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Surgical Technology Faculty Perceptions of Using High-Fidelity Simulation in Teaching

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This is to certify that the doctoral study by

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Walden University
2025

Abstract

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by

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MS, Walden University, 2018

BA, McNeese State University, 2012

Dissertation Submitted in Partial Fulfillment

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Abstract

Surgical technology education is critical in equipping individuals for healthcare careers; however, educators in the field have recognized that a gap in practice exists regarding clinical preparedness between surgical technologists and other healthcare professionals. This study's research explored faculty perspectives on implementing high-fidelity simulation (HFS) in surgical technology curricula, highlighting the importance of this issue for educators and program directors who seek to enhance the training of future surgical technologists. This basic qualitative study, guided by the technology acceptance model (TAM), examined how researchers and faculty using TAM perceived HFS and its effects on student learning and readiness. Two key research questions were focused on the usability of high-tech learning tools for surgical technology students and faculty perspectives regarding HFS for teaching and assessment. Data collection included semistructured interviews with 15 surgical technology faculty program directors. Thematic analysis with open narrative coding revealed that they viewed HFS as an essential resource that enhances student success and learning outcomes. Participants perceived that HFS facilitates interactive learning experiences and provides immediate feedback, significantly aiding assessment processes. They stated that embracing HFS in surgical technology education improves students' training experiences. Recommendations included surgical technology program directors advocating for adopting HFS within curricula to foster faculty buy-in and elevate learner engagement. By informing surgical technology educators about the benefits of simulation-based training, this research can contribute to positive social change by empowering faculty to implement these improvements and better prepare students for their roles.

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Table of Contents

List of Tables……………………………………………………………………………...v

Chapter 1: Introduction to the Study..1

Background 2

Problem Statement 3

Purpose of the Study 5

Research Questions 5

Conceptual Framework 5

Nature of the Study 6

Definitions...7

Assumptions..9

Scope and Delimitations 9

Limitations 10

Significance...11

Summary 11

Chapter 2: Literature Review...12

Conceptual Framework 13

Application of the TAM in Current Literature 16

Current Surgical Technology Research 18

Interprofessional Education for OR Teams 22

Fidelity Differences in Simulations 24

Faculty and Student Perceptions of Simulation in Curricula...............................27

SBL in Allied Health Education 30

Simulation Usage in Dental Studies 32
Simulation Usage in Medical Imaging Studies 34
Simulation Usage in Pharmaceutical Studies 36
Simulation in Occupational Therapy Studies 38
Devices in Instructional Learning 39
VR Simulators 40
AI in Simulations 42
Summary and Conclusions 44
Chapter 3: Research Method 45
Research Design and Rationale 45
Role of the Researcher 46
Methodology 47
Participant Selection 47
Instrumentation 49
Procedures for Recruitment, Participation, and Data Collection 51
Data Analysis Plan 54
Trustworthiness 56
Credibility 57
Dependability 58
Confirmability 58
Ethical Procedures 59
Summary 59
Chapter 4: Results 61

Setting 61
Data Collection 63
Data Analysis 65
Results 68
RQ1 68
RQ2 76
Evidence of Trustworthiness..85
Summary 88
Chapter 5: Discussion, Conclusions, and Recommendations 90
Interpretation of the Findings..91
TAM as a Useful Framework 91
TAM for New Technology like AI and VR.. 92
PU of Technology 93
Attitudes Toward Technology Adoption 94
Fidelity Differences in Simulation.. 95
HFS and Integration of Simulation in Curricula.. 97
IPE and Collaboration.. 98
Challenges and Barriers to Implementation.. 99
Limitations of the Study..102
Recommendations..102
Implications..105
Conclusion 107
References..109

Appendix A: IQs..133

Appendix B: Map of IQs to Research Questions...135

Appendix C: Interview Guide and Alignment with Research Questions 137

Appendix D: RQ1 Code Quick Reference Guide 140

Appendix E: RQ2 Code Quick Reference Guide 141

Appendix F: Study Themes 142

List of Tables

Table 1 *Participant Demographics* 64

Chapter 1: Introduction to the Study

Technology has enabled the higher education system to undergo vast transformations since the pandemic emerged. Higher education has been highly influenced by technological instruction (Imran et al., 2023). Educational institutions and administrations are rapidly reshaping their implementation timelines as a result of technological advancements. By engaging in simulation-based learning (SBL), students can practice and test their skills in controlled environments using realistic scenarios and situations (Koukourikos et al., 2021). This approach to education is compelling in fields like healthcare, engineering, and aviation, where practical application of knowledge is essential. The most common digital learning tools are business analytics, robotics, artificial intelligence (AI), and virtual reality (VR), which facilitate end-to-end digital connections and help achieve digital learning goals (Zhang & Aslan, 2021). Humida et al. (2022) argued perceived ease of use of technology and associated risks influence behavioral intentions.

Following sufficient training and preparation with static manikins or low-fidelity simulations, faculty often use high-fidelity simulation (HFS) as a secondary teaching method. HFSs support development of clinical skills, decision-making, and teamwork in healthcare (Livne, 2019). They have a profound impact on surgical technology education and overall effectiveness of surgical teams (Gholinejadzirmanlou et al., 2023). Faculty use simulations to assess skills, clinical decision making, and interprofessional interactions (Koukourikos et al., 2021). Simulations are not fully used by surgical technology faculty due to lack of funding or reluctance to use HFS as a teaching method (Alshehri et al., 2023).

Background

Administrators in surgical technology and surgical assisting programs carefully review faculty, student-to-faculty ratios, financial resources, physical resources, learning resources, admissions policies, student records, curriculum, evaluation methods, and program outcomes. The Accrediting Review Council on Education in Surgical Technology and Surgical Assisting (ARC-STSA), in collaboration with the Commission on Accreditation of Allied Health Education Programs is dedicated to surgical technology education. A shortage of qualified personnel during World War II led to a growing need for help to perform surgical procedures, and the profession of surgical technology was created during this time. An accredited surgical technology and surgical assisting program must submit an annual report to ensure compliance with established criteria to maintain accreditation.

According to the U.S. Bureau of Labor Statistics (USBLS, 2022), employment of surgical assistants and technologists will grow 6% from 2021 to 2031. The USBLS (2022) explained surgical technologists (STs) held about 110,700 jobs in 2021. Staffing in allied health professions has been severely affected by the worldwide pandemic between 2021 and 2023. Lack of staffing, coupled with lower admissions to community colleges, attrition among employed STs, and professional burnout have led to severe shortages nationwide (ARC-STSA, 2024). According to the ARC-STSA (2024), expanded resources and accelerated clinical training could ease these shortages and increase student enrollment in surgical technology programs.

Researchers assessed higher education surgical instructors’ acceptance of technology as a predictor of instructor technology use. While research on faculty perceptions concerning usefulness and use of technology is limited, researchers found certain factors positively influence perceptions. Or and Chapman (2022) found assessing faculty outcome expectancy positively impacted their acceptance and use of digital technology. Threet (2021) described hands-on and simulation-based training as one of the best ways to engage students and prepare them for entering the field. In addition, Long (2018) stated higher education institutions must shift with new technologies to prepare students for real operating rooms. However, De Paepe et al. (2018) explained challenges that may affect teachers’ perceptions and acceptance of technology, including institutional pressure, inadequate time, inadequate technological resources, lack of student engagement, and failure to train faculty.

Problem Statement

The problem in this study is that while higher education is beginning to use HFS in surgical technology teaching, little is known about faculty perceptions about ease of use, perceived usefulness, and attitudes towards using the tool for instruction and assessment best practices. Higgins et al. (2020) stated contemporary dental curricula provides student learning opportunities using HFS for nonclinical and clinical learning involving dental and oral health psychomotor skills. Higgins et al. (2020) recommended additional studies be conducted about using HFS in health-related fields because there is a lack of published literature on best practices related to simulation in dental and oral health education.

Martin et al. (2020) found faculty attitudes about digital technologies in higher education affected learner and learning outcomes. A limited number of studies have examined adoption of digital technologies in higher education curricula by faculty. Whigham (2018) found transitioning from traditional teaching methods challenges nurse educators to integrate technology into curriculum. Due to technological advances, nursing curricula incorporate simulations as a teaching paradigm (Whigham, 2018). According to the local Association of Surgical Technology (AST) chapter, surgical technology graduates are in high demand. However, training with older digital manikins does not provide HFS with quick assessment capabilities. Therefore, investigating faculty's perceptions about readiness, motivation, benefits, and challenges of using HFS in surgical technology curricula may affect their skills in terms of training learners.

Meeting future operating room (OR) professional demands requires strategies that improve providers' collaboration and team dynamics. Aloini et al. (2022) showed team adjustments to communication and structure helped 75 breast surgical teams in an Italian hospital meet uncertain situations such as surgical glitches with different complexity levels. These results impact the field of surgical technology because each surgical team includes different colleagues who have different experiences (Aloini et al., 2022). Collaborating with different team members leads to best practices for future communication, preventing surgical glitches, and enhancing team dynamics and performance, especially for routine surgeries like breast surgery (Aloini et al., 2022).

Purpose of the Study

This basic qualitative research involved understanding perspectives held by faculty members who specialized in surgical technology. In particular, I explored perspectives on utility and ease of use of high-fidelity learning tools in surgical technology education. Additionally, this study involved investigating attitudes of these faculty members toward integration of high-fidelity learning tools for both instructive and evaluative purposes during training of surgical technology students.

Research Questions

The following research questions were addressed in this study:

RQ1: How do surgical technology faculty members perceive the ease of use and usefulness of high-fidelity learning tools in the context of instruction and assessment for surgical technology learners?

RQ2: What are the attitudes and perspectives of surgical technology faculty members regarding the integration of high-fidelity learning tools for enhancing the educational experience and evaluating the performance of surgical technology students?

Conceptual Framework

The conceptual framework for this study was the technology acceptance model (TAM). Lemay et al. (2018) stated technology acceptance research involves predicting how people use technology depending on their intentions. Rahimi et al. (2018) stated the TAM is a tool to predict how individuals interact with information systems and accept technology. Davis' TAM was used to explained how system design affects user behavior. The TAM framework is used by researchers to understand technology acceptance and usage. Davis (1986) found the TAM useful in terms of examining user perceptions of perceived usefulness, perceived ease of use, and attitude toward technology usage.

Davis (1986) defined perceived ease of use as individuals' belief in the simplicity and convenience of using a specific technology. Users' perceptions of technology's ease of use influence their satisfaction with performance and functionality. Satisfied users are likely to recommend simulations, resulting in more successful adoption and impact (Choi et al., 2020). Perceived usefulness of technology involves the extent to which faculty members believe it will be beneficial (Davis, 1986). It may be easier for faculty to implement HFS if they see it as an effective method for improving student learning outcomes. According to Davis (1986), enjoyment or pleasure is the basis of individual attitudes toward technology use. Use of simulation in education is more likely among faculty with positive attitudes toward HFS as compared to those with negative perspectives (Pannekoeke et al., 2023). By examining TAM constructs, I can provide guidance on implementing user-friendly, useful, and appealing HFS for potential users.

Nature of the Study

Observing and assessing experiences, attitudes, and behaviors can be challenging quantitatively (Tenny et al., 2022). Statistical analysis and numerical data are important aspects of quantitative research while meaning and interpretation are more important to qualitative research (Pyo et al., 2023). Tenny et al. (2022) explained qualitative research involves interviews, focus groups, and observation. Basic qualitative research involves exploring individual or group experiences and perspectives to gain a deeper understanding of a phenomenon (Tenny et al., 2022). I used a basic qualitative design, interviewing 15 surgical technology faculty who implemented HFS in their curriculum. As part of the basic qualitative design, I interviewed participants to explain what they were thinking, feeling, and experiencing at a particular time or during an event of interest.

Definitions

Artificial intelligence (AI): Robots or digital computers that are capable of performing tasks normally attributed to intelligent beings (Copeland, 2024).

Attitude toward usage (ATU): ATU predicts users' behavioral intention to use, which determines actual system use (Davis, 1989).

Certified Surgical First Assistant (CSFA): CSFAs plays vital roles in the OR by offering crucial support to primary surgeons (Association of Surgical Assistants [ASA], 2025).

Code: A code is a distinctive label or concise phrase that is used to identify a specific piece of data that is relevant or significant in a given context (Saldaña, 2021).

Content expert (CE): A CE is an expert regarding a particular subject area or learning topic who contributes to research and development decisions about content and pedagogy (Castillo & Morales, 2019).

Fidelity: Fidelity involves providing participants with learning environments in which to develop nontechnical skills that are safe and controlled so they can make mistakes, correct those mistakes in real time, and learn from them without fear of compromising patient safety (Kovoor et al., 2021).

High-fidelity simulation (HFS): Realistic simulation scenario that requires selection of a multidimensional simulation concept (Carey & Rossler, 2023).

Interprofessional education (IPE): When students from different professions learn together to enhance collaboration and improve health outcomes (Paige et al., 2021).

Operating room (OR): A specialized area within a hospital or surgical facility designed for performing surgical procedures (AST, 2025).

Perceived ease of use (PEU): The degree to which a person believes that using a particular system is free of effort (Davis, 1989).

Perceived usefulness (PU): People using or not using an application to the extent they believe it will help them perform their jobs better (Davis, 1989).

Simulated patient (SP): Person who is trained to reproduce a history realistically, physically, and/or emotionally, just like an actual patient would present (Wall, 2019).

Simulation: Educational technique that helps learners experience authentic scenarios without actually being present in those situations. It allows participants to interact and engage in practical ways, making the learning process more effective and immersive (Lean et al., 2021).

Simulation-Based education (SBE): SBE involves healthcare professionals' knowledge, skills, and behaviors regarding better patient-centric care and preparedness to ensure patient safety and its application in real-life situations (Saleem & Khan, 2023).

Simulation-Based learning (SBL): Simulated environments to replicate real-world scenarios, allowing learners to practice skills and decide in safe and controlled settings (Saraswathy et al., 2022).

Surgical technologist (ST): STs are trained specifically to prepare for surgical procedures, including in the OR. As part of the surgical team, STs perform surgical counts with surgeons, manage the sterile field, and pass instruments during surgery (AST, 2024).

Technology acceptance model (TAM): The TAM is a widely-used model that provides a framework for understanding individual attitudes towards and acceptance of technology (Davis, 1986).

Virtual reality (VR): Computer-generated reality that allows learners to experience visual and auditory encounters instead of real ones (Kovoor et al., 2021). VR devices in health education include PeriopSim, Virtual Community Placement, Oculift, and Google Cardboard (Meccawy, 2022).

Assumptions

According to Simon (2011), researchers perceive assumptions as unprovable study elements. I assumed participants offered their viewpoints regarding the effectiveness and user-friendliness of HFS in surgical instruction and assessment. I also assumed participant responses concerning their perceptions and attitudes were transparent. I shared my knowledge and expertise with participants in order to alleviate anxiety and prepare for the best interviews possible. These assumptions were crucial in terms of establishing this study's significance.

Scope and Delimitations

I applied Davis' TAM to address ST faculty perceptions about using HFS. I excluded allied health faculty outside ST programs or those with less than 3 years of teaching experience. Because I designed this HFS implementation for faculty members with experience, faculty members who were not in surgical technology programs were excluded from the study. Furthermore, faculty from institutions which did not offer associate degrees were excluded to gain a better understanding of implementation.

Limitations

Studies are limited by factors researchers cannot control (Simon, 2011). Time constraints and a small sample size were limitations of this study. Due to the small sample size in the study, saturation may have occurred sooner than expected. According to Naeem et al. (2024), researchers identify patterns or themes within data when studying a particular topic. Due to repeated themes, saturation can occur sooner than expected, reducing the possibility of collecting additional data that might be useful (Hennink & Kaiser, 2022). According to Hennink and Kaiser (2022) small sample sizes may be sufficient if researchers are skilled at coding and interpreting data, as well as conducting in-depth interviews. A second potential bias in this study was my role as a teacher of a HFS involving surgical technology modules. Data collection, analysis, and overall research process are impacted by my subjective experiences, perspectives, and cultural backgrounds. Patton (2014) recommended using bracketing to address this bias. During bracketing, subject biases are consciously bracketed, thereby removing judgments. I used bracketing and wrote notes in my reflexive journal to address my personal biases. Study design and participants’ honesty may have limited generalization of results since I focused on one allied health profession. I designed interview questions to ensure participants were honest and open about their experiences and perceptions.

Significance

In this study, I examined faculty perceptions and beliefs regarding HFS in surgical technology curricula. Findings of this study may inform faculty and other health professionals about creating realistic and interactive scenarios that help students gain experience and confidence, as well as provide information about positive and negative experiences and benefits of HFS. This study can lead to positive social change by strengthening team dynamics while improving clinical skills and student outcomes and identifying faculty perceptions and building a process to determine best practices. I conducted my research by enrolling 15 faculty from surgical technology programs in the United States. Faculty perceptions of high-fidelity technology in the classroom can help faculty and students gain immediate clinical feedback so new skills and knowledge can be applied immediately.

Summary

In this chapter, I presented a basic qualitative study exploring perceptions of surgical technology faculty on their use of HFS in curricular. I tried to bridge the gap between theory and practice in surgical technology education by incorporating HFS into training programs. This gap in practice can lead to difficulties when students enter the clinical setting and find themselves unable to perform necessary tasks confidently. In this chapter, I presented the introduction, background, problem statement, study purpose, research questions, conceptual framework, nature of the study, definitions, assumptions, scope and limitations, limitations, significance, and a conclusion. A literature review is presented in Chapter 2.

Chapter 2: Literature Review

This basic qualitative research involved exploring perceptions of surgical technology faculty regarding their PEU, PU, and attitudes towards using the technology tool for instruction and assessment of best practices. The problem in this study is that while higher education is beginning to use HFS in surgical technology teaching, little is known about faculty perceptions about PEU, PU, and attitudes towards using (ATU) the technology tool for instruction and assessment best practices. According to Abdullah et al. (2020), student centered learning sessions help students stay focused, provide a relaxed learning environment, enhance peer communication, and develop independent learning skills. Moreover, transformation of virtual learning instruction has led to the invention of medical education via virtual learning models and virtual simulations (Khalil et al., 2023). Many researchers employed the TAM model to examine use of technology in medical healthcare instruction. Across healthcare professions, manikin simulation appears to be a common practice, and it includes part-task models that allow students to practice one specific task as well as full-body manikins that are equipped with sensors that simulate changes in homeostatic functions (Grant et al., 2021). Higgins et al. (2020) suggested academics should publish their research on simulation-based dental education to ensure all dental faculty can develop contemporary simulation curricula that provides optimum learning and teaching opportunities. I explored the application of the TAM to HFS in allied health education. A number of studies documented interprofessional education (IPE) by assessing OR teams, incorporating simulations into dental, imaging, pharmacological, and occupational therapy programs, and assessing student and faculty perceptions of simulations in curricula.

To study faculty perceptions of usefulness of technological simulations in surgical instruction, electronic library databases were used to locate academic and peer-reviewed articles**.** Search terms were: *ease of use*, *perceived usefulness*, *attitudes towards using instruction technologies*, *perceptions*, *surgical technology*, *online teaching*, *information and communication technology (ICT) in surgical technology*, *surgical nurse*, *interdisciplinary simulation in the operating room*, *current trends in surgical technology*, *simulation in allied health education*, and *simulation usage in medical education*. I used the following databases: EBSCOHost, ERIC, ProQuest, and Academic Search Premier. In addition to these websites, I also refer to the Association of Perioperative Nurses, the AST, and the International Nursing Association for Clinical Simulation and Learning. Themes were identified from reviewed scholarly articles, including ease of use, faculty input and inclusion, faculty perceived usefulness of technological tools, and purposeful technology.

Education that integrates with technology enables learners to keep up with societal advances and provides unlimited opportunities for success. Simulation learning environments can be a valuable resource as students transition to digital healthcare environments (Carroll et al., 2018).

Conceptual Framework

Conceptual frameworks help researchers generate systematic order in terms of study logic. Cognitive and emotional engagement indicators are measured via technology-mediated learning (Halverson & Graham, 2019). I used the framework to investigate specific HFS activities in terms of desired outcomes.

For this study, I used the TAM. Technology acceptance research involves predicting how users behave and use technology (Lemay et al., 2018). The TAM is a popular model for predicting users' intentions regarding information systems and technology as well as acceptance o (Rahimi et al., 2018). According to Davis (1987), system design features, PU, PEU, and attitude toward adoption are causally related.

During the 1970s, new technologies and personal computers were introduced. Fishbein and Ajzen developed the TAM based on the theory that behavior intentions determine actual behavior. The theory of reasoned action indicates attitudes toward behavior and subjective norms could predict behavioral intentions. Davis (1987) defined behavior intention as an individual's subjective probability that they will perform a specified behavior. According to Davis (1986), a majority of technological systems failed or underperformed during the 1970s and 1980s.

Davis created the TAM based on the premise of the attitude paradigm in psychology that involves investigating how external stimuli relates to beliefs, attitudes, and behaviors. Davis initially used the theory of reasoned action as a guide when developing the TAM. Technology adoption in the workplace has been the focus of most TAM studies. Cognitive and affective responses to new technology are based on people's cognitive perceptions of their PU and PEU (Davis, 1986). In this study, I used PEU, PU, and ATU to assess faculty members' perceptions of HFS usage in surgical technology programs.

PEU refers to the tendency of a person to pick the system that is easiest to use if all other factors are equal. Davis (1989) found individual intentions to use new technology could predict their later acceptance and adoption. Davis (1986) stated three constructs influence acceptance or rejection of a given system: ATU, PU, and PEU. Attitudes can be measured, differentiated from beliefs, and explained in terms of how external stimuli are generated and related to beliefs, attitudes, and behaviors.

ATU technology is a factor in terms of determining if learners will accept or reject systems. Fishbein and Ajzen (1975) found attitude and subjective norms greatly affect individual positive or negative feelings about particular behaviors. ATU is a function of two beliefs: PU and PEU (Davis, 1986). Using a given system is largely determined by prospective users' attitudes toward it (Davis, 1986).

According to Davis (1986), PU is users' beliefs that particular information systems enhance job performance. Davis (1986) stated PEU involves individual perceptions that systems could influence their job performance. In surgical technology settings, PU includes using fidelity to measure faculty perceptions of benefits of using technology.

PEU is a measure of how easy technology is to use (Davis, 1986). Users may accept technology they are forced to use, but their beliefs inform different considerations for use depending on situations (Davis, 1989; Lemay et al., 2018). According to Whigham (2018), HFS equipment is often purchased with the expectation faculty embrace modern technology, when they may not be prepared. However, they must be more confident when implementing HFS into curricula.

Application of the TAM in Current Literature

Simulation in surgical technology education is a new approach. STs are sometimes required to meet specific educational standards or hold certifications. Several studies have applied the TAM to examine technology use in education. For example, Estriegana et al. (2019) examined 223 undergraduate engineering students' technology acceptance of an online learning environment (OLE), including virtual laboratories, interactive lessons, videos, and gamification in a computer science class. Using the TAM to examine data from quantitative surveys, Estriegana found that students' hands-on exercises allowed students to play an active role and engage and motivate them more effectively than passive learning activities. Playfulness and efficiency are added as additional factors, which may influence perceptions of usefulness, ease of use, and satisfaction (Estriegana et al., 2019). Kim et al. (2021) examined 216 higher-education hospitality learners in June 2020 after the Covid-19 pandemic required mandatory online courses. Quantitatively analyzing the survey data, the study's findings showed that using the TAM and theory of planned behavior frameworks was sufficient for collecting data on the acceptance of technology by users in an educational setting. Like Estriegana et al. (2019), Kim et al. used TAM as the lens to review undergraduate students' acceptance of online learning. Both studies showed students' acceptance of remote, online learning.

Granić and Marangunić (2019) presented a systematic review to generalize higher education faculty acceptance of using technology in curriculums. The authors used 71 studies from 2003 to 2018 to explain how researchers used TAM in learning and teaching in multiple domains. Findings indicated that TAM was a credible framework for assessing various learning technologies. Application of the TAM framework is essential to the planned study because Granić and Marangunić's findings support recommendations to use TAM to evaluate various learning technologies, such as AR/VR simulation training.

Lemay et al. (2018) performed a mixed-methods study using 143 nursing and paramedic undergraduate learners to report the perceived usefulness and use of technology by analyzing the learner's acceptance of simulation technology usage. Key findings of the study showed that perceived usefulness, ease of use, and behavioral intentions when applying HFS deepened conceptual understanding and knowledge application. Like Granić and Marangunić (2019), Lemay et al. is a relevant source that suggests the TAM's critical elements in a classroom environment are meant to reproduce clinical situations as accurately as possible when applying SBL in curriculums.

Rahimi et al.'s (2018) systematic review focused on 245 learners' acceptance of using simulation-based technology in virtual or online laboratories. The authors confirmed that the TAM was a tool to monitor the acceptance of using virtual or online laboratories in educational settings. The study assessed the following components of TAM: perceived ease of use, perceived usefulness, and attitude toward using simulation-based technology. Like Granić and Marangunić (2019), Rahimi et al.'s findings are relevant to the proposed study because they analyze the use of technology in healthcare environments and the perceptions of the technology used in surgical technology curricula. Carroll et al. (2018) examined healthcare education and simulation technology innovations using mixed methods. The key findings of this study included implementing simulation into laboratory practice to improve healthcare practice and faculty development. Carroll et al. discussed the significance of bridging simulation technology environments in surgical technology laboratories to improve learners' skills. Students' technical competencies were supported by simulation in clinical learning environments (Carroll et al., 2018.)

The wearable technology genre enhances the facilitation of teaching in higher education. Wearable technology includes devices with physiological sensor capacities to assess and evaluate stressors' effect on student performance during instruction. Using an online questionnaire with 572 respondents, Al-Emran et al. (2022) aimed to learn the technology adoption of smartwatches through the TAM framework. The author found that certain technical and psychological factors affect users' willingness to use smartwatches. The results showed that respondents' trust in smartwatches was not significantly related to PU but to PEU. Devices with high computational capabilities, such as smartwatches, glasses, pills, and sensors, are becoming more prevalent (Al-Emran et al., 2022). I will introduce the theme of current use of these technological devices in the next section.

Current Surgical Technology Research

After 40 years of specialized education in surgical technology, the worldwide pandemic significantly impacted the future of staffing operating rooms with STs. However, based on the limited amount of research on practicing ST, they are not keeping pace with the rest of the surgical team regarding technological literacy. While Bak (2021) is not a peer-reviewed article, it represents a cornerstone in surgical technology research, stating, as a fundamental premise of simulation, it supports surgical technology education as it encourages deliberate practice of skills and reinforces theories and principles of sterility. The remaining four peer-reviewed articles cover topics related to communication skills, team-building skills, and using SBL to enhance skills.

STs can develop communication and critical thinking skills through SBL, leading to clinical competency and successful completion of their courses. Bak (2021) evaluated 76 learners from two surgical technology programs to determine how much virtual surgical simulation contributes to student success. Compared to HFS, the virtual surgical simulation did not impact students' final grades (Bak, 2021). Surgical technology education is aligned with simulation, as simulation encourages the deliberate practice of skills and reinforces theories and principles of sterile technique (Bak, 2021).

There is a high demand for STs due to advancements in medical technology, technically complicated surgical procedures (e.g., robotics, enhanced microscopic surgery), and advances in health care in general. During the COVID-19 pandemic, Shields et al. (2023) investigated 48 apprentices hired for the Surgical Technologist Apprentice Program (STAP). Twenty-seven individuals completed the program and are currently employed because of the program. Others resigned for various reasons (Shields et al., 2023). The STAP program provided an innovative solution to meet the demand for STs, especially during the COVID-19 pandemic; it provided individualized simulation laboratory experience for the apprentices to improve their comfort level and advanced surgical skills competency. According to Shields et al., hospital-based and community college apprenticeship programs like STAP signify the growing need for STs as many leave full-time employment for travel positions.

STs are necessary in military surgical settings, representing teams operating in crisis situations. Experienced STs help reduce communication barriers created by military rank, area of specialization, and culture. Stucky et al. (2022) examined the association between interpersonal communication and social distance in military ORs. Participants included 50 interprofessional surgical team members of active duty and civilian nurses, surgeons, anesthesiologists, and an ST (Stucky et al., 2022).

The author found that effective communication between surgical clinicians regarding frequency, close working relationships, socialization, and advice led to providing vital care on the battlefield and keeping teams consistent, fostering team cohesion, and encouraging frequent interaction inside and outside the workplace improved team performance (Stucky et al., 2022). According to the article, surgical teams' technical and nontechnical skills, including teamwork, determine the quality of their performance just as they do with surgical technology education.

Another author reviewed the stresses of being a surgical technology student. In surgical technology programs, clinical education involves integrating the profession's knowledge, skills, attitudes, values, and philosophies. Zardosht et al. (2018) examined the challenges surgical technology students face in their courses and the field. Zardosht et al. (2018) analyzed interviews with 16 participants and three themes emerged: "stressful environment" (p. 6409), "contradictions between expectations and reality" (p. 6411), and "humiliating experiences" (p. 6411) in addition to a general theme of bitter experiences.

Acquiring clinical competence and skills is important for surgical technology students. Using semistructured interviews, Zardosht et al. (2020) sought to understand the surgical technology clinical teaching process in a real operating room with 14 students, seven education instructors, six operation room staff, one faculty dean, three surgeon assistants, and four head nurses. The author found that nonacceptance by other team members was a major concern for the students as they wanted to be valuable, contributing members. Students sought to gain clinical competence and approval in the interactive and fast-paced operating room environment using several strategies: individual efforts to gain team approval, shadowing the surgical team, and seeking assistance of instructors when needed (Zardosht et al., 2020). According to Zardosht et al. (2018), surgical technology students face a stressful environment in the clinical setting, dealing with conflicts between their expectations of a role and the realities of being a surgical technology student, as well as humiliating experiences in the OR.

There is a growing need for efficient and structured intraoperative teaching in an environment optimized for learning, especially given the constraints of operating room time and caseload and faculty’s inconsistent preparation and motivation. Bak (2021) mentioned when added to healthcare education, simulation was conducted to help professionals master complex skills. In surgical technology programs, clinical education is a multifaceted process with unknown elements (Zardosht et al., 2020). Similar to Bak, Zardosht et al. (2020) discussed the importance of providing authentic learning spaces for improving self-efficiency in healthcare education.

Interprofessional Education for OR Teams

As a team, anesthesiologists, anesthetist nurses, STs, circulating nurses, and surgeons work together in the operating room to provide surgery for patients. In operating rooms, teamwork and communication can lapse due to miscommunication at various stages of perioperative care. In Gros et al. (2021), 134 team members were assigned to participate in 13 simulated surgical case scenarios based on the volunteer surgeon's specialty. Gros et al.'s (2021) key findings showed a statistically significant shift toward greater self-reported confidence from presimulation to postsimulation using four team-based principles: "using effective communication" (p. 433), "utilizing resources well" (p. 433), "establishing role clarity" (p. 433), and "using effective situational awareness" (p. 433). Gros et al. (2021) emphasized the importance of all surgical team members, including STs, performing specific technical and cognitive skills while demonstrating efficient coordination and communication.

Team-based simulation training requires identification of nontechnical skills such as cooperation, capability, communication, and condition of the simulation environment. Paige et al. (2021) studied operating room (OR) personnel using semistructured focus group interviews to determine effective teamwork for implementation of IPE. The qualitative study assessed 15 OR staff members, including an ST (Paige et al., 2021). The author found that over a one-month period, four themes emerged related to effective teamwork in the OR: smooth flow, unity of effort, communication, and positive attitudes. Similar to Gros et a1. (2021), Paige et al. used IPE to determine key teamwork characteristics to improve communication and performance in the OR.

One of the most important aspects of teamwork in the operating room is that most surgeons share common history and have already established several connections, such as trust relationships and knowledge of each other’s skills and preferences. Using quantitative semi structured interviews, Shi et al. (2021) examined 22 members of the surgical team. A key finding from the study was that effective teamwork depends on effective communication. Shi et al. found that barriers to communication include lack of cordiality, lack of engagement from other staff, distractions, role hierarchy, and unfamiliarity with colleagues. Like Gros et al. (2021), Shi et al. reported lack of communication with teams resulted in negative outcomes and ineffective team dynamics. The teamwork of multidisciplinary healthcare professionals is essential for safe and effective patient care.

Determining the optimal OR time for each surgical team member and the most efficient composition of the surgical team is integral for successful robotically assisted sacrocolpopexy for pelvic organ prolapse . Harmanli et al. (2020) assessed the effectiveness of time management and efficiency of 132 OR team members for 359 consecutive robotically assisted sacrocolpopexy procedures. In robotic surgeries, the ST, and first assistant’s contributions to operating efficiency were greater than the surgeon’s (Harmanli et al.). Like Aloini et al. (2022), Harmanli et al. found that a ST or first assistant who is experienced may be able to react independently to any other unwanted event when the surgeon is on the console.

Fidelity Differences in Simulations

Simulating real-world situations and evaluating performance with a high degree of fidelity mimics the experience of working with real patients in an HFS. Fidelity is related to the extent a simulation model mimics reality (Nazari et al., 2020). Nazari et al. (2020) reported that fidelity is determined by three domains: environment, equipment, and psychological factors. According to Nazari et al., low-cost simulations can be used to train surgical residents with high fidelity and usefulness. While more surgical technology programs have obtained simulators since COVID-19, some are still using alternative and affordable simulation technologies, such as VR and screen-based simulations, to provide highly realistic simulation training.

Simulating with low fidelity helps learners gain technical skills and demonstrate competence after gathering background knowledge through the provided content. Basunbul et al. (2021) used a systematic review to evaluate 30 articles regarding simulation training in surgical education. Structured surgical training curricula incorporates simulators into their training protocols since many programs use simulation techniques to develop skills (Basunbul et al., 2021). Like Nazari et al. (2020), Basunbul et al. found that low-fidelity is a model that is usually used for a repetitive simulation of a skill, known as a table-top simulator, as it is less expensive and has a lower degree of realism.

HFSs are the most realistic models and provide maximum interaction for learners in an environment resembling hospital clinical experiences. Martin et al. (2020), using an electronic survey tool, quantitatively evaluated responses from 247 higher education faculty about the importance, competency, and motivation of incorporating innovative technologies into their curriculums. Adoption of different technologies in higher education included HFS, both in healthcare and other industries (Martin et al., 2020). The authors found that faculty attitudes regarding the importance of digital technologies in higher education affected learners' outcomes. Positive attitudes by trained professionals towards teaching with innovative technologies encouraged student engagement (Martin et al., 2020). Conclusions in multiple HFS healthcare studies showed an improved understanding of technical skills and confidence in learners through peer debriefings on confidence and competence (Nazari et al., 2020; Skov et al., 2022; Walls et al., 2019).

Medical manikin simulation can be tailored to meet a variety of learning objectives using high-fidelity manikins. Walls et al.'s (2019) study encompassed 25 graduate students to assess the perceived usefulness of high-fidelity simulated patients (SPs). The simulation module encompassed occupational therapy students assessed through standardized simulation to document their perceived value of the learning experience. The study found that students have positive experiences when using SPs and increased simulation fidelity experiences.

Whigham (2018) used an exploratory qualitative research case study with 12 interviews with undergraduate nursing faculty in Florida. As a result of observing the impact of HFS in nursing curricula on students' critical thinking, the author concluded that students could transfer their skills to clinical practice better using HFS than static manikins. Whigham's study addressed the gap in practice by training the educator to understand how to evaluate the benefits of implementing HFS into the curriculum.

Findings showed that although faculty members believed the simulated learning would transfer with the students into the clinical setting, the simulations required extra time and resources needed to implement. Based on Whigham's conclusions and recommendations, providing professional development and user-friendly technology would enhance the simulated learning experience for faculty and learners.

Moran et al. (2018) conducted a systematic review from 2007 to 2018, highlighting the changes in the healthcare environment by implementing simulation technology into allied health education curricula. The key findings were that older pedagogical approaches like face-to-face lectures and static manikins no longer produced acceptable outcomes, while HFS technology allowed learners to get additional skills training. Moran et al.'s (2018) findings supported recommendations from the HFS articles (Martin et al., 2020; Whigham, 2018) that higher education faculty perceived their students' psychomotor skills improved using various simulation approaches.

As part of nursing education outside the traditional classroom, several studies have examined the effects of low-fidelity simulation on medication administration. Forty-four nursing students participated in three low-fidelity simulation-based educations (SBEs) of 60 minutes each, including a debriefing session using role-playing during weeks 4, 6, and 8 of their courses (Brauneis et al., 2021). Results showed enhanced student confidence and knowledge of medication safety after participating in SBEs in pharmacology classroom settings (Brauneis et al., 2021). Like Basunbul et al. (2021), Brauneis et al. discovered the use of low-fidelity modules in a simulation lab enhanced nursing students' clinical skills.

SBE programs typically focus on physicians, but successful surgery requires multidisciplinary approaches including ST's, nurses, imaging professionals, and pharmacy. During an endovascular aneurysm repair. Skov et al. (2022) examined how the level of SBE among seven endovascular scrub nurses affected team performance and heart rate variability Skov et al. The authors described three clear findings in the case study. First, nurses and members of the endovascular team accepted the live observation performed by the SBE as life-like experiences. Second, participants had lower endovascular aneurysm repair errors per hour after SBE. Third, participants' mental stress levels were lower after SBE. Skov et al.'s findings supported using systematic SBE for scrub nurses' training may enhance team performance and reduce mental stress during endovascular aneurysm repair procedures. Similar to Toale et al. (2021), Skov et al. concluded that using SBE in a range of specialties improved skills, clinical competency, and team building.

Faculty and Student Perceptions of Simulation in Curricula

Understanding how educators and learners perceive TAM, online learning theories, and obstacles to online education is crucial for the future of SBE. Stickney et al. (2019) published a survey of 171 faculty members examining their online teaching experiences and satisfaction. The literature on faculty attitudes in online higher education has used TAM and TAM2 to understand the acceptance of new technologies (Stickney et al.). Faculty members are key to SBE success, so it is important to understand why they are hesitant to use nontraditional course delivery.

The use of simulation in allied healthcare is new, unlike in medicine and nursing curricula. Alshehri et al. (2023) interviewed 10 faculty members to get their perception of using simulation-based modules in a cardiovascular program. Alshehri et al. (2023) reported data analysis revealing four emerging themes: “simulation concept” (p. 355), “safety benefits of simulation” (p. 357), “simulation as a safe learning environment” (p. 358), and “challenges of simulation” (p. 359). Similar to Stickney et al. (2019), Alshehri et al. found that in the clinical environment, simulation prepares healthcare trainees to be safe and efficient by connecting theory with practice.

Educating healthcare professionals through complex, multidimensional processes and educational activities that address cognitive, affective, and psychomotor objectives. Saraswathy et al. (2022) conducted a descriptive study with 63 nursing faculty members. The author found that faculty perceive SBL improves student performance, developing clinical skills through repetitive practice and assistance with managing rare surgical cases (Saraswathy et al., 2022).

A qualitative analysis of the research has been conducted on residents’ and trainers’ perceptions and experiences concerning the assessment of surgical skills. Four distinct themes emerged from a qualitative review of 21 articles about observations and insights of residents and trainers as they relate to the simulation-based assessment of surgical skills (Toale et al., 2021). The themes included: (a) “perceptions and experiences of simulation as a valid assessment method in principle”, (b) “perceptions and experiences of simulation-based assessment as a method for training trainees”, (c) “perceptions and experiences of simulation-based assessment as a method of certification and credentialing", and (d) "perceptions and experiences of simulation-based assessment as a method for selecting or recruiting surgical trainees" (Toale et al., 2021, pp. 725-726). Like Bak (2021), Toale et al. (2021) reported how simulation-based assessments influenced the attitudes, experiences, and perceptions of individuals.

In health science education, understanding the innovation-decision process can provide greater insight into faculty development needs and allow curriculum writers to design more and better experiential learning opportunities. Johnson (2021) evaluated 12 occupational and physical therapy faculty using interviews regarding their stated thematic saturation. In debriefing after simulation-based activities, participants' perceptions and experiences were divided into four categories: providing a valuable immersive experience, assessing critical thinking skills during training, adjusting to the initial delivery, and experimenting with this innovative teaching method (Johnson, 2021). As with Toale et al. (2021), Johnson had four emerging themes evaluating the perceptions of trainers in healthcare education.

SBL combined with debriefing after the activity shows multiple benefits. Doherty-Restrepto et al. (2018) investigated 23 first-years athletic training students' views on faculty-led and peer-led debriefing in SBL concerning performing a knee assessment. Results showed several positive outcomes whether debriefing sessions were student or faculty led. Students' perceptions about their clinical ability to perform a knee assessment increased along with their confidence. They also felt ready to transfer their SBL to real-world settings. Like Toale et al. (2021), Doherty-Restrepto et al. affirmed that integrating debriefing and self-reflection in SBE leads to a significant improvement in learning.

Using smartphones, social media, and sharing information and emotions are natural to young medical professionals like Generation Z. Plch et al. (2020) conducted an integrative review with 38 studies to answer how students in different medical disciplines perceive technology-enhanced learning. Based on their findings, they believe that technologies are both information and communication mediums (Plch et al., 2020). Both Plch et al. and Toale et al. (2021) concluded that learner attitudes toward technology integration are a significant factor for successful module implementation.

Students, simulation facilitators, and course professors evaluated nursing simulations from the perspective of its efficacy and transferability. Egan et al., (2022) using qualitative analysis, 150 participants were asked to rank the perceived effectiveness of current simulation approaches. The results of the study indicate that participants reported that simulation with adequate group sizes prepared them for their SBAs, enabled them to engage in clinical roles more effectively, and incorporated feedback more effectively (Egan et al., 2022).

SBL in Allied Health Education

This section covers the adoption of SBE, new approaches, techniques, and technology that emerged in allied health curricula. There are difficulties in surgical training and the availability of HFS, which necessitate using additional, more effective, and efficient teaching and learning methods. Using eight of the 14 key indicators for otolaryngology, Brown et al. (2020) found 29 videos published out of 161 journal articles

(18%). Learners are increasingly interested in surgical videos that demonstrate key anatomy, procedural steps, and surgical dexterity as part of simulations available to them (Brown et al., 2020). Brown et al. showed the importance of SBE training in ST by highlighting the benefits of high-fidelity VR to provide a full sense of immersion.

Healthcare education programs utilize SBL to teach physicians, nurses, and allied healthcare professionals at all levels, from undergraduate to graduate study. According to Lean et al.'s (2021) qualitative study, simulation, and gaming approaches are used for teaching and learning in higher education. By simulating conditions and behaviors in a fictitious environment, experiments can be conducted to illustrate real behaviors and outcomes (Lean et al., 2021). With 58.3 percent of higher education faculty currently or previously using role play, the study found that it was the most common learning technique (Lean et al., 2021). Lean et al.’s study is relevant to surgical technology curricula because it analyzed the levels of fidelity in SBL depending on the suitability of the learning outcomes.

A bridge between theory and practice is achieved through technology-enhanced simulation. Simulation, as defined by Koukourikos et al. (2021), is the process of trying to replicate clinical practice as closely as possible. Simulating VR using computers and standardized patients creates a realistic learning environment for health professionals (Koukourikos et al., 2021). Simulating technology-enhanced scenarios is different from simulating standard patients because technology enhanced healthcare simulation lacks standard patients or human actors.

Medical education often uses manikins with various levels of fidelity for simulation, which is a popular form of surgical technology education. The use of simulation is increasing in healthcare research, with static manikins, standardized patients, cadaver laboratories, and HFS technology-enhanced simulators (Meerdink & Khan, 2021). In an observational study based on surveys, 204 responses were collected from 40 scenarios (Meerdink & Khan, 2021). In the study by Lean et al. (2021) and Meerdink and Khan (2021), learners believed that working with an SP would improve their comfort, but that they would benefit more from SP-based simulation than that of a manikin.

A simulation design scale may be used to assess nursing and allied health students' perspectives on important design elements required for learning during IPE simulation activities. In a simulation study involving 334 students, O'Shea et al. (2021) assessed simulation activities designed for 334 students across five allied health disciplines. The simulation design scale validation tool showed that "feedback, support, and fidelity" (p. 56) were the most valuable elements for learning (O'Shea et al., 2021). Similar to Koukourikos et al. (2021), O'Shea et al. reported that learning outcomes were high when facilitators provided positive feedback and support to students.

Simulation Usage in Dental Studies

The current philosophies and modalities used in dental and oral health SBE demonstrate instructional technology changes made to meet student learning needs. Higgins et al. (2020) reviewed six submitted articles related to psychomotor skills in dental curricula when using HFS. Higgins et al. found that when dental faculty used HFS in the curriculum, students received opportunities to practice hands-on tasks and train in realistic settings without harming patients.

A narrative review of augmented virtual and nixed reality in dentistry described existing platforms and future challenges in VR for dentistry education. Monterubbianesi et al. (2022) reviewed dental articles from January 2016 to August 2021 related to VR, augmented reality (AR), mixed reality, artificial intelligence, and robotics. The authors found that VR experienced simulated digital realities similar to physical realities, creating scenarios that cannot be experienced in real life (Monterubbianesi et al., 2022). Monterubbianesi et al. made three specific conclusions related to the use technology modalities in dental education. The authors concluded that augmented virtual and nixed reality dental simulations demonstrated relevancy for teaching dental morphology, applying preclinical and clinical education, and utilizing artificial intelligence. With the advent of 3D virtual models, different anatomical structures can now be visualized, enhancing learning experiences (Monterubbianesi et al., 2022) Similar to Higgins et al. (2020), Monterubbianesi et al. noted that to improve clinical skills, schools use simulators integrated into a virtual dental operatory alongside lifelike manikin.

In preclinical to clinical transitioning dental education, instructors facilitated using a blended learning approach, including virtual learning modules. Cho and Ganesh (2022) assessed 135 students’ knowledge with a pre and posttest of key topics that students traditionally struggle with when transitioning from preclinic to clinic. A recent study found that remote learning was an effective educational modality in otherwise hands-on courses due to its versatility (Cho & Ganesh, 2022). Like Monterubbianesi et al.

(2022), Cho and Ganesh found that modern digital technologies assisted in reshaping dentistry curricula.

Simulation Usage in Medical Imaging Studies

One author examined the impact of high-fidelity computer-based sonography simulators on a cohort of sonography learners' clinical skills. Evans et al. (2023) assessed five anatomical scanning skills with 25 sonography students from three educational sites. First-year sonography students exposed to changed simulation curricula performed better on most sonographic examinations than previous cohorts that did not use the simulations (Evans et al., 2023). One student from site one related that the simulator allowed them to become acquainted with pathologies never encountered before. In a similar way to site one, students from sites two and three reported simulation scanning helped them gain confidence before taking live experiences.

Diagnostic medical sonography students discussed the simulation's influence on their competence to describe, prepare, and conduct sonographic examinations. Kloc et al. (2019) used simulation to evaluate the effect of strategy on sonography students' affective skills and self-reported confidence. Kloc et al.'s mixed-methods study examined a diagnostic medical sonography clinical seminar course at a midsized community college that included 11 female students in three scripted patients care simulation scenarios. Learners felt neutral or unconfident in performing patient exams for testicles or scrotum, 1st trimester obstetrics, and 2nd trimester obstetrics (Kloc et al.). Kloc et al. data demonstrated all three examinations, learners' confidence in their ability to perform the examinations increased. Like Evans et al. (2023), Kloc et al.'s study focused on deliberate practices, attaining, and maintaining technical proficiency, getting expert guidance, and learning in a real-life setting.

Sonography requires significant effort, faculty time, and specialized equipment while being highly operator-dependent and having a steep learning curve. When Pessin and Tang-Simmons (2018) incorporated simulation into their programs, they noted challenges including funding, space, faculty, and curriculum changes. The authors collected survey responses from 137 program directors in obstetrics and gynecology, abdomen, cardiothoracic, peripheral vascular, and small-parts sonography. Study results revealed that 75% of participants introduced complex techniques with sonography SBE to their abdominal, peripheral vascular, or cardiology curriculum (Pessin & Tang-Simmons, 2018). Eighty-eight percent of the participants believed that students should always participate in simulation lessons (Pessin & Tang-Simmons, 2018). Like Johnson (2021), Pessin and Tang-Simmons found that faculty members perceived SBE as highly effective.

Interventional specialties like radiology use simulation at the undergraduate level to improve student motivation and performance. Emin et al. (2019) documented 15 studies that were devoted to interventional radiology, one to endovascular surgery, and one to image-guided anesthesia. Based on the findings, introducing SBE in curricula earlier will be valid for undergraduate education because interventional radiology has a significant resemblance to surgical principles such as manual dexterity and soft skills (Emin et al., 2019). As with surgical technology, Emin et al.'s study found that minimally invasive interventional approaches, such as interventional radiology, are gaining acceptance using SBE in curricula.

A preliminary qualitative pilot study was necessary to get more data on interventional radiology undergraduate curricula. As part of the eight-month pilot project, 84 participants were asked to share their views on the current landscape of undergraduate interventional radiology education (Theodoulou et al., 2020). According to the pilot findings, an overwhelming majority of respondents (90.7%) agreed that more exposure to interventional radiology during medical school instruction would be beneficial (Theodoulou et al., 2020). Theodoulou et al. (2020) concluded that interventional radiology training via simulation is like surgical training because it allows skills to be practiced and evaluated in a controlled environment.

Simulation Usage in Pharmaceutical Studies

In pharmacy education, AR, also known as augmented reality (AR), is used in two types of computer-based simulations that use simulation software to help students learn specific skills. A combination of different simulation techniques may be the best way to achieve student academic outcomes (Korayem et al., 2022). Korayem et al. (2022) reviewed the SBE modalities and student assessment approaches in undergraduate pharmacy programs. The authors summarized the features of various types of simulations used in pharmacy education, including computer-based simulations, AR, SPs, manikins, role-plays, and serious gaming techniques. Korayem et al. (2022, p. 657) found that the SBE method is essential for developing skills (e.g., teamwork, decision-making, and communication that are hard to develop through conventional education. Like Kloc et al.

(2019), Korayem et al. found that the immersive learning experience ensured that pharmacy students were well-prepared to manage the complexities of their future profession and deliver optimal patient care.

Incorporating simulation into pharmacy education can bridge the gap between classroom learning and real-world application. Utilization of HFS in teaching and assessing students leads to learning and competency. Based on a purposive and snowball sampling approach, Singh et al. (2023) selected 57 pharmacy institutions worldwide, including high, intermediate, low, and non-users of MyDispense (dispensing software). The findings of 18 responses indicated that providing prompt feedback to learners was advantageous to faculty and saved time from dispensing individual feedback (Singh et al., 2023). In the same manner as nursing learners use static manikins in mock lab settings and attend required face-to-face courses, applying simulation allows the learner to complete an infinite number of rotations to master the skill.

A nursing SBL was adapted to involve pharmacy students and evaluated as an IPE tool for perceptions and effectiveness in curricula. Kayyali et al. (2019) mentioned for pharmacy education to maintain a science base that supports patient-centered care, partnership, communication, and person-centered care, SBL is needed. Kayyali et al. discussed the four phases of simulations in healthcare education: (a) introduction, where instructors explain the session's purpose and objectives; (b) briefing, where students learn how to use the simulation and how to get assistance; (c) scenarios during which participants learn about the case to simulate and clarify their and others' roles; and (d) debriefing, during which facilitated feedback allows for reflective discussion. Four hundred forty students participated in IPE sessions. Three themes emerged in the findings. First, pharmacy students gained a better understanding of their and others' roles. Second, SBL enabled a safe setting for applied practice. Finally, integrating IPE into curriculums (Kayyali et al., 2019) allowed learners to see the big picture of their setting. Like Paige et al. (2021), Kayyali et al. found that incorporating SBL into IPE proved a successful and valuable educational tool.

Simulation in Occupational Therapy Studies

A new feature of occupational therapy curricula is substituting simulation learning for practice education. Grant et al. (2021) discussed how manikin simulation has been widely adopted in other healthcare professions, ranging from part-task models that allow students to practice one specific task to human simulators containing sensors that simulate homeostatic changes. The review of 32 publications on simulation in occupational therapy education revealed SPs were the primary form of simulation in undergraduate training (Grant et al., 2021). Comparable to Pessin and Tang-Simmons (2018), Grant et al. concluded that simulation provides a safe environment to practice technical and interprofessional communication skills and builds confidence.

An occupational therapy curriculum using first-year learners examined human patient simulators. DiZazzo-Miller et al. (2021) reported that when using human patient simulators, students can be prepared for the future and judged on their competency in a controlled environment that supports patient safety and promotes knowledge and practice that correlates to real-world encounters in a controlled environment. Findings revealed three distinct themes of the 146 OT learners' human patient simulator experiences:

"clinically applicable learning, team and family dynamics, and the human experience" (DiZazzo-Miller et al., 2021, p. 5). The themes showed how learners incorporate practical skills, involve patients and families, and use feedback from HFS modules (DiZazzo-Miller et al., 2021). While OT and surgical technology are in the process of implementing SBE, pharmacy (Singh et al., 2023) and nursing (O'Shea et al., 2021) have used SBE for decades.

Occupational therapy programs worldwide face challenges finding placements that offer quality learning experiences, such as case studies, videos, roleplay, or simulations, that ensure students attain professional competencies. Turesson and Falk (2023) examined teachers' and learners' experiences using reflective notes, a focus group, and questionnaires to describe a newly implemented practical examination in occupational therapy using SPs. Three themes emerged from the findings: "(1) the practical examination as a learning situation; (2) the teacher's role during the practical examination; and (3) an opportunity for developing practical skills" (Turesson & Falk, 2023, p. 429). When instructors used SPs in a practical examination, students interacted with each other and applied knowledge and skills in a safe environment (Turesson & Falk, 2023). Similar to Grant et al. (2021), Turesson and Falk found that students developed practical skills and gained experience in clinical settings.

Devices in Instructional Learning

The surgical community is developing alongside modern technology leading to the emergence of new treatment modalities. As treatment options develop and expand, new training methods are needed for surgical instruction (Bazan et al., 2020). Simulations allow for structured courses and examinations of students in a controlled environment (Unal & Uzun, 2021). Kovoor et al. (2021) stated recent advances in surgical training and education have not only affected curricula and institutional proficiency standards, but also the use of a variety of technological media. In innovative applications, instructors can combine didactics, scientific articles, and textbooks in a way that is accessible to students.

Surgical instructors are adopting smartphone apps to enhance teaching methods. Video cameras, computers, and smartphones are imperative to clinical medicines; these devices revolutionized how patient care is provided by surgeons in operating rooms (Gupta et al., 2019). In surgical educational settings, instructors provide students with videos of surgical procedures and training that further examine intraoperative steps, improving their operational skills (Augestad et al., 2020). Other online platforms enable trainees to listen to surgical podcasts, access contemporary journals, compute the infection risk after hernia repair, and consult contemporary performance instructions for cancer patients (Wells et al., 2021). In addition to anatomy and skill enhancement applications, question banks are also available for immediate feedback (Koukourikos et al., 2021). The rest of this section will discuss the simulation devices used in healthcare education.

VR Simulators

As advancements in technology continue to reshape various industries, the field of dentistry is also embracing the potential benefits of AI integration. By bridging the theoretical and practical application of VR in dental education curriculum, students acquire the necessary skills to implement VR technologies in the real world. As such, instructional teams use 3-D technology to create a virtual environment for teaching psychomotor skills to undergraduate dental students while enhancing their diagnostic skills and treatment planning abilities (Imran et al., 2021). Imran et al. (2021) conducted a literature review to highlight clinical applications of VR and SBE in undergraduate dental education. According to the author, most students trained using VR simulators learn quicker, perform better, and accomplish more practice than those using conventional preclinical laboratories. VR simulation-based teaching represents an integral part of learning for undergraduates and postgraduates due to the advancement of technology (Imran et al., 2021). Like surgical technology, dental VR simulations benefit education standardization, feedback, and curriculum integration.

Surgical training faces various challenges, including the investigation of AR as a potential supplement to traditional training methods. Kovoor et al.'s (2021) meta-analysis findings, including two randomized controlled trials, showed the validity and effectiveness of using AR in surgical education. The meta-analysis included articles from 2005 to 2018 using the keywords: surgery, augmented reality, education, and training to assess the AR role in surgical education (Kovoor et al.). Kovoor et al.'s findings are essential to this study as they provide the groundwork for using simulation technologies for surgical education while recommending more real-life environment studies before the widespread adoption of AR technology.

The use of VR is gaining popularity in health professions education, providing students with a platform for experiencing and mastering situations without putting themselves or patients at risk. Lie et al. (2023) analyzed seven articles about VR implementation in health professions. Findings showed VR training should use self-guided, multiple short sessions to deliver procedural content under low- to moderate-immersion conditions (Lie et al., 2023). Lie et al. included benefits to VR as students could observe VR simulations, conduct the VR activity, and then instruct their peers on how to conduct their own. Implementing VR in health professional education depends on faculty and learners' ability to change their interaction and their assumption of their capability to use the technology. Lie et al. (2023) discovered the importance of faculty and learners being well-trained with the simulation tool to enhance the learning experience. Imran et al. (2021), Kovoor et al. (2021), and Lie et al. (2023) found that virtual reality is becoming more important in health education, helping learners gain confidence.

AI in Simulations

The high-quality delivery of health services depends on the instruction given to healthcare students to develop empathetic attitudes and technical skills. When combined with artificial intelligence, digital technologies can quantify skill performance and offer new insights into psychomotor expertise (Mirchi et al., 2020). By developing a virtual training platform for a complex neurosurgical procedure, the Virtual Operative Assistant, a new method of teaching simulation-based training aimed to present a new simulation-based training approach and validate it. (Mirchi et al., 2020). Findings included the successful introduction of simulation-based training using a novel teaching framework with 50 participant trainees. The authors also validated using the framework with the virtual assistant to perform a complex neurosurgical task. AI and VR simulations may contribute to surgical and medical education by establishing a baseline of skills levels, just as surgical technology education does.

One study identified curriculum and resource gaps across the Australian health system based on the ideas of healthcare education experts working with AI. Gray et al. (2022) received survey responses from 39 healthcare experts about their views of AI education for the health workforce. The survey covered six topics: organization roles, teaching methods, AI topics, learning activities, AI attitudes, and comments (Gray et al., 2022). Results highlighted essential areas related to ethical implications, the use of large data sets for AI clinical applications, machine learning principles, and employing AI to lighten the cognitive load of healthcare workers, machine learning principles, AI for diagnosis, and treatment, AI governance, and barriers to implementation. Similar to Kayyali et al. (2019), Gray et al. found that education providers and AI technology provider partnerships ensured uniform training across subgroups and authorities in health care.

Healthcare institutions use AI-enabled systems to evaluate professional healthcare competencies. According to Liaw et al. (2023), an AI-enabled VR simulations could help nursing students evaluate their interprofessional communication competencies. The authors used a pre to posttest design to evaluate 35 nursing students' interprofessional communication competencies and experiences with an AI medical doctor. According to Liaw et al. (2023), using an AI-enabled pedagogical agent in interprofessional communication positively affects students' knowledge and self-efficacy. Similar to Gray et al. (2022), Liaw et al. found that using AI-enabled VR simulations for teaching healthcare students could prepare them to be part of a collaborative workforce that can deliver quality and safe patient care.

Summary and Conclusions

Chapter 2 included literature review search strategies and information about the TAM. The TAM has three constructs: PU, PEU, and ATU (Davis, 1986). I reviewed past literature on surgical faculty PEU, PU, and ATU in terms of surgical instruction and assessments. I also discussed participants' use of simulation in pharmacy, assessment, and practical environments.

In the literature review, I found limited studies exploring surgical technology faculty's perceptions regarding PU and PEU of SBL. Most studies and literature addressed students' perceptions and attitudes toward instructional technology in nursing or other health professions. Past research focused on professionals such as nurses and engineers' perceptions of using technology and not much focused on attitudes of instructors. Most of the research agreed SBL enhanced student performance. Nonetheless, further research is needed regarding instructors' PU, PEU, and ATU. This study was focused on exploring surgical technology faculty perceptions to broaden what is known about how they perceived PEU and usefulness of simulation-based technology.

Chapter 3: Research Method

I aimed to understand perspectives held by faculty members specializing in surgical technology. Specifically, I sought to explore their perspectives regarding PEU use and utility of high-fidelity learning tools within surgical technology education. Also, I investigated these faculty members' attitudes toward integration of high-fidelity learning tools for instructive and evaluative purposes during training of surgical technology students.

I enhanced knowledge regarding surgical technology faculty's perceptions of pedagogical technology by assessing their perceptions of high-fidelity learning technology PEU and usefulness as well as attitudes toward digital learning tools. This chapter includes information about the research setting, design, and rationale for the study. Additionally, I describe the research methodology, instrumentation, recruitment, participation, data collection, and data analysis. Lastly, I describe trustworthiness issues and ethical procedures.

Research Design and Rationale

The following research questions were addressed in this study:

RQ1: How do surgical technology faculty members perceive the ease of use and usefulness of high-fidelity learning tools in the context of instruction and assessment for surgical technology learners?

RQ2: What are the attitudes and perspectives of surgical technology faculty members regarding the integration of high-fidelity learning tools for enhancing the educational experience and evaluating the performance of surgical technology students?

Role of the Researcher

This section includes information about my tasks as the researcher. It was my responsibility to design procedures, recruit participants with 3 or more years of using HFS in curricula, interview them, transcribe recordings, code data, and analyze and interpret results. This basic qualitative study involved developing instruments, conducting semistructured interviews, transcribing Zoom audio recordings, and taking notes from primary interviews. My key methodological tasks were selecting the study's research design, recruiting participants, and collecting and analyzing data.

I revealed relationships with respondents and explained management of my biases and strategies for handling ethical concerns. In research, biases influence ways researchers collect, analyze, and interpret data. Researcher biases can undermine integrity of qualitative research, posing challenges to credibility (Baldwin et al., 2022). A better understanding of my biases led to more accurate, reliable, and unbiased findings resulting from better decision making. Subjective interpretations affect data collection by researchers. I used bracketing to reduce bias and separate personal beliefs from data analysis.

Prior to research, I held perceptions, beliefs, and interpretations regarding simulations. My past experiences included using a HFS as a faculty member in the classroom. To avoid influencing research outcomes and interpretations, I identified predispositions to ensure transparency using a reflective journal. My journal was used to express my thoughts and emotions, as well as reflect on my experiences and learning. As a researcher, I needed to disclose my professional connections with participants.

Participants were faculty members from different universities who were employed in surgical technology and able to discuss expanding simulation-based instruction. I engaged with respondents from different programs in the United States. Therefore, my research was not influenced by conflicts of interests.

Methodology

This section includes an outline of the process for selecting participants, research tools, recruitment process, data collection, and plan for analyzing data. The research design was a basic qualitative study. As part of semistructured interviews, participants were asked open-ended questions so they could express their views and experiences. Individual interviews provided an opportunity for participants to share their thoughts, experiences, and perspectives. Success of the study relied on integration of methodological components. When interviewing, it was important for me to develop structured prompts to ensure consistency and guide conversations with participants. I included open-ended questions in accordance with Patton’s guidelines to encourage participants to express themselves freely. When developing a plan for information analysis and data collection, researchers must consider research questions, problems, theories, and purpose (Patton, 2014). I used the qualitative design to obtain an understanding of perceptions and interests of participants.

Participant Selection

In this study, participants were instructors of surgical technology at 2-year colleges or associate degree programs in the United States. Associate’s degrees are the terminal degree path for STs. At the time of this study, there were only two bachelor’s programs in the United States. These programs require a surgical technology associate's degree to enroll.

I posted a recruitment flyer with information to increase interest in this study. By designing an attractive and user-friendly flyer, I sought to attract a diverse pool of participants and ensure successful recruitment. Applicants for this study were required to work at a U.S.-based institution, have an associate's degree in surgical technology, have at least 3 years of experience teaching surgical technology, and using HFS in their curriculum. U.S.-based surgical technology instructors who did not have at least an associate's degree in surgical technology or had less than 3 years of teaching experience were disqualified. At the beginning of each interview, I verified inclusion criteria were met. If participants did not meet these criteria, I thanked them for volunteering and ended the interview.

Creswell and Creswell (2018) recommended three to 30 participants be recruited, depending on the type of design. I gathered data through participant interviews. Saunders et al. (2018) stated saturation is primarily a matter of identifying redundancy in the data. I recruited 15 participants. Participants were recruited from public information websites. I also asked program directors in the surgical technology field for participant recommendations. In addition, at the end of each interview, I used the snowball sampling technique by asking existing participants to recommend others for the study. To explain the study and inclusion criteria, I emailed e-flyers to participants.

Purposeful sampling was used to select participants in a deliberate and systematic way. By using purposeful sampling, I was able to explore faculty perceptions regarding

HFS as a teaching tool. Using this method to gather data can help researchers improve credibility and relevance of their study findings (Creswell, 2012). Purposeful sampling prioritizes depth, resulting in smaller sample sizes compared to probability sampling.

Instrumentation

I created the interview protocol to align RQs and the conceptual framework, literature review, and content expert (CE) feedback. Interview questions (IQs) also aligned with TAM's three constructs (see Appendix C). Participants answered questions about the HFS and its impact on student learning. Open-ended IQs encouraged dialogue between participants and me. I used additional follow-up questions to further address details, get more insights, and ensure clarity of ideas. Prior to ending interviews, I asked participants to recommend colleagues who may be interested in participating in the study (see Appendix B).

CE Qualifications and Feedback

In qualitative research, especially dissertations, CE analyses are essential. Expertise, credibility, and an unbiased perspective should guide the careful selection of CEs (Tumin & Tobias, 2019). To confirm that the interview protocol aligned with the research objectives, the interview protocol was shared with the CEs. During the evaluation process, two STs were provided with information about the study, their roles as experts, and directions on how to evaluate the IQs in relation to the framework and research questions.

With over 18 years of experience as a practicing certified ST (CST) and certified surgical first assistant (CSFA), CE1 has provided scrubbing and assistance across various specialties but openly expressed their passion for neurosurgery and orthopedics. With over 12 years of experience in education, CE1 has directed surgical technology programs at three colleges in the Midwest U.S. region. CE1, in addition to obtaining a master's degree in educational technology, also received a certificate in online teaching, which played a crucial role in the implementation of HFS in the campus curricula. For 30 years, CE2 has served as a CST in cardiac surgery and as a registered nurse specializing in thoracic and vascular surgery in the northern region of the United States. With a 9-year tenure as a professor in the field of surgical technology, CE2 also assumed the responsibility of program chair for allied health. There are a number of HFS exercises that have been incorporated into CE2's curricula to promote student learning.

I received valuable feedback from CE1 and CE2 to refine my IQs. CE1 recommended modifying the wording of IQ1 and IQ3 to better align with the research question. CE1 and CE2 liked IQ2 and agreed that it was relevant to this study. CE1 and CE2 suggested small wording changes in the language to ensure that responses covered all aspects of the respondents' experiences. CE2 suggested changing the wording of IQ4 to better elicit the faculty's perceptions of being involved in the selection of simulation tools and the development of new curricula. CE1 reported that IQ5 demonstrated strong structure and relevance in capturing faculty's perceptions. To ensure the thoroughness of surgical simulation assessment tools, CE2 recommended using subquestions for IQ5. The CEs' expertise, insights, and guidance informed the development of the IQs to improve their quality and impact.

Alignment of IQs with the TAM, Literature Review, and CE Sources

In this section, I explain how I developed Appendix C, a table that shows how the TAM framework, my literature review, and CE feedback informed my IQs. Appendix C shows headers for several columns: IQs, framework, literature review, CE, and justification. I listed the IQs in the far left column. The framework column provides a citation, or the name of a construct related to the IQ, while the literature review column provides citations for sources that informed the IQ. The CE column indicates that the IQ was added or modified based on CE review. The final column justifies the decisions related to including each IQ. In Appendix C, the quality, relevance, and credibility of the sources used in the study are described in a structured manner. I outline the IQs, framework, literature review, expert analysis, and the justification for using HFS. Next, I highlight some examples from Appendix C. Both IQ2 and IQ6 aligned with the TAM's PEU construct in relation to HFS implementation. Therefore, I put an X in the column by IQ2 and IQ6 in the TAM column. Similarly, I added citations of the literature review articles for IQ2 in the literature review column (see Imran et al., 2021; Khosravi et al., 2022; Liaw et al., 2023). Several authors from the literature review contributed to the discussion of IQ5, describing both the benefits and challenges of HFS for training purposes.

Procedures for Recruitment, Participation, and Data Collection

The recruitment procedure began by seeking approval from the Walden University IRB. The IRB process ensured the study would follow ethical guidelines and protect participants’ rights and confidentiality. To capture diverse experiences and perspectives, I used a small sample size of 15 participants to achieve data saturation. Creswell (2012) stated that sample size should be large enough to describe the phenomenon of interest sufficiently and answer the research question. After I received IRB approval, I recruited participants from publicly available contact information for surgical technology program directors in the United States.

The recruiting process began when I sent an email with my e-flyer to surgical technology program directors explaining the study and inclusion criteria. I sent batches of blind copied emails to 40 program directors at a time, attaching my recruitment flyer. Potential participants needed to send an email to my Walden email address that indicated they wanted to participate in this study. Participation in this study was voluntary, and participants could withdraw without giving a reason at any time. I conveyed that participants may contribute to the advancement of surgical technology education and contribute to scientific knowledge. In response to potential participants' email correspondence, I emailed a consent form and scheduled an interview. The consent form stated that I abided by all relevant ethical guidelines and acknowledged any restrictions or limitations. At the beginning of the interview, participants were asked to share any questions or concerns they had. To be eligible for the study, participants were required to say "yes" when I asked them to agree to be interviewed for this study using audio recording. The Zoom audio recording application allowed me to record each interview and obtain an audio recording.

The transcription was verified for accuracy after I listened to the recording. I followed up with participants using member checking documents via email. After receiving guidance from the committee of the first audio transcription, I conducted interviews until saturation was reached. Therefore, the second interview did not have to be scheduled immediately after the first. I stored all files, including audio files, in a password-protected cloud-based storage account that is accessible to me only for a five-year period.

One day before the interview, I emailed the selected respondents reminding them of the time and date. Approximately 30 to 45 minutes were allotted for the interview. I used the mock interview respondent's feedback to guide the length of time needed for future interviews. Respondent feedback was an essential component of the qualitative research process. It allowed participants to understand their contributions to the research, while also providing researchers with valuable insights on interview questions (Creswell & Miller, 2000). By conducting effective respondent feedback techniques, researchers can build trust, foster collaboration, and ensure ethical research practices.

Before the interview's conclusion, I asked participants to provide additional comments and refer colleagues who may be interested in participating. This recruiting process is called snowball sampling (Creswell, 2013). Snowball sampling involves initial participants who are then encouraged to refer to other participants who have similar characteristics or experiences (Creswell, 2013). Due to their shared interests or involvement in the same groups, participants in these hidden populations are closely connected, and they can inform others about the study's benefits and reassure them of confidentiality (Creswell, 2013). Snowball sampling is a valuable qualitative research technique, allowing researchers to reach diverse populations and collect data through participant referrals.

Data Analysis Plan

Sutton and Austin (2015) suggested that qualitative research typically begins with data collection and continues through data analysis. I scheduled qualifying participants for an individual interview. A key part of the interview consisted of specific questions regarding the challenges the participants encountered when integrating HFS into their surgical technology program curriculum. The data collected were kept private to maintain participants' trust. Participants' names were masked immediately to protect their privacy (Creswell & Creswell, 2018). I hid all participants' names from this point forward using pseudonyms starting with P1.

Using reflexivity to acknowledge and discuss the influence of my background and experiences demonstrated my commitment to transparency and reproducibility. During the data collection and analysis, reflexivity means examining your judgments, practices, and beliefs (Olmos-Vega et al., 2022). Transparency builds trust in research amongst study participants, peers, and partner organizations. Member checking documents were presented for feedback to all participants during member-checking (McKim, 2023). I included participant feedback, comments, and suggestions in the member checking document, including but not limited to data interpretations, clarification requests, and alternative interpretations. I planned for the data collection and analysis process to last three months.

TAM was my selected framework to analyze how individuals perceive and choose to adopt transforming technologies (Davis, 1986). The model provided a framework for studying factors that influence the adoption of evolving technologies. It helped me identify critical factors that influence user acceptance. The following steps were used to conduct data analysis with the TAM: data collection, data coding, data analysis, and interpretation. I analyzed constructs: ATU, PU, and PEU (Davis, 1986). I used narrative coding to identify similarities and differences between data.

Narrative coding is a powerful qualitative research approach focusing on the stories and narratives embedded within the data. Using terms as codes, narrative coding identifies the structural properties of participants' narratives (Saldaña, 2021). By analyzing the narratives, I better understood the context in which the data was collected (Sutton & Austin, 2015). Narrative coding offered me a valuable approach to qualitative research by highlighting participants' stories, experiences, and perspectives. Creswell (2012) stated that findings and interpretations must be accurate throughout the data collection and analysis.

Qualitative codes captured the essence of my research story, which facilitated categorization and analysis of interactions when grouped according to similarity and regularity. Saldaña (2021) mentioned as a result of coding, I could group similarly coded data into categories or "families" since they share certain characteristics. To streamline the process, I used the codes-to-theory model, where codes are identified from the data, linked to major categories in the qualitative study, and themes and concepts emerge from those categories Saldaña (2021). Researchers noted that coding and categories are important stages that lead to theme development (Khokhar et al., 2020). To identify coding categories aligned with the three constructs of TAM, I used thematic analysis to identify innovation and adaptation, user acceptance, social influence, challenges and barriers, usefulness, and satisfaction, and learning curves.

Trustworthiness

Qualitative research values trustworthiness highly. I collected and analyzed non-numerical data, such as interviews, to better understand complex phenomena. Considering ethical considerations, engaging participants, using multiple data sources, and utilizing data analysis techniques increased the likelihood of producing reliable, credible qualitative research. Findings were trustworthy because I followed the principles of credibility, dependability, confirmability, and transferability (Stahl & King, 2020). Trustworthiness is a cornerstone of qualitative research; establishing it in my doctoral study was crucial.

Qualitative results are considered credible and follow established guidelines for collecting and analyzing qualitative data, resulting in a relatively accurate representation. There is a difference between qualitative standards of trustworthiness and positivistic term’s reliability and validity, which are more prevalent in quantitative literature (Creswell, 2013). Creswell (2013) and Loeb et al. (2017) outlined guidelines for crafting *persuasive* or *compelling* interpretations of naturalistic data. The four trustworthiness criteria mentioned by Stahl and King (2020) were used in my research: credibility, dependability, confirmability, and transferability. These criteria helped to determine whether the data presented was unbiased.

Credibility

The credibility of qualitative research findings relies on the participant's perception of reality. A study's credibility is determined by the extent to which participants can relate the study findings to their everyday realities (Shenton, 2004). Researchers enhance the credibility of qualitative studies by implementing diverse strategies. The methods I used included participant feedback and analysis. Participant feedback involved getting feedback from participants to confirm the accuracy of the research findings. The participants received a member-checking document via email to ensure honesty within this study and that I understood their meaning-making during the interview. Participants were asked to validate and edit additional information summarizing how I interpreted their interview in the member-checking document. Providing participants with an understanding of their rights contributes to honesty and credibility (Shenton, 2004). Participants received an electronic member-checking document via email to verify the accuracy of the data within two weeks of the interview.

Transferability

According to Shenton (2004), qualitative research is transferable when applied to other contexts. While developing the interview protocol, I documented my thoughts in my reflexive journal. I kept field notes about the participant's response during the interview. I also wrote in my reflexive journal to avoid biases. In my reflections, I discussed biases, perspectives, experiences, and personal observations. I gained valuable insights into the study by involving participants in member checking to ensure accuracy and reliability (Creswell, 2012). Transcribing the document and sharing a summary of its meaning content with the participant helped me ensure validity.

Dependability

According to Shenton (2004), research data's ability to answer research questions shows dependability. Reflexive journaling and audit trails using thick descriptions improve the dependability of qualitative studies. Providing detailed context helped me make the research more reliable and subsequently helped readers assess the credibility and relevance of the findings. After each interview, I documented the process and my reflections in my reflexive journal, adding to the audit trail of my research decisions. The task entailed documenting data, process notes, and analysis memos that I kept in my reflexive journal. Audit trials determine if the researcher followed research protocols. Interview transcripts and field notes were incorporated into the audit trail.

Confirmability

Confirmability is important in qualitative research to ensure reliable and valid findings. Detailed descriptions of the method, as stated by Shenton (2004), help readers understand the reasoning behind the chosen approach. Detailed descriptions serve the purpose of providing a detailed account of the methodology employed to ensure that the research process aligns with the research objectives. Elo et al. (2014) stated that confirmability relates to the objectivity and potential for alignment among multiple independent individuals regarding the accuracy, relevance, or meaning of the data. To ensure reliable results, I supplied detailed information encompassing the participants, settings, research procedures, and data analysis methods (Creswell, 2013).

Ethical Procedures

The reliability of qualitative studies is contingent upon the adherence to ethical protocols. In order to comply with ethical protocols, I submitted forms and provided a detailed list of responsibilities to Walden University's Institutional Review Board for the study. Ethical data collection encompasses procedures for collecting data, getting consent, and contacting individuals (Newman et al., 2021). I took measures to ensure research privacy through the outlined procedures. I used a password-protected folder to store the collected data. I will maintain an electronic folder for the data for the prescribed timeframe of five years and subsequently delete it by appropriate methods.

Ensuring the safety of study participants fell under my responsibility. Measures were taken to protect the participants' identities in the study. To maintain confidentiality, the identities of all participants were fully concealed. The informed consent form explained the potential risks involved, such as physical, psychological, legal, and privacy risks. The process ensured confidentiality, aiming to minimize potential risks. The main goal of upholding ethical procedures is prioritizing the benefits obtained from the research while minimizing any potential harm or risks to the faculty (Barrow et al., 2022). Inclusion in the research was limited to those who meet the criteria for data collection.

Summary

Qualitative research was conducted to gain insights regarding subjective experiences, attitudes, beliefs, and behaviors. I conducted semistructured interviews with individuals with firsthand knowledge regarding the research topic. Interviews were conducted remotely. I analyzed content and meaning of text data, including interview transcripts and member-checking documents. I identified recurring themes, patterns, and categories within data.

I employed a basic qualitative research design for data collection and analyzed data to understand complex phenomena. This allowed for flexibility and creativity during data collection and analysis, making it a valuable approach in the surgical technology field where understanding subjective experiences and meanings is crucial. Qualitative methods were used to gain insights regarding human experiences and contribute to different fields of knowledge.

Chapter 4: Results

The purpose of this basic qualitative descriptive study was to understand perspectives held by faculty members specializing in surgical technology. This study offers stakeholders realistic perspectives regarding effects of incorporating HFS into surgical technology curricula. Study findings could facilitate identifying needs of programs in the United States. I focused on attitudes of these faculty members toward integrating high-fidelity learning tools for both instructive and evaluative purposes during training of surgical technology students.

This chapter includes findings of this basic qualitative study. The chapter includes descriptions of the setting, data collection, data analysis, study results, evidence of trustworthiness, and a summary. During the data collection and analysis sections, I describe how I analyzed, coded, and interpreted data.

Setting

Surgical technology program directors nationwide took part in a virtual research study. I identified programs in educational institutions that used HFS. In this study, all faculty used HFS, but one faculty member chose not to incorporate technology-based HFS into their curricula. Fourteen of 15 participants addressed the funding gap for HFS in surgical technology programs. This was crucial for ensuring graduates were well-equipped to meet demands of the industry and provide high-quality patient care. Advocacy for increased funding, partnerships with healthcare organizations, and grant opportunities could mitigate challenges.

The focus of this basic qualitative study was associate's degree surgical technology programs' use of HFS in their curricula. Participants were 15 certified STs who had over 3 years of experience teaching. Two participants also held certifications as CSFAs. CSFAs play a vital role in the OR by offering crucial support to primary surgeons (ASA, 2025). They assist with various surgical tasks, including holding and passing instruments, suturing, and managing tissue during procedures to ensure the best possible surgical outcomes. Participants in this study included 13 women and two men. All participants had access to learning management systems, simulation manikins, Kahoot, and 2D simulation tools. Participants talked about how HFS tools enhanced the development of surgical skills by offering realistic experiences that helped them become more proficient and confident in terms of their abilities. Some participants had access to *the Journal of Medical Insight*, Apple TV, surgical science tools, PeriopSIM, Incisions Academy, Touch Surgery, and video applications. These platforms are used to practice and improve skills in safe environments, removing risks associated with live surgeries. Although these platforms have higher price tags than traditional static manikins, they provide advanced features such as VR, 3D simulations, web-based applications, and video tutorials.

Several personal and organizational factors affected program directors' views regarding HFS in surgical technology curricula. Budget constraints led many directors to see this technology as less feasible due to high initial costs for equipment and maintenance. Personnel changes, including turnover among skilled instructors, can hinder implementation of HFS. New staff may need time to adapt and may not be trained in effective teaching methods (Whigham, 2018). Directors' preferences for simulation are often shaped by their past experiences and personal comfort levels. Inadequate training for staff and students can result in negative perceptions of technology (Fernández-Batanero et al., 2021). Organizational readiness regarding technology infrastructure, including availability of technical support, is also important. All participants stated inadequate resources may compromise simulation effectiveness, affecting its perceived value.

Additionally, ongoing curriculum reforms to meet accreditation standards can lead directors to diminish the perceived importance of simulation. Institutional cultures favoring traditional teaching methods may not be open to adopting HFS (Shaw et al., 2021). I considered these factors when interpreting varied responses among program directors and providing context for study findings.

Data Collection

Authorization to contact program directors was unnecessary, as their information was listed on a public website. After receiving confirmation from the IRB on May 1, 2024 (approval #02-28-17-0492545), I emailed recruiting flyers to 100 program directors in 13 Southern states. In May 2024, five program directors replied to emails, agreeing to participate in the study. Upon receiving a reply to invitational emails stating willingness to participate, I immediately responded requesting best times, dates, and locations for interviews to take place. In July 2024, a second set of emails went out to program directors across the United States. By August 1, 2024, 15 interviews were scheduled (see Table 1).

Table 1

Participant Demographics

Participant code	Gender	Years of experience teaching HFS
P1	F	5-9
P2	F	10-14
P3	F	15-19
P4	F	15-19
P5	F	15-19
P6	F	15-19
P7	F	25+
P8	F	10-14
P9	F	5-9
P10	M	10-14
P11	F	10-14
P12	F	10-14
P13	F	10-14
P14	M	10-14
P15	F	0-4

I conducted Zoom interviews to collect data. Program directors of surgical technology programs in the United States were interviewed between May 16 and August 6, 2024. Each program director participated in one interview, ranging from 45 minutes to 1 hour. During interviews, program directors answered eight open-ended questions (see Appendix A) that involved their perspectives on HFS use in surgical technology curricula, views on technology-based simulation tools, and how they influenced their decisions on which technologies and applications are integrated into surgical technology curricula.

To ensure validity and reliability, I audio-recorded interviews and transcribed audio recordings using Zoom’s transcription feature. I emailed a member-checking document to participants within 10 days of their initial interviews to provide summaries of their meaning. Four participants responded to member checking documents. They made no changes or comments on interview transcripts. No participants requested follow-up interviews or conversations about the study.

Data Analysis

Once interviews were concluded, I began to analyze data. According to Creswell (2012), researchers should consider data interpretation and analysis as an ongoing and reflective process. Researchers refer to organizing data in order to discover patterns, themes, and relationships, formulate explanations, and revisit data as they are collected (Saldaña, 2021). I found analysis took shape only after analyzing complete data.

Analysis of the interview data included transcribing the audio-recorded interviews into a Word document using the interview protocol. I saved these files using participant codes numbered 1 to 15. After transcribing the interviews into Word, I used the Dedoose (SocioCultural Research Consultants, 2023) qualitative data analysis software to code patterns within and between categories. The Dedoose Analysis Workspace menu offered me access to the software's interactive charts, tables, and plots, enabling me to visualize, explore, organize, and present my findings (see SocioCultural Research Consultants, 2023). The data analysis was conducted systematically by developing categories from initial codes. This approach allowed effective analysis, leading to valuable insights and answers to the research questions, all while grounding the findings in established knowledge. Creswell (2012) pointed out that organizing the data into categories can reveal patterns between the data. The categories that develop can then support the central phenomenon.

The data analysis process is a crucial stage that involves systematically examining the collected data to identify patterns, themes, and insights (Bingham, 2023). This process typically begins with data familiarization, where researchers immerse themselves in the data, often taking notes and reflecting on their initial impressions (Naeem et al., 2024). By analyzing each participant's interview responses, I identified the data, breaking it down into smaller units and assigning codes to relevant segments. The codes helped me to organize the data and provided a foundation for further analysis of themes and categories.

During the data analysis process, researchers may encounter conflicting information that can provide valuable insights, challenging their initial perspectives (Creswell, 2012). Ahmed (2024) stated it is essential for researchers to maintain an open-minded approach, remaining receptive to any counterevidence that presents itself, rather than rigidly clinging to their preconceived notions. In this specific study, however, the analysis did reveal an outlier within the research findings, resulting in a mostly cohesive and consistent outcome.

I began by thoroughly analyzing the qualitative data, which included interview transcriptions and field notes. The first step involved breaking the data down into manageable segments. I then assigned codes to these segments that highlighted the significance of various elements in relation to the research question. A code is a distinctive label or concise phrase that identifies a specific piece of data that is relevant or significant in a given context (Saldaña, 2021). Codes with similar meanings were organized into broader categories, allowing for an exploration of the relationships among these codes and categories. I will provide an example of how I coded into broader categories. Saldaña (2021) described categories as a variety of themes and serve as an effective means of structuring these themes into broader levels of analysis. An instructor can enhance their students' educational experience by integrating nontechnological teaching methods, such as hands-on activities and group discussions, using technology to create a balanced approach (Tuma, 2021).

The stages of curriculum development encompass planning, implementation, and assessment. Upon reviewing the participants' responses regarding the benefits of simulation tools in education, I noted that they described enhanced engagement by providing real-world scenarios for practice and enabling safe experimentation. I categorized these responses under several themes: simulation tools in education, curriculum design and integration, and challenges with using HFS. Themes are developed by organizing related codes, which facilitates a deeper comprehension of the underlying meanings or essence of the data (Saldaña, 2021). The analysis I conducted strongly supports the inclusion of simulation tools in conjunction with other teaching methods. Also, simulation tools have different levels of fidelity pertaining to their realism. When I coded the elements of classroom management, integrating simulation into didactic learning, curriculum mapping, and critical thinking, under curriculum integration, I created a broad understanding of how they combined to form an effective educational framework. I then constructed a table to explain the themes and how they answered the research question, supported by direct quotations from the data to provide context and evidence. Throughout this process, I provided detailed documentation of the analytical steps I took to enhance the study's overall trustworthiness.

Results

This section presents the findings of this study, which have been organized around distinct themes that directly correspond to each research question. Throughout the coding process, various themes emerged, each representing a nuanced aspect of the data. These themes were subjected to an analysis that ensured alignment with the overarching research questions and the conceptual framework guiding the study. This comprehensive examination not only highlights the significance of the themes but also reinforces their relevance in addressing the research objectives.

RQ1

I identified three major themes from the interview responses. Themes 1 to 3 answer RQ1 (see Appendix D). Theme 1 was as follows: Incorporating simulation tools into surgical technology education enhances learning outcomes, better prepares students for clinical practice, and ultimately improves patient safety in surgical settings. Categories for Theme 1 include (a) a variety of simulation tools and (b) curriculum integration. Codes are (a) VR and simulation use, (b) simulation tool importance, (c) nontechnological modules, (d) stages in curriculum, (e) benefits of simulation tool, and (f) levels of fidelity.

Theme 2 was as follows: Integrating HFS into surgical technology curricula enhances the training of future STs. HFS provides learners with realistic practice scenarios that promote critical thinking, teamwork, and decision-making under pressure, preparing them for clinical environments and enhancing patient safety. Categories for Theme 2 include (a) design and assessment and (b) cognitive skills. Codes are (a) classroom management, (b) integrating simulation into didactic learning, (c) curriculum mapping, and (d) critical thinking.

Theme 3 was as follows: Surgical technology faculty overcome challenges related to HFS funding and training because simulations provide real-life surgical simulations. The following challenges hinder the implementation of HFS in healthcare:

- High costs: The tools and service packages required for HFS are expensive.
- Faculty shortage: There is a shortage of faculty trained in simulation pedagogy.
- Time constraints: Integrating simulation into curricula can be time-consuming.
- Lack of buy-in: Securing buy-in from faculty and administration can be challenging.
- Limited resources: The resources needed for effective simulation are often insufficient.
- Technological complexity: Proper training is needed to navigate the complex technology involved.
- Scenario accuracy: Ensuring that simulation scenarios accurately reflect real-world patient situations is essential but difficult.

Categories for Theme 3 include (a) challenges in implementation and (b) instructor training and comfort. Codes are (a) cost of tools and service packages, (b) limited resources, (c) shortage of faculty trained in simulation pedagogy, (d) buy-in from administration, (e) curriculum redesign, (f) lack of training on technology complexity, and (g) buy-in from ST faculty.

Theme 1

Incorporating simulation tools into surgical technology education enhances learning outcomes, better prepares students for clinical practice, and ultimately improves patient safety in surgical settings. I identified Theme 1 using the following two categories: variation in simulation tools and curriculum integration. Two critical codes stand out in surgical technology education simulation tools: VR and the importance of simulation tools. Applying VR and simulation technologies involves training STs through various methods, including VR simulators, laparoscopic trainers, anatomical models, and HFS. These resources offer immersive and interactive learning experiences that enhance the educational process. Surgical technology faculty expressed that both 2D and 3D simulation tools, such as VR and AI, offer a more immersive learning experience compared to traditional methods. P2 and P8 felt that VR enabled learners to hone their skills in a realistic environment, improving patient safety and preparedness. Simulation tools refer to 2D and 3D simulation tools, such as VR and AI, that offer a more immersive learning experience than traditional methods. Multiple participants felt that VR enables learners to hone their skills in a realistic environment, improving patient safety and preparedness. For example, P3 and P7 reported that surgical technology faculty often participate in HFS but realize some need to use technology. P3 stated, "VR is helping the learners apply hands-on skills once they enter the lab or clinical setting. VR equipment is used to reiterate the knowledge learned during lectures and from the 2D modules".

P6 and P13 expressed that starting with a simple manikin for new and incoming students is essential before progressing to more advanced models. P6 stated there is an order of simulation tools that should meet the learner's best needs, starting with static manikins. Additionally, P6 added that static manikins mimic human anatomy and can provide realistic scenarios for practicing routine and complex surgical tasks without the risks associated with live patients. P6 expressed that learners gain hands-on experience while developing a deeper understanding of surgical practices and patient safety when their training incorporates static manikins. All participants agreed that hands-on simulations are crucial in surgical technology education because they provide students with practical, real-world experiences. All participants felt that learners foster a deeper understanding of the surgical environment and enhance their clinical skills by actively engaging in surgical procedures and techniques through AI, VR, or 2D simulation.

Theme 2

Integrating HFS into surgical technology curricula enhances the training of future STs. HFS provides learners with realistic practice scenarios that promote critical thinking, teamwork, and decision-making under pressure, preparing them for clinical environments and enhancing patient safety. Upon completing the axial coding process, I discerned two distinct categories that emerged from my analysis: the first category focused on design and assessment, encompassing the various methodologies and frameworks used in evaluating educational programs and learning experiences. Three codes were identified within the design and assessment category: classroom management, the integration of simulation into didactic learning, and curriculum mapping. The second category focused on cognitive skills assessment, with the key outcome being the development of critical thinking. By incorporating essential thinking through HFS in surgical technology education, students are equipped with basic technical skills and enhance their cognitive abilities, allowing them to become proficient and confident professionals in the field.

In response to Interview Question 4, which asked participants about their perceptions of designing simulation modules for surgical technology programs throughout their careers, P10 remarked that understanding the simulation scenarios before implementation would assist in preparing surgical technology faculty educators to utilize the available tools effectively. Similarly, P1, P6, and P13 noted that implementing mock surgical procedures based on foundational skills would help surgical technology faculty be more prepared for simulation activities. Additionally, P11 expressed that creating a well-defined scenario with step-by-step instructions for surgical procedures from beginning to end benefited learners. P7 emphasized the importance of surgical technology faculty being prepared for hands-on activities in the classroom.

During the COVID-19 pandemic, surgical technology faculty felt it was challenging to prepare learners without face-to-face classroom instruction. P6 stated that using 2D applications allowed learners to remain engaged in their education during this period. P8 and P10 emphasized the crucial role of simulation in curriculum integration in developing critical thinking skills. Surgical technology faculty perceived that when they were comfortable with the tools being used, their and students' expectations aligned with the goals of the simulation activities. Several participants felt that preparatory procedures building on foundational skills helped them to be well prepared for simulation activities. P11 expressed that writing a well-defined scenario, including step-by-step instructions on surgical procedures from beginning to end, benefited learners. P3, P8, and P12 felt that writing out the scenario and instructions helped them implement simulations at an expected level for specific scenarios. P7 commented that it was important for surgical technology faculty to be prepared for hands-on activities in the classroom. During COVID-19, all participants found it challenging to prepare learners without face-to-face classrooms being available. P6 stated that the use of 2D applications allowed learners to stay active during their educative career in the COVID-19 era. P8 and P10 shared similar thoughts that that critical thinking by learners was a required skill displayed by implementing simulation into curriculums. P2 expressed that "when they were comfortable with the tools, they could align everyone's expectations with the simulation activity's goals".

Theme 3

Surgical technology faculty overcome challenges related to HFS funding and training because simulations provide real-life surgical simulations. The following challenges hinder the implementation of HFS in healthcare: high costs, faculty shortage, time constraints, lack of buy-in, limited resources, technological complexity, and scenario accuracy. Several challenges hinder the implementation of HFS in healthcare, including the high costs of tools and service packages, a shortage of faculty trained in simulation pedagogy, time constraints when integrating simulation into curricula, buy-in from ST faculty and administration, limited resources, lack of training on technological complexity, and the need to ensure that scenarios accurately reflect real-world patient situations. These seven codes encompass two categories: challenges in implementation, instructor training, and familiarity with HFS. These factors can considerably hinder the adoption of simulation in surgical technology education and training. P2 and P8 noted that simulation requires significant technological proficiency from both students and educators, as it promotes higher levels of engagement compared to more traditional, passive teaching methods. Fourteen of 15 participants agreed that in simulation-based training surgical technology education, instructors utilize a spectrum of low- to high-fidelity simulations as teaching tools, progressively incorporating advanced technology. P7 adamantly stated that technology is not needed to give learners hands-on experiences they need to be successful in an OR. However, instructors often face substantial challenges when implementing new teaching and simulation techniques.

All participants noted that the level of professional development provided for using the simulation tools was insufficient. P3, P5, P6, and P10 received initial training when the tool was purchased but not annual competency training by the vendor. They mentioned the training sessions did not adequately cover the skills and knowledge required to utilize these tools effectively in their work. Participants P3, P8, P9, and P12 indicated that a skills week was organized for faculty at the onset of each cohort year. The training during this skills week included a limited integration of HFS approaches and revealed a hesitance to utilize simulation as a replacement for traditional laboratory skill assessments.

P1, P5, P10, P14, and P15 felt that implementing HFS simulation in surgical technology curricula presented significant time constraints. These constraints included the extensive preparation required for simulation sessions, the need for faculty training, and the allocation of sufficient time for students to engage with the simulations effectively. All participants stated balancing these demands with the existing curriculum can be challenging, potentially leading to reduced instructional time for other critical components of the program. P15 speculated that having one instructor was difficult when running a surgical simulation. While one learner received adequate training, there was not enough time to debrief them and continue with the next learner. P7 expressed a significant challenge is the issue of limited faculty buy-in for using HFS in surgical technology instruction primarily due to pay and resource constraints Participants P3 and P7 have been afforded adequate spacing but also lean on community partnerships to offset financial or spacing issues. The primary challenge faced by P7, P11, and P15 lies in maintaining a consistent faculty presence amidst the competitive salary offerings from the industry.

Incorporating HFS into condensed curricula poses significant challenges due to time constraints. All participants stated it remains essential to include these simulations to equip students with vital hands-on experience and foster the development of critical skills. P1 said that if an instructor has access to simulators but feels uncomfortable using them, their effectiveness may suffer. Ultimately, P2, P3, P4, P6, P8, and P15 felt that the success of the teaching approach largely hinges on the instructor's skills and enthusiasm. The successful integration of HFS into surgical technology curricula necessitates commitment from faculty, administration, and students. By emphasizing curriculum alignment, simulation development, faculty training, and ongoing evaluation, educational programs can cultivate an enriching learning environment that equips students to navigate the complexities of contemporary surgical practice. All participants perceived that achieving successful implementation of HFS necessitated that curricula strike a balance between delivering thorough training and addressing the practical limitations of a shortened schedule.

RQ2

Three prominent themes emerged in my analysis of responses to RQ2 (see Appendix E). Theme 4 was as follows: Surgical technology provides various career opportunities in specialties, management, and education, with continuing education workshops vital for enhancing skills and knowledge. Categories for Theme 4 include (a) educational background and credentials and (b) professional development. Codes are (a) educational path, credentials and certifications, skill enhancement, leadership training, and mentorship and networking.

Theme 5 was as follows: Educators in 2-year surgical technology programs can improve student outcomes and better prepare them for the surgical environment. Categories for Theme 5 include (a) high fidelity simulations and (b) training and preparation. Codes are (a) student skill development, (b) hands-on learning, (c) assessment evaluation, (d) student preparation and orientation, and (e) feedback with reflection.

Theme 6 was as follows: Surgical technology curricula incorporate creative educational methods or strategies to improve learning outcomes. Categories of Theme 6 include (a) teaching strategies and (b) interprofessional education. The codes are (a) modular simulation activities, (b) flipped classroom models, (c) virtual reality (VR) simulations, (d) simulation-based interprofessional training, and (e) competency-based training.

Theme 4

Surgical technology provides various career opportunities in specialties, management, and education, with continuing education workshops vital for enhancing skills and knowledge. The educational background for teaching HFS in surgical technology typically encompasses a robust foundation in surgical technology, healthcare education, and simulation-based training. Educators often possess clinical experience in surgical technology and advanced degrees in education or related fields. For instance, their in-depth understanding of anatomical structures and surgical procedures allows them to teach clearly and confidently, making complex concepts more accessible to students. P2, P4, P5, P8, P9, P11, P12, and P14 described surgical technology educators as having keen skills to excel in designing and implementing simulation scenarios that accurately replicate real-life surgical environments, allowing students to practice and hone their skills in a controlled setting. Two participants, P3 and P8, portrayed how the integration of VR technology further enhanced simulations, offering realistic, immersive experiences that could be accessed remotely, thus providing greater flexibility and accessibility without the limitations of traditional laboratory settings. The analysis revealed four distinct categories that emerged from IQ1, the importance of educational pathways, the significance of credentials and certifications, the influence of these factors on teaching methodologies, and their role in career development.

All participants possessed at least an associate's degree in surgical technology, equipping them with a foundational comprehension of surgical procedures, instruments, and patient care. All participants explained that this educational background ensured they had the essential clinical knowledge and technical skills to teach and implement HFS in surgical technology education effectively. P2 stated that the educational path of surgical technology instructors dramatically impacts the quality of education provided to students, ultimately influencing the proficiency and readiness of future professionals in the surgical field. P15 emphasized that their hands-on experience and academic training allow them to create and manage realistic simulation scenarios that closely mirror actual surgical environments. This combination significantly enhances the students' learning experience.

Instructors with advanced degrees and relevant certifications significantly bolster their program's credibility. Having a well-educated faculty attracts high-caliber students and also facilitates partnerships with hospitals and surgical centers, which are vital for providing clinical rotations and internships. P7 and P14 noted that their advanced degrees have aided them in effectively managing classroom dynamics. Among the 15 participants, six earned at least a bachelor's degree. In terms of advanced education, seven participants obtained a master's degree, and one participant is currently pursuing a doctorate. Additionally, one participant, P12, completed their doctoral degree. This distribution highlights the diverse educational backgrounds represented within the group of participants in this study. Notably, P5 minored in surgical technology during their Bachelor's studies.

Out of 15 participants, two, P5 and P11, held the CSFA credential. According to P5 and P11, including individuals with this certification in surgical technology education significantly enhances the program's credibility, demonstrating a commitment to high standards in the field. P11 noted that this certification provides valuable insights into real-world surgical scenarios, enabling students to bridge the gap between theoretical knowledge and practical applications in the operating room. Additionally, P2 and P15 expressed that "the hands-on experience offered by these instructors fosters engaging and relevant classroom discussions, ultimately benefiting student learning outcomes".

Theme 5

Educators in two-year surgical technology programs can significantly improve student outcomes and prepare them for the surgical environment using HFS. These simulations provide realistic, hands-on experiences that closely mimic surgical settings, allowing students to practice and refine their skills. According to P1, P2, P6, P10, P13, P14, and P15, these simulations offer students realistic, hands-on experiences that closely replicate actual surgical environments, enabling them to practice and refine their skills in a controlled setting. P2, P3, P8, P9, and P12 perceived that the immersive quality of HFS fosters greater student involvement than traditional classroom teaching by making the learning process more interactive and practical. P2 shared that students gain a deeper understanding of surgical procedures, instruments, and patient care, which leads to improved learning outcomes and better preparation for real-world clinical practice. P1, P2, P4, P9, and P11 articulated that enhancing student engagement through active participation, collaborative learning, and relevant curricula is crucial for improving learning outcomes in surgical technology education. By fostering an environment that emphasizes skill acquisition through five codes, student skills development, hands-on learning, assessment evaluation, student preparation and orientation, and feedback with reflection, educators can effectively prepare students for successful careers in the surgical field. Ultimately, these elements can contribute to increased patient safety and improved quality of care in surgical settings.

HFS enhances student engagement and learning outcomes within two-year associate degree programs in surgical technology. All 15 participants agreed that these simulations offer students realistic, hands-on experiences that closely replicate actual surgical environments, enabling them to practice and refine their skills in a controlled setting. P2 and P8 answered repetitively that the immersive quality of HFS fosters greater student involvement by making the learning process more interactive and practical. P7 expressed hands-on and experiential nature of simulations provides students with invaluable opportunities to practice and hone their skills in a realistic and controlled environment. According to P1, P4, P6, P10, and P13 students gain a deeper understanding of surgical procedures, instruments, and patient care, which leads to improved learning outcomes and better preparation for real-world clinical practice. P4 and P14 shared that the experiences reflect a consensus that HFS significantly contributes to enhanced student engagement and readiness for the complexities of the surgical field.

Educators should offer ongoing and constructive feedback on student performance during practical exercises and simulations. P7 proclaimed providing feedback is essential for helping students recognize their strengths and areas for improvement, thereby nurturing a growth mindset. P1, P4, P5, P7, P10, P12, and P15 recommended that regular performance evaluations be conducted throughout the lab portion of the curricula, allowing instructors to assess student competencies in real-world settings. The evaluations include comprehensive discussions regarding technical skills, professionalism, and the capacity to manage pressure effectively, as noted by P7.

Participants also spoke about their program designs. They shared that the programs are designed with ongoing assessments, such as quizzes, practical exams, and peer evaluations to track student progress and pinpoint areas needing additional support. Fifteen participants spoke on the completion of modules or the entire program. They explained that summative assessments, including simulations modules and written tests, are conducted to evaluate overall competencies. Students are assessed by their ability to demonstrate the essential skills and behaviors required for a surgical technologist, with a particular emphasis on critical tasks and technical expertise.

Theme 6

Surgical technology curricula incorporate creative educational methods or strategies to improve learning outcomes. Innovative practices in implementing high-fidelity simulation in surgical technology include these five codes: modular simulation activities, flipped classroom models, simulation-based interprofessional training, VR simulations, and competency-based training. Four participants, P3, P6, P8, and P10, explained how modular simulation units with focused simulation techniques were quickly integrated into the existing curriculum without overwhelming the schedule. P6 explained that the training units were designed to replicate real clinical scenarios, enabling students to practice and refine their skills in a safe and controlled environment. Both P2 and P3 emphasized the significance of each module concentrating on specific procedures or competencies, ensuring a comprehensive and immersive educational experience.

The flipped classroom model in allied health simulation training involves students engaging with instructional materials, such as lectures and readings, outside the classroom, usually through online platforms. P1, P2, and P10 indicated that classroom time is dedicated to hands-on simulation activities, allowing students to apply the knowledge they have independently acquired. They described this method as enhancing active learning, fostering collaboration, and providing opportunities for immediate instructor feedback and guidance during simulation exercises. P2, P3, P5, P7, P10, P11, P12, and P13 felt that the flipped classroom model in simulation training improved student engagement, knowledge retention, and practical skill development by shifting the focus from passive to active learning.

IPE, through operating room simulation modules, immerses students from a range of healthcare disciplines, including nursing, surgical technology, anesthesia, and surgery, in a highly realistic operating room environment (Zhang & Wang, 2024). P2, P7, P10, and P12 highlighted that these hands-on simulation experiences promote effective teamwork and communication and deepen their understanding of each professional's unique responsibilities and contributions to patient care. All participants mentioned that by engaging in collaborative exercises, students develop essential skills that prepare them for real-world medical scenarios, fostering a culture of mutual respect and shared knowledge among future healthcare providers.

P1, P2, P8, and P9 noted that through realistic scenarios and hands-on practice, students learned to collaborate effectively. The realism of this approach enhanced their ability to provide coordinated and comprehensive care in real-world clinical settings. P2 and P7 emphasized that the goal of IPE in these simulation modules is to improve patient outcomes by fostering interprofessional collaboration and minimizing errors in the operating room. P12 explained the realism of these types of simulations, which gives learners the shock and awe of the surgical arena in a safe environment.

Utilizing VR technology in surgical technology simulation labs provides realistic, immersive experiences that can be accessed remotely. VR implementation reduces the need for physical space and time. P3, P6, P9, and P10 explained how this approach allows students to practice and refine their skills in a virtual environment that closely mimics real-life surgery scenarios, offering flexibility and accessibility without traditional lab settings. P2 explained that VR technology is in its infancy for surgical technology, and the haptics do not provide adequate feedback for learners. P3 and P8 have implemented VR into their modules so that first-year students can learn fundamental skills and that they have received good feedback.

Competency-based training in surgical technology focuses on specific skills and allows students to progress at their own pace, ensuring thorough understanding and skill acquisition within a limited timeframe. Multiple participants, P1, P2, and P12, felt that focusing on particular competencies during surgical technology lab simulations and allowing students to progress at their own pace ensures thorough understanding and skill acquisition within the limited timeframe. P12 proclaimed that utilizing VR technology in these labs to provide realistic, immersive experiences that can be accessed remotely reduces the need for physical space and time. P15 eluded that VR implementation provides students with tools to practice and refine their skills in a virtual environment that closely mimics real-life surgery scenarios, offering flexibility and accessibility without the constraints of a traditional lab setting.

At the conclusion of chapter four, a comprehensive summary of themes offers a synthesized overview of the key findings and insights derived from the qualitative data. This summary underscores the predominant themes evident in participants' responses, demonstrating their relevance to the research questions and conceptual framework. Each theme is articulated concisely, highlighting its importance in understanding the influence of high-fidelity simulation on student learning within surgical technology programs. Additionally, the summary reflects on the interconnections among themes, illustrating how they collectively enhance our understanding of participants' experiences and perceptions. By encapsulating these insights, the summary serves as a bridge to the following chapter, which will explore the implications, conclusions, and recommendations in the broader context of educational practices and technological integration.

Evidence of Trustworthiness

Creswell (2012) defined the criteria for trustworthiness in qualitative research as including internal and external validity, reliability, and objectivity. I collected interview data from 15 surgical technology faculty to ensure the accuracy, saturation, and validity of the findings. I conducted face-to-face interviews with program directors. The data analysis process involved analyzing the collected data to identify evidence supporting common themes to support evidence in the single interview data.

Creswell (2012) noted that member checking was used to clarify the researcher's interpretations. This process occurred after transcribing, coding, and analyzing the data to ensure authenticity. In this study, credibility was established through the process of participant feedback. This involved soliciting participants' input to confirm the research findings' accuracy. Each participant received a member-checking document via email, which served to ensure transparency and clarity regarding their experiences and interpretations during the interviews. Participants were encouraged to validate the information and make any necessary edits to the additional summaries reflecting how their interviews were interpreted. This electronic member-checking document was distributed within two weeks following the interviews, allowing participants the opportunity to verify the accuracy of the data collected.

An essential factor in ensuring transferability is the detailed description of participants. This encompasses their characteristics, backgrounds, experiences, and unique traits. By offering a comprehensive profile of the participants, researchers can better assess the similarities and differences between them. Understanding the context of research findings is crucial for evaluating how applicable those findings are in broader settings or different populations, known as generalizability. By grasping the nuances of specific study conditions, methodologies, and participant characteristics, researchers, practitioners, and policymakers can better determine whether the results can be reliably extended to other situations. I employed purposive sampling to select surgical technology program directors who incorporated HFS into their curricula. The transferability of the findings from this study may provide valuable insights for future research on the integration of HFS across all surgical technology courses.

To ensure the dependability of this study, I described its focus, the researcher's role, the positions of the participants, the criteria for selecting them, and the context from which the data was gathered (Creswell, 2012), acknowledging my bias towards the use of technology in surgical technology curricula. During the data collection phase, open-ended interview questions were initially utilized to obtain comprehensive insights from 15 participants. These open-ended questions enabled participants to articulate their thoughts and share detailed narratives of their lives and experiences. I used a nonjudgmental and empathetic approach, fostering an environment that encouraged participants to freely express their thoughts, emotions, and perceptions. Upon further reflection, it became evident that open-ended questions might not offer the necessary depth or clarity on specific topics. To address this limitation, a decision was made to enhance the data collection methods by integrating structured questions. These impromptu questions provided a framework that guided respondents in articulating their thoughts and experiences (Smith et al., 2019). By incorporating structured questions, it became possible to delve deeper into particular aspects of the research topic.

Confirmability refers to the extent to which the findings of a qualitative research study can be supported by multiple data sources or perspectives. It entails employing various methods to ensure that the research outcomes are both reliable and credible. Strategies such as triangulation, member checking, and audit trails can be utilized to achieve confirmability. Content validity is crucial to surgical technology education, as it ensures that simulation scenarios accurately represent the skills, knowledge, and competency required in real-life surgical situations. The two CEs offered invaluable feedback on aligning interview questions with the research questions, ensuring that each inquiry effectively addressed the specific constructs outlined in the study's conceptual framework. Their insights significantly contributed to refining the questions' clarity and relevance, enhancing the coherence between qualitative data collection and the research objectives. Furthermore, the experts identified potential gaps in the original questions and recommended modifications that enriched the quality and depth of the anticipated participant responses. Bracketing is a valuable technique in qualitative research that enhances validity and confirmability. By setting aside preconceived notions and biases, researchers can approach their work with greater objectivity, resulting in more reliable and valid findings. Throughout this study, I made reflexive journal notes to keep my bias in check. Although bracketing alone cannot guarantee absolute validity and confirmability, it serves as a useful tool for researchers committed to rigor in their qualitative research.

Summary

This study involved exploring perspectives of program directors regarding use of HFS instructional tools within surgical technology curricula. This chapter included information about interviews with participants. I also addressed methods in conducting the study, as well as data collection and analysis processes. In this basic qualitative study, several themes were revealed that addressed research questions. Themes that emerged from RQ1 were simulation in education, curriculum design and integration, and challenges. Simulation in education involves applying simulation techniques to enhance student learning and engagement, promoting critical thinking and collaboration. Curriculum design and integration includes effectively incorporating simulations into existing curricula, ensuring alignment with educational objectives and accommodating diverse learning styles. Challenges include obstacles educators encounter when implementing simulations involving resource limitations, technological issues, and resistance to change while examining potential solutions to these challenges.

Themes that emerged from RQ2 were career pathways and professional growth, student engagement and learning, and innovative practices. Career pathways and professional growth include opportunities for career advancement and professional development, encompassing mentorship and training initiatives. Student engagement and learning involves strategies that are designed to enhance student involvement and deepen understanding, emphasizing active learning and integration of technology. Innovative practices include creative methods and new approaches in education that enhance teaching and learning outcomes, including use of cutting-edge technologies and interdisciplinary strategies. Together, these themes were used to address evolving educational practices that support both educators and students.

Lastly, I explained reliability and validity to establish study trustworthiness. The study showed favorable faculty perceptions of HFS in surgical technology curricula can enhance educational quality, increase student readiness, and lead to adapting changing healthcare practices. Chapter 5 includes interpretations of findings that were presented in Chapter 4. I also discuss limitations that may have affected trustworthiness of this study. Additionally, I address recommendations for future research and the potential for positive social change.

Chapter 5: Discussion, Conclusions, and Recommendations

This chapter includes a comprehensive discussion of study results. It includes an overview of the dissertation, detailed elaboration of findings, interpretations of study results, implications of research, and assumptions and limitations. It concludes with recommendations for surgical technology education and future research. Kim et al. (2021) outlined the adoption of wearables, software, digital tools, and virtual assistance can lead to experience in real works scenarios in a safe environment. HFS with repeated skill practice is essential for enhancing care delivery, immediate learner feedback and ensuring safe patient outcomes by minimizing the potential for human error.

Simulated situations are an effective method for evaluating performance and clinical skills. The simulation approach allows for control of external factors, standardizing problems presented by patients and enabling instructors to provide positive feedback to students for clinical readiness (Nair et al., 2024). This study was designed to address a gap in practice in literature concerning surgical technology faculty perceptions of integrating HFS into curricula. I aimed to explore their views regarding advantages and challenges of using HFS in 2-year associate’s degree programs in the United States. I conducted qualitative interviews to collect insights from 15 surgical technology educators. This study helped to address the gap in practice regarding integration of technology in educational settings, particularly teacher training and professional development. Elendu et al. (2024) stated as traditional clinical teaching methods evolve, medical educators embrace change by incorporating simulation to enhance students’ skill transfer and provide immediate feedback regarding their competencies.

Interpretation of the Findings

This study included critical insights regarding the evolving landscape of educational practices, particularly in terms of SBL and faculty development. RQ1 involved addressing the impact of HFS on educational outcomes, exploring themes such as the role of simulations in enhancing student engagement, the of innovative technologies within curricula, and challenges surgical technology educators face when adopting these methods. Meanwhile, RQ2 involved career pathways and professional growth, student engagement, and innovative educational practices (see Appendix F).

TAM as a Useful Framework

The TAM was confirmed to be a valuable framework for understanding how users accept and use technology across various contexts, particularly in educational environments. Researchers have highlighted the model's effectiveness in terms of predicting technology adoption by emphasizing two key constructs: PU and PEU. Users are more likely to adopt new technologies if they believe these technologies enhance their performance and are easy to use (Davis, 1989; Venkatesh & Davis, 2000). Galimova et al. (2024) stated by focusing on the interplay between PEU, PU, and resulting ATU technology, the TAM is used to provide actionable insights to enhance adoption and integration of innovative educational technologies. By integrating the TAM, I effectively assessed faculty perceptions regarding simulations in surgical technology education, and their willingness to incorporate this tool into their curricula.

Firsthand findings across various healthcare disciplines further underscore the relevance of the TAM. Granić (2022) confirmed the TAM reliably predicts adoption of technologies in educational settings. Additionally, Granić and Marangunić (2019) affirmed the validity of the TAM in higher education and stated faculty acceptance of technology significantly influences instructional effectiveness. Hussain et al. (2025) stated understanding these relationships can aid developers in terms of creating more user-friendly technologies that are tailored to skill levels of their target audience, ultimately leading to increased adoption rates. These findings suggest applying the TAM to investigate faculty perceptions regarding surgical technology aligns with established literature and provides a robust framework for promoting informed decision-making regarding adoption of technological tools to enhance student learning outcomes in this study.

TAM for New Technology like AI and VR

The TAM was used for understanding faculty perceptions and acceptance of new educational technologies like AI and VR. PEU and PU significantly influence technology adoption (Davis, 1989). Participants highlighted the importance of PEU in terms of implementing AI and VR technologies. Wong et al. (2023) indicated learners who approach new technology with open attitudes recognize VR technology as a highly-valuable training platform. Participants expressed concerns about simulation tool complexity and learning curves. For instance, P6 addressed the necessity for comprehensive training, indicating lack of familiarity with technology could deter effective integration. This study aligned with using TAM as a framework, where greater PEU likely increases technology acceptance (Granić, 2022). P6 said, “Many instructors do not feel sufficiently prepared to lead simulations effectively.”.

Interviews revealed participants perceived AI and VR as beneficial for enhancing student engagement and clinical skills. Participants frequently expressed how AI and VR provided realistic scenarios facilitating critical thinking and decision-making. P15 stated, "the more realism we build into our training, the better our students perform in real-world situations." This positive perception of usefulness is crucial; if surgical technology faculty believe AI and VR can enhance educational outcomes, they are more likely to adopt these technologies (Lemay et al., 2018). This finding confirmed broader literature emphasizing PU in technology adoption is important. Kim et al. (2021) stated, when educators in this profession recognize the effectiveness of educational technologies in terms of enhancing instructional practices, they are more likely to adopt and integrate these tools into their teaching methodologies. Kim et al. stated technological innovations are rapidly evolving, as surgical technology educators must navigate increasingly complex landscapes for available resources. I examined relationships between PEU, PU, and ATU. The TAM was valuable to improve adoption and integration of innovative educational technologies. Therefore, addressing concerns regarding PEU and effectively communicating benefits of AI and VR as essential for fostering their acceptance in educational settings.

PU of Technology

My research disconfirmed faculty members require more concrete evidence regarding the impact of HFS on learning outcomes before they are willing to fully embrace its integration. Literature on its effectiveness and use has proven challenging for participants. When surgical technology educators perceive technology as applicable, it significantly enhances student engagement and learning outcomes (Lemay et al., 2018; Kim et al., 2021). Lemay et al. (2018) found simulations provide hands-on learning experiences and foster critical thinking and problem-solving skills among students, ultimately leading to improved performance. Effective SBL requires instructors to be proficient terms of the technical aspects of simulations as well as facilitating debriefings while providing constructive feedback (Elendu et al., 2024). This study confirmed integrating HFS into surgical technology curricula can motivate faculty to adopt these innovations in their teaching, thereby enhancing student learning experiences.

It is essential to recognize that some surgical technology faculty members may be skeptical about the immediate benefits of integrating these technologies into their curricula. Elendu et al. (2024) mentioned by fostering a collaborative environment that promotes experimentation, continuous professional development, and evidence-based discussions, institutions can cultivate a culture that embraces innovation and more effectively prepares students for the challenges of the surgical profession. This disconfirmation, as indicated by participant P7's responses, highlights a broader cultural resistance that can exist within educational institutions. This skepticism can hinder the adoption of HFS in educational settings (Kim et al., 2021).

Attitudes Toward Technology Adoption

The integration of new educational technologies, such as HFS, confirmed insights into how individual perceptions can affect acceptance and usage. According to research by Granić and Marangunić (2019), attitudes toward technology adoption are influenced by three key factors: perceived behavioral control, subjective norms, and individual intentions. Nursing faculty's attitudes regarding the adoption of HFS are significantly shaped by their perceptions of control over effectively using these technologies (Pananganan, 2023). Like Pananganan (2023), this study's participants reported that when surgical technology faculty members believe they possess the necessary skills and resources, they have a more favorable attitude toward adopting these tools.

When surgical technology faculty face significant barriers such as insufficient training or technological challenges, their willingness to adopt these tools diminishes (P1 & P15). The findings of my study confirmed Granić and Marangunić's (2019) that faculty's perceived control plays a vital role in shaping attitudes toward technology. Additionally, social influences can significantly affect individual decision-making. Current literature suggested scenario-based standardized patient-simulated exercises, facilitated by dedicated faculty and supported by reflective debriefing sessions, have been shown to effectively bridge the gap between theoretical knowledge and practical application in clinical settings (Khalil et al., 2023; Koukourikos et al., 2021; Lean et al., 2021). Similar to the findings of Granić and Marangunić (2019), this study confirmed that surgical technology faculty who witnessed positive outcomes from colleagues who successfully adopted these technologies developed a sense of optimism and hope, fostering a shift in their attitudes and encouraging them to embrace HFS themselves.

Fidelity Differences in Simulation

My findings showed that differences in the quality of simulations had a clear impact on outcomes in surgical technology training. This highlights just how important well-designed simulations are for helping students build and apply practical skills.

Fidelity in simulation, as explored by Grant et al. (2021), offers a comprehensive framework for understanding how different levels of fidelity can influence learning outcomes and learner experiences. Fidelity in simulation relates to the degree of realism integrated into the simulation environment, which ranges from low fidelity (e.g., simple task trainers) to high-fidelity (e.g., advanced manikins or VR). According to Grant et al. (2021), the fidelity of a simulation impacts not only skill transfer but also learner engagement and satisfaction. HFSs are often associated with improved transfer of learning to real-world settings, with findings indicating that participants exposed to scenarios exhibit better skill acquisition and retention compared to those involved in lower-fidelity simulations (Guerrero et al., 2022). The realism inherent in these simulations was crucial for preparing learners for genuine clinical situations, as higher fidelity offers a more immersive experience that closely reflects real-life challenges (Grant et al., 2021).

Moreover, HFSs tend to enhance learner motivation due to their realistic nature, fostering a deeper emotional connection to the learning process. This increased engagement can lead to greater persistence and effort, making learners more likely to invest themselves in simulations that closely mirror authentic clinical encounters (Grant et al., 2021). While HFSs can yield superior educational outcomes, they also require significant resources and institutional investment. Grant et al. (2021) highlighted that the costs associated with HFS technology may present a barrier to its widespread adoption in educational programs. In this study, surgical technology faculty confirmed that budgetary constraints were a significant barrier to adopting HFS tools in their curricula. As a result, surgical technology faculty must carefully consider the advantages of enhanced realism alongside the practical limitations of implementing such simulations across various educational contexts.

HFS and Integration of Simulation in Curricula

This study's findings about the multifaceted benefits and potential challenges of the implementation of high fidelity and integration of simulations into educational curricula were confirmed in the literature review. Faculty responses indicated that HFS serves as a vital tool for enhancing clinical education, making its integration essential for contemporary curricula (Elendu et al., 2024). Surgical technology faculty participants often emphasized that the realistic practice environments provided by HFS are invaluable for student learning. As one faculty member remarked, "HFS enables students to make mistakes and learn in a controlled setting" (P6), highlighting the technology's role in facilitating practical skill development without compromising patient safety.

However, the integration of HFS into existing curricula is not without difficulties. Faculty expressed concerns related to curriculum alignment. For example, P7 noted that "synchronizing simulations with established learning objectives can present a complex balancing act". Careful planning and collaboration among Surgical technology faculty are necessary to ensure that simulation training complements traditional educational methods rather than disrupts the learning experience (Elendu et al., 2024). My findings supported Carroll et al. (2018) conclusion that integrating high-fidelity simulation (HFS) into surgical technology education requires a deliberate and well-planned approach.

Specifically, simulation activities should be intentionally aligned with the curriculum and clearly tied to educational goals to be most effective.

Furthermore, the need for faculty training emerged as a theme. For example, P6 pointed out that “not all instructors feel adequately prepared to lead simulations effectively”. This finding confirmed Khalil et al. (2023) that the successful integration of HFS into curricula necessitates ongoing professional development and support to build faculty confidence and competence in utilizing these educational tools. Lie et al. (2023) underscored the importance of faculty development programs specifically tailored for simulation education to enhance instructional efficacy and increase the adoption rates of innovative technologies. Finally, enhancing resource allocation was deemed crucial for successful integration, as P11 noted “without financial support for resources, our simulation programs struggle to maintain viability”. Advocating for increased funding is essential to uphold the quality and accessibility of HFS experiences in educational programs.

IPE and Collaboration

The confirmation of IPE and collaborative practices is increasingly vital in equipping healthcare professionals to address the complexities inherent in modern healthcare delivery. IPE involves bringing together students from various healthcare disciplines to learn from, with, and about one another, thereby fostering collaboration and enhancing the effectiveness of team-based care delivery (Gros et al., 2021; Higgins et al., 2020). Similar to P5’s remarks in this study, current literature mentioned that this approach was pertinent in today’s complex healthcare environments, where effective teamwork can significantly improve patient outcomes (Kilroy et al., 2025). The primary objective of IPE is to develop collaborative competencies, enabling healthcare professionals to work adeptly within teams. In their responses to the study, both P1 and P12 highlighted that engaging in IPE can significantly contribute to improving communication skills, fostering mutual respect, and reducing professional silos among healthcare providers, as noted by (Carey & Rossler, 2023). Aloini et al. (2022) found that IPE improved teamwork and collaboration among students and positively influenced their attitudes toward other professions, underscoring the value of early exposure to interprofessional interactions.

Collaboration within healthcare settings has been associated with improved patient safety and satisfaction. P6 and P12, like Higgins et al. (2020), emphasized that teams trained in IPE demonstrated better health outcomes than those without such training, highlighting the effectiveness of collaborative practice in enhancing patient care. Higgins et al. (2020) noted that IPE equips future healthcare professionals to navigate the complexities of patient care while cultivating an environment of respect and effective communication. However, implementing IPE presents challenges, including faculty resistance and the need for curriculum redesign. Therefore, fostering a culture that values interprofessional collaboration is crucial for overcoming these barriers and fully realizing the benefits of usage.

Challenges and Barriers to Implementation

The challenges and barriers to implementing HFS and other innovative educational technologies, as highlighted by Whigham (2018), are particularly pertinent.

The integration of HFS in educational settings often extends various obstacles that can impede its successful adoption and incorporation into curricula. A primary challenge in my study identified by P1, P4, P5, P7, P10, P11, P13, P14, and P15 was the substantial financial investment required for HFS technology and resources. Whigham (2018) emphasized that institutions frequently grappled with budget constraints, limiting their access to the latest simulation equipment and technology. P3 and P8 were the sole individuals in the study who did not face any budgetary constraints and subsequently opted to purchase HFS tools. Their financial flexibility allowed them to acquire these tools, which may provide them with a distinct advantage in their respective projects. The lack of resources hinders the delivery of comprehensive simulation experiences, ultimately diminishing the effectiveness of training programs (Koukourikos et al., 2021).

Another barrier that extended this finding was the necessity for adequate training for faculty members stated by P1, P2, P14, and P15. Whigham (2018) noted that many instructors feel ill-equipped to effectively implement HFS in their teaching practices due to a scarcity of professional development opportunities. P8 noted that professional development for surgical technology faculty includes HFS representatives being invited at the start of each academic year for training. Carey and Rossler (2023) reported that without an adequate training cycle, underutilization occurs, where available HFS resources are not fully leveraged, leading to suboptimal learning outcomes.

The integration of HFS into established curricula often presents substantial challenges. Surgical technology faculty members reported difficulties aligning simulation exercises with specific learning objectives, resulting in difficult balancing acts as they strove to fit HFS into existing educational frameworks. The struggle reflects the tension between innovative teaching methods and traditional academic structures, which can hinder the adoption of new practices (P12). Furthermore, Whigham (2018) pointed out that resistance to new technologies among faculty is common, particularly among those accustomed to traditional teaching methodologies. Resistance may arise from a fear of the unknown or a belief that conventional methods suffice. P7 mentioned that they are not using new technologies in their curriculum but have changed teaching modalities over the years. Bardach et al. (2022) mentioned overcoming this resistance is crucial for cultivating a culture of innovation and collaboration in educational environments.

This study's themes presented in the Appendix F chart revealed how findings confirm, disconfirm, or extend the themes. Benefits included the creation of a realistic practice environment that fostered skill development, enhanced critical thinking, and improved decision-making abilities while offering immediate feedback in a safe setting. Similar to my study, Ismail et al. (2024) identified academic, resource-based, and professional factors as key themes for challenges when integrating HFS into healthcare curricula. Nevertheless, several challenges must be addressed, such as the resource-intensive nature of HFS implementation, the necessity for additional faculty training, challenges in integrating simulations into existing curricula, and obstacles in developing effective assessment methodologies. Nair et al. (2024) reported that maximizing the effectiveness of HFS cultivated better-prepared healthcare professionals requires addressing challenges through improved faculty development, collaborative curriculum design, increased resource allocation, and structured feedback systems.

Limitations of the Study

One limitation of this study which impacts trustworthiness was that the purposeful sample included only program directors from associate degree surgical technology programs, excluding input from surgical technology faculty and students. Including a more diverse faculty sample could yield different results than those in the current study. The limitation concerning the necessity for a wider range of life experiences in this study emphasizes an important factor that could affect the effectiveness of SBL environments (Frei-Landau & Levin, 2023). While existing literature primarily focused on the technical and pedagogical aspects of simulation tools, it may not adequately consider the diverse backgrounds and experiences of the surgical technology faculty involved in the simulations (Saleem & Khan, 2023).

The sample size of the current study was limited to program directors with more than three years of experience in teaching associate degree programs in the United States. This selection of criteria means that the findings may not have been generalized to all surgical technology faculty, particularly those in programs that do not offer an associate degree or those who do not have experience with HFS in their teaching practices. The exclusion of these other faculty members may lead to a narrow understanding of the effectiveness and application of SBL in surgical technology education.

Recommendations

HFS is an invaluable educational tool that enhances the development of clinical reasoning skills and may improve patient safety (Nair et al., 2024). Therefore, the following recommendations are for updates in specific areas. Firstly, program directors should ensure that associate degree surgical technology program faculty incorporate weekly HFS learning modules into their curricula. Introducing students to HFS early in fundamental surgical technology courses is advisable to foster familiarity and comfort with this teaching method. These simulated experiences can occur on campus, through online 2D modules, or in dedicated simulation labs that promote interprofessional collaboration. HFS is an invaluable addition to surgical education, offering improved opportunities for skill development and teamwork training. HFS is an essential component of surgical education to ensure students develop comprehensive competencies. It provides enhanced opportunities for skill development and teamwork training, which are crucial for their success in the surgical field. Therefore, I recommend that surgical technology program directors prioritize the integration of high-fidelity simulation in their curricula to equip students with the necessary skills and collaborative abilities needed in the dynamic surgical environment.

Furthermore, the review of current literature did not identify studies that specify a minimum number of simulations required for associate degree students to demonstrate competency. Surgical technology higher education programs should incorporate HFS to effectively introduce students to the surgical environment and clarify various team members' distinct roles and responsibilities. By using HFS to recreate operating room scenarios, including preoperative and postoperative care, students can gain valuable hands-on experience and a comprehensive understanding of the collaborative dynamics essential to successful surgical outcomes (Zhang & Aslan., 2021). HFS activities may help students develop essential skills, allowing them to practice important surgical techniques in a controlled setting, such as setting up procedures, handling instruments, and maintaining sterile techniques. Simulation of a variety of surgical procedures, like orthopedic and cardiovascular surgeries, will give students hands-on experience. Hawker et al. (2023) focused on scenarios covering aseptic techniques that highlighted infection control and sterilization methods. In the final semester, simulations can tackle high-stress situations, such as intraoperative complications like bleeding and equipment failure. Like this study, Alrashidi et al. (2023) stated advanced simulation techniques will improve quick decision-making and self-confidence and encourage teamwork among students.

The third recommendation would be to enhance the effectiveness of experiences; providing faculty training in simulation pedagogy, healthcare simulation, and HFS technology is essential. Some surgical technology programs have only one staff member serving as the program director and clinical coordinator. However, many of these instructors lack formal training in education, which can pose challenges in creating effective teaching strategies and methodologies. This training facilitates the seamless execution of interprofessional simulation scenarios, which require collaboration among various healthcare professionals, such as nurses and anesthesiologists, to replicate surgical team dynamics accurately. Establishing clear metrics for evaluating student performance during simulations and focusing on technical skills, teamwork, communication, and adherence to safety protocols is crucial. It is also essential to update the curriculum regularly, based on feedback from alums, clinical preceptors, and current industry standards in surgical technology.

My fourth recommendation is to extend the research to investigate specific outcomes related to student performance and engagement is essential in surgical technology education. The surgical technology faculty can provide evidence that addresses these concerns by employing quantitative and qualitative methods to assess how HFS impacts actual student outcomes (Bak, 2021). Similar to this study's findings, Singh-Pillay (2024) mentioned such investigations could include student retention, skill acquisition, and overall academic performance when exposed to SBL fostering greater acceptance among faculty and encouraging more widespread integration of practical technological tools in the educational landscape. By emphasizing its positive effects on student performance and engagement, educational institutions can create a more innovative and effective learning environment, preparing students for the complexities of their future careers.

Implications

Integrating HFS into educational settings can drive positive social change by fostering a more competent and collaborative healthcare workforce. With continued exploration and technological advancements, HFS sessions can empower skilled faculty to seamlessly incorporate these simulations into their curricula, offering vital training for aspiring surgical technology students (Gholinejadzirmanlou et al., 2023). This enhanced educational approach will refine communication skills and promote inter-professional collaboration among students, ultimately improving patient outcomes. Furthermore, institutions can create a teamwork culture prioritizing patient-centered care by equipping students with the skills necessary to work effectively in multidisciplinary teams. Positive social change is also promoted with the transformation that leads to better healthcare delivery and a more resilient societal structure, where healthcare professionals are prepared to address complex health challenges collectively, ultimately enhancing the quality of life for patients and the communities they serve.

Utilizing the TAM to understand faculty perceptions of HFS in surgical technology curricula is important. According to TAM, beliefs about ease of use and usefulness are crucial for technology adoption (Davis, 1986). Faculty members must believe that HFS will enhance educational experiences and student outcomes. Program directors are key in managing curriculum development, faculty recruitment, and accreditation, ensuring alignment with current healthcare education techniques. P15 mentioned that this dual responsibility requires strong organizational and communication skills to support students and faculty. Positive perceptions of HFS can lead to its adoption, transforming instructional practices (Dahri et al., 2024). Conversely, if faculty view HFS as complex or unhelpful, resistance may hinder effective implementation. Institutions can enhance surgical technology education by fostering a positive view of HFS through communication and professional development, resulting in better-prepared graduates.

Current studies reported that a noticeable surge in published reviews over recent years signifies an escalating enthusiasm for SBL within healthcare education (Alharbi et al., 2024). To advance this field further, future research should explore learning outcomes through the insightful perspectives of faculty members, who play a crucial role in shaping educational experiences (Elendu et al., 2024). Moreover, conducting comparative studies is vital to thoroughly evaluate the effectiveness of SBL methods against traditional teaching approaches, thereby illuminating the advantages and potential improvements in teaching strategies for aspiring healthcare professionals.

Conclusion

This basic qualitative dissertation addressed the social problem in surgical technology curricula concerning the critical need for enhanced clinical preparedness among STs by integrating HFS into surgical technology curricula. By examining the perspectives of program directors who actively incorporate SBL, this study provides valuable insights into the usability and effectiveness of HFS as a pedagogical tool. The findings, grounded in the TAM, highlight the PEU and PU of HFS and a positive ATU implementation among faculty. The evidence gathered indicates that HFS not only enriches the learning experience for students but also fosters immediate feedback and interactive learning opportunities, which are essential for developing competent surgical technologists. This research contributes to the ongoing dialogue about improving educational practices in surgical technology, aiming to bridge the readiness gap between STs and other healthcare professionals.

Furthermore, by promoting faculty buy in and enhancing student engagement through the strategic use of HFS, this study has positive implications for future curriculum development and pedagogical frameworks within surgical technology programs. It advocates for a transformative approach to education that prepares students for successful careers in healthcare and ensures they have the necessary skills and confidence to excel in dynamic surgical environments. By addressing the educational disparities within this field, this study also catalyzes positive social change, empowering future healthcare professionals to deliver safer, higher-quality patient care and contributing to the overall improvement of healthcare outcomes in the community.

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Appendix A: IQs

Inclusion and Interview Questions

Inclusion criteria questions to be answered and met before the interview starts.

Is your surgical technology program located within the United States?

Do you have an associate degree in surgical technology?

Do you have at least three years of experience teaching surgical technology and utilize fidelity manikin simulation in their curriculum?

IQ1. Tell me about your educational background?

How has your educational background influenced your approach to simulation in teaching?

IQ2. What simulation tools are beneficial in a Surgical Technology program? Why?

What is your perception of using high fidelity 2-d simulation in surgical technology education programs?

What is your perception of using Virtual Reality Simulation in surgical technology education programs?

IQ3. Surgical technology is increasingly incorporating high-fidelity simulation tools for skill development.

Can you walk me through your perception of an approach to onboard instructors on these tools?

How do you ensure they receive ongoing training to maximize the learning experience for students?

IQ4. During your career, tell me your perception of designing simulation modules technology programs?

During your career, how and when did you design simulation modules for surgical technology programs?

IQ5. What measurable objectives have you used when implementing high-fidelity simulation tools in surgical technology education programs?

What levels of student engagement do you see after implementing high-fidelity simulation tools?

What instructional strategies that you found to be favorable in your surgical technology career when using high-fidelity simulation?

IQ6. Tell me how using simulation affects your perspective on teaching didactic content and clinical laboratory skills.

Please share your perceived changes or challenges that surgical technology faculty encounter when implementing high-fidelity simulation.

What perceived changes or challenges may surgical technology faculty encounter when implementing high-fidelity simulation?

IQ7. Please tell me about the benefits and challenges of using high fidelity simulation for training learners in clinical settings.

What suggestions do you have to improve the current techniques being used?

IQ8. Can you share anything about high-fidelity simulation tools that were not covered today?

What innovative practices have you discovered using high-fidelity simulation tools?

Appendix B: Map of IQs to Research Questions

Interview Questions	RQ1	RQ2
IQ1. Tell me about your educational background?		X
How has your educational background influenced your approach to simulation in teaching?		
IQ2. What simulation tools are beneficial in a Surgical Technology program? Why?	X	
What is your perception of using high fidelity 2-d simulation in surgical technology education programs?		
What is your perception of using Virtual Reality simulation in surgical technology education programs?		
IQ3. Surgical technology is increasingly incorporating high-fidelity simulation tools for skill development.		X
Can you walk me through your perception of an approach to onboard instructors on these tools?		
How do you ensure they receive ongoing training to maximize the learning experience for students?		
IQ4. During your career, tell me your perception of designing simulation modules for surgical technology programs?	X	
During your career, how and when did you design simulation modules for surgical technology programs?		

IQ5. What measurable objectives have you used when implementing high-fidelity simulation tools in surgical technology education programs? What levels of student engagement do you see after implementing high-fidelity simulation tools? What instructional strategies that you found to be favorable in your surgical technology career when using high-fidelity simulation?		X
IQ6. Tell me how using simulation affects your perspective on teaching didactic content and clinical laboratory skills. Please share your perceived changes or challenges that surgical technology faculty encounter when implementing high-fidelity simulation. What perceived changes or challenges may surgical technology faculty encounter when implementing high-fidelity simulation?	X	
IQ7. Please tell me about the benefits and challenges of using high -fidelity simulation for training learners in clinical settings. What suggestions do you have to improve the current techniques being used?	X	
IQ8. Can you share anything about high-fidelity simulation tools that were not covered today? What innovative practices have you discovered using high-fidelity simulation tools?		X

Appendix C: Interview Guide and Alignment with Research Questions

Interview Questions	Framework	Literature Review	Justification
IQ1. Tell me about your educational background? How has your educational background influenced your approach to simulation in teaching?	X		Background of technology use is important for TAM use.
IQ2. What simulation tools are beneficial in a Surgical Technology program? Why? What is your perception of using high fidelity 2-d simulation in surgical technology education programs? What is your perception of using Virtual Reality Simulation in surgical technology education programs?	X Ease of use	X (Imran et al., 2021 ; Khosravi et al., 2021 ; Liaw et al., 2023)	TAM and the literature review informed my question about faculty perceptions of using simulation in their courses.
IQ3. Surgical technology is increasingly incorporating high-fidelity simulation tools for skill development. Can you walk me through your Perception of an approach to onboard instructors on these tools? How do you ensure they receive ongoing training to maximize the learning experience for students?	X Perception	X (Carroll et al., 2018)	Professional development fosters collaboration and teamwork, as employees work together to solve problems and share insights.

IQ4. During your career, tell me your perception of designing simulation modules for surgical technology programs? During your career, how and when did you design simulation modules for surgical technology programs?	X Opinion and behavior	X (Stickney, et al., 2020; Walls et al., 2019 ; Zardosht et al., 2020)	When designing simulation modules faculty member should consider the influence of TAM has on learner achievements.
IQ5. What measurable objectives have you used when implementing high-fidelity simulation tools in surgical technology education programs? What levels of student engagement do you see after implementing high-fidelity simulation tools? What instructional strategies that you found to be favorable in your surgical technology career when using high-fidelity simulation?	X Perception, opinion	X (Stickney et al., 2019 ; Walls et al., 2019; Zardosht et al., 2020)	Understanding the factors that influence TAM and adoption of HFS tools, we can tailor our implementation strategies to maximize their acceptance and utilization.
IQ6. Tell me how using simulation affects your perspective on teaching didactic content and clinical laboratory skills. Share your perceived changes or challenges that surgical technology faculty encounter when implementing high-fidelity simulation. What perceived changes or challenges may surgical technology faculty encounter	X Ease of use	X (Martin et al., 2020)	The use of simulation also presents challenges and requires instructors to adapt their teaching strategies.

when implementing high-fidelity simulation?			
IQ7. Please tell me about the benefits and challenges of using high -fidelity simulation for training learners in clinical settings. What suggestions do you have to improve the current techniques being used?	X Opinion	X (Alshehri et al., 2023; Basunbul et al., 2021)	The literature review has informed this question about using TAM and theoretical framework, while also examining the benefits and challenges of training learners using HFS.
IQ8. Can you share anything about high-fidelity simulation tools that were not covered today? What innovative practices have you discovered using high-fidelity simulation tools?	X Perception, ease of use	X (Moran et al., 2018; Whigham et al., 2018)	These tools provide researchers and practitioners with valuable insights into the TAM, enabling the development of more effective and user-centric solutions.

Appendix D: RQ1 Code Quick Reference Guide

Themes	Categories	Codes
Theme 1: Incorporating simulation tools into surgical technology education enhances learning outcomes, better prepares students for clinical practice, and ultimately improves patient safety in surgical settings. Physical activities	Variety of simulation tools Curriculum integration	VR and simulation use Simulation tool importance Nontechnological modules Stages in curriculum Benefits of simulation tools Levels of Fidelity
Theme 2: Integrating HFS into surgical technology curricula enhances the training of future STs.	Design and assessment Cognitive skills	Classroom management Integrating simulation into didactic learning Curriculum mapping Critical thinking
Theme 3: Surgical technology faculty overcome challenges related to HFS funding and training because simulations provide real-life surgical simulations. Volunteering	Challenges in implementation Instructor training and comfort	Cost of tools and service packages Limited resources Shortage of faculty trained in simulation pedagogy Buy-in from administration Curriculum redesign Lack of training on technology complexity Buy-in from ST faculty

Appendix E: RQ2 Code Quick Reference Guide

Themes	Categories	Codes
Theme 4: Surgical technology provides various career opportunities in specialties, management, and education, with continuing education workshops vital for enhancing skills and knowledge.	Educational background and credentials Professional development	Educational path Credentials and certifications Skill enhancement Leadership training Mentorship and networking
Theme 5: Educators in two-year surgical technology programs can improve student outcomes and better prepare them for the surgical environment.	High fidelity simulations Training and preparation	Student skill development Hands-on learning Assessment evaluation Student preparation and orientation Feedback with reflection
Theme 6: Surgical technology curricula incorporate creative educational methods or strategies to improve learning outcomes.	Teaching strategies Interprofessional education	Modular simulation activities Flipped classroom models Virtual Reality (VR) simulations Simulation-based interprofessional training Competency-based training

Appendix F: Study Themes

Literature Review Themes	Confirm	Disconfirm	Extend	Explanation
TAM as useful framework (Davis, 1986) (Rahimi et al., 2018)	X			Like other studies in medical education, TAM was valuable in learning how participants used and accepted various technologies.
TAM for new technology like AI and VR (Davis, 1987)			X	My findings extended the use of TAM to HFS.
Perceived usefulness of technology (Lemay et al, 2018) (Kim et. al, 2018)		X		Many studies show that high-fidelity simulations effectively enhance learning, but some faculty members may desire more concrete evidence of their impact on student outcomes.
Attitudes toward technology adoption. (Granić & Marangunić 2019)	X			Faculty attitudes are crucial; thus, ongoing professional development could shift negative perceptions to positive ones, enhancing adoption rates.
Fidelity Difference in Simulation (Grant et al., 2021)	X			Simulation fidelity greatly affects perceived effectiveness, guiding the development of suitable resources

High Fidelity and Integration of Simulation in Curricula (Carroll et al., 2018)	X			Simulations with high fidelity provide opportunities for surgical technology learners to critically think and learn in a safe environment.
Interprofessional Education and Collaboration (Higgins et al., 2020)	X			While simulations promote collaboration, they must be carefully designed to reflect the authentic dynamics of interprofessional teamwork.
Challenges and Barriers to Implementation (Whigham, 2018)			X	Understanding the specific challenges faced by various institutions can aid in designing targeted support and resources to promote successful implementation.