for all children, including those from populations with diverse backgrounds that differ from the teachers' (Howard, 2016). Many preservice teachers, including those in this study, have identified that they do not have sufficient training or experience in working with children from varied backgrounds (Kokkinos, Stavropoulos, & Davazoglou, 2016). Now, more than ever, there is need to have highly prepared educators who can step into complex teaching environments, such as those in the urban setting, and be prepared to teach content in ways that meet the needs of students.

One possible solution to assist better preparation of educators amidst these challenges is to provide experiences in a soft-failure environment. One example of a soft-failure environment that has risen in prominence is virtual reality. In this study, we explored if virtual reality is a tool that can bring preservice teachers to higher skill levels before entering the classroom. Since the early millennium, there has been increased attention placed on modes of instruction that can supply greater realism and immersion. The perceived immersion allows researchers to begin to address the need and affordance of immersive experiences afforded by virtual reality (VR) in preservice teacher's construction of understanding. VR also provides learners greater control of their learning process (Annetta et al., 2014). For this research, a

R. Lamb
Neurocognition Science Laboratory, East Carolina University, Greenville, NC, USA
e-mail: lambr19@ecu.edu

E. Etopio (✉)
University at Buffalo, The State University of New York, Buffalo, NY, USA

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_10

VR environment was designed for the preservice educator that complements real-life experiences and authentic tasks in the classroom.

VR is thought to have considerable potential for pedagogical applications and teacher preparations in teacher education (Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2017), as several studies have probed its effects on practice and skills training in several fields: (a) vocational education (Hu, 2020), (b) trauma mitigation (Loucks, et al., 2019), (c) medical education (de Faria, Teixeira, de Moura Sousa Júnior, Otoch, & Figueiredo, 2016), (d) counseling and clinical social work education (Haniff, Chamberlain, Moody, & De Freitas, 2014), and (e) social studies education (Kandalaft, Didehbani, Krawczyk, Allen, & Chapman, 2013). The results of these studies mostly focus on VR as a skills trainer (Sugand, Akhtar, Khatri, Cobb, & Gupte, 2015). The results of these studies indicated improvement in skill use and applications. More importantly this study may assist in the identification of future directions for VR use and ways to improve VR for use in the classroom.

Virtual reality (VR), as it is used in this context, is understood as the use of three-dimensional graphic systems in combination with various interactive interfaces to provide the effect of immersion and interaction (Lamb et al., 2019; Lamb, Lin, & Firestone, 2020; Lamb, Etopio, & Lamb, 2019). VR in terms of what the authors are discussing is not three-dimensional models on a flat computer screen. These environments are often tremendously limiting, and immersion is broken as soon as the user looks away. In addition, within these environments it is very difficult to make use of tools, such as proximity, due to the inability of the preservice teacher to "walk" into the screen. Within the VR context, there are two forms of immersion that need consideration: the first is mental immersion and the second is sensory immersion (Lamb, 2013; Lamb & Annetta, 2014; Lamb et al., 2018). The two types of immersion are an important part in creating a successful experience within VR. Within the VR environment when the user moves, the visual, auditory, or haptic devices related to immersions must responsively and in an interpretable way change in response to the use movements (Ferreira & Mavroidis, 2006). This is particularly important in the context of VR teacher education.

On the other hand, mental immersion refers to the "state of being deeply engaged" within a VR environment (Calleja, 2014). For example, if a VR world is designed for educational use in teacher development, the success in mental immersion is based on how involved the user becomes as a part of the classroom environment and what skills and content the environment is designed to teach (Santos et al., 2014).

A second important feature of VR that separates it from other educational technologies is the real-time interactivity in stereoscopic three-dimensional environments. That is, a virtual reality system is able to interpret gestures and respond to the new activity with relatively little lag in environmental changes, resulting in a more authentic and real-world-like immersion. Interactivity and VR's ability to respond promotes sensation of immersion by responding to user intentions with actions on the screen. This allows users to not only visually interact with objects but to manipulate graphic objects on the screen; i.e., they touch and feel the objects using auditory, haptic, and tactile inputs (Klatzky, Giudice, Bennett, & Loomis, 2014).

Lamb et al., 2014; Lamb & Premo, 2015 has posited that technologies have intrinsic properties that activate cognitive attributes that help learners to engage in meaningful learning and problem-solving. In short, VR technology is well suited to convey difficult abstract concepts, practice skills, and interact in complex environments due to the visualization, fluidity, interactivity, and immersion of the environment (Psotka, 2013). When educators design an environment for delivery of complex concepts, it is necessary to ensure the presence of the three features of interaction, immersion, and authenticity, in the learning environment.

10.2 Purpose, Research Question, and Hypothesis

The purpose of this study is to investigate, compare, and characterize interactive VR-based preservice teacher clinical teaching environments with those of real-life teaching environments. The authors suggest that properly crafted VR clinical environments will not differ across multiple measures to include localized hemodynamic responses and neurocognitive processing. Hemodynamic response is the measure of the ratio of oxygenated and deoxygenated blood as it moves to areas of the brain engaged when executing tasks. These measures will provide means to understand if cognitive processing and psychophysiological responses, i.e., sensory and psychological immersion, are significantly different between real-world environments and sufficiently authentic VR environments. Identification of differences or lack of differences will provide the basis and evidence for increased use of VR environments and associated pedagogical approaches in preservice teacher education programs. Outcomes also will provide evidence for potential transferability of skills between VR and real-classroom approaches. The research questions addressed in this study are as follows: *Research Question 1*: Are responses related to each condition, i.e., real-life and VR different in means to hemodynamic response and neurocognitive processing when compared between each condition and to baseline activations for each individual preservice teacher? *Research Question 2*: Do levels of immersion both psychological and sensory as measured through psychophysiological data and retrospective survey differ between VR and field experiences in student teaching?

10.3 Methods

10.3.1 Procedure, Unit of Analysis, and Sample

Fifty-four healthy, right-handed college-aged students, 13 males and 41 females, provided informed consent prior to participation in the study. Students were randomly assigned to either a real-life classroom or VR classroom condition. Written lesson plans with objects were submitted to the research staff in cooperation with the Teacher Education Institute at the university.

10.3.2 Conditions

Each condition, VR classroom and real-life classroom, made use of the same teaching scenarios and lasted approximately 3 h. Classroom conditions were similar because the VR scenarios were recorded from preservice teacher's field experiences. The classroom teaching consisted of topics related to energy and matter and aligned with the scope and sequence of the state curriculum. The mean age of the preservice teachers was 25.76. Each of the preservice participants was currently on level related to mathematics and reading. The researchers pre-screened participants in mathematics and reading using the Woodcock-Johnson IV Achievement Test in the areas of Delayed Memory for Names, Memory for Sentences, Visual Closure, Calculation, Applied Problem Solving, and Quantitative Concepts (Schrank, Mather, & McGrew, 2014). Participants were identified as neurotypical through extensive interviews and review of histories as suggested in the Compendium of Neuropsychological Tests (Strauss, Sherman, & Spreen, 2006). This was done in an effort to ensure consistency of participants. Real-life classroom participants were fitted with various ambulatory noninvasive psychophysiological measures sensors under their clothing, i.e., pulse, respiration, eye tracking, and galvanic skin response in addition to neuroimaging via a small functional near-infrared spectrometer (fNIRS) band placed on their head. VR classroom participants were fitted with the same measures while wearing virtual reality headset. Due to the nature of fNIRS, the virtual reality headset did not interfere with reading from the fNIRS.

10.3.3 Measures of Cognitive Dynamics Functional Near-Infrared Spectroscopy (fNIRS)

The continuous-wave fNIRS device was connected to a sensor pad with 4 infrared light sources and 16 detectors, optodes, designed to sample prefrontal cortical areas that underlay the forehead. Signal processing and data preparation for statistical analysis was accomplished using the fNIRS Soft Professional version. fNIRS, video, and blood volume data acquisition and synchronization occurred using a MP150 data acquisition device synchronized to mark the beginning of baseline I (null conditions), the start and end of each of the problems (stimulus), and the post-assessment baseline II (null condition). The stimulus was presented as a block to each participant. This approach replicated an A-B-A (baseline I, stimulus, and baseline II) design and allowed each participant to act as an internal control condition. Video analysis was conducted, post hoc, to verify synchronization and to ensure correct marker placement. Analysis of optode sensor reading measurements occurred using repeated measures ANOVA. Hemodynamic responses were measured as a whole, and localization of hemodynamic activation was assessed only as a means to show parity between conditions. Pulse, respiration, and galvanic skin response, in addition to retrospective survey analysis, was used to examine immersion of the participants in each condition. The temporal resolution helped to obtain valuable continuous information on the fluctuations and disruptions in cognitive processing and localization of oxygenated hemoglobin increases (fNIRS) in the brain due to task engagement, i.e., working with students (e.g., Klimesch, 2012). The fNIRS method examined the temporal changes in hemoglobin oxygenation that reflect increased mental activity in the frontal lobe.

10.3.4 Autonomic Nervous System Measures

Measures of heart rate variable (HRV) were obtained under each of the two conditions, real-life and virtual reality. The researchers made use of an Empatica E4 Wrist sensor. GSR and HRV provide evidence of autonomic nervous system stress responses and provide evidence of attention and engagement (Thayer, Åhs, Fredrikson, Sollers, & Wager, 2012; van der Zwan, de Vente, Huizink, Bögels, & de Bruin, 2015). Global signal changes were removed using propositional scaling (Critchley, Elliott, Mathias, & Dolan, 2000). Eye tracking occurred using a SensoMotoric Instrument (SMI) Scene Eye Tracker to examine fixation duration and fixations per area of interest. In addition to fixations, saccades were examined. Saccades are the eye movements occurring between fixations when a particular area of interest is brought into the shaper central area of vision (Kovesdi & Barton, 2013). During saccades, no cognitive processing takes place, meaning nothing is actively addressed. Saccades provide the extent of coverage (i.e., amplitude) and rate (i.e., velocity) and allow for examination of the complexity of a visual stimulus (Jacob & Karn, 2003; Kovesdi & Barton, 2013). Combining saccades and fixations is a meaningful way to understand what particular visual regions receive the most attention within a visual environment such as a classroom (Goldberg & Kotval, 1999).

10.3.5 Paper Measures

In addition to the physiological measures, the participants completed a 5-point Likert-type scale: *Virtual Reality Classroom Environment Questionnaire* (internal consistency reliability = 0.84). *Strongly Agree* was rated at 5 and *Definitely Disagree* was rated at 1. Lower scores equated to less perceived realism and interaction in the VR and real-life classroom scenarios. In addition to the Likert-type scale responses, the participants commented on “unique experiences or things” related to the sessions. Preservice teachers were assessed using the Student Teacher Assessment Record (STAR, 2015), an internal university assessment rubric. A university clinical supervisor completed a rubric for each student focusing on the four domains of Content Knowledge, Pedagogical Knowledge, Pedagogical Content Knowledge, and Professional Qualities. Each of these domains is rated as Emerging, Developing, Competent, and Proficient. Student teachers were debriefed after each session using a standardized protocol.

During physiological measurement for each condition, the participant's activities were divided into three phases: Phase I, pre-exposure (15 min); Phase II, exposure for each scenario (maximum of 2.5 h); and Phase III, postexposure (15 min). Video recording of the activity occurred to allow for time marking of significant events. During Phase I and Phase III, the subjects performed under null conditions, i.e., no stimulus in order to establish baseline activation levels. During the exposure stage, the preservice teachers were measured under one of the two conditions, real-life classroom or VR classroom.

More importantly, the responses of the virtual students in the VR simulation were as authentic as possible due to the presence of artificial intelligence and machine learning algorithms. Completion of each condition was timed and had a 15-min waiting period that allowed the hemodynamic and physiological response signal to return to baseline conditions (Afergan et al., 2014).

The identification of the type of processing associated with the participant's activities in the real-life and VR classrooms was measured through hemodynamic response and correlated retrospective survey outcomes. An increase in cognitive/hemodynamics dynamics directly relates to an increase in the amount of cognitive processing (Afergan et al., 2014). In order to quantify and triangulate hemodynamic responses, survey data, and physiological data, the authors analyzed visualization of localized responses.

10.3.6 Scenario Characteristics

The scenarios for each of the classroom conditions had common characteristics, since the scenarios were recorded from the same school where the preservice teachers' field experiences occurred. Each scenario for the VR condition was filmed using a high-definition virtual reality camera with 4K resolution and overlaid with Unity code to create interactivity to increase authenticity of the experience. The inclusion of Unity programing allowed for increased interactivity during the scenario, which would not have been available only using VR video. The initial classroom filming for the VR content occurred within a seventh grade classroom at an urban charter school in the Northeastern United States where the university places cohorts of preservice teachers.

The school is a full-service K-8 school with approximately 435 students. The school itself is a charter school, one of the oldest in the area. School demographics consist of 68% African American, 31% Hispanic, and 1% Caucasian. Approximately 10% of the student population is classified as special education, and 100% of the population receives free and reduced lunch. The school is approximately evenly split with 51% male and 49% female with students applying to the school via a lottery system. Students' pass rates on state exams are typically in the mid to upper teens on end of course state exams.

Classroom Environment The VR classroom environment was filmed and developed from an actual classroom in the school described. The classroom belonged to a fourth-year teacher who partners with the university education group for early clinical experiences. Preservice teachers taught curriculum-based content in this classroom of 15 students with 5 of the students with an Individual Educational Plan (IEP). IEPs ranged from behavioral manifestations to learning disabilities.

Real-World Classroom Student teachers taking part in actual classroom experiences (as opposed to VR) were placed in schools and classrooms with similar demographic characteristics as those found in the VR scenarios. As with the preservice teachers taking part in the VR work, the classroom-based preservice teachers submitted lessons on topics related to energy and matter and aligned with the scope and sequence of the state curriculum. During their time in the classroom, they were asked to examine the classroom layout, objects, and posters and to assess their value to the classroom. Secondly, they were asked to get the students ready to learn for the day's activities, identify which behaviors to prioritize, and address student needs. The final task for the preservice teacher was to establish classroom control and to teach a 20-min lesson on the topic of matter and energy.

First VR Scenario The first scenario was designed for preservice teachers to examine the classroom layout, objects, posters, and everything in the classroom and to assess their value to the classroom. In this first case, the preservice teacher is in the front of the room. As the teacher views the room, they have the ability to move closer to any object in the room and examine them in detail.

Second VR Scenario The second scenario takes place shortly after the first scenario. During this scenario the preservice teacher is in the same classroom as scenario one. During this scenario, seventh grade students enter the classroom and engage in variety of behaviors (i.e., walking in, sitting down to do their initial work, using their cell phone, standing up on chairs, and engaging in confrontation). The preservice teacher in this scenario is tasked with getting the students ready to learn for the day's activities, identifying which behaviors to address and in what order, and prioritizing student needs.

Third VR Scenario The third scenario follows the second scenario once the preservice teacher has established classroom control and begun to teach the lesson. The preservice teacher planned a 20-min lesson on a topic related to energy and matter. During the lesson, the seventh grade students engaged in on-task and off-task behaviors with continuous escalation (to include physical altercations) of behaviors.

10.3.7 Data Processing

Periods were segmented from the time of stimulus onset to 8 s later for each independently identified activity. In this way, we are able to establish relationships between the collected data. While this does not necessarily allow for direct identification of specific tasks in teaching, it does allow for a more general level of response to both the real-life and the VR classroom environments. This allows researchers to examine the parity between VR and real-life activities. Time between each participant was 20 min to allow sensors to be cleaned and to dry.

Hemodynamic values were standardized with respect to the initial baseline, teaching conditions, and then the second baseline. The standardized values for all physiological and paper measures were then averaged across each subject and each block resulting in composite images and graphs. The standardized values obtained in each phase are the behavioral-dependent variables of interest.

Statistical Analysis Neuroimaging (fNIRS), paper measures, and physiological data were analyzed. Specifically, analysis occurred on the mean and maximum attributes of each of the measures. For example, with respect to the fNIRS, the researchers used standardized O_2Hb_i; for the physiological measures, the researchers directly examined the data signals and the durations of fixations and saccades. Each of the measures was standardized and statistically tested for means differences using a repeated measures ANOVA (rANOVA), factorial ANOVA, and planned post hoc comparisons using a combination of statistical software (MATLAB and SPSS version 24). rANOVA was used to assess the main effect of hemodynamic response differences between baseline I, stimulus, and baseline II O_2Hb_i levels. Multiple comparisons were done to identify specific differences between baseline I, stimulus, and baseline II O2Hbi levels. Condition differences were examined on aggregated hemodynamic responses, physiological measures, and composite paper responses.

10.4 Results

The main effect of the condition was not statistically significant in terms of the composite F test consisting of retrospective engagement survey, physiological measures, and neuroimaging $F(3, 159) = 1.76$, $p = 0.21$, $\acute{\eta}^2$ = no effect (NE). These results provide evidence that there is little difference in how the human brain, autonomic nervous system, and behavioral outcomes process real and virtual environments as found in a recent *Nature* article (Minderer, Harvey, Donato, & Moser, 2016). The evidence found through examination of neuroimaging, physiological, and traditional measures suggests that responses for both groups, VR and real-life, were significantly above baseline and illustrated the same localization and levels in the brain.

Analysis of the neuroimaging provides further insight into localization and intensity of hemodynamic response as the preservice teachers engaged in their craft. Figure 10.1 provides a data visualization of the differences across time using 30-min composite images. Comparison of standardized activation of composite values illustrates that there is no difference in location of activation across conditions. Figure 10.1 also illustrates the location and intensities of activations associated with each of the conditions.

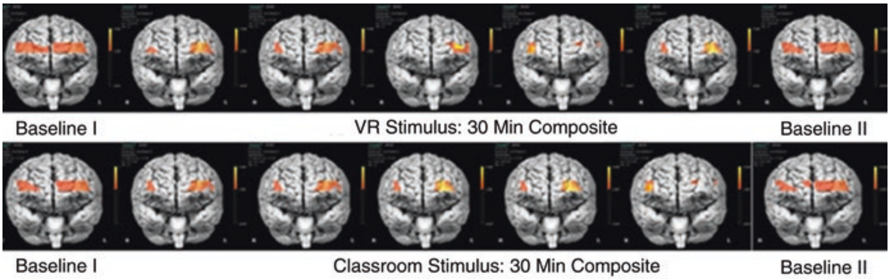

Fig. 10.1 Composite activations across conditions

Analysis of the direct autonomic nervous systems responses provided further evidence of the similarity of physiological response between the virtual reality and real-life conditions. These approaches also contribute to our understanding of the *processes* underlying learning in virtual reality. This also addresses the access of cognitive processing that has traditionally been achieved using the self-report paradigm (Paas, 1992; Paas & Van Merriënboer, 1994). Self-reports do not provide insight into fluctuations in cognitive processing over time, unless they are applied repeatedly within the task, which disrupts the primary cognitive activity (e.g., Ayres, 2006; Lamb, Firestone, Schmitter-Edgecomb, & Hand, 2019). Also, these autonomic measures allow examination of working memory processes involving interaction with long-term memory schemas, which become automated with practice and may be unavailable for introspection (Kuldas, Hashim, Ismail, & Bakar, 2015). Given the limitations of self-report the author employed eye tracking, ANS measures, and fNIRS measures to study attentional and cognitive dynamics in VR learning environments. These measures and converging of date from traditional sources provide a more comprehensive account of attentional and cognitive processing during a multimedia learning task (Fig. 10.2).

The eye tracking data in Fig. 10.3 provides an overview of fixations and durations illustrating that the VR conditions promote the same levels of attentional dynamics as real-life activities. Of the three cognition measures identified, only eye tracking has been employed in multimedia learning research to understand attentional processes learners employ when using VR. As a research methodology to investigate allocation of attention during multimedia tasks, eye tracking can be both versatile and incisive (Duchowski, 2007). For example, gaze contingent displays can be used to rapidly adapt task displays in response to attention, and observations of changes in pupil size can be used as an indicator of cognitive load (Chen & Epps, 2014).

Figure 10.4 illustrates the outcomes associated with the survey responses. Figure 10.4 illustrates that there is general consensus among the participants that the VR activities in comparision to the classroom activities are similar enough to be considered realistic. University review also indicates that the students were at a similar level between the VR and classroom condition.

Fig. 4 Survey of engagement results

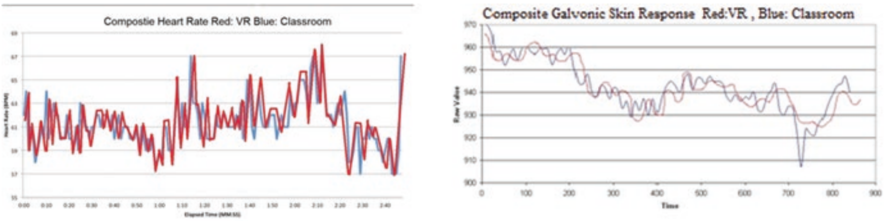

Fig. 10.2 Heart rate data and galvanic skin response

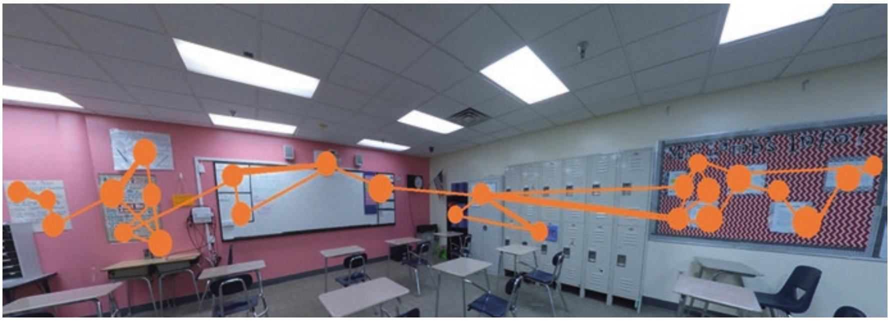

Fig. 10.3 Example scan pathways for the first scenario. (*Note*: This is a picture of the classroom used in both the VR and real-world scenario)

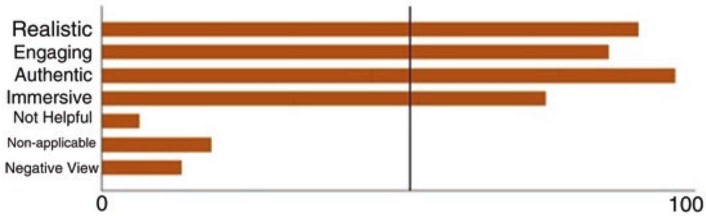

Fig. 10.4 Composite survey responses

10.5 Discussion

There are numerous ways for teacher educators to provide clinical experiences. While extended experiences in classrooms with real students and mentor teachers remain essential, VR yields exciting possibilities for early clinical preparation. The results of this study are in line with previous studies that suggest the brain from a cognitive and physiological perspective does not distinguish between highly realistic simulations such as those found in this study and real-life interactions. VR environments enable highly realistic simulations for learners engaged in teaching (Nelson & Annetta, 2016). During immersion in the VR classroom, the realism of the environment for the preservice teachers allows them to learn from modeled real-life situations for transfer of theory into practice.

While the authors do not in any way encourage replacing real-life clinical experiences with VR experiences, practice within a virtual classroom as a precursor to real-life clinical experiences may be of benefit. The use of VR as a means to provide initial clinical experiences provides repeated practice of targeted skills without adverse effects with actual students. For example, preservice teachers can experience consequences of yelling at students, ignoring certain behaviors that typically escalate into disruption, or not providing sufficient level of direction. While this would be negligent in actual classrooms, interaction in soft-failure environments can cue preservice students' recognition of student behaviors and effective responses. Instructors can provide feedback and scaffold responses known to be successful in the classroom. In particular, the preservice teacher may compare approaches and iterate the development of these approaches more quickly, i.e., in the span of hours as opposed over a semester or year. Thus, VR offers greater sensory cueing and multimodal feedback to enable the easy transfer of VR learning and understandings into real-world learning and understandings as the learner engages in interaction with teaching (Hancock, Mercado, Merlo, & Van Erp, 2013). Increased practice in realistic environments will provide greater automaticity associated with various pedagogical skills, better preparing them to establish safe and consistent environments necessary for learning.

10.5.1 Limitations

Time constraints associated with the semester reduced the ability of the researchers to gather data illustrating additional teacher development. In addition, the lack of baseline data from initial entry into the program does not allow for assessment of growth. Other additional possible limitations of the study lie in the research design. While the intention was to provide a randomized controlled trial, there are still some threats to internal validity. Since the study uses a self-electing voluntary sample, there will be selection bias. Repeated measures findings would give stronger evidence of validity and be more generalizable in relation to the affordances associated with VR as a training tool in education and other fields (Repper & Breeze, 2007).

10.5.2 Conclusion

VR promotes meaningful use of technology in the teacher education programs and provides a means to train and assess specific skills in interactive scenario-based environments. The authenticity, immersion, and fluidity afforded by VR make it a powerful tool for teacher education. As confirmed through neuroimaging, psychological measurement, and survey analysis from a cognitive, behavioral, and affective perspective, there is very little perceived difference. Consistent with findings in fields as premed and other preprofessional programs where they have replaced wet laboratories with virtual reality-based laboratories, clinical experiences through VR can improve the competence of new teachers and their capacity to effectively instruct students.

10.5.3 Implications for Practitioners

Teacher educators will be able to more fully enhance the preparation of the next generations of in-service teachers for service in urban environments through the use of the virtual environments. More importantly, while the potential of VR for use by K-12 students is increasingly being explored, its use as a teacher preparation tool has not been explored, while this research illustrates it may be a tool that holds potential for enhancing their clinical preparation prior to entering a real classroom. Future research is a means to understand the effectiveness of these simulations through provision of the frequent, individualized, learning opportunities (Dieker, Rodriguez, Lignugaris/Kraft, Hynes, & Hughes, 2014). This research into the use of VR is a means to provide initial clinical experiences for the development and training of preservice teachers. VR as with other forms of simulation provides repeated practice of targeted skills without adverse effects with actual students. In particular, preservice teachers may compare approaches using common language through common experience and iterate the development of these teaching approaches more quickly, i.e., in the span of hours as opposed over a semester or year. Perhaps, more importantly, is the flexibility of scheduling and ability of preservice teachers to access a "classroom" at any time without prior arrangement and scheduling. Lastly, in addition to the ability to record preservice students in a traditional means for assessments, the digital nature of VR allows for standardization of scenarios for self-, peer, and program-based assessments of pedagogical and management skills, all of which can be embedded in the VR scenario and underlying program.

References

Afergan, D., Peck, E. M., Solovey, E. T., Jenkins, A., Hincks, S. W., Brown, E. T., & Jacob, R. J. (2014, April). Dynamic difficulty using brain metrics of workload. In *Proceedings of the 32nd annual ACM conference on Human factors in computing systems* (pp. 3797–3806). ACM.

Annetta, L., Lamb, R., Minogue, J., Folta, E., Holmes, S., Vallett, D., & Cheng, R. (2014). Safe science classrooms: Teacher training through serious educational games. *Information Sciences, 264*, 61–74.

Ayres, P. (2006). Using subjective measures to detect variations of intrinsic cognitive load within problems. *Learning and instruction, 16*(5), 389–400.

Calleja, G. (2014). Immersion in virtual worlds. In *The Oxford handbook of virtuality* (pp. 222–236). Oxford, UK/New York, NY: Oxford University Press.

Chen, S., & Epps, J. (2014). Using task-induced pupil diameter and blink rate to infer cognitive load. *Human-Computer Ineraction, 29*(4), 390–413.

Critchley, H. D., Elliott, R., Mathias, C. J., & Dolan, R. J. (2000). Neural activity relating to generation and representation of galvanic skin conductance responses: A functional magnetic resonance imaging study. *Journal of Neuroscience, 20*(8), 3033–3040.

de Faria, J. W. V., Teixeira, M. J., de Moura Sousa Júnior, L., Otoch, J. P., & Figueiredo, E. G. (2016). Virtual and stereoscopic anatomy: When virtual reality meets medical education. *Journal of Neurosurgery, 125*(5), 1105–1111.

Dieker, L. A., Rodriguez, J. A., Lignugaris/Kraft, B., Hynes, M. C., & Hughes, C. E. (2014). The potential of simulated environments in teacher education: Current and future possibilities. *Teacher Education and Special Education, 37*(1), 21–33.

Duchowski, A. T. (2007). *Eye tracking methodology. Theory and practice* (p. 328). New York, NY/London, UK: Springer.

Ferreira, A., & Mavroidis, C. (2006). Virtual reality and haptics for nanorobotics. *IEEE Robotics & Automation Magazine, 13*(3), 78–92.

Goldberg, J. H., & Kotval, X. P. (1999). Computer interface evaluation using eye movements: Methods and constructs. *International Journal of Industrial Ergonomics, 24*(6), 631–645.

Hancock, P. A., Mercado, J. E., Merlo, J., & Van Erp, J. B. (2013). Improving target detection in visual search through the augmenting multi-sensory cues. *Ergonomics, 56*(5), 729–738.

Haniff, D., Chamberlain, A., Moody, L., & De Freitas, S. (2014). Virtual environments for mental health issues: A review. *Journal of Metabolomics and Systems Biology, 3*(1), 1–10.

Howard, G. R. (2016). *We can't teach what we don't know: White teachers, multiracial schools*. New York, NY: Teachers College Press.

Hu, Z. (2020, June). Influence of Introducing Artificial Intelligence on Autonomous Learning in Vocational Education. In International Conference on Applications and Techniques in Cyber Security and Intelligence (pp. 361–366). Springer, Cham.

Jacob, R. J., & Karn, K. S. (2003). Eye tracking in human-computer interaction and usability research: Ready to deliver the promises. *Mind, 2*(3), 4.

Kandalaft, M. R., Didehbani, N., Krawczyk, D. C., Allen, T. T., & Chapman, S. B. (2013). Virtual reality social cognition training for young adults with high-functioning autism. *Journal of Autism and Developmental Disorders, 43*(1), 34–44.

Klatzky, R. L., Giudice, N. A., Bennett, C. R., & Loomis, J. M. (2014). Touch-screen technology for the dynamic display of 2D spatial information without vision: Promise and progress. *Multisensory Research, 27*(5–6), 359–378.

Klimesch, W. (2012). Alpha-band oscillations, attention, and controlled access to stored information. *Trends in Cognitive Sciences, 16*(12), 606–617.

Kokkinos, C. M., Stavropoulos, G., & Davazoglou, A. (2016). Development of an instrument measuring student teachers' perceived stressors about the practicum. *Teacher Development, 20*(2), 275–293.

Kovesdi, C. R., & Barton, B. K. (2013). The role of non-verbal working memory in pedestrian visual search. *Transportation Research Part F: Traffic Psychology and Behavior, 19*, 31–39.

Kuldas, S., Hashim, S., Ismail, H. N., & Bakar, Z. A. (2015). Reviewing the role of cognitive load, expertise level, motivation, and unconscious processing in working memory performance. *International Journal of Educational Psychology, 4*(2), 142–169.

Lamb, R. L. (2013). *The application of cognitive diagnostic approaches via neural network analysis of serious educational games*. Fairfax, VA: George Mason University.

Lamb, R. L., & Annetta, L. (2014). The use of online modules and the effect on student outcomes in a high school chemistry class. *Journal of Science Education and Technology, 22*(5), 603–613.

Lamb, R. L., Vallett, D. B., Akmal, T., & Baldwin, K. (2014). A computational modeling of student cognitive processes in science education. *Computers & Education, 79*, 116–125.

Lamb, R., & Premo, J. (2015). Computational modeling of teaching and learning through application of evolutionary algorithms. *Computation, 3*(3), 427–443.

Lamb, R. L., Annetta, L., Firestone, J., & Etopio, E. (2018). A meta-analysis with examination of moderators of student cognition, affect, and learning outcomes while using serious educational games, serious games, and simulations. *Computers in Human Behavior, 80*, 158–167.

Lamb, R., Firestone, J., Schmitter-Edgecombe, M., & Hand, B. (2019). A computational model of student cognitive processes while solving a critical thinking problem in science. *The Journal of Educational Research, 112*(2), 243–254.

Lamb, R. L., Etopio, E., Hand, B., & Yoon, S. Y. (2019). Virtual reality simulation: Effects on academic performance within two domains of writing in science. *Journal of Science Education and Technology, 28*(4), 371–381.

Lamb, R., Etopio, E., & Lamb, R. E. (2019). Virtual reality play therapy. International Journal of Play Therapy.

Lamb, R., Lin, J., & Firetone, J. B. (2020). Virtual Reality Laboratories: A Way Forward for Schools?. Eurasia Journal of Mathematics, *Science and Technology Education, 16*(6), em1856.

Loucks, L., Yasinski, C., Norrholm, S. D., Maples-Keller, J., Post, L., Zwiebach, L., ... & Rothbaum, B. O. (2019). You can do that?!: Feasibility of virtual reality exposure therapy in the treatment of PTSD due to military sexual trauma. *Journal of anxiety disorders, 61*, 55–63.

Minderer, M., Harvey, C. D., Donato, F., & Moser, E. I. (2016). Neuroscience: Virtual reality explored. *Nature, 533*(7603), 324–325.

Nelson, D., & Annetta, L. A. (2016). Creating Disruptive Innavators: Serious Eduactional Game Design on the Technology and Engineering Spectrum. In Connecting Science and Engineering Education Practices in Meaningful Ways (pp. 3–17). Springer, Cham.

Paas, F. G. (1992). Training strategies for attaining transfer of problem-solving skill in statistics: A cognitive-load approach. *Journal of Educational Psychology, 84*(4), 429.

Paas, F. G., & Van Merriënboer, J. J. (1994). Variability of worked examples and transfer of geometrical problem-solving skills: A cognitive-load approach. *Journal of Educational Psychology, 86*(1), 122.

Psotka, J. (2013). Educational games and virtual reality as disruptive technologies. *Journal of Educational Technology & Society, 16*(2).

Repper, J., & Breeze, J. (2007). User and career involvement in the training and education of health professionals: A review of the literature. *International Journal of Nursing Studies, 44*(3), 511–519.

Santos, M. E. C., Chen, A., Taketomi, T., Yamamoto, G., Miyazaki, J., & Kato, H. (2014). Augmented reality learning experiences: Survey of prototype design and evaluation. *IEEE Transactions on Learning Technologies, 7*(1), 38–56.

Schrank, F. A., Mather, N., & McGrew, K. S. (2014). *Woodcock-Johnson IV tests of achievement*. Rolling Meadows, IL: Riverside.

STAR. (2015). *Student teacher assessment record*. Retrieved from http://gse.buffalo.edu/tei/ct

Strauss, E., Sherman, E. M., & Spreen, O. (2006). *A compendium of neuropsychological tests: Administration, norms, and commentary*. Washington, DC: American Chemical Society.

Sugand, K., Akhtar, K., Khatri, C., Cobb, J., & Gupte, C. (2015). Training effect of a virtual reality haptics-enabled dynamic hip screw simulator: A randomized controlled trial. *Acta Orthopaedica, 86*(6), 695–701.

Thayer, J. F., Åhs, F., Fredrikson, M., Sollers, J. J., & Wager, T. D. (2012). A meta-analysis of heart rate variability and neuroimaging studies: Implications for heart rate variability as a marker of stress and health. *Neuroscience & Biobehavioral Reviews, 36*(2), 747–756.

Tondeur, J., Pareja Roblin, N., van Braak, J., Voogt, J., & Prestridge, S. (2017). Preparing beginning teachers for technology integration in education: Ready for take-off? *Technology, Pedagogy and Education, 26*(2), 157–177.

van der Zwan, J. E., de Vente, W., Huizink, A. C., Bögels, S. M., & de Bruin, E. I. (2015). Physical activity, mindfulness meditation, or heart rate variability biofeedback for stress reduction: A randomized controlled trial. *Applied Psychophysiology and Biofeedback, 40*(4), 257–268.

Chapter 11
Virtual Reality: Bringing Education to Life

Eileen O'Connor

11.1 Literature Review: Background

With the allure of virtual reality (VR) market-wise feasible since 2004 with Second Life (Second Life, n.d.), educationally lauded with Harvard's River City historical K12 education project (The River City Project, n.d.), and commercially productive with World of Warcraft (World of Warcraft, n.d.) and the like, the ready availability of VR settings can now be a creative, multipurpose, and powerful instructional boon for both K12 environments and teacher education programs. Since 2010, the availability of open-source environments in VR environments, maintaining a virtual space (often called islands), is essentially free with cost associated with server maintenance or rental (O'Connor & Domingo, 2017). Instructors can now develop the background, context, and activities having these VR spaces available for experiences, lessons, quests, simulations, and adventures.

For some time, educators have found the value of these environments for complex situations. In advanced flight training, Koglbauer (2015) found that students with virtual flight simulators learned specific multitasking activities more rapidly. In psychiatric healthcare clinical trials, virtual simulations can help patients control their psychotic states (Pot-Kolder, Veling, Geraets, & Van Gaag, 2018). Although most published research focuses on higher-education or professional applications, K12 uses abound. In 2010, O'Connor demonstrated how middle school youth participating from geographically dispersed locations developed and presented high-quality academic projects with VR settings. Ocasio (2016) uses VR in K12 settings with second-language acquisition going well beyond what can be readily done in a classroom, particularly valuable when working with youthful populations.

Virtual reality settings could have particular appeal to youth. Martin (2014) posits a belief (heralded within recent research) that younger students from their prior virtual experiences will be more motivated to participate in virtual settings because of the "telepresence" they experience in virtual reality environments. Given the abil-

E. O'Connor (✉)
SUNY Empire State College, Saratoga Springs, NY, USA
e-mail: 12866eileen.oconnor@esc.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_11

ity of virtual reality visitors to become immersed and engaged in such environments, instructors can select environments that already elicit learned behaviors and expectations, such as a classroom or laboratory setting, establishing a tone for serious work. Piaget (1950) noted that learners call on their previous mental schema as they are brought into situations. Having familiar environments can possibly establish particular behavioral expectations. However, Schmeil, Eppler, and DeFreitas (2012) remind virtual educators to move beyond simply making 3-D displays of areas that could be developed in 2-D environments and fully explore the potential of immersive experiences.

However, Park (2012) warns educators not to oversimplify the ways to build motivation in virtual settings, and Frost, Matta, and MacIvor (2015) found that the gamification (bringing in game-like attributes) aspects designed into a learning management system lacked the voluntary and compelling aspect that could have improved motivation to participate. It seems that younger participants may have expectations for the type of interactions they may be used to from gaming settings. Although an instructor may not have the engagement found by Dunleavy, Dede, and Mitchell (2009), where students became so involved in their GPS game that they lost perspective of their true physical location, through thoughtful application of motivational principles, an instructor can enhance the students' willingness to participate and stay interested.

Along with the potential for new ways to involve and engage learners, curriculum design must be at the center of any VR-mediated instruction. McManimon (2011) generalizes about how virtual environments when used with constructivist principles support pedagogically sound activities, such as situated learning, role-playing, cooperative/collaborative learning, problem-based learning, and creative learning. When developing VR activities, a Vygotsky-like approach can create initial problem-solving challenges where the more-knowledgeable students helped their less capable virtual colleagues, leading to a great motivation to participate by all participants. As educators have been reminded by Wiggins and McTighe (2005), working "backward" from the desired performance or understanding, instructors should consider the competencies needed to achieve the performance that would designate the VR participation and activities a success.

Effectiveness of any learning tool or environment needs to be insured through assessment and evaluation. To this effect, VR environment presents traditional and unique opportunities. As reported by O'Connor and Domingo (2017), data can be readily gathered: through snapshots taken to document events; by using reports, surveys, and quizzes that could be administered through other sources or brought in through the web-link possibilities within the virtual environment; and by videotaping the students' experiences observed by the instructor within the environment itself. Customary assessment feedback can be given through discussion boards, instructor evaluations, or even the awarding of badges (Hakulinen, Auvinen, & Korhonen, 2015). Virtual reality environments can offer new possibilities for youthful learning and for teacher education.

11.2 Implementing VR

Virtual reality environments have virtually infinite applications; the teacher or instructor actually develops the environment, the rules, the expectations, and the possibilities. This chapter will consider a subset of these possibilities, addressing understanding, acquiring, and developing these environments, suggesting curriculum approaches, considering the learners, and finding ways for evaluation.

11.3 Understanding This Environment

Virtual reality (VR) has been available through game-like environments and through user-based environments such as Second Life since the early 2000s. Recent introduction of VR headsets has opened several new avenues; however, the VR environment considered here does not require the use of VR headsets and instead is a computer- or laptop-based experience where the user participates through an avatar and works within virtual reality settings that he or she either visits or creates. The virtual "physical" units of the spaces are known as islands. The open-source versions of these environments allow the range of pre-made islands (from Creative Commons shared work) to custom environments. Educators will most likely work with hybrids of acquired and developed artifacts. Items on these islands can have the verisimilitude to the real world or can be created in rudimentary ways by educators and student participants. Images, photos, websites, and streamed video can come into these spaces too allowing them to serve as centers for multiple lessons, meetings, or scenarios.

11.4 Acquiring Environments – Co-workspaces Too

Technically, the open-source movement has made virtual reality (VR) environments available for free if server storage and support is available. Although many schools have this ability, the process of monitoring and setting up these spaces suggests that initially instructors should rent their own server space which can be reasonably done with vendors such as Kitely (n.d.) where you can have up to 4 virtual islands with up to 40 avatar participants present at any time within a month for $20 a month. Participants must download a "viewer" so that they can display the graphics-enabled components on their machine; island owners can make spaces freely available or they can even set up a fee structure for island entry. Islands can remain on a *hypergrid*, which allows for virtual visitors, as true of Internet, or can be limited to only invited visitors.

It is also possible to venture into these areas in a limited way through organizations that offer sandbox-level trial areas (where you can test small applications), such as those offered by Avacon (n.d.), a nonprofit VR education venture. You can also join this author in co-workspace in VR. These co-shared working spaces in the physical world are gaining popularity (Amador, 2019); these nascent VR co-spaces have the same appeal with sharing resources and talent. Send an email to the author to consider a co-workspace arrangement.

VR islands can also be acquired and developed independently. These websites provide Creative Commons access to many of the fundamentals needed to develop these environments – for operations and building documentation (https://sites.google.com/view/vrmarian/adv-development) and for steps in VR creation (https://sites.google.com/site/vrimmersivecourse/). Visit all pages on those sites for information. Graduate courses too may be taken to provide integrated basic VR design and curriculum development along with graduate credit.

11.5 Developing Applications

Again, since the social, meetings, simulated experiences, collaborative projects, role-playing, and storytelling, is unlimited in these environments (O'Connor & Domingo, 2017), only several of the most salient extended educational components are highlighted here.

11.6 Meetings, Collaborations, Presentations, and Poster Sessions

Avatar participants can meet in settings that might occur in a physical face-to-face environment within an immersive experience that can be populated with images, websites, and videos having discussions and interactions that would be possible in any face-to-face meeting. As in any such experience, the educational value is guided by the goals, objectives, and expectations for the meeting itself within the usual level of organization, control, and event management. Much as could be expected from any classroom event where individuals might be sharing ideas and experiences, these VR-mediated environments could have the benefit of bringing individuals from different classes or schools, from different parts of the country, from government officials or educators in other settings, or from experts in the field. The benefit of minimizing travel can allow rich experiences. As found by O'Connor and Worman (2019), students in a teacher education program that was geographically dispersed found they were able to develop collegial relationships with fellow classmates that went well beyond the discussion boards that are so typical of online education courses. To determine the success of any particular venture, it would be important to understand the larger goals and to consider ways that evidence can be gathered to ensure learning, communication, and access issues. (See the section on evaluation below for methods of documenting observations.)

11.7 Quests and Games

With a storyline, a motivation to achieve, or a problem must be solved, educational and challenging can be instantiated within a VR environment. From the simple scavenger hunt and icebreaking activities that are often done to acclimate people to VR settings to more advanced problem-solving quests, team creation toward a competitive goal achievement can happen within a classroom setting or across geographies. As considered further below, participants can be allowed to build their own items and artifacts within these spaces, leading to games that can incorporate computer-aided design (CAD) features too. Students can be challenged to design the most effective settings for particular conditions, working on the principles from the International Society of Technology in Education (ISTE) as an "Innovative Designer. 4a. Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems" ("ISTE Standards for Students," 2020, para 5).

As an example, consider how a VR setting was developed to support an interdisciplinary project (O'Connor, 2020). The VR settings (these were made available through Creative Commons brought within this open-source environment) were used to provide a context for a STEM/STEAM unit that encouraged students to explore multiple connected spaces. These spaces included a Middle East luxury oasis; a dour-looking Medieval setting; a walled city with a village, a prison, an archery area, a church, and castle battle-ready ramparts; and a relaxing garden area for meetings. Students were guided toward selecting various quests where they could investigate, assemble, and present an area of their interests. Educational, Internet-based resources were provided to help students investigate issues such as problems with water procurement and hydrology in the Middle East, the cause and effect of disease and disease vectors in spread of the bubonic plague during the middle ages, and the interactive exploration of physics principles on ramps designed within the VR space itself. The support materials and directions were themselves assembled in a Google slideshow with links, and this material was made accessible from within the VR setting itself. Note: these open-source VR settings can bring in Internet links and Internet videos, as were used in this project.

Thus, VR setting can be employed in creative ways to situate studies, stories, or games. Gathering settings from artists, or creating setting by and with the students, can create a meaningful immersion in an experience well beyond the classroom environment.

11.8 Simulations and Role-Playing

Many virtual settings themselves are readily available for free, through Creative Commons licensing; a few examples are shown in Fig. 11.1. A teacher or instructor may find that there is a space already available for going on a journey to a historical

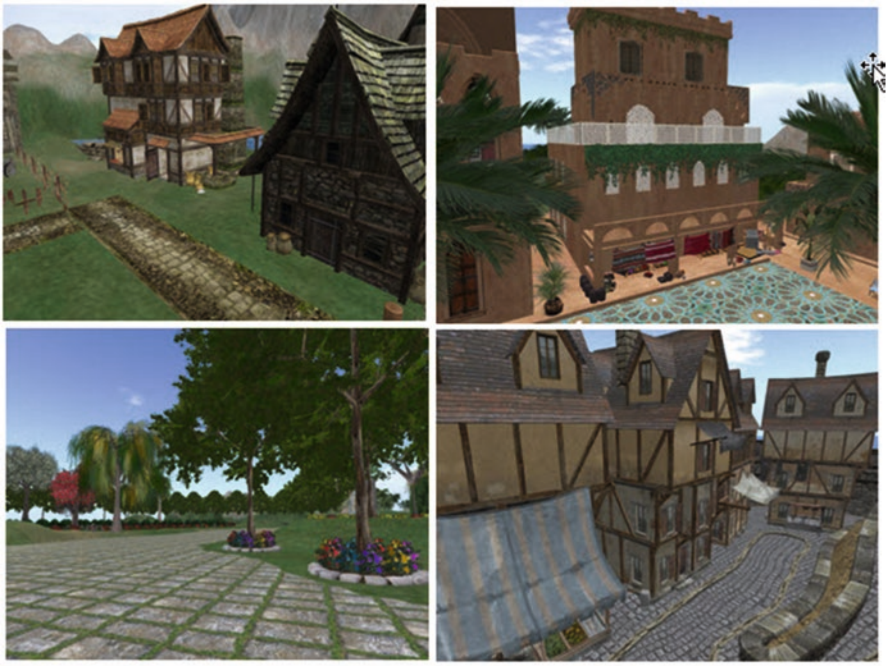

Fig. 11.1 Pre-built islands; top left clockwise – Medieval, Middle East, Renaissance, gardens

time, a step into a scene from a novel or a play, a visit to an education or museum environment, or many other available settings that could serve as backgrounds to events that can now be participated in by individuals and students either in the same room or coming in from a variety of geographic settings. In courses where languages are being taught, it can often be a challenge to get students beyond their reticence to speak in the target language; therefore, using a VR setting can minimize some of the students' anxiety (Ocasio, 2016). Some educational environments are being developed for hospital and healthcare training and for scenarios that may be hazardous or at high risk. When the actual training or clinical environment is very difficult or if the scenario itself is hazardous, as in military training (Carlson, 2006), VR experiences have been developed to simulate these difficult-to-visit environments. For instance, the environment described in the prior section could be used to challenge students to solve historical problems or visit facsimiles of locations that they might not have the funds to visit. To develop complex setting and scenarios, participants can be guided, challenged, and assessed on becoming ISTE's "Global Collaborator: 7b. Students use collaborative technologies to work with others, including peers, experts or community members, to examine issues and problems from multiple viewpoints" ("ISTE Standards for Students," 2020, para 8).

To get an *exactly specified environment*, an instructor might need to enlist the resources of the art department, learn how to make resources him- or herself, or apply for grants or funding to hire artists. The artists who develop the Creative Commons work can generally be commissioned for custom work.

11.9 Mathematics, Computer-Aided Design, and STEM/STEAM

The VR platform itself is a 3-D developmental experience. Students can begin at basic levels with creating geometric shapes in three dimensions and linking these areas through coordinates or through 3-D movements. Mathematics goal operations are evident throughout, and students can see the inherent value of understanding both Cartesian coordinates and three-dimensional settings (Fig. 11.2). As 3-D interfaces become more popular, it will be important for students to understand these environments and how they are developed from their initial stages. Just as coding and computational thinking are important skills for twenty-first century learners, understanding how to develop CAD and three-dimensional applications can be fos-

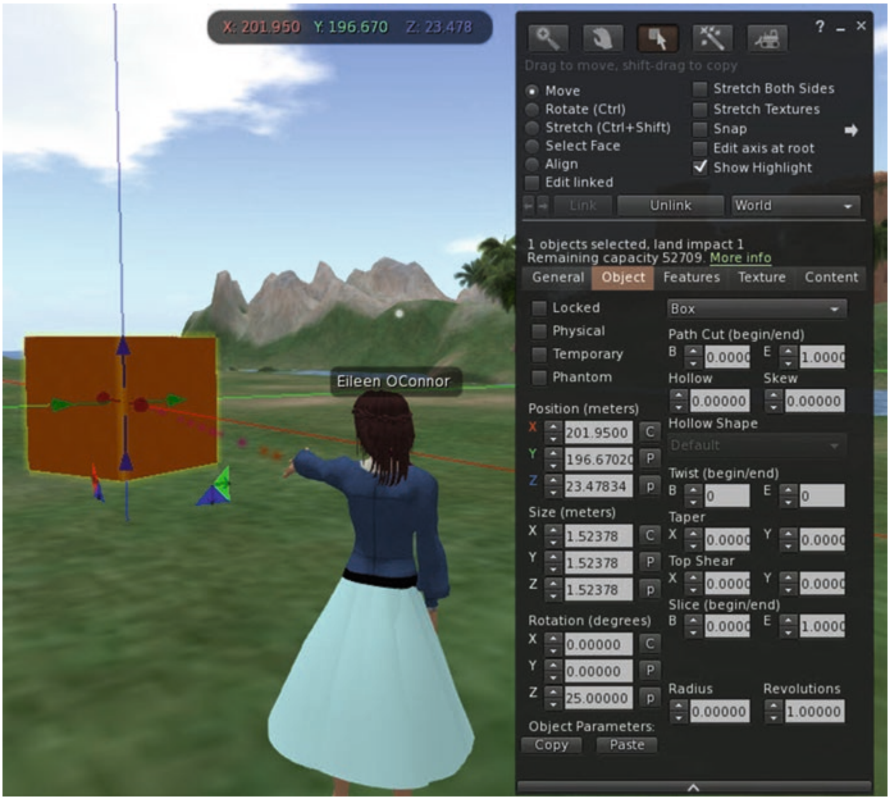

Fig. 11.2 The mathematics of design

tered in these environments. With today's emphasis on enhancing STEM (science, technology, engineering, mathematics) experiences with the A for arts (STEAM), the development of these mathematical shapes and positions then becomes enhanced with the integration of arts, textures, and designs.

As noted by ISTE, students must become "Empowered Learner: 1d. Students understand the fundamental concepts of technology operations, demonstrate the ability to choose, use and troubleshoot current technologies and are able to transfer their knowledge to explore emerging technologies."

11.10 Mathematics and Economics

Central within the basic VR artifacts themselves is a built-in economy. These environments were created initially by Second Life and other vendors to provide a way for people to meet virtually and to also buy and share items and articles and have events that might be hosted for fees. The advent of open source in the 2010 has brought virtual reality environments more within the realm of educators because items can often be shared without cost. Thus, the built-in feature of assigning charges to artifacts that are developed could be put to classroom uses in the mathematics of pricing and can also be put to use in terms of looking at the economics of particular commodity sales. A teacher might even combine a class on artifact development, with the mathematics class that looks at revenues that were generated, with the social studies class that studies market fluctuations. The VR built-in financial economy can become a tool for teaching.

11.11 Coding and Scripting

Most every item and artifact can be programmed using a language similar to C# to make them interactive and responsive to touches by avatars; to open, close, and modify settings; and so on. The interactivity well known in the large gaming VR environments comes from this built-in coding, as evident in the portion of a tracker script shown in Fig. 11.3. Many scripts are already available in ready-made VR settings, and more are made available in online Creative Commons repositories, thus serving as starting points for learning coding. Students can have the opportunity to learn coding commands and actually see them implemented in environments that are visually tangible, albeit virtual. As noted by ISTE, students can demonstrate: "Computational Thinker. 5d. Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions."

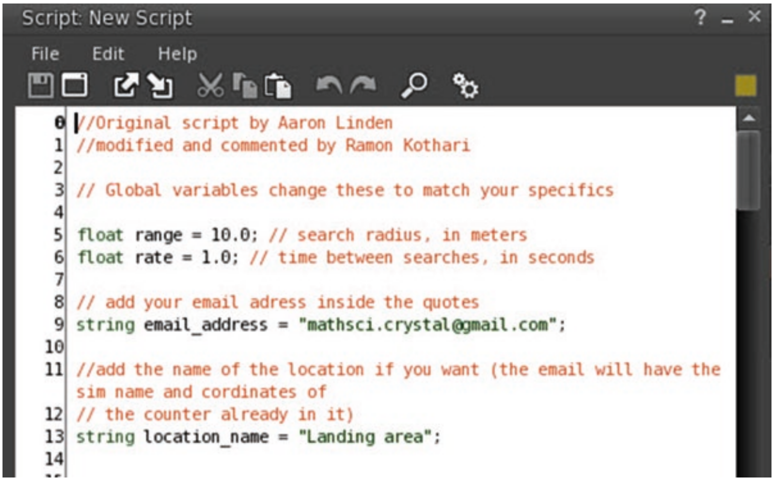

Fig. 11.3 Coding possible with objects

11.12 Understanding the Avatar

Although beyond the scope of this chapter, finding how individuals, be they young or mature, develop and react to and within their virtual identities (O'Connor & Worman, 2019) is a subject for considerable study. Suffice it for now to say, avatars in open-source environments have movement, lip synch, animated sequences, and some built-in gestures (Fig. 11.4). The current state of the arts does not allow for haptic, sensory input. Avatars can have a full range of activities and actions, if permitted by the island owners, as summarized in Table 11.1.

11.13 Designing for Learning and the Learner

Depending upon the application desired, the instructor or learning environment designer should have a clear perspective on the ultimate end goal of the VR usage, influencing also the different evaluation processes selected, as stated further below. In creatively designing these systems though, it is important to value all of the cognitive and affective aspects that are possible – these can be very rich, robust environment.

Therefore, it is important to consider the actual student or end user within the environment, valuing the interactions and collaborations themselves that might occur within the space as part of the possible desired outcome, mindful again of ISTE's collaboration standard. Particularly if the environment is being developed for K12 students, it is important to consult with the end user during the development process itself, possibly having some serve as advisers. As noted by Martin (2014),

Fig. 11.4 Multiple ways to communicate; text or an impatient avatar gesture

Table 11.1 Ways that avatars can participate

Avatar abilities	Possibilities
Audio and text	Multilevel communications; text chats can be exported
Snapshots and video	Built-in snapshot feature; external video capture
Instant message and storage	Extend communication beyond synchronous meetings
Walk, run, fly, teleport	Move to different locations, individually or collectively
Multiple experiences	Observe images, presentations, websites, streamed videos
Change appearance/clothing	Explore new ways to look and interact with others
Gestures, movements, "sits"	Communicate, interact, and move
Building objects	Create objects in sandbox areas

the mindset of youthful participants particularly if the instructor or developer has had little direct experience as these environments themselves can contribute toward an effective design. In current approaches to software design (Principles behind the Agile Manifesto, n.d., para. 4), developers must work with the customers on a continuous basis; this should be true in educational development as well. Using the guidelines from ISTE, students can become active participants in VR project design becoming "Global Collaborator: 7c. Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal."

11.14 Evaluating: The Learning Experience/The Environment

Understanding whether any learning environment or game is acceptable in serving as an academic function depends upon two levels – (1) to understand whether the learner him- or herself achieved the expected learning outcomes is an initial and primary requirement. It is also necessary (2) to evaluate the functionality of the learning environment itself. In a traditional classroom setting, the instructor has de facto evaluated the environment as having the right number of seats, ensuring students are prepared to learn, and having the appropriate buildings and physical services needed. In a VR environment, the instructor must determine if the setting itself is working properly to get all participants involved, engaged, and participating effectively. Information about participants' learning can be gathered in many ways some of which are traditional and some of which are enhanced by a VR environment, as shown in Table 11.2.

Consider some of these expanded and applied assessment ideas below and apply these to the evaluation of the environment itself:

- *Analytics* (built-in measures of participation; data displayed with graphs is often used to make the numbers meaningful) – can be added within virtual environments to determine what avatars come to the locations, how long they stayed, and even what areas they visited – there are many ways to implement these types of virtual-world monitors, and newer ways of measurement are emerging rapidly.
- *Observation, snapshot taking, and videotaping* – can allow instructors to monitor and observe the participants much like in "real-world" setting if they were in a meeting area or classroom with the individuals. The videotaping allows preser-

Table 11.2 Overview of ways to monitor virtual performance

Activity	Gathered with students present	Can be conducted later
Observations/ videotaping/snapshots	Document and store as many interactions as possible	Participants can share or upload snapshots taken
Building activities	Can be observed building	Artifacts left for later review
Interactions and text chats	Interactions can be viewed; store text chats for examination later	Text and audio files can be saved and examined later
Presentations/ role-playing	Reports, presentations, interactions with artifacts, scenarios, and role-play	Participants videotape themselves and submit later
External quizzing	NA	Participants take quizzes after leaving the virtual environment
External reports	NA	Participants make reports – snapshots could be included
Surveys	Survey tools are available within the virtual environment	Surveys taken after participants leave the environment
Avatar trackers	Trackers document time when avatars enter a space	Trackers data analyzed for visited and persistence at these points

vation of the interactions and presentations that occurred within a virtual space For instance, O'Connor (2012a) was able to bring a ninth grade teacher to address a pre-service teacher audience about an effective citizen-detective science lesson that he had developed, as captured on video. Being mindful that the participants are coming in from various locations can let instructors appreciate the value of this format. Instructors can use these storage features as a way to take attendance, learn about behaviors and outcomes, and evaluate materials that are delivered or presented.

- *Classic assessment of projects and interactions* – since a virtual space can be used much like any meeting place, assessment guidelines and rubrics could be developed and made available to clarify expectations and to establish evaluation criteria. O'Connor (2012b) developed an assignment that required students to meet within a VR setting and analyze work of different teachers that was displayed via a video that was brought into the VR setting. The online component of the assignment required students to analyze and discuss the different teaching styles they had viewed as a way to evaluate different classroom science teaching practices.
- *Badging* – is an emerging area where the participants themselves conduct peer evaluations (O'Connor & McQuigge, 2014). Since virtual worlds can display websites, it is possible to display the work of members, clients, and other participants and have peers specify their "votes" and thus contribute to a peer-ranking system.

This chapter offers a glimpse into the many avenues for education and communication that are available through virtual reality open-source environments. The author welcomes feedback on this chapter and on work that might be initiated and is open to sharing work through VR co-workspaces.

References

Amador, C. (2019, May 10). Coworking is the new normal, and these stats prove it. *All Work*. The Future of Work Since 2003. Retrieved from https://allwork.space/2019/05/coworking-is-the-new-normal-and-these-stats-prove-itt/

Avacon. (n.d.). Retrieved from: https://www.avacon.org/blog/about/

Carlson, S. (2006, November 24). War games go virtual. *Chronicle of Higher Education* (pp. A36–A38).

Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education Technology, 18*, 7–22. https://doi.org/10.1007/s10956-008-9119-1/

Frost, R. D., Matta, V., & MacIvor, E. (2015). Assessing the efficacy of incorporating game dynamics in a learning management system. *Journal of Information Systems Education, 26*(1), 59–70.

Hakulinen, L., Auvinen, T., & Korhonen, A. (2015). The effect of achievement badges on students' behavior: An empirical study in a university-level computer science course. *International Journal of Emerging Technologies in Learning, 10*(1), 18–29.

ISTE – International Society for Technology in Education. https://www.iste.org/standards/for-students

Kitely. (n.d.). Retrieved from: www.kitely.com

Koglbauer, I. (2015). Training for prediction and management of complex and dynamic flight situations. In *Procedia – social and behavioral sciences, 209 (The 3rd international conference "Education, reflection, development", 3th – 4th July, 2015)* (pp. 268–276). https://doi.org/10.1016/j.sbspro.2015.11.232

Martin, A. (2014). Motivating learners with virtual reality. In J. Viteli & M. Leikomaa (Eds.), *Proceedings of EdMedia: World conference on Educational Media and Technology 2014* (pp. 2631–2636). Association for the Advancement of Computing in Education (AACE).

McManimon, S. (2011). Constructivist approach to employing virtual reality learning environments in instruction. In M. Koehler & P. Mishra (Eds.), *Proceedings of society for information technology & teacher education international conference 2011* (pp. 2161–2164). Chesapeake, VA: Association for the Advancement of Computing in Education (AACE).

O'Connor, E. A. (2012a). *Crime scene – Project based learning (part 1)*. https://youtu.be/aToCEUtg024

O'Connor, E. A. (2012b). *Using a virtual meeting to review and discuss videos of a K12 workshop*. https://youtu.be/hz1ld2AUTUQ

O'Connor, E. A. (2020). *Using open-source VR for STEM/STEAM interdisciplinary projects*. https://docs.google.com/presentation/d/1OYj4cb7361ofLWk8dFg3O7q1_D_rdGsm2zIJHt6vsuw/edit?usp=sharing

O'Connor, E. A., & Domingo, J. (2017). A practical guide, with theoretical underpinnings, for creating effective virtual reality learning environments. *Journal of Educational Technology Systems, 45*(3), 343–364.

O'Connor, E. A., & McQuigge, A. (2014). Exploring *badging* for peer review, extended learning and evaluation, and reflective/critical feedback within an online graduate course. *Journal of Educational Technology Systems, 42*(2), 87–105.

O'Connor, E. A., & Worman, T. (2019). Designing for interactivity, while scaffolding student entry, within immersive virtual reality environments. *Journal of Educational Technology Systems Volume, 47*(3), 292–317.

Ocasio, M. A. (2016). Second life: Creating worlds of wonder for language learners. *Learning Languages, 21*(2), 6–9. https://files.eric.ed.gov/fulltext/EJ1124808.pdf

Park, H. (2012). Relationship between motivation and student's activity on educational game. *International Journal of Grid and Distributed Computing, 5*(1), 101–114. Retrieved from http://www.sersc.org/journals/IJGDC/vol5_no1/8.pdf

Piaget, J. (1950). *The psychology of intelligence*. New York, NY: Routledge.

Pot-Kolder, R. M., Veling, W., Geraets, C. N., & Van der Gaag, M. (2018). Virtual-reality-based cognitive behavioural therapy versus waiting list control for paranoid ideation and social avoidance in patients with psychotic disorders: A single-blind randomised controlled trial. *The Lancet: Psychiatry, 5*(3), 217–226.

Principles behind the Agile Manifesto. (n.d.). https://agilemanifesto.org/principles.html. Retrieved July 26, 2019

Schmeil, A., Eppler, M., & deFreitas, S. (2012). A structured approach for designing collaboration experiences for virtual worlds. *Journal of the Association for Information Systems, 13*(10), 836–860.

Second Life. (n.d.). Retrieved from: https://secondlife.com/

The River City Project. (n.d.). Retrieved from: http://muve.gse.harvard.edu/rivercityproject/

Wiggins, G., & McTighe, J. (2005). *Understanding by design–expanded* (2nd ed.). Alexandria, VA: Association for Supervision and Curriculum Development.

World of Warcraft. (n.d.). Retrieved from: https://worldofwarcraft.com/en-us/

Chapter 12
Simulated Learning Environments to Support General and Special Education Preparation Programs in Developing Teacher Candidate Instructional Strategies and a Disposition Toward Coaching

Maria B. Peterson-Ahmad and Melanie Landon-Hays

12.1 Introduction

Schools today are increasingly diverse. Teachers will work with students who are typically developing but will also have students who exhibit learning and behavior challenges. Additionally, teachers are held accountable for the vital skills of supporting a culturally responsive classroom while collecting and analyzing student data to monitor student progress that drives instructional decisions. Teacher preparation programs are challenged with training high-quality teacher candidates who can work effectively with all students (students who are at-risk, students with and without disabilities) as they simultaneously raise student achievement and employ culturally responsive pedagogy (Beare, Marshall, Torgerson, Tracz, & Chiero, 2012; Peterson-Ahmad, 2018). Effectively preparing special education teachers is of particular concern because the number of students with disabilities increases each year and the demand for special education teachers is continually on the rise (McLeskey, Tyler, & Flippin, 2004; Rees-Dawson, 2016; Tyler & Brunner, 2014).

Research documents a positive correlation between pre-service educators' pedagogical preparation in content matter and performance in the class and has recognized that teachers who have had advanced preparation in teaching methodologies and strategies have a greater chance of longevity in the classroom (e.g., Ingersoll, Merrill, & May, 2012; Katsiyannis, Zhang, & Conroy, 2003; Peterson-Ahmad, 2018). If effective teachers engage their students actively by using different teaching strategies in their classrooms (Darling-Hammond, 2010), it is

M. B. Peterson-Ahmad (✉)
College of Professional Education, Texas Woman's University, Denton, TX, USA
e-mail: mpeterson3@twu.edu

M. Landon-Hays
Western Oregon University, Monmouth, OR, USA

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_12

important that pre-service teachers have a range of teaching strategies in their professional repertoire from which to draw upon (Ledger, Ersozlu, & Fischetti, 2019). The intersection of coursework and field experiences, in addition to knowing how to use reflective practices to aid in continual self-improvement, is critical in teacher preparation programs. Simulated learning environments such as TeachLivE and Mursion are supplementary platforms that teacher preparation programs can provide essential and foundational practice of skills with teacher candidates cross-programmatically.

12.2 Simulated Learning Environments

Simulated learning environments are arenas that offer a controlled setting and enable pre-service teacher candidates the opportunity to learn and improve pedagogical skills through rehearsal and reflection such as instructional, classroom management, data collection, or how to navigate parent-teacher conferences (to name a few examples). Although simulations have been in use in teacher preparation for many years using films, role-playing experiences, card games, and other activities, computing power has increased significantly enough to develop complex, interactive simulations of teaching and learning. Experiences in the simulated learning environments enable teacher candidates to transfer knowledge learned from college coursework and apply it in the context of the virtual classroom, thereby solidifying and deepening understanding of skills and providing contextualized professional development. These experiences, in combination with after-action review, create opportunities to further construct beliefs and practices that are grounded in teaching experiences that are authentic but safe and constructive.

Simulated learning environments afford these opportunities by allowing individuals to have repeated (teaching) trials involving high-stakes situations without risking the loss of valuable resources (e.g., money, time, and people). Experiences working with virtual simulation enable pre-service teachers to transfer knowledge learned from college coursework and apply it in the context of the virtual classroom, thereby solidifying and deepening understanding of skills and providing contextualized professional development (Peterson-Ahmad, 2018). A virtual simulation can be defined as the combination of real and virtual worlds that provide users with a sense of presence. As efforts to improve teacher preparation programs continue and evidence of the benefits of experiential learning effectiveness grows, so does the need for innovative ways to incorporate such aspects into higher education courses. The need for the use of such environments in teacher preparation programs is growing because of the changing demographics of both students and teachers in today's schools; therefore, virtual simulations have the opportunity to potentially change the way in which pre-service educators are trained. These environments also benefit the teacher educators working with pre-service candidates who may not have the opportunity to observe them in their fieldwork. By working with candidates in this environment, coursework is refined to better match the reality of the field experience, and improved connections are made.

The information presented in this chapter will specifically discuss two simulated learning environments used by the authors in teacher preparation programs: (1) TeachLivE and (2) Mursion.

1. TeachLivE was created and based upon the work of Dr. Hughes and colleagues in the Synthetic Reality (SREAL) Laboratory at the University of Central Florida through which they created an infrastructure for providing avatar-mediated interaction in 2005 (Nagendran et al., 2013). Since TeachLivE's inception, researchers have been studying the extent to which virtual simulation serves as an efficacious tool for educators to practice a variety of skills relevant to what will be expected of a teacher in a real classroom environment. TeachLivE is a blend of artificial and human intelligence that provides authentic interactions where participants respond to the avatar's movements, actions, and discourse in real time.
2. The Mursion virtual learning environment is powered by a blend of artificial and human intelligence driven by simulation specialists ("interactors"), trained professionals who orchestrate the interactions between avatar-based characters and trainees. This blended approach provides the realism needed to make experiences that involve intense human-to-human interaction impactful. It also enables each simulation to be hyper-responsive to the unique live performance of each individual learner, allowing learners to fully immerse themselves and thus produce significant and lasting changes in practice (Mursion, 2016). In October 2014, Mursion entered into a licensing agreement with the University of Central Florida (UCF), authorizing Mursion to serve as the exclusive provider of all interactive, simulation-based training and related services. TeachLivE at UCF, now operating as the Center for Research in Education Simulation Technology (CREST), developed the prototype technology and continues in a research capacity, while Mursion is the exclusive provider of commercial services. Mursion also takes part in research partnerships with several academic institutions and Educational Testing Services (C. Straub, personal communication, October 13, 2019) (Figs. 12.1, 12.2, and 12.3).

The avatars in the TeachLivE and Mursion simulated learning environments embody specific archetypes typified by common personalities that would exist within any environment. There are classroom-style groups of avatars which consist of five student avatars, and each is unique in that they represent an array of demographics and personalities (Peterson-Ahmad, 2018). The avatars and teacher candidates engage in realistic interactions and discussions where there are multiple opportunities to practice specific teaching skills and strategies. In 2015, TeachLivE partnered with Mursion to scale up the technology with a continued focus on education, while further expanding the simulated learning environment for us in healthcare, hospitality, and other fields.

Both TeachLivE and Mursion are highly viable tools that teacher preparation programs can utilize with all types and levels of general and special education

Fig. 12.1 Mursion elementary school student avatars in a classroom setting

Fig. 12.2 Mursion middle school student avatars in a classroom setting

teacher candidates. Simulated learning environments allow for teacher candidates to have early and multiple experiences throughout their teacher preparation program to practice the various complexities that are represented in actual classrooms. TeachLivE and/or Mursion provide full immersion into a teaching experience by

Fig. 12.3 Mursion adult avatars for use in school/student-related meetings

providing the verbalization of teaching interactions in front of a classroom with proportionally sized avatars that provide immediate responses (Dieker, Straub, Hughes, Hynes, & Hardin, 2014; Elford, 2013). Various levels of complexity can be controlled dependent on the level in which the teacher candidate is in. For example, the levels of behavior, response rates, and the way in which avatar responds can be modified (Dawson, & Lignugaris/Kraft, 2017).

This variability affords educator programs the flexibility needed to tailor the teaching situation to the needs of novice teachers. This flexibility ameliorates two of the biggest challenges mentioned previously in providing teaching experiences to teacher candidates. First, teacher candidates often lack readiness to learn the difficult and complex skills they are to master. Rather than being eager to learn about instructional design, many students are more interested in classroom management and discipline when they first begin education coursework. They are simply too new to be prepared to discuss differentiation, alignment, and adaptations to their planning and instruction. Second, teacher educators need to provide instructional settings that are authentic in their emphasis on candidate learning. Often, traditional field placements are high-stakes settings that don't allow our candidates to experiment and grow with ongoing feedback. These settings don't allow them to try out their ideas because candidates are immediately put on stage with no chance for rehearsal. They can quickly fail by losing control of the class, losing face in front of their more knowledgeable mentor teacher, or only teaching a lesson once and not being able to adjust before moving on to the next lesson. Simulated learning environments remedy these issues.

12.3 Using TeachLivE and Mursion to Prepare Teacher Candidates

Research has begun to emerge that has investigated the use and efficacy of simulated learning environments as part of teacher preparation programs. It has been validated in several research studies that time spent in simulated learning environments such as TeachLivE or Mursion increases teachers' frequency of higher-order questions and specific feedback to students, increases overall confidence in teaching, makes instruction and classroom management-based decisions in a more fluid and autonomous manner, and increases overall generalization of skills (e.g., Dawson, & Lignugaris/Kraft, 2017; Dieker, Hughes, Hynes, & Straub, 2017; Smith & Klumper, 2018).

Other research identifies the importance of utilizing a coaching component that accompanies teacher candidates during their use of simulated learning environments such as TeachLivE or Mursion. Instructional coaching can be described as a partnership between a mentor educator and a teacher candidate to gauge present levels of teaching and to set/revise goals (Peterson-Ahmad, 2018). "Simulation that incorporates after action review based on the theoretical model of performance mastery through feedback has the potential to reduce discrepancies between current performance and a goal" (Straub, Dieker, Hynes, & Hughes, 2015, p. 15). Through immediate coaching and intervention to remediate specific skills, teacher candidates within the research provided steady patterns of improvement related to delivery of student-specific praise, error corrections, providing students opportunities to respond, and providing instruction and classroom management-related directives (e.g., Dawson, & Lignugaris/Kraft, 2017; Peterson, 2014; Peterson-Ahmad, 2018; Peterson-Ahmad, Pemberton, & Hovey, 2018).

Research has been conducted with both TeachLivE and Mursion by the chapter authors specifically and will be discussed below to reiterate the legitimacy of using a simulated learning environment with general and special education teacher candidates.

TeachLivE Peterson (2014) studied $N = 8$ undergraduate special education teacher candidates and the extent to which they provided opportunities to respond (actions that elicit a response; verbal or nonverbal) within the TeachLivE simulated learning environment. Half of the participant group ($N = 4$) received instructional coaching immediately following all TeachLivE sessions, while the other half of the participant group ($N = 4$) did not, to investigate whether or not the TeachLivE simulated learning environment in addition to coaching impacted the rate at which opportunities to respond occurred. Participants also completed a self-reflection following each session to think about and write down what they felt went well, what they would like to change for the next session, and what goals they had for themselves.

Participants taught the same lesson across four TeachLivE sessions, starting the lesson over each time. The researcher sat in the simulations and coded each of the participants on opportunities to respond that were exhibited including scripted directly from the lesson plan, closed response, original newly formed question, organization request (e.g., please take out your pencil), or behavioral (e.g., behavioral questions). Across all eight participants, four increased their overall frequency of providing opportunities to respond between initial and final sessions. Half of the participants showing such improvement were from the group that received immediate coaching following each TeachLivE session. Seventy-five percent of all participants decreased their use of scripted questions, and 50% decreased their use of closed questions. Seventy-five percent increased use of management-related questions, and because the behaviors of the avatars were dependent on the teacher candidates teaching, data was inconclusive regarding behavioral data. One hundred percent of participants, however, increased their use of original opportunities to respond between the first and last sessions (Peterson-Ahmad, 2018, p. 4).

Participant self-reflection data noted several common themes including (1) positive comments, (2) negative comments, (3) things to change for the next session, and (4) feelings about providing OTR. Analysis yielded that overall, participants self-reflected 17.43% positive-type statements, 3.66% negative statements, 21.81% things to change for next time statements, and 17.74% statements regarding overall feelings about providing opportunities to respond. Participants also wanted to better identify individualized student needs. For example, participant responses included: "I really started to see what each student was doing while we were discussing and I noticed things that they would do when I was speaking to them specifically," "I felt as if I gave all students a chance to speak, however, when probing, I did not always provide room for students to make connections. I feel as if my questions were not always clear," "Try to incorporate everyone because I left one avatar completely out today; I didn't call on them once," "I feel I could have given more wait time as they begin to talk," or "I could have used more open-ended questions" (Peterson, 2014; Peterson-Ahmad, 2018).

Data suggests that sessions in the TeachLivE simulated environment, in addition to instructional coaching, were effective tools that allowed for increased reflection. With continued TeachLivE sessions that include combined instructional coaching, teacher candidates could continue to make further changes that would increase teacher/student interactions, motivate students to become more involved in the lessons by providing higher rates of opportunities to respond, and increase appropriate classroom management strategies to allow for all students to become involved and highly engaged in learning.

Mursion Landon-Hays, M., Peterson-Ahmad, M.B., & Frazier, A. (2020) studied one class of special education graduate students ($N = 18$) and one class of general education secondary pre-licensure graduate students ($N = 19$). Students in each class were given the opportunity to co-teach in pairs in a middle school simulated class of avatars with diverse abilities, using informational text and a lesson on content vocabulary. This experience, along with classroom instruction based on high-leverage practices, sought to build a foundation for students across general education and special education programs, bridging the gap between knowledge and practices. A main goal of the study was to measure students' perceived self-efficacy in teaching using the TSES scale, with qualitative data collected through post-teaching reflection and observational notes. Participants completed the TSES scale at the beginning of the study and at the end. They also completed a self-reflection after each session, reflecting on what went well, what they would change, and goals for their next session.

Participant pairs taught the same lesson across five Mursion sessions, starting the lesson over each time, with coaching guidance provided for the special education students by the general education professor and coaching for the general education students provided by the special education professor. The respective professor sat in the simulations and coded each of the participants on their use of high-leverage practices including explaining and modeling content, practices, and strategies; coordinating and adjusting instruction during a lesson; and checking student understanding during and at the conclusion of lessons. Participants reflected on their self-efficacy each time. Across all participants, the majority increased their efficacy in explaining and modeling content between initial and final sessions. Half of the participants demonstrated improvement in integrating strategies for teaching a concept, and 60% of all participants became more mindful of individual student participation in their lessons, checking in with greater frequency on student understanding and engagement. One hundred percent of participants, however, increased their efficacy in coordinating and adjusting instruction during a lesson.

Participant self-reflection data noted several common themes including (1) increased awareness of partner interactions in teaching, (2) lessons that included more explicit descriptions of modeling content and strategies, (3) increased specificity in action toward goals for future teaching, (4) growth in authentic understandings of individual student needs, and (5) increased self-efficacy toward teaching content using high-leverage practices. One student reflected, "I was very proud of this lesson; We got straight to the point of the lesson which was vocabulary and had equal amounts of input and control as teachers; We were also able to incorporate a visual activity which was a goal from last session." Reflecting on attention to individual student needs, participants set goals to increase their attention and teaching toward student needs. For example, "Next time, we would encourage students to make more personal connections with the vocabulary words; see if students can come up with their own definitions and more creative sentences," "We could use a visual; Harrison had a hard time finding the word assess and it may have been easier if he could have seen it," and "In our next lesson, we could integrate activities students can do independently or with a partner to practice the skills; integrate more differentiation specific to Harrison." These insights that focus specifically on Harrison (an avatar) demonstrate student attention to differentiation, an inclusive classroom that provides personalized instruction for a student who may have a learning disability, and an increased attention to student needs rather than teacher needs.

Data for this Mursion study, just as it did with the TeachLivE study, suggests that sessions in the Mursion simulated environment in addition to instructional coaching were effective tools that allowed for increased reflection and improved teacher efficacy. Continued Mursion sessions that combined instructional coaching with self-reflection offered teacher candidates the opportunity to continue to make changes that increase their self-efficacy in teaching; heighten their ability to work with students who have differing learning needs; structure their instruction to be more direct, explicit, and strategic; and practice intentional improvement aligned with their self-identified teaching goals. Additionally, finding methods for bridging the gap between siloed areas of study, such as special education and general education, can lead to increased shared understanding of the disciplines, easier collaborations, and more authentic integration of high-leverage practices for future teachers of students with high-incidence disabilities who spend a majority or all of their day in the general education classroom setting.

12.3.1 Recommended Use and Scope of Practice

Initial results of this work with two simulated learning environments (TeachLivE and Mursion) demonstrate their impact on teacher candidates, as well as an influence on the design and administration of the preparation programs the teacher candidates attend. Today's general education classrooms are changing, and all levels of educators are expected to be able to effectively support and teach a wide range of learners, including students with disabilities (DaFonte & Barton-Arwood, 2017). Educational reform is focused on improving teacher instruction and student learning; however, this cannot be done without the collaboration of general and special education teachers. With the potential of such expansive job responsibilities, the prevailing view is that "educators perform better when they work together" (Leonard & Leonard, 2003, p. 1). The importance of promoting collaboration between general and special education teacher preparation programs is important in order to learn how (Hamilton-Jones & Vail, 2014) "to provide a coherent educational program to support student's academic achievement" (Ketterlin-Geller, Baumer, & Lichon, 2015, p. 52). When planning instruction for students with disabilities, collaboration is key and takes mindful effort, persistence, and continued professional development (Hamilton-Jones & Vail, 2014; Robinson & Buly, 2007). Preparing teacher candidates for collaboration and co-teaching needs to begin in teacher preparation programs (Conderman & Johnston-Rodriquez, 2009).

For novice teacher candidates, there are benefits to repeated practice in a safe environment where one can fail with reflection and try again while receiving peer feedback and coaching. The simulated teaching environment provides the opportunity to teach the same lesson over again, with adjustments based on immediate feedback, something that cannot be done in a traditional classroom setting. Subsequently, teacher candidates' self-efficacy increases as they experience tangible improvement linked to the application of research they are studying in their coursework, with timely interactions from peers and instructors. The real-time nature of the simulated environment provides this sorely needed structure that is the bridge between classroom work and field experiences.

For teachers as developing professionals, there is a positive impact from the opportunity to work in a co-teaching model. Teacher candidates learn to plan micro-lessons focused on targeted instructional practices alongside peers who are learning the same concepts. We noticed changes in teaching partnerships based on lesson plans teacher candidates submitted prior to teaching, conversations they had while preparing to teach, and insights gained from reflections on teaching aligned with coaching feedback. This give and take in planning and instruction was a positive outcome cited by teacher candidates, whose prior co-teaching experiences were marked by the power imbalances inherent in the traditional classroom setting. Further, teacher candidates' awareness of instructional coaching as a model for professional development was heightened, preparing them dispositionally for this important growth model.

Finally, these studies demonstrate the positive impact of the simulated learning environment for teacher candidate planning and instruction. Each time candidates taught a lesson in the simulated environment, they had to submit a lesson plan demonstrating their pre-planning and adjustments to prior lessons based on conversations with their co-teacher and from coaching notes. Special education teacher candidates researched literacy teaching strategies (such as "the Frayer model") implemented in general education classrooms and taught these strategies with a focus on the whole class and an eye on individuals who might struggle. General education teacher candidates planned more direct and explicit instruction, increasing their modeling and questioning to understand individual learner's needs. Both groups expressed an increased understanding of the challenges and opportunities of an inclusive classroom setting by shortening their time in didactic instruction and moving toward more work with student avatars that allowed for differentiation, personalization, and building community. Their lessons became less "fluffy" and more directly aligned with identified learning outcomes.

For teacher education programs, the simulated learning environment afforded the opportunity to teach across programs. Both the special education and general education professors worked more collaboratively, as we fine-tuned the simulated session to fit both special education and general education needs, alerting one another to the ways our programs framed discussions of high-leverage practices and lesson planning. Because the simulated learning environment was on-site at our University, we were able to participate in the simulated fieldwork experience, observing our students teaching in ways that the traditional model of providing only coursework on campus did not allow. We each coached one another's students, learned more about each other's programs, and subsequently adjusted our program outcomes to be more inclusive of these new understandings of the bridges between special education and general education.

12.3.2 Benefits of Using Simulated Learning Environments

There are multiple benefits in using a simulated learning environment. Below, the authors discuss three major benefits found in their research and identified in other research related to simulated learning environments.

1. *Use of targeted rehearsal opportunities in combination with high-leverage practices*. A simulated learning environment allows teacher candidates repeated opportunities to rehearse specific pedagogical strategies (both academic and classroom management related), make mistakes, reflect, and then try again to refine teaching practices before they start working in actual classrooms with real students:
2. *Immediate feedback and goal setting.* Utilizing an instructional coaching model combined with the use of a simulated learning environment allows for multiple immediate and post-feedback opportunities. Having opportunities to receive feedback allows for a targeted and collaborative experience between teacher candidates and faculty members to goal set and measure improvement over time and simulated learning environment sessions. This coaching model alerts teacher candidates to a mentoring tool that novice teachers may not recognize but will encounter when they become teachers.
3. *Cross-disciplinary conversations between general education and special education teachers*. The ability for teacher candidates to practice strategies for effective co-teaching between disciplines is one that offers early exposure to various formats of co-teaching methodologies in addition to learning about roles and responsibilities of each teacher within.

12.3.3 Limitations of Using Simulated Learning Environments

While benefits certainly outweigh the limitations of a simulated learning environment, two main things must be considered:

1. *Cost.* There are costs associated with providing a simulated learning environment in teacher preparation programs. While costs vary based on the levels of simulation that a university may provide, this should be taken into consideration when planning for such experiences. This is also one reason why there is limited research on the use of simulated learning environments in teacher preparation programs, as it is relatively new and selective to programs that have access to and can afford the use of this technology.
2. *Time.* If a teacher preparation program chooses to adopt and use this technology into its program, strategies to support and build in simulation experiences for teacher candidates need to be explicit and aligned to outcomes and objectives of the respective teacher preparation program.

12.4 Conclusion

Teachers are the single most important factor to influence student learning and academic outcomes, and high-quality experiences that afford early opportunities for teacher candidates to learn critical academic and behavior skills early on are essential. Simulated learning environments, such as TeachLivE or Mursion, afford teacher candidates the opportunity to have repeated trials to practice specific skills that accompany vital skills needed in a real classroom such as individualizing and differentiating instruction based on specific student needs or managing behaviors in an efficient and effective manner.

Instructional coaching allows mentor teachers to support teacher candidates in their teacher education program to support pedagogical strategies in addition to supporting acquisition of content through modeling, observing, implementing, and refining teaching and classroom management strategies and practices. Instructional coaching also allows for increased reflection and discussion about what happened, what should have happened, and needed changes (Knight, 2009; Peterson-Ahmad, 2018). Combining instructional coaching with the use of a simulated learning environment apprentice's teacher candidates to coaching is a viable form of professional development, while providing them feedback that is in the moment and actionable. As teacher candidates reflect on their teaching experience, the advice from the coach, and the immediacy provided by the virtual environment, they can set goals for the next teaching session that are linked to concrete feedback that will promote improvement. This leads to increased self-efficacy and targeted goals.

Providing teacher candidates with the opportunity to teach the same lesson over again, while focusing on fixing mistakes they identified through collaborative conversations, has a positive and long-lasting impact on their instruction. These transferable skills are generalized in the more complex classroom setting, while the teacher candidates' self-efficacy increases tangibly from repeated practice. Because traditional classroom practices have so many variables that a candidate may not be ready for, learning to teach can be overwhelming, and areas for improvement can be hard to target. Simulated learning environments, such as TeachLivE and Mursion, provide a semi-controlled space for teacher candidates to practice and grow, building a strong instructional foundation through heightened awareness of their own practice and targeted goal setting for future classroom success.

References

Beare, P., Marshall, J., Torgerson, C., Tracz, S., & Chiero, C. (2012). Toward a culture of evidence: Factors affecting survey assessment of teacher preparation. *Teacher Educator Quarterly, 39*, 159–173.

Conderman, G., & Johnston-Rodriquez, S. (2009). Beginning teachers' views of their collaborative roles. *Preventing School Failure, 53*(4), 235–244.

DaFonte, M. A., & Barton-Arwood, S. M. (2017). Collaboration of general and special education teachers: Perspectives and strategies. *Intervention in School and Clinic, 53*(2), 99–106. https://doi.org/10.1177/1053451217693370

Darling-Hammond (2010). Teacher education and the American future. *Journal of Teacher Education, 61*(1-2), 35–47.

Dawson, M. R. (2016). *From TeachLivE to the classroom: Building pre-service special educators' proficiency with essential teaching skills*. Doctoral dissertation.

Dawson, M. R., & Lignugaris/Kraft, B. (2017). Meaningful practice: Generalizing foundation teaching skills from TLE TeachLivE to the classroom. *Teacher Education & Special Education, 40*(1), 26–50.

Dieker, L.A., Rodriguez, J.A., Lignugaris/Kraft, B., Hynes, M.C., & Hughes, C.E. (2014). The potential of simulated environments in teacher education: Current and future possibilities. *Teacher Education and Special Education, 37*(1), 21–33.

Dieker, L. A., Hughes, C. E., Hynes, M. C., & Straub, C. (2017). Using simulated learning environments to improve teacher performance. *School University Partnerships, 10*(3), 62–81.

Elford, M. D. (2013). *Using tele-coaching to increase behavior-specific praise delivered by secondary teachers in an augmented reality learning environment*. Doctoral dissertation. Available from ProQuest (UMI No. 3559157).

Hamilton-Jones, B. M., & Vail, C. O. (2014). Preparing special educators for collaboration in the classroom: Pre-service teachers' beliefs and perspectives. *International Journal of Special Education, 29*, 76–86.

Ingersoll, R., Merrill, L., & May, H. (2012). Retaining teachers: How preparation matters. *Educational Leadership, 69*, 30–34.

Katsiyannis, A., Zhang, D., & Conroy, M. A. (2003). Availability of special education teachers: Trends and tests. *Remediation Special Education, 24*, 246–253.

Ketterlin-Geller, L. R., Baumer, P., & Lichon, K. (2015). Administrators as advocates for teacher collaboration. *Intervention in School and Clinic, 51*(1), 51–57.

Knight, J. (2009). *Coaching approaches & perspectives*. Thousand Oaks, CA: Corwin Press.

Landon-Hays, M., Peterson-Ahmad, M.B., & Frazier, A. (2020) Learning to teach: How a simulated learning environment can connect theory to practice in general and special education educator preparation programs. *Education Sciences, 10*(7).

Ledger, S. E., Ersozlu, Z. N., & Fischetti, F. (2019). Preservice teachers' confidence and preferred teaching strategies using TeachLivE virtual learning environment: A two-step cluster analysis. *EURASIA Journal of Mathematics, Science & Technology Education, 15*(3), 1–17.

Leonard, L., & Leonard, P. (2003). The continuing problem with collaboration: Teachers talk. *Current Issues in Education, 6*(15), 1–10.

McLeskey, J., Tyler, N. C., & Flippin, S. S. (2004). The supply and demand for special education teachers: A review of research regarding the chronic shortage of special education teachers. *Journal of Special Education, 54*(1), 31–42.

Mursion (2016). Case study: Bill & Melinda Gates foundation research study licensure. https://www.mursion.com/case-studies/bill-melinda-gates-foundation-research-study/

Nagendran, M., Gurusamy, K. S., Aggarwal, R., Loizidou, M., & Davidson, B. R. (2013). Virtual reality training for surgical trainees in laparoscopic surgery. *Cochrane Database of Systematic Reviews*, 8.

Peterson, M. B. (2014). *Pre-service special education teachers' frequency of opportunities to respond in the TeachLivE virtual classroom*. Doctoral dissertation. Available from ProQuest (UMI No. 3623983).

Peterson-Ahmad, M. B. (2018). Enhancing pre-service special education preparation through combined use of virtual simulation and instructional coaching. *Education Sciences, 8*(10), 1–9. https://doi.org/10.3390/edusci8010010

Peterson-Ahmad, M. B., Pemberton, J., & Hovey, K. (2018). Virtual learning environments for teacher preparation. *Kappa Delta Pi Record, 54*(4), 165–169.

Robinson, L., & Buly, M. R. (2007). Breaking the language barrier: Promoting collaboration between general and special educators. *Teacher Education Quarterly, 34*(3), 83–94.

Smith, K., & Klumper, D. (2018, September). Virtually in the classroom. *Educational Leadership*, 60–65.

Straub, C. Dieker, L. A., Hynes, M., & Hughes, C. (2015). *Using virtual rehearsals in TLE TeachLivE mixed reality classroom simulations to determine the effects on the performance of science teachers: A follow-up study (year 2)* (pp. 1–64).

Tyler, T. A., & Brunner, C. C. (2014). The case for increasing workplace decision-making: Proposing a model for special educator attrition research. *Teacher Education & Special Education, 37*(4), 283–308.

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

Krista Vince Garland and Dennis Garland

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

K. Vince Garland (✉)
SUNY Buffalo State, Buffalo, NY, USA
e-mail: garlankm@buffalostate.edu

D. Garland
Niagara University, Lewiston, NY, USA
e-mail: dgarland@niagara.edu

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3_13

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).

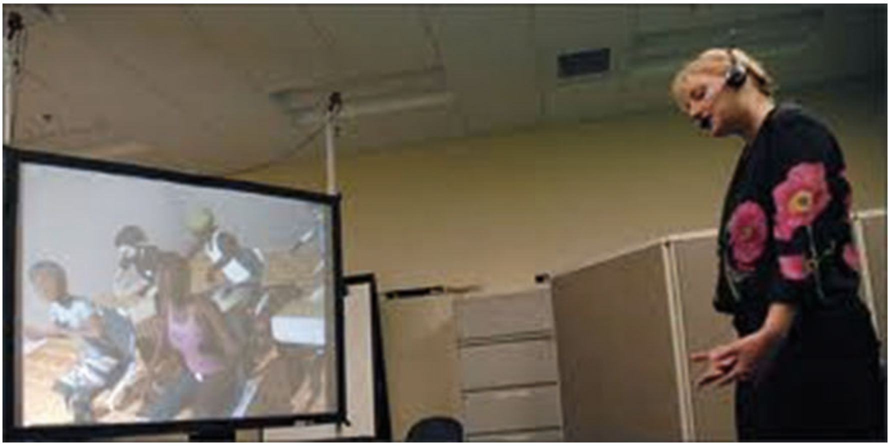

Fig. 13.1 Early iteration stationary laboratory at the University of Central Florida with rear projection unit and requisite participant headpiece, circa 2011

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.

References

Alexander, B., Ashford-Rowe, K., Barajas-Murphy, N., Dobbin, G., Knott, J., McCormack, M., …, Weber, N. (2019). EDUCAUSE. *Horizon report: 2019 higher education edition.* Louisville, CO: EDUCAUSE.

Andreasen, J. B., & Haciomeroglu, E. S. (2009). *Teacher training in virtual environments*. Paper presented at the annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education, OMNI Hotel, Atlanta, GA.

Benedict, A., Holdheide, L., Brownell, M., Foley, A. M., & CEEDAR. (2016). *Learning to teach-practice-based preparation in teacher education. Special Issues Brief.* Center on Great Teachers and Leaders.

Council for the Accreditation of Educator Preparation CAEP. (2013). *CAEP accreditation standards*. Washington, DC. Retrieved from http://caepnet.org

Darling-Hammond, L. (2010). *Evaluating teacher effectiveness: How teacher performance assessments can measure and improve teaching.* Retrieved from http://www.americanprogress.org/issues/2010/10/pdf/teacher_effectiveness.pdf

Dawson, M. R., & Lignugaris/Kraft, B. (2017). Meaningful Practice: Generalizing foundation teaching skills from TLE TeachLivETM to the Classroom. *Teacher Education and Special Education, 40*(1), 26–50. https://doi.org/10.1177/0888406416664184

Dieker, L., Hynes, M., Hughes, C., & Smith, E. (2008). Implications of mixed reality and simulation technologies on special education and teacher preparation. *Focus on Exceptional Children, 40*(6), 1–20.

Dieker, L. A., Hughes, C. E., Hynes, M. C., & Straub, C. (2017). Using simulated virtual environments to improve teacher performance. *School University Partnerships (Journal of the National Association for Professional Development Schools): Special Issue: Technology to Enhance PDS, 10*(3), 62–81.

Dieker, L. A., Rodriguez, J. A., Lignugaris/Kraft, B., Hynes, M. C., & Hughes, C. E. (2013). The potential of simulated environments in teacher education: Current and future possibilities. *Teacher Education and Special Education, 37*(1), 21–33.

Garland, D. P., & Vince Garland, K. M. (2020). Using technology-based simulation to prepare special education teachers. In P. del Prado Hill & K. Garas-York (Eds.), *The impact of PDS in challenging times.* Charlotte, NC: Information Age Publishing.

Garland, D. P., Vince Garland, K. M., & Vasquez, E. (2013). Management of classroom behaviors: Perceived readiness of education interns. *Journal of the Scholarship of Teaching and Learning, 13*(2), 133–147.

Grossman, P., Hammerness, K., & McDonald, M. (2009). Redefining teaching: Reimagining teacher education. *Teachers and Teaching: Theory and Practice, 15*, 273–290. https://doi.org/10.1080/13540600902875340

Holden, K.B. (2016). *Effects of self-regulated learning training + eCoaching on pre-service general education teacher's instruction and student outcomes.* Unpublished doctoral dissertation. University of North Carolina at Greensboro, Greensboro, North Carolina.

Individuals with Disabilities Education Improvement Act of 2004. (2004). 108–446, U.S.C §1400 300 *et seq*.

Judge, S., Bobzien, J., Maydosz, A., Gear, S., & Katsioloudis, P. (2013). The use of visual-based simulated environments in teacher preparation. *Journal of Education and Training Studies, 1*(1), 88–97.

Kelley, M. J., & Wenzel, T. (2019). How TeachLivE™ transformed our teaching practices in reading education and pre-service. *SRATE Journal, 28*(1), 9–22.

Khalil, D., Gosselin, C., Hughes, G., & Edwards, L. (2016). Teachlive™ Rehearsals: One HBCU's study on prospective teachers' reformed instructional practices and their mathematical affect. Conference Papers -- Psychology of Mathematics & Education of North America, 767–774.

Leko, M., Brownell, M., Sindelar, P., & Kiely, M. (2015). Envisioning the future of special education personnel preparation in a standards-based era. *Exceptional Children, 82*(1), 25–43. https://doi.org/10.1177/0014402915598782

McLeskey, J., Barringer, M.-D., Billingsley, B., Brownell, M., Jackson, D., Kennedy, M., …, Ziegler, D. (2017, January). *High-leverage practices in special education.* Arlington, VA: Council for Exceptional Children & CEEDAR Center.

McLeskey, J., & Brownell, M. (2015). *High-leverage practices and teacher preparation in special education* (Document No. PR-1). Retrieved from University of Florida, Collaboration for Effective Educator, Development, Accountability, and Reform Center website: http://ceedar.education.ufl.edu/tools/best-practice-review/

No Child Left Behind Act of 2001. (2002). 115 U.S.C. § 1425 *et seq*.

Spencer, S., Drescher, T., Sears, J., Scruggs, A., Schreffler, J., & Beck, D. (2019). Comparing the efficacy of virtual simulation to traditional classroom role-play. *Journal of Educational Computing Research, 57*(7), 1772–1785.

Straub, C., Dieker, L., Hynes, M., & Hughes, C. (2014). *Using virtual rehearsal in TLE TeachLivE™ mixed reality classroom simulator to determine the effects on the performance of mathematics teachers*. 2014 TeachLive national research project: Year 1 findings. Orlando, FL: University of Central Florida.

Straub, C., Dieker, L., Hynes, M., & Hughes, C. (2015). *Using virtual rehearsal in TLE TeachLivE™ mixed reality classroom simulator to determine the effects on the performance of science teachers: A follow-up study (year 2)*. 2015 TeachLivE national research project: Year 2 findings. Orlando, FL: University of Central Florida.

U. S. Department of Education, Institute of Education Sciences. (2010). *Assessment of educational progress*. Washington, DC: National Center for Educational Statistics.

Vince Garland, K. M. (2012). *Coaching in an interactive virtual reality to increase fidelity of implementation of discrete trial teaching*. Unpublished doctoral dissertation. University of Central Florida.

Vince Garland, K. M. (2014). *TeachLivE™ from New York: Developing innovative practices in immersive teaching technology*. SUNY innovative instruction technology grant project outcomes report. Buffalo, NY: SUNY Buffalo State.

Vince Garland, K. M., Holden, K., & Garland, D. P. (2016). Individualized clinical coaching in the TLE TeachLivE™ lab: Enhancing fidelity of implementation of system of least prompts among novice teachers of students with autism. *Teacher Education and Special Education: The Journal of the Teacher Education of the Council for Exceptional Children, 39*(1), 47–59.

Vince Garland, K. M., Vasquez, E., & Pearl, C. E. (2012). Efficacy of individualized clinical coaching in a virtual reality classroom for increasing teachers' fidelity of implementation of discrete trial teaching. *Education and Training in Autism and Developmental Disabilities, 47*(4), 502–515.

Wood, M. B., Turner, E. E., Civil, M., & Eli, J. A. (Eds.). (2016). *Proceedings of the 38th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Tucson, AZ: The University of Arizona.

Index

E. Bradley (ed.), *Games and Simulations in Teacher Education*, Advances in Game-Based Learning, https://doi.org/10.1007/978-3-030-44526-3

T

U

V