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Computer-Based Simulation in Occupational Therapy Lecture Courses: A Program Evaluation of Simulation Implementation

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Keywords

education, instructional design, Simucase, teaching

Cover Page Footnote

Special thanks to Krista Eckels, MOT, OTR/L for providing expertise related to simulation in health professions.

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ABSTRACT

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PLAIN LANGUAGE SUMMARY

Research shows that computer-based simulations work well for fieldwork, but we know less about using them in classrooms. This project looked at the use of computer-based simulations to teach in classrooms after the pandemic. Students took a survey after each simulation. They shared their thoughts on their learning and confidence. The survey results showed that 87-95% of students thought the simulations helped them learn. Also, 85.7-100% felt more confident in their therapy skills. Students shared extra comments about how they learned best and what they liked. Students learned the most from the productive failure method. They liked the flipped classroom method best. Using different teaching methods with simulations in the classroom is helpful. Overall, the study shows that computer-based simulation is a good teaching tool in classrooms.

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Computer-Based Simulation in Occupational Therapy Lecture Courses: A Program Evaluation of Simulation Implementation

Simulation experiences are an effective teaching tool for healthcare professions (Galloway, 2009). Occupational therapy educators most frequently use simulation with standardized patients, student actors or role play, and video cases (Bethea et al., 2014; Grant et al., 2021). In the past few years, the creation of online computer-based simulation programs has opened new pedagogy and fieldwork opportunities for occupational therapy educators. The popularity of these programs grew during the COVID-19 pandemic as a resource for health education programs to continue in a virtual format (Davis et al., 2022; DeIuliis et al., 2021). During COVID, the Accreditation Council for Occupational Therapy Education (ACOTE) accepted virtual-based simulated learning experiences as a method to meet educational standards for Level I Fieldwork (2018). ACOTE continues to recognize virtual environments for Level I Fieldwork in the 2023 Standards (ACOTE, 2023). A midwestern occupational therapy program rushed computer-based simulations into use during the pandemic to provide clinical experience demonstrations when courses were forced online. Students and faculty reported positive anecdotal feedback with the addition of simulation. More transitions occurred including curricular changes from a master's to a doctoral degree just prior to the pandemic and faculty turnover during and after the pandemic. These changes prompted faculty evaluation of computer-based simulation to clarify whether its continued use during in-person learning was a beneficial instructional strategy.

The National Council of State Board for Nursing conducted a seminal longitudinal and multisite study, revealing similar or better student clinical skill performance when simulation replaced up to 50% of traditional face-to-face clinical experiences in prelicensure nursing programs (Hayden et al., 2014). In occupational therapy clinical education, students demonstrated commensurate performance when placed in 40-hour simulation fieldwork placements with actor role-play as compared to 40-hour traditional face-to-face fieldwork placements (Imms et al., 2018). Further studies compared computer-based simulation fieldwork experiences to traditional fieldwork as the pandemic persisted and new technology emerged. Researchers reported student and educator satisfaction with computer-based simulated fieldwork experiences and equivalent learning outcomes compared to traditional clinical settings (Harris et al., 2022; Mattila et al., 2020). Grant et al. (2021) found that computer-based simulation in occupational therapy programs was well received by students. The authors recommended further research to measure the effectiveness of learning clinical practice skills (Grant et al., 2021).

While evidence supports computer-based simulation as an alternative to in-person fieldwork, limited evidence investigates using computer-based simulations to support learning in didactic courses. Studies in communications science and communication disorders programs yield information that may relate to occupational therapy education (Carter, 2019; Clinard & Dudding, 2019; Elliott & Brumbau). Students who completed computer-based simulations using the Simucase platform outperformed students who completed a comparable written case study with clinical skill and critical thinking outcome measures (Carter, 2019). Clinard and Dudding (2019) reported equivalent learning outcomes between student groups who completed computer-based simulations and those who interacted with in-person clients. Students reported positive perceptions and improvement in knowledge acquisition by using a computer-based simulation program throughout a pediatric lecture course (Elliott and Brumbaugh, 2021). This literature supports the effectiveness of computer-based simulation as a pedagogical tool.

Simucase is a commercially available computer-based simulation platform supporting learning for several health professions (Simucase, 2024). The program uses interactive virtual clients to facilitate learning through video-recorded responses. Students complete case studies applying the occupational therapy process by reviewing history, conducting interviews an assessments and interventions, interprofessional collaboration, and measuring progress (Ondo et al., 2021). Simucase program developers advise educators to use the platform to meet their specific course and curriculum objectives.

Kolb's experiential learning theory supports the use of simulation. Kolb (1984) described a cyclical learning process, in which learning occurs through experience and reflection. The four stages of learning include: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Learning may begin at any stage in the cycle, then continuing in order. Kolb's theory places a high value on reflection and hands-on experience to improve learning: practicing, testing new ideas, observing an expert, and implementing skills. Computer-based simulation programs provide practical experiences through interactive video clients and reflection opportunities. A knowledge gap still exists related to the instructional design and implementation process in which educators construct and measure learning objectives, experiences, and outcomes using a computer-based simulation platform outside of fieldwork experiences. The primary focus of this study was to evaluate students' perception of learning and the use of computer-based simulation in occupational therapy lecture courses. A secondary focus was to compare different instructional designs reflecting Kolb's experiential learning theory to see which best support learning. Knowledge gained from program evaluation informs the use or removal of simulation for future cohorts.

Method

Participants

Participants included 49 students from a cohort of an entry-level occupational therapy doctoral program at one Midwestern university. All students from a cohort enrolled in pediatric assessment and intervention courses with simulation instruction were eligible to participate in the study. There were no additional exclusion factors. The University Institutional Review Board deemed the student quality improvement; therefore, written consent from the participants was not required.

Assessment Tools

Researchers examined student perceptions using a survey design. Two tools were used to gather student data: Simulation Effectiveness Tool – Modified (SET-M) and the Student Feedback Survey.

Simulation Effectiveness Tool – Modified (SET-M)

With permission from creators, researchers used the Simulation Effectiveness Tool – Modified (SET-M) (Leighton et al., 2015) to measure student satisfaction and their perceived learning from the simulation experiences. SET-M evaluates four components of the simulation process: prebriefing, participant learning, participant confidence, and debriefing. The survey consists of 19 questions with three available answers indicating level of agreement with each statement on a scale from strongly agree, somewhat agree, to do not agree. It also includes one open-ended question for students to share additional comments. The SET-M was created for nursing education and has demonstrated adequate construct validity and reliability to evaluate simulations used in healthcare education (Leighton et al., 2015).

Student Feedback Survey

Researchers developed the Student Feedback Survey for this program evaluation. Students reported their reflective thoughts and perceptions about the overall simulation experience through the 12-question survey. The survey contained questions about preferred simulation instructional design, favored simulation case, cost benefit, and future recommendations. Questions were forced answer (yes/no) with follow-up open-ended questions. Simulation instructors and one researcher designed the survey. No survey testing was completed prior to use.

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Research design

This program evaluation examined students' learning perceptions with computer-based simulations to determine if they were a beneficial addition to the program's lecture courses. Study outcomes address Kirkpatrick Level I assessment, measuring students' reactions or responses to the computer-based simulations as a teaching and learning tool (Kirkpatrick & Kirkpatrick, 1994).

Two sequential pediatric occupational therapy lecture courses used a computer-based simulation platform, Simucase, as a teaching tool (Simucase, 2024). Researchers trialed four instructional strategies aligned with adult learning theory principles. Instructional strategies were provided in the same order for all students, including *Self-Instruction with Written Outcome Feedback, Distributed Practice, Flipped Classroom, and Productive Failure.* Instructors chose simulation cases matched with course content and learning objectives. Instructors followed best practices for simulation implementation, with prebrief and debrief facilitated by content experts in pediatric occupational therapy practice (Gaba, 2004). During debriefings, students reflected and shared their experiences in small and large group discussions using questions provided by the computer-based simulation platform and questions created by the course instructors.

Self-Instruction with Written Outcome Feedback

The first instruction design facilitated a summative experience in which students independently completed an assigned simulation and a supplemental graded assignment. Self-instruction allows students to complete the simulation at their own pace and is often paired with computer-based simulations (Chiniara et al., 2013). Students engaged in the *Paidyn* Simucase simulation by completing an occupational therapy reevaluation of a 2-year-old girl and a graded occupational therapy evaluation report assignment summarizing their simulation findings. Students received written outcome feedback about the simulation with a grade on the assignment.

Distributed Practice

Students interacted with a three-year-old boy, *Diego*, Simucase simulation to learn how to administer a developmental assessment using distributed practice across six weeks of the semester. The distributed practice instructional design included studying or practicing content at least two times (with some content duplication) with a break in between (Dunnack et al., 2021). Simulation was scaffolded with students completing and debriefing one of five developmental assessment domains each week of class for five weeks. This instructional method continued for each assessment subtest, with the last week, week 6, focusing on interpreting the developmental assessment findings. Students were able to build on previous learning and develop deeper understanding using distributed practice with this case.

Flipped Classroom

The third instructional design utilized the flipped classroom, in which students studied new course material before class to allow for interactive learning during class (Hawks, 2014). The *Leora* and *Owen* Simucase simulations were selected to reinforce course topics about augmentative and alternative communication, assistive technology, and therapeutic interventions. Before class, students viewed pre-recorded videos as a prebrief introduction to the case. Students then completed the first half of a simulation, including chart review, client interview, caregiver interview, and collaborative interprofessional discussions. During class, students discussed their initial findings with a small group of peers. Then, the whole class watched the therapy intervention portion of the simulation, with guest speakers and faculty adding their observations. Researchers recommended that students complete the last two parts of the simulation (reporting on client goals and summarizing the simulation) on their own.

Productive Failure

Students completed the *Gabriel* Simucase with content about pediatric seating, positioning, and assistive technology. The simulation followed the productive failure instructional design, in which the simulation is given before direct instruction to facilitate student learning through self-discovery of knowledge gaps (Dubovi, 2018; Palominos et al., 2021). After a short pre-recorded prebriefing, students completed the simulation with little prior instruction. They reflected on their performance by writing about their initial impression and identifying areas for continued learning and growth. Next, students received direct instruction in a class field trip to a seating, positioning, and assistive technology vendor to learn more about matching client considerations with available products. Students completed the simulation again to apply new learning to the case. In addition to the simulation, students completed additional reflection questions and a letter of medical necessity supplemental assignment. The simulation was debriefed in class in small and large groups after the second simulation completion.

Data collection

Students anonymously completed the SET-M survey following each of five simulations. During the final week after all simulations, students completed the Student Feedback Survey. Completion was voluntary. Researchers collected and managed all data using a secure, web-based software platform.

Data Analysis

Quantitative data were analyzed using descriptive statistics (e.g., frequencies and means). Researchers applied thematic analysis with qualitative data collected through the Student Feedback Survey. The educational team immersed themselves in the data by reading all the responses. They then reviewed the data independently, making note of potential codes. Codes were then grouped into sub-categories, which were reorganized into patterns. The team then analyzed the data together to compare initial codes to find patterns (Braun & Clarke, 2006).

Results

Simulation Effectiveness

44 of 49 students participated in at least one point of data collection with the SET-M, with a range of 24 – 44 survey responses for each administration. All student responses were averaged to gauge the perceptions of the class across two of the SET-M domains: learning and confidence. The range of agreement across simulations was 87.2 - 95.0% of students who somewhat agreed or strongly agreed that the simulations supported their learning in the following items:

1. I am better prepared to respond to changes in my patient's condition.
2. I developed a better understanding of the pathophysiology.
3. I am more confident of my assessment skills.
4. I felt empowered to make clinical decisions.
5. I had the opportunity to practice my clinical decision-making skills.

The range of agreement was 85.7 – 100% of students who somewhat agreed or strongly agreed that the simulations supported their student confidence in the following survey areas:

1. I am more confident in my ability to prioritize care and interventions.
2. I am more confident in communicating with my patient.
3. I am more confident in my ability to teach patients about their illness and interventions.
4. I am more confident in my ability to report information to health care team.

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5. I am more confident in providing interventions that foster patient safety.
6. I am more confident in using evidence-based practice to provide care.

Students reported their perceived learning and confidence on the SET-M questionnaire after each simulation experience. The data are presented in the order that the simulations were used across the courses (Table 1). Most student responses on the SET-M were favorable, with over 50% indicating they strongly agreed with questions regarding both perceived learning and confidence. Conversely, only 0-5% of student responses reported that they did not agree that the computer-based simulations improved their learning and confidence in the final simulation.

Table 1

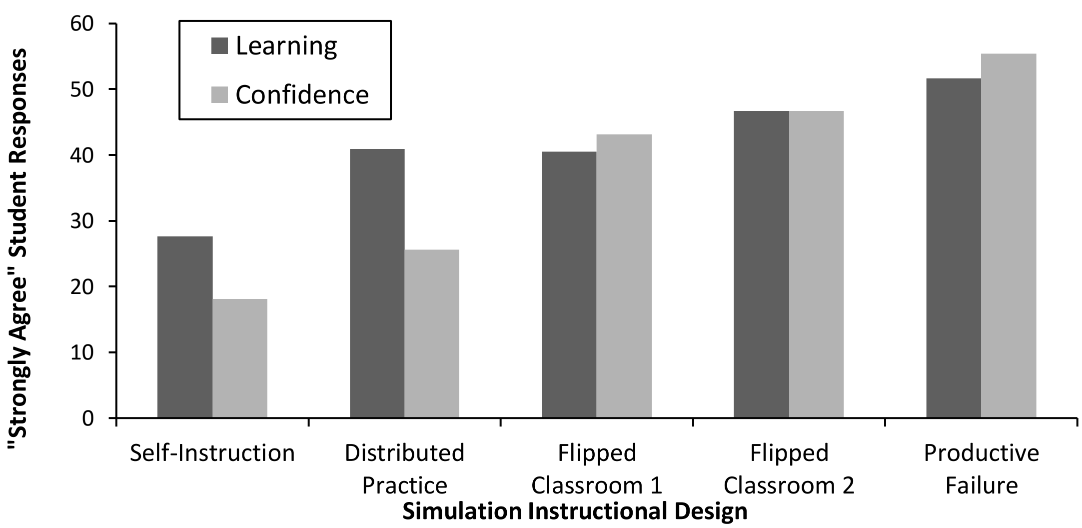
Average Percentage of Student Responses on the SET-M Questionnaire

	Self-Instruction, Written Feedback (n=47)	Distributed Practice (n=45)	Flipped Classroom 1 (n=44)	Flipped Classroom 2 (n=45)	Productive Failure (n=24)
Student Learning					
Do not agree	12.8	8.9	7.7	4.4	5.0
Somewhat Agree	56.8	50.2	51.8	48.9	43.3
Strongly Agree	27.6	40.9	40.5	46.7	51.7
Student Confidence					
Do not agree	14.3	8.8	9.5	7.3	0.0
Somewhat Agree	56.4	65.6	47.3	44.0	44.6
Strongly Agree	18.1	25.6	43.2	46.7	55.4

The responses also reflect an upward trend with each subsequent simulation experience for students' perceived learning and confidence. Only students' strongly agree responses are reported as average percentages to SET-M questions (Figure 1).

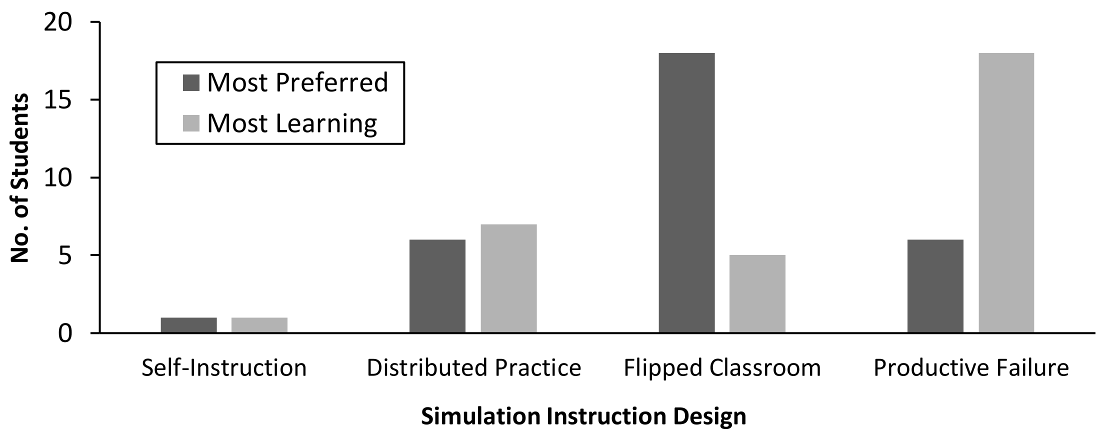
Figure 1

Students' SET-M Questionnaire Strongly Agree Responses for Simulations



Student Perceptions
In the cohort with 49 students, 31 (63%) students completed the Student Feedback Survey. The results demonstrated clear majorities in students' opinions in the forced answer (yes/no) questions. Students indicated varying perceptions about their learning attainment and preferences. The majority, 18 of 31 students (58%), reported that they preferred learning with the flipped classroom instructional design the best. Six students (19.5%) each preferred distributed practice and productive failure. One student (3%) preferred self-instruction with written feedback. Students shared differing responses about their perceived level of learning, with 18 students of 31 (58%) reporting learning the most with the productive failure instructional design and distributed practice for 7 students (23%). Figure 2 shows 31 student responses for most preferred instructional design, and most perceived learning. When asked if they recommend the computer-based simulation program, 28 of 31 students (90%) responded affirmatively. 26 of 31 students (84%) agreed that the simulation program was worth the yearly subscription cost.

Figure 2
Student Responses About Simulation Instructional Design Preference and Learning



Two patterns emerged from students' open-ended responses on the Student Feedback Survey using thematic analysis described by Braun and Clark (2006): experiential learning via technology and learning process. Table 2 shows an example of the coding process. The patterns are outlined below and are illustrated by selected student responses.

Table 2
Coding Process Example

Pattern	Sub-category	Representative Quotes
Experiential Learning Via Technology	Curriculum Support	*The simulations helped me apply knowledge from class to applicable case studies.*
	Experiential Learning	*I am a visual learner so getting to practice the OT process with the program was valuable to me.*
	Real Life	*It is the closest thing you can get to practice without actually seeing a client.*
	Technological Barriers	*It would be easier with clearer videos!*

Experiential Learning Via Technology

Students reported positive learning experiences that reinforced curriculum content, met varying learning styles with experiential learning activities, and allowed students to interact with real cases. Students also reported some difficulty using the technology.

Curriculum Support. Students applied course content in the simulations, augmenting student knowledge acquisition. Students shared that content about pediatric conditions, assessments, and the occupational therapy process was reinforced through the simulation experience. Of the students responding positively to these simulations, one stated, "The simulations helped me apply knowledge from class to applicable case studies." Another student shared, "It helped me connect content from the lecture and put it into practice."

Experiential Learning. Students appreciated learning using an alternative format with real client videos, supporting learning styles not typically met in lecture courses. Students with visual and kinesthetic learning styles found the active learning simulation experience especially beneficial. One student stated, "I am a visual learner so getting to practice the OT process with the program was valuable to me." Another student shared the value of engaging in a safe, low stakes learning activity, stating, "I think using Simucase gives an opportunity to practice some skills before putting them to use with real people."

Real Life. Several students commented about the benefit of engaging with "real" clients through the computer-based simulations. One student shared, "It is the closest thing you can get to practice without actually seeing a client." Other students shared that the experience was preferable to worksheets, reading a textbook, and role-play, "I think it was better than a role-play in class because it felt more real and could be taken more seriously."

Technology Barriers. Students became more comfortable with the computer program over time, stating, "It was confusing to get used to at first but found it to be very informational." However, some students expressed frustration with learning the technology platform and difficulty seeing therapy nuances through the videos, sharing, "It would be easier with clearer videos!"

Learning Process

Students demonstrated internal motivation to learn by engaging in all simulation experiences, including those without explicitly attached grades. Students participated in and valued debriefing activities to find the answers to the simulated cases, seeking to understand the professional reasoning behind the correct answers.

Discussions. Students appreciated time for discussions with their peers as part of the learning process during and after the simulations. One student said, "It was good to hear other student's ideas when discussing what they would do and what questions they would ask."

Feedback. Students wanted more feedback. They wanted to know the correct answers and also wanted to know why those answers were correct to develop their professional reasoning. One student explained, "If possible, it would be nice to have more clinical reasoning given as to why an answer was correct or incorrect. Sometimes I guessed and didn't really know why I was correct and all the program said was 'good job.'" Students requested additional feedback from class debriefings and the computer-based simulation program. Other students shared their positive experiences working with a peer to gain additional feedback.

Different Perspectives. Students valued hearing different perspectives and approaches to the simulation cases from other peers, instructors, guest speakers, and therapists collaborating from other disciplines. One student stated, "I enjoyed hearing the perspectives of guest speakers and professors in relation to the case. This helped me to be reassured and confirm my thinking."

Discussion

This project described students' learning perceptions with computer-based simulations in lecture courses across two semesters with various instructional designs. Overall, participants reported that the computer-based simulations were effective instructional methods for learning. These results are similar to other studies utilizing simulations for occupational therapy education (Dadswell et al., 2021; Wu & Shea, 2022). The COVID-19 pandemic expedited the use of simulation in occupational therapy education, and the instructional tool demonstrates continued value for in-person learning. Most students agreed that the computer-based simulations should continue to be implemented in future courses within the occupational therapy doctorate (OTD) program. Students also endorsed the financial value of the cost for a one-year membership for the simulation program at the time of the study.

Students reported consistent positive responses when using interactive computer-based simulations. Students perceived improved learning and confidence in their skills in each simulation. Students reported the most learning through the simulation using a productive failure design. This design challenged students to invest more time in the simulation, identify knowledge gaps, and pursue new learning. However, the productive failure implementation design was not the preferred design for learning. Instead, most students preferred the flipped classroom design. This preferential discrepancy is consistent with research on *desirable difficulties* describing the relationship between student motivation to learn and instructional methods that are more difficult to produce more significant learning (Bjork, 1994; Zepeda et al., 2020). Like the concept of the *just right challenge* in occupational therapy, educators need to carefully choose the difficulty level to assist students in reaching learning objectives.

Some students reported being overwhelmed and confused while learning new technology. To alleviate frustration with the initial learning curve, computer-based simulations could be introduced by completing one in class rather than as a homework assignment. Initial difficulty and frustration diffused after students completed additional simulations over the semesters.

Though each simulation was measured as a standalone experience, there is an upward trend in student learning and confidence across the two semesters. Positive perceptions reported by students also steadily increased, with more students rating items with *strongly agree* and fewer *do not agree* scores. Explanations for this trend may include improved familiarity with the Simucase program, improved student occupational therapy knowledge gained over two semesters, improved faculty facilitation with each simulation, or a combination of these factors. However, the reduced response rate may also indicate only students motivated to provide positive perceptions were responding over time.

Student survey fatigue was also a factor with survey response rates dropping from a 90% response rate for the first four SET-M questionnaires to 49% for the final administration. Repeated survey solicitation, even with a brief survey, should be carefully considered. For future quality improvement data collection, the research team would reduce repeated survey use and administer the SET-M only to measure a specific change, such as the effectiveness of the simulation use in another OTD course, simulation facilitation with different faculty, or with a new cohort of students.

The first author has limited experience with simulation instruction and facilitation. Though instructors studied and followed best practices, the team continued learning about simulation as the study unfolded. The computer-based simulation instruction was created from instructional designs with varying levels of support as part of a quality improvement study. The findings are specific to the cohort of students and university.

Educational decision-making and review, which includes systematic program evaluation, may shift the process from information gathering to scholarly work (Balmer, 2022). Balmer's (2022) program evaluation standards-based checklist measures the process for accuracy, feasibility, integrity, and utility. This project met all four items on the checklist. Our clear articulation of the project, the implementation process, and reasoning behind action steps taken reflects accuracy. This project is feasible for other programs to duplicate with little additional cost and with realistic parameters. Project integrity was upheld by reviewing all aspects and gaining insights from various stakeholders including faculty, students, and other department members. Finally, evaluating the novel use of computer-based simulation is of local interest to our program and is a common discussion topic across broader audiences at occupational therapy conferences demonstrating project utility.

Future Implications

While this program evaluation project reflected Kirkpatrick Level 1 outcomes, results led to Level 4 outcomes, changes in organization practice involving the use of computer-based simulation. Future research may provide insight use of simulation for other occupational therapy schools. Studies could assess and compare academic performance, specific knowledge or skills, and learning transfer in additional coursework or fieldwork. Future projects could compare students' scores or grades with other cohorts who learned the course content through alternate means or measure student learning through course tests, assignments, or performance demonstrations.

Conclusion

This study proposes that a variety of instructional designs for computer-based simulations supported students' perceived learning in occupational therapy lecture courses. Instructors could use array of instructional design options to inform simulation implementation in lecture courses. Computer-based simulations were well received to augment didactic course content. Some technical barriers with computer-based simulation platforms remain, which may be resolved with student practice and instructor simulation selection.

Knowledge Translation Takeaway

Educators can effectively translate the knowledge gained from this study with actionable steps and strategies to introduce or improve the use of computer-based simulations in occupational therapy education.

- When adding simulations to lecture courses, carefully design or select commercially available computer-based simulations that complement the course curriculum and learning objectives. This ensures that the simulation is not an obscure add-on but integrates into and reinforces the course material.
- Computer-based simulations pair well with a variety of instructional designs. Select instructional designs that meet students' reported desire to experience therapy, build professional reasoning, and elicit meaningful feedback and discussion.
- Encourage discussions about the simulation experiences between peers and experts, including course instructors, other faculty members, practitioners from other disciplines, and guest speakers. Students reported that they liked hearing a variety of perspectives about the simulation cases. Educators could facilitate additional professional reasoning and diverse professional perspectives by pairing simulations with class field trips, guest speakers, current practice topics, and journal articles.

- If computer-based simulations in lecture courses are new to a program, try using it in one or two classes first to gain experience and feedback before implementing it across the curriculum.
- Introduce the computer-based simulation technology gradually to reduce frustration and technology barriers. Educators could complete a simulation as a whole class activity, in small groups or pairs, to get to know the platform before assigning individual work. Educators could record a video prebrief so students can be introduced to the case and expectations immediately before engaging in the simulation.
- Vary grading mechanisms and additional assignments to further build on the simulation cases. Educators could grade a written evaluation report after completing a simulation where students evaluate a client. Students could be asked to create an intervention plan for the next therapy session after completing a simulation about occupational therapy intervention. Extra credit could be given to students who complete an additional simulation on a specialty topic (e.g., school-based practice for a child learning braille, AAC evaluation conducted by an SLP) that is not currently used in the program.

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