BEST PRACTICES IN HEALTHCARE SIMULATIONS

COMMUNICATION SCIENCES AND DISORDERS

CAPCSD
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Best Practices in Healthcare Simulations:

Communication Sciences and Disorders

A Task Force of the Council of Academic Programs in Communication Sciences and Disorders

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Acknowledgments

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Preface

Graduate programs in Communication Sciences and Disorders (CSD) are faced with challenges in providing high quality clinical training to students. These challenges include expanding scopes of practice, limited availability of off-campus supervisors and preceptors, and expectations for interprofessional education within the context of an increasingly complex healthcare system. (Dudding, 2015; ASHA, 2014). In 2013, the Council of Academic Programs in Communication Sciences and Disorders (CAPCSD) created a task force to examine use of alternative clinical education methods to meet some of these challenges (CAPCSD, 2013). The resulting white paper supported the use of alternative clinical education methods, including simulations, as a viable educational tool to allow students in CSD to acquire professional competencies. (CAPCSD, 2013). In 2016, ASHA's Council for Clinical Certification (CFCC) voted to modify the implementation language for Speech-Language Pathology Standard V-B to allow up to 20% of the required 375 direct clinical hours to be obtained through simulation (American Speech-Language-Hearing Association (ASHA) Council for Clinical Certification in Audiology and Speech-Language Pathology,2016).

With the promises and challenges of the use of simulation before us, it is important that graduate programs move forward with an understanding and knowledge of the existing evidence-base within and outside of the professions. This document provides the basis for implementing simulations in graduate programs in speech-language pathology and audiology. It offers an explanation of the types of simulations, as well as best-practices for implementation and evaluation of these experiences. It serves as a starting point for programs interested in developing and/or expanding use of simulations for clinical education, and includes a call for further research regarding the best uses of simulations within CSD.

Cerumen removal using task trainers

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Hybrid simulation using manikin and actor

Chapter 1—Healthcare Simulations

Simulations as a Technique

The word *simulations* brings to mind thoughts of expensive simulation centers filled with life-like manikins and a technology team worthy of a space launch. What is important to realize is that simulations are "a technique—not a technology—to replace or amplify real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner" (Gaba, 2004, p. i2). Simulations can be used to train students in a specific skill or task (e.g., performing cerumen removal), as an evaluation tool to assess clinical competencies (e.g., standardized assessments) or as an experiential learning opportunity for students (e.g., working within an interprofessional team).

Healthcare Simulations Defined

Healthcare simulations are a form of simulations used to train healthcare professionals to perform clinical skills and to work in teams with the goal of improved patient safety. Healthcare simulations "create a situation or environment to allow persons to experience a representation of a real healthcare event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions" (Lopreiato, 2016). In addition to nursing and medicine, healthcare simulations are used by physical therapy, audiology, occupational therapy, speech-language pathology and other allied health professionals. Healthcare simulations are often described in levels according to how closely the simulation replicates the real-world experience in terms of physical, environmental and psychological elements (Lopreiato, 2016). This is known as fidelity. For purposes of this document, we have identified five categories of healthcare simulation, ranging in levels of fidelity: (1) standardized patients, (2) task trainers, (3) manikins, (4) computer-based (gaming), and (5) immersive virtual reality.

Definitions and Examples of Simulations in Communication Sciences and Disorders

Type of simulation	Definition	Application
Standardized patients	A person simulates an actual patient in a realistic, standardized and repeatable way.	Delivering bad news such as identified hearing loss in newborn; counseling patient regarding risks of aspiration.
Task trainers	A device to train in a specific procedure or skill. Represents a part or region of a body. Can be used in combination with other types of simulations.	Using otoscopy trainer to practice insertion and viewing landmarks in the ear; employing head and neck trainer to practice speaking valve placement.
Manikins	A life-size human-like simulator. Vary in fidelity and cost. High-fidelity simulators include heart, lung, movement, hearing, and voice functioning. Controlled by computers and software.	Using a manikin programmed with oxygen saturation values to teach tracheostomy and speaking valve management; programming a specialized manikin to estimate ABR (auditory brainstem response) thresholds.
Computer based simulations	A simulation represented on a computer screen, often based on interactive gaming technologies.	Implementing virtual case studies to teach diagnostic skills; allowing to practice hearing assessments on a virtual audiometer.
Immersive virtual reality	A computer-based three-dimensional representation that has the feeling of immersion.	Role playing with use of avatars in an interprofessional environment.

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Evidence in Support of Simulations

This section is not meant to serve as an exhaustive review of the literature but presents some of the key studies supporting the effectiveness of healthcare simulations for clinical education.

The Journal of Nursing Regulation published the results of a landmark study investigating the use of simulations in pre-licensure nursing education (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). In a randomized control study, 660 students across 10 programs were randomly assigned to be in one of three groups: a control group and two treatment groups. The control group received all clinical education through traditional means, while treatment groups replaced 25% or 50% of traditional clinical education with simulation. There were no significant differences between the control group and treatment groups in the measures of clinical competency, critical thinking, and preparedness to practice as a registered nurse (RN). Further, the researchers found no significant difference in pass rates on the National Council Licensure Examination (NCLEX) (Hayden et al., 2014). The researchers recommended that up to 50% of required clinical hours in pre-licensure nursing education programs could be replaced with simulations with no adverse effects on the training of nursing students.

In a similar study of physical therapy students, researchers found that replacing up to 25% of traditional clinical experiences with simulated experiences did not affect student performance on an examination of clinical skills when compared to a control group of students who participated in traditional clinical training (Watson et al., 2012). In a meta-analysis of over 600 articles from the fields of medicine, nursing, dentistry and other health professions, Cook and colleagues (2011) examined the effectiveness of simulations for student training. The researchers concluded that "…technology-enhanced simulation training in health professions education is consistently associated with large effects for outcomes of knowledge, skills, and behaviors and moderate effects for patient-related outcomes" (Cook et al., 2011, p. 978). These results suggest that the use of simulations in the training of allied health students is a viable alternative to traditional hands-on practice with real patients.

Research specific to the use of simulations in CSD is limited, and yet what is available is in support of simulation use. Published studies demonstrate that standardized patients as a form of simulation is a viable instructional strategy (Alanazi, et al, 2017; Hill, Davidson, & Theodoros, 2013; Naeve-Velguth, Christensen & Woods, 2013; Syder, 1996; Zraick, Allen, & Johnson, 2003; Zraick, 2002). In addition, studies on the use of task trainers (Benadom & Potter, 2011), high-fidelity manikins (Alanazi, et al., 2016; Nicholson, Atcherson, Franklin, Anders, Nagaraj, Franklin & Highley, 2016; Estis, Rudd, Pruitt, & Wright, 2015; Potter & Allen, 2013; Ward et al., 2015) and computer-based game scenarios (Lieberth & Martin, 2005) indicate that simulated learning environments are acceptable to students as training tools. Students demonstrated an increase in comfort levels with various techniques, and gained foundational knowledge for working with a variety of different disorder groups. Research related to the use of other types of simulations such as immersive virtual reality were not identified.

Types of Simulations

Standardized Patients

A well-accepted form of patient simulation is the standardized (sometimes aka simulated) patient (Barrows,1971). A standardized patient is a person trained to portray a patient scenario, or an actual patient using his/her own history and physical exam findings, for the instruction, assessment, or practice of communication and/or examining skills of a healthcare provider. The standardized patient may be an able-bodied individual trained to simulate a patient's illness, or may be a patient with stable findings who is trained to present his/her disease. The 'standardization' referred to in the term 'standardized patient' relates to the consistent content of verbal and behavioral responses by the standardized patient to stimulus provided by a student or examinee. A standardized patient encounter is a simulated patient encounter, but a simulated patient encounter is not necessarily standardized (Adamo, 2003). Specific patient genders and ages are represented (Chambers, Boulet, & Furman, 2001; Hanson, et al., 2002; Brown, Doonan, & Shellenberger, 2005) as well as people with diverse ethnic and socioeconomic backgrounds and beliefs (Robins, White, Alexander, Gruppen, & Grum, 2001; Collins, Schrimmer, Diamond, & Burke, 2011). The student may encounter difficult personality types and sensitive subject matter through interviews with the standardized patient (Thacker, Crabb, Perez, Raji, & Hollins, 2007; Taylor, 2011). Enhanced learning results from the student having the opportunity to hone skills in a safe and supportive environment. Perhaps even more importantly, the same encounters highlight personal strengths and can build student confidence. Lastly, using standardized patients guards against the real patient, a genuinely ill and possibly frightened individual, encountering an inexperienced or inadequate clinician (Ryan, et al., 2010).

Standardized patients often participate in a performance-based clinical assessment called the Objective Structured Clinical Examination (OSCE). Since its introduction by Ronald Harden and associates 40 years ago (Harden, Stevenson, Downie, & Wilson, 1975), the OSCE has become a well-accepted method of clinical skills assessment requiring students to perform specific tasks within a prescribed period in a highly- structured encounter (Harden, 1988). The appeal of an OSCE is that it places the student in a simulation where each encounter is largely un-cued, open-ended and standardized, thereby providing an opportunity for more authentic skills assessment than is available through paper and pencil testing (Vu & Barrows, 1994). History taking, physical or other examination, and problem-solving skills are evaluated (Kane, 1992). Interpersonal and professional communication skills are evaluated by designing encounters that focus on the assessment of interpersonal skills (Norcini & McKinley, 2007). Predetermined performance criteria are scored on a rating scale or checklist by a trained observer (Zanetti, et al., Pugnaire, 2010), either at the time of the encounter, or immediately subsequent to it, or later from videotape (Swartz, et al., 1999). Skills in summarizing and interpreting the information collected in the encounter with the standardized patient are often measured using post-encounter exercises consisting of open-ended questions or short-answers (Barrows, 1993). Because of the considerable expertise needed to determine whether correct information was utilized by the student, and the listed diagnoses were probable, it is customary to have knowledgeable health professionals provide the evaluation of these exercises (Tamblyn & Barrows, 1999). Usually, scores across these exercises are averaged to compute examination component (i.e., test-level) scores. OSCEs may be administered at various points in the educational process - for example, after the second year of medical school, or after completion of a particular clinical placement. As such, results of an OSCE can provide evaluation of a part of a curriculum and serve as an impetus for its improvement, thus ensuring that students are gaining the clinical skills necessary to provide quality patient care (Zraick, 2004).

There are a number of key elements to an effective standardized patient program. These include: (1) case development, (2) training of standardized patients, (3) development of the OSCE, (4) procedures for conducting the OSCE, (5) recruitment and training of judges, and (6) measurement and evaluation. The interested reader is referred to Zraick (2012) and Hill, Davidson & Theodoros, (2010) for a thorough presentation of these elements.

Digitized Manikins and Task Trainers

Other types of simulators are specialized devices that replicate components of a real-world task. In order to do this, they have a control system (i.e. computer), a human-machine interface and a device with models the real world human system (Lopreiato, et al., 2016). Simulation technology includes devices that allow the learner to practice a particular skill using a "life-like" replica or computer program. The first medical simulator was ResusciAnnie; developed in the 1960s, it allowed individuals to practice cardiopulmonary resuscitation prior to seeing critically ill patients. As mentioned earlier, simulation technology is often described in terms of its fidelity or the degree to which they approach reality and are ranked from low to high (Aebersold & Tschannen, 2013; Brown, 2017). Simulators with low fidelity are non-computerized manikins or models, mid-fidelity simulators use computer programs or video games, and high-fidelity simulators use computerized manikins.

Two types of simulation technology used in training students in speech-language pathology and audiology are task trainers and manikins. Both allow the learner to practice repeatedly until the skill is acquired. These devices can be used to teach concepts or as assessment tools. Task trainers can be either life-like models of different body parts, such as an ear or head/neck region, or non-anatomical devices/mechanical models used to teach function, pathologies or testing concepts. However, all task trainers have the ability to break down a specific physical task into easily grasped action steps and pieces of information. An example of this technology is an otoscopy trainer, which is a computer-based trainer consisting of an artificial ear and otoscope, through which the student can learn about the anatomy of the tympanic membrane and practice identifying a variety of middle ear pathologies.

Digitized manikins are high-fidelity simulators or computerized manikins that allow students to practice conducting tests or procedures. These life-size simulators are designed to be realistic and are available in a variety of preterm, infant, child, and adult models. High-fidelity simulators simulate physiologic functions (e.g., cardiac function, pulse rate, respiratory patterns, pupil dilation, muscle tone, EEG, cochlear hair cell movement) which may be programmed to respond accordingly to interventions or interactions (Damassa & Sitko, 2010). Physiologic parameters are displayed on a simulated patient monitor and controlled by a computer and operator. A benefit of high-fidelity simulators is the opportunity to practice complex, high-risk low-incidence procedures in a safe, yet realistic and responsive, context. For example, otoacoustic emissions or auditory brainstem response testing are conducted on a lifelike infant manikin (Brown, 2017). High-fidelity preterm manikins have been used to train clinical and non-clinical students to assess oral feeding skills in preterm infants (Broadfoot, 2015; Ferguson & Estis, 2018). Training to prepare speech-language pathology, respiratory therapy, and nursing students for interprofessional collaborative practice for patients with Passy Muir Valves is effectively conducted with high-fidelity manikins (Estis, Rudd, Pruitt, & Wright, 2015). Through the computer-controlled manikin, many pathologies or disorders can be replicated and the student can practice each of the tests or protocol to diagnose or identify them.

Computer-based Gaming

Computer-based simulations are "the modeling of real-life processes with inputs and outputs exclusively confined to a computer, usually associated with a monitor and a keyboard or other simple assistive device. Subsets of computer-based simulation include virtual patients, virtual reality task trainers, and immersive virtual reality simulation" (Lopreiato, et al., 2016). Computer-based simulations are often derived from interactive gaming technologies and learning theory, and present a clinical experience through a "story" or scenario where the learner is required to make choices to complete the simulation. The experience of the simulation is controlled by the learner, who can start and stop the simulation at will, make choices in any order rather than follow a predetermined sequence, and re-start the experience at any point and as many times as he would like. Feedback about decision-making is provided to the learner throughout the experience. The ability to partially or fully complete the simulation as many times as the learner wants, making the same or different choices based on the feedback provided, is the hallmark of the computer-based simulation experience. The computer-based simulation is a "low-stakes" experience for the learner, as the experience is completed with a virtual patient and family, and not in a real-time environment with real-time clients and families. This allows for learning via mistakes and feedback in a safe setting without punitive consequences. The reduced-stress environment facilitates learning and critical thinking, which can then be applied to real-time patients and families in the future.

"Computer-based simulations can provide learners with uniform experiences...

A wide variety of academic and clinical learning experiences can be provided in CSD curricula via computer-based simulations. These can consist of task trainers focused on a limited amount of information or a specific skill set, a simulation of an assessment scenario, or a simulation of an intervention session or program. Fidelity of the computer-based simulation is increased as the simulations become more realistic via video of real patients rather than computer-generated avatars, and when the scenarios are holistic and environmentally-based, with interprofessional opportunities.

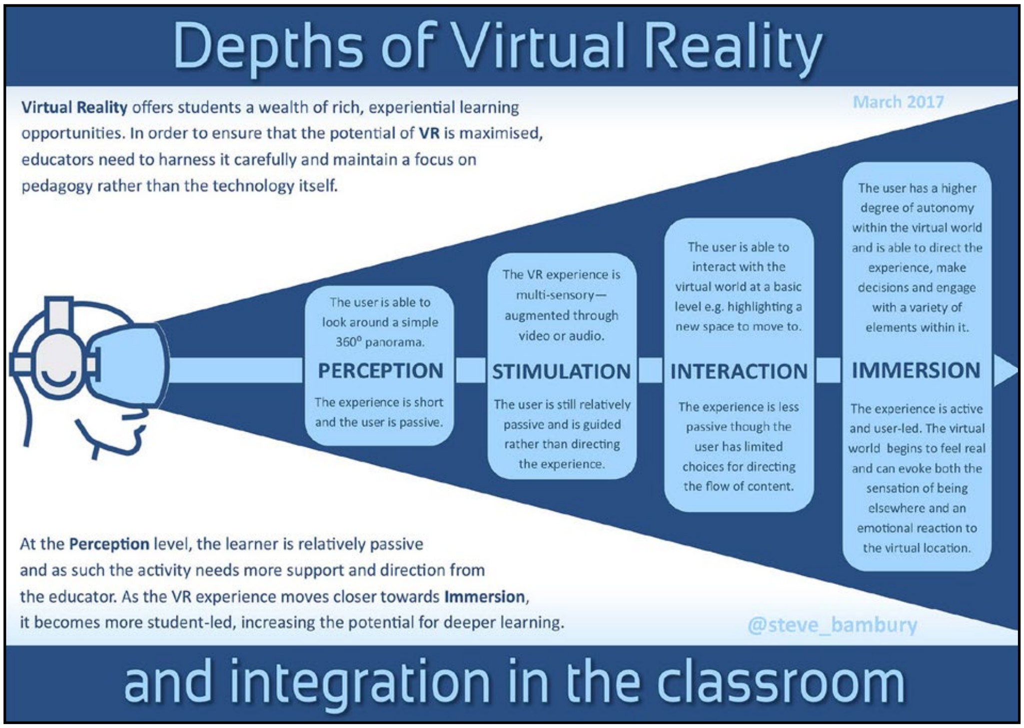
Computer-based simulations build a bridge between knowledge and skill, providing opportunities to apply academic knowledge to clinical decision-making. These experiences are essential in the training of skilled clinicians with critical thinking abilities. This is mediated via the simulation facilitator during debriefing sessions. After engaging in a computer-based simulation, learners must be provided with the opportunity to participate in a debriefing session with a knowledgeable facilitator who also completed the computer-based simulation (this can have been done either synchronously or asynchronously). Learners participate by answering self-reflective and applied questions related to the simulation, the environment it occurred in, the clinical decisions they made, and how the knowledge and skill gained in the simulation can be utilized with real-time patients. Computer-based simulations can provide learners with uniform experiences and exposure to disorders and patients to which they would otherwise not have access.

Virtual Reality

Virtual reality (VR) is the latest technology that holds promise in the realm of simulations. Virtual reality, in the broad sense, refers to a three- dimensional experience created by computer technologies to create an immersive, interactive environment that simulates real life. Virtual environment or virtual world refers the computer-generated environment in which the person interacts in a manner that simulates the real world. Virtual simulation is defined as real people controlling a simulated experience (Lopreiato, et al., 2016). Examples of virtual simulations include flight simulators, surgical simulators (e.g., laparoscopic surgery) and vestibular testing. In some cases, the interaction takes place in the form of a 3-D computer-generated persona, known as an avatar. In other cases, interaction takes place with use of game controllers, motion detectors, haptic gloves or even hand motion.

Any discussion of the technologies employed for virtual reality is likely to be outdated by the time of publication due to the rapid evolution of VR technologies. The types of technology currently available reflect varying levels of immersion and simulated reality. That is, technologies vary in the immersion factor and how "real" (e.g., fidelity) the experience seems to the user. It is also helpful to view simulations from a pedagogical perspective. Brambury (2018) has suggested four pedagogical levels; ranging from perception, stimulation, interaction and immersion (https://www.virtualiteach.com/vr-edu-model).

Many of the technologies employed in VR come from the world of gaming, social media and business, and are adapted for the creation of virtual healthcare simulations. One such example is the 360-degree video, also known as immersive or spherical video. Through use of an omnidirectional camera, images are "stitched"



Source: Steve Bambury (https://www.virtualiteach.com/vr-edu-model).

together to provide a 360-degree view of the scene. The scenes are then edited and posted/shared for playback on a smartphones, head-mounts, or computers. The videos are often viewed with benefit of VR viewers/headsets, (i.e., Google cardboard, Samsung Gear) to provide a stereoscopic experience. Cameras dedicated for this purpose range in price from $100 to $5,000. An internet search of 360-degree videos and/or VR apps will yield many examples of this technology. Currently 360-degree videos have variable levels of fidelity and offer limited ability for interaction and immersion. Yet, there is promise in developing software applications and programming languages that will allow the user to interact with the video through augmented text and video using eye gaze. These factors make 360-degree video technologies an affordable and accessible method of creating virtual simulations.

At this time, VR technologies that allow for interaction and immersion include virtual worlds (i.e. Secondlife, Sensar, Engage) and gaming programs designed for dedicated VR systems such as PlayStation, HTC Vive and Oculus Rift. Virtual worlds usually include the use of avatars to interact in a simulated learning environment. These applications are generally designed for the user to author and create within the environment. At this time, the creation of applications for immersive technologies requires a knowledgeable programmer and specialized authoring software. There is a rich industry of ready-made VR experiences designed for gaming. An online store known as SteamVR (http://store.steampowered.com/) allows users to purchase and download games for HTC Vive and Oculus Rift. A search of the site may yield some educational applications, appropriate for use in CSD teaching and research.

Even harder to predict are the future technologies in VR. Augmented Reality (AR) is seen by some as the next step in VR. For those familiar with the PokemonGo phenomena of 2016 when everyone was walking around with their smartphones trying to capture Pikachu, you have indeed experienced AR. There are a number of applications being developed for the retail industry. It is expected that AR will make its way into the educational arena.

Another exciting immersive technology is holography. The recording of light, rather than an image, is reflected to create a 3D image known as a hologram. Holograms can be viewed with special optics including the HaloLens. Holograms are considered a mixed reality (MR) in that they combine both real world and virtual world experiences. The reader is encouraged to conduct an internet search using the terms *"hologram"* and *"education"* for examples of this technology.

As the reader will note, there are many considerations in deciding to implement simulations into a university curriculum in CSD. One consideration is the selection of the appropriate technologies. Readers are strongly encouraged to move beyond the technologies and consider the pedagogical and curricular issues addressed in subsequent chapters of this document.

Chapter 2—Essential Components of High Quality Simulation Experiences

Quality simulation learning experiences (SLE) go beyond the technologies and are grounded in educational philosophies and learning theories (Gaba, 2004). This chapter introduces the reader to the key concepts and the major pedagogies underlying a quality simulated learning experiences. With this knowledge, the reader can feel confident in participating in a high quality SLE focused on student learning.

According to Kneebone (2005), quality SLEs include:

1. Deliberate practice in a safe environment
2. Expert instructors available to the learners
3. Simulation experiences that mimic real life
4. Experiences that are learner centered.

Let's explore each of these components and discuss applications in CSD.

Best Practices

What is deliberate practice and why is it essential in our SLE?

The simulation experience is constructivist in nature in that it is a social practice in which participants interact with one another in a goal-oriented fashion (Dieckmann, Gaba & Rall, 2007). A key tenet of constructivist learning theory is that learners construct new knowledge based on their experiences and active engagement in the learning process.

A central principle of simulation is deliberate practice. Deliberate practice is when learners actively practice a skill or task to improve their current level of proficiency (Clapper & Kardong-Edgren, 2012). Deliberate practice must include immediate, specific, and informative feedback, problem-solving and evaluation, and opportunities for repeated performance. Simulations are well-suited for skill development such as fitting an earmold, passing a videoscope through the nasal passage, and programming a cochlear implant device. SLEs offer the opportunity for repeated practice without the risk of harm to the patient.

In order for maximal learning, SLEs must be based on a strong foundation of safety and trust (Truog & Meyer, 2013). That means guidelines to protect the ethical, legal and regulatory rights of students. Specifically, these guidelines should include: a) codes of conduct and confidentiality guidelines; b) learner evaluations of the experience, and; c) consent for photo use and recording (Wilson & Wittmann-Price, 2015).

What are the roles of the instructors?

High quality SLEs are ones in which participants are actively engaged in the learning process and develop critical thinking skills. In order to accomplish these objectives, it is imperative for the instructor to have a clear understanding of the characteristics of learners and teachers, foster experiential learning, and support critical thinking and metacognition. The instructor should factor in the differences in training and professional experiences in designing SLEs; especially when designing interprofessional experiences. The Society for Simulation in Healthcare strongly recommends an apprenticeship/mentoring model for anyone interested in serving in the role of instructor.

How important are fidelity and realism?

One of the conditions of a quality SLE is that it mimics real life (Kneebone, 2005). Realism in the context of simulation is important in assuring that the experiences allow the learner to immersive themselves, and suspend disbelief (Wilson & Wittman-Price, 2015). Consideration should be given to the physical, psychological, equipment and environmental fidelity. Physical fidelity refers to how real the "patient" appears (e.g., a mannequin that has voice and can respond to questions). Psychological fidelity refers to preparation of the learner. The capabilities of the technology employed (e.g., ability to replicate a profound sensorineural hearing loss) is known as equipment fidelity. The level of the realism of the surroundings (e.g., the experience takes place in a simulated hospital room) is environmental fidelity (Dieckman, 2007). Learning objectives, cost, and access to available resources often impact the level of realism achieved.

What are some ways to assure that the experiences are learner centered?
Essential to any educational endeavor is the creation of learning objectives that are specific and measurable. Well-constructed learning objectives are based on needs of the learners and identified gaps in the curriculum. Learning objectives will assist the instructor in selecting the appropriate technologies, creating and scripting the experience, and conducting evaluation of learning outcomes. Learning objectives should include the cognitive, affective and psychomotor domains (Kern, 2009). Readers are directed to Chapter 4 for guidance on constructing student centered learning objectives for use in simulations.

A Framework for Designing, Implementing and Evaluating Simulation

In 2005, Jeffries authored the seminal article "A Framework for Designing, Implementing, and Evaluating Simulations Used as Teaching Strategies in Nursing" (Jeffries, 2005). This framework includes five components: teacher factors, student factors, educational practices, design of the simulation and outcomes. The article echoes the work of Kneebone and others as it describes educational simulations as being student-centered, with the locus of responsibility of learning with the student. Simulations, should include opportunities for active learning, and rich collaboration experiences. In terms of the simulation design, characteristics include clear objectives, mimic clinical experiences (e.g., fidelity), with a level of complexity appropriate to the learner. Readers are encouraged to reference this work for details.

The Pre-brief, Scenario and Debrief

The SLE is often described as consisting of three phases: pre-briefing, the simulation scenario and debriefing. The pre-briefing component is an orientation and/or introduction to the SLE. During this time, learners receive information about the equipment used in the simulation, the scenario and roles. In order to encourage a safe learning environment, it is recommended that the pre-briefing include a discussion of expectations of performance, including learning objectives, and evaluation measures (Dieckmann, Gaba & Rall, 2007; Gaba, 2004; Jeffries, 2005).

Much consideration is given to the scenario, sometimes referred to as the case. The scenario can vary in length and complexity, based on the learning objectives. The scenario provides the context for the SLE. In creating a scenario, the author should create a storyline that is based on the pre-established learning objectives. A scenario should involve opportunities for clinical decision-making, as well as the acquisition of knowledge and skills. The developer should consider the expected level of learner participation (e.g., is this a student-led or instructor-led learning experience?), the level of fidelity (e.g., how realistic is the experience?), as well as the physical set-up of the room/environment, equipment and supporting documentation. For a full discussion of developing a scenario for simulation, the reader is directed to Aliner (2011) and Jeffries, Dreifuerst, Kardon-Edgren & Hayden (2015).

The debrief is often cited as the most critical learning experience of the simulation process, which typically occurs immediately following the simulation experience. The debrief is led by an experienced facilitator who has observed or participated in the SLE. During this time, the participants receive feedback and are encouraged to engage in reflective thinking, while various aspects of the simulation are discussed. The debriefing is key in learner assimilation and transfer of learning to future situations, which is ultimately the goal of SLE (Jeffries, et al., 2015).

The International Nursing Association for Clinical Simulation and Learning (INACSL, 2017) published a series of seven articles, each focused on a standard of best-practice in simulation. The articles are readily available for viewing at https://www.inacsl.org/i4a/pages/index.cfm?pageID=3407, and include a rationale and criteria for each of the best-practices.

A Summary of INACSL Best-Practices in Simulation℠

Standard	Statement	Criteria
Terminology	Consistent terminology allows for clear communication, shared perspectives to advance the science.	To promote consistent understanding by explicating the terms used in simulation best practices.
Professional Integrity	The simulation environment should be one of mutual respect, with clearly stated expectations for the attitudes and behaviors of all participants.	In order to promote a safe learning environment, the participant agrees to: • protect the content of the simulation • demonstrate professional and ethical behavior • receive and provide constructive feedback
Participant Objectives	All simulation-based learning experiences begin with clearly written, measurable objectives.	Objectives should: • address domains of learning • correspond to knowledge and skills of the learners • be congruent with program objectives • incorporate evidence-based practices • include a holistic view of the client • be achievable within a timeframe
Facilitation	The method of facilitation should be appropriate to the needs of the learners and expected outcomes.	Methods should be congruent with: • learning objectives • expected outcomes
Facilitator	The facilitator should be proficient in all aspects of simulation. The facilitator should be provided with formal coursework, continuing education, and mentorship.	The facilitator should: • clearly communicate learning objectives and expected outcomes • create a safe learning environment • promote fidelity • follow best practices for integrity, facilitation, assessment and evaluation • foster learning through constructive feedback and debriefing
Debriefing Process	All simulation experiences should include a debriefing session, aimed toward reflective thinking.	An effective debriefing process includes: • competent facilitator who has observed the simulation • a safe environment conducive to learning and self-reflection • based on a structured framework that supports the learning objectives and outcomes
Assessment and Evaluation	Formative and summative assessments can be used in the simulation experience.	The type of assessment and/or evaluation of the simulation experience should promote valid and reliable results. It may include: • formative assessment • summative evaluation • high-stakes evaluation

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Pediatric dysphagia simulation experience

Chapter 3—Integrating Simulations into the CSD Curriculum

The promise of simulation as an instructional tool lies in its varied application and integration into the existing curricula. Simulations can be used for direct teaching and to supplement didactic coursework. An example of such an activity would be an instructor sharing a video of a diagnostic procedure in class, and directing a discussion about treatment options (e.g., debrief) with the classroom as a whole. Another approach to supplementing traditional classroom instruction would include a 'flipped" classroom whereas students review the content outside of class through readings or recorded lectures, and conducting a simulation within the class time. These are both examples of instructor-led activities. Simulations created as lab-assignments to extend learning outside of the classroom would be an example of a student-centered activity. Computer-based applications and interactive videos lend themselves to such applications.

Successful integration of simulated learning environments (SLE) into a curriculum is determined by careful planning and cultivated buy-in on the part of stakeholders. Kern and colleagues (Kern, et al., 2009) identified six steps in curriculum development.

- Step 1: Complete a needs assessment in order to identify the problem or educational gap.
- Step 2: Assess the needs of the learners by level of training, available resources and barriers.
- Step 3: Create specific and measurable learning objectives that target the cognitive, psychomotor and affective learning domains.
- Step 4: Select educational methods based on the learning objectives and available resources.
- Step 5: Implement the SLE, including a pilot and phase-in period.
- Step 6: Conduct evaluation and obtain feedback, both formative and summative; involving all stakeholders.

Each of these steps deserves full consideration before simulations can be successfully implemented into an existing curriculum.

Simulation-based learning is most effective when it is integrated with other, more traditional, learning environments. We know that it is a complementary means of clinical education that helps to prepare students prior to high stakes experiences with real clients or patients. Programs must identify needs and opportunities across the entire curriculum and identify where simulation can be most effectively and efficiently integrated. Simulation-based healthcare curricula need to be planned, scheduled, and implemented across the entire curriculum, with as many stakeholders involved as possible (Issenberg & Scalese, 2008).

Programs will vary, of course, as to the amount and types of opportunities their students have to participate in SLEs. Redesigning curricula to include simulated experiences is in programs' best interests. If done with overall curriculum planning, simulations can help to solve other logistic pressures programs may be facing. For example, simulation can be used as both formative and summative assessment, and as a means of engaging faculty in curricular design and programming.

Applications Within the Curriculum

Simulations can be used for clinical skill development. This application is often used by our colleagues in medicine and nursing. The unique benefit of simulation is that it allows for repeated practice until a level of competence in a particular skill is observed. An example in our professions would be the use of a task trainer consisting of a tracheostomy tube and associated parts. The students can practice assessing the status of the cuff and identifying parts of the apparatus. The simulation environment allows them to become comfortable observing the suctioning of secretions through a tracheostomy tube. This type of experience can reduce students' anxiety and increase confidence prior to their entering a clinical experience with a live patient/client. Similarly, audiology students can use a task trainer of the ear to practice otoscope placement and assess the status of the ear canal and tympanic membrane. Simulations are also advantageous for teaching professional skills such as communication, teamwork and consultation skills such as collection of a case history, interviewing, and presenting findings/results. Standardized patients are often used for these purposes, although some computer-based simulations target these skills as well.

Academics and clinical educators are especially interested in simulations as a method of remediation for students who are not able to demonstrate clinical competency through more traditional means. Simulations allow for repeated and independent practice. Simulations allow the instructor to scaffold learning, based on previously acquired skills. They can be designed to target specific knowledge and skills and provide feedback within the simulation. Consider a student who has failed an in-class assignment on interpreting results of a standardized measure, not able to determine a level of impairment based on norm-referenced scores. This student is not ready to follow the same sequence of learning as the other students, which should be followed by assessing a client in the on-campus clinic. Instead, a simulation can be utilized as an interim step, where the student is required to correctly administer, score, and interpret norm-referenced tests with simulated clients. Once the criterion of skill has been met, the student can then "go live" and administer a norm-referenced test to a real client, score it, and interpret the results, this time in a high-stakes situation where first-time performance matters.

A simulated remediation scenario can be developed for just about any skill. It can be part of an assessment or treatment scenario, such as interviewing a client, taking data during one intervention activity, making a diagnosis based on assessment data, or making a recommendation based on client progress. Once a student demonstrates mastery of the component parts of assessment or treatment, she can then participate in a more holistic simulation, such as a complete diagnostic assessment of a client from referral to diagnosis, or an intervention session from choosing short-term objectives and appropriate activities, taking data and supporting the client, to progress documentation.

The skill or activity itself is not the most important part of the simulation; the most powerful parts of SLEs are the pre-briefing and debriefing mediated by a knowledgeable and skilled simulation facilitator to support student learning. The debriefing experience provides a safe environment for students to reflect, to connect back to the learning objectives, and to apply the learning to the development of clinical decision-making. Warrick, Hunsaker, Cook and Altman (1979) defined the objectives of debriefing as: (1) identification of different perceptions and attitudes; (2) linking the simulation to specific theory, content, or skill techniques; (3) development of a shared narrative for future thought and discussion; (4) opportunity for feedback on involvement, behavior, and decision-making; and, (5) reestablishment of the classroom climate to pre-simulation purposes. Socratic questioning is utilized to promote the learners' critical thinking and reflection, which is essential for experiential, lifelong learning.

A standardized assessment for clinical competencies is the holy grail of clinical educators. Many other healthcare fields employ the use of Objective Structured Clinical Exams, known as OSCEs, for such purposes. OSCEs may be conducted using any form of simulation and/or a combination of simulation modalities (e.g., use of a standardized patient with a task trainer attached to their arm to allow for taking vitals). OSCEs can be summative high stakes, as is the case with medical board exams, or formative in nature (Zraick, 2002). For a complete discussion of the use of simulations for student evaluation, refer to **Chapter 4—Outcomes and Evaluations.**

Although beyond the scope of this document, simulations can also be used in work-force training. That is, they can be used to train practicing professionals and preceptors desired skills. In certain settings, professionals are required to complete OSCEs to demonstrate a skill such as suctioning of tracheostomies prior to performing the procedure on a patient.

Implementation Within the Curriculum

A number of factors related to the use of simulations have gotten us to where we are today. Those factors include: the success of the use of simulations in other fields, interest in the use of simulations in CSD, the challenges in providing high-quality and personalized clinical education, the 2013 CAPCSD white paper advocating for the use of alternative clinical education methods, and the 2016 CFCC modifications to the implementation language for SLP Standard V-B to allow clinical hours to be obtained through simulations.

Training programs in speech-language pathology and audiology are therefore relatively new to the integration of simulations into their curricula. One of the first challenges has been, and continues to be, the availability of faculty with formal simulation education training. Teaching with simulations may be intimidating for even seasoned faculty, because most did not experience simulation in their own education. Those who have begun teaching with simulations have gained their knowledge through attending workshops, researching and reading about simulation, working through trial and error, and/or observing or working with an educator experienced in the use of simulations, likely in another field (Chabalowski, 2015; Dudding & Nottingham, 2018). Once a faculty member becomes proficient enough to effectively develop and provide simulation experiences to students, he or she can then mentor other faculty in developing these skills. At the present time, the only specialty certification available to faculty is via the Society for Simulation in Healthcare (SSH), which has developed rigorous standards for the Certified Healthcare Simulation Educator (CHSE), initial and advanced certification.

Chabalowski (2015) indicated that programs wanting to integrate simulations into their curricula may be met with administrative resistance. In order to change the culture of teaching and learning in CSD programs to accept simulation, educators must advocate for simulation and the cultivation of new simulation educators. Administrators and stakeholders must be made aware of the need for faculty training; faculty time for simulation development, implementation, and evaluation; the need for additional space, equipment, and staff; the need for creative scheduling and inter-departmental cooperation; and a means of measurement of student engagement, learning, and development of clinical skills and critical thinking. Resources must be allocated to engage in the best practice of integration of SLEs into CSD curricula.

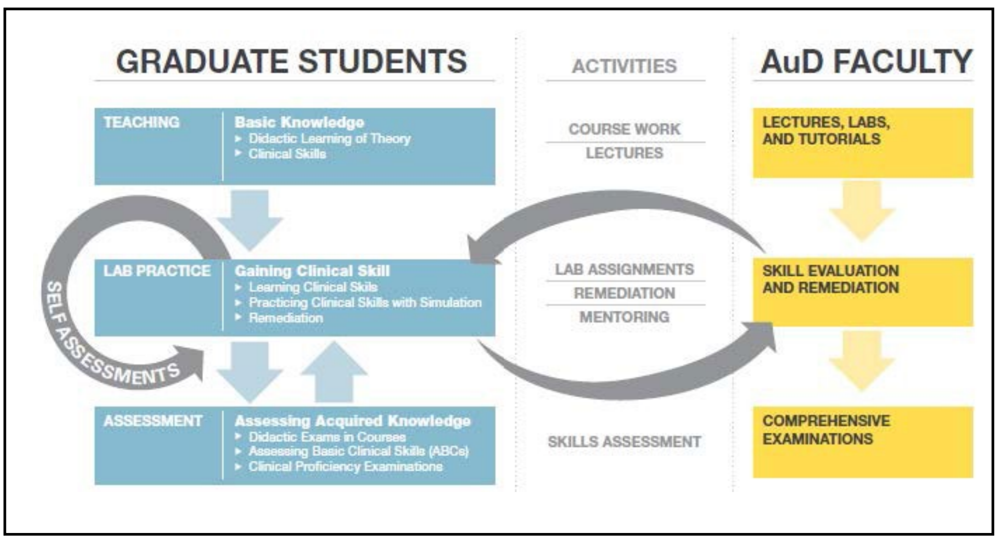
> ***"...we have innovators in audiology and speech-language pathology.***

In spite of the newness to our field, and limited faculty, resources, and knowledge about the development and use of simulations, we have innovators in audiology and speech-language pathology. There are programs already utilizing simulations, and many more in the development and planning stages. Programs typically begin inclusion of SLEs in the curriculum on a limited basis. This is usually based on identified gaps in their academic or clinical experiences, to address an area of need for the current group of students. Or perhaps a program may make simulation experiences available to students due to unique opportunities that may become available to the program via another department or program on campus. It is of course necessary to address specific needs of your current group of students, and to take advantage of opportunities that may be available on a short-term basis, however, if a program intends to utilize simulations for the long-term, it is in its best interest to complete an overall curriculum review and determine how to best integrate simulated experiences across the entire curriculum (Wilson & Wittman-Price, 2015).

As programs complete these curricular reviews, evaluate the efficacy of the use of simulations as a clinical education methodology, and assess their resources, it becomes clear that integration of simulations into CSD clinical training programs can and is taking various forms. Some CSD programs are in universities with prominent healthcare programs that have existing simulation facilities and are integrated into interprofessional experiences with other departments. They may have access to high fidelity manikins, task trainers, and standardized patients. Other programs may have access to immersive virtual reality experiences with art and design and computer science programs. Yet others may utilize available online virtual computer-based simulations. Programs may combine different simulation technologies and utilize them for different purposes (e.g., virtual computer-based simulations for remediation and for providing clinical hours and competencies in specific disorder areas combined with standardized patients for formative and summative clinical skill assessments). Some programs are advanced in their integration and implementation of simulations into their clinical teaching, while others are in the beginning stages, and still others are in the exploration stage. Each program needs to determine its own best approach to integrating simulation into the curriculum based on its unique circumstances.

At the same time, as CSD embarks upon use of simulation as a clinical education tool, we must collect and document the evidence to support its use. What are the best models for use of simulation in audiology and speech-language pathology? Are students developing critical thinking skills by participating in simulations? Do simulations facilitate development of clinical skills so that students are more prepared for interactions with live clients? These are just some of the many questions that need to be answered.

Some of our CSD colleague are already at work in this regard. An example of an educational model that utilizes simulation in a Doctor of Audiology (AuD) training program is shown in Figure 2.0. In this model, the more traditional method of instruction and assessment is combined with the use of simulation. Didactic learning is enhanced with clinical skills learning and practice with simulation. The goal of this model is to produce competent audiology students who are prepared to move to the clinic portion of their training. An important step in this model is the use of assessments for the development of plans for the remediation of skills in which the student is not competent (Brown, 2017). With the use of simulation and formative assessments, instructors can determine those who are not attaining the appropriate level of proficiency and develop strategies for remediation so the student can succeed. In this example, the use of simulation occurs in the gaining clinical skills section of the model and involves different types of simulation depending on the skill set required. Simulation can also be an integral part of the assessment component of the model. It is important to note the loop-backs, which indicate that there is not a single remediation plan but a continuous flow until the student gains competency and exits through the traditional (Summative) assessment.



An educational model for the use of simulation in an Audiology training program (Brown, 2017). Published with permission from the American Academy of Audiology.

This is just one step toward documentation of models and toward developing the evidence base for the use of simulations in communication sciences and disorders curricula. Much more work needs to be done. We know that currently there is a wide spectrum of the use of simulations across programs, and that there is not a right or a wrong simulation type to choose, or means of implementation. As long as programs follow the procedures outlined in Kern, et al., (2009) and integrates simulation into the curricula appropriately, we are working along the lines of best practice, advancing our CSD training programs, and preparing for the future of speech-language pathology and audiology.

Otological examination with standardized patient

Chapter 4—Outcomes and Evaluation

Simulation in its many forms must impact the education of the learner. The use of simulation is to divide the task from the patient so that the learning experience can occur in a safe environment; however, it also must serve to enhance the learning by the student. This means that the result must include outcome measures and evaluation points which will inform the learner of their progress and when they have reached the knowledge or their mastery of the skill.

Establishing Learner Outcomes

Development of effective simulation-based learning experiences begins with clearly written student or participant objectives. These objectives are the guide to simulation for the student and for the instructor. They are foundational for determining if desired learner outcomes have been achieved through the simulation experience (Lioce et al, 2013). "Standards of Best Practices for Simulation" were set forth in the journal *Clinical Simulation in Nursing* (2013). "Standard III: Participant Objectives" (Lioce et al, 2013) outlines several criteria for participant objectives and guidelines for each criterion. These criteria are applicable to the use of simulation in Communication Sciences and Disorders (CSD) and are summarized below.

1. **Address the domains of learning.**

When writing participant objectives, consider the concepts of cognitive, affective, and psychomotor domains. Determine which of these areas are to be improved through the simulation experience. Use Bloom's taxonomy to explicitly state the level of learning expected (e.g., remembering, understanding, applying, analyzing, evaluating, creating), and maximize the opportunity to achieve higher levels of learning through simulation. In writing participant objectives, be specific and clear, using a verb and a noun to indicate what you hope the participant will be able to do as a result of the simulation experience (e.g., evaluate readiness for Passy-Muir Valve placement, create a plan of care).

2. **Correspond to the participant's knowledge level and experience.**

Set challenging yet attainable goals based on the participants' prior knowledge and clinical experience. Consider Vygotsky's Zone of Proximal Development when selecting participant objectives and create a learning environment that helps them reach new levels of knowledge and skill in a supportive context.

3. **Remain congruent with overall program outcomes.**

Lioce (2013) emphasized linking the simulation participant objectives to program outcomes. For speech-language pathology and audiology graduate students, consider how the simulation participant objectives address knowledge and skills standards for certification. For example, an interaction with a standardized patient could relate to Standard V-B, 3.c, "Provide counseling regarding communication and swallowing disorders to clients/patients, family, caregivers, and relevant others.

4. **Incorporate evidence-based practice.**

As participant objectives are developed, integrate evidence-based practice by considering related research and providing opportunities to utilize evidence-based skills and to promote evidence-based rationales for assessment and/or treatment. Reflection and feedback on use of evidence-based practices can be incorporated into simulation learning experiences.

5. **Include viewing of client holistically.**

While perspectives on holistic care differ between nursing, speech-language pathology, and audiology, this criteria for effective participant objectives is linked to our emphasis on individualized, culturally-competent care.

6. **Be achievable within an appropriate time frame.**

Evaluate, pilot, and revise participant objectives to ensure that they are attainable within the timeframe allotted for the simulation learning experience. The development of clear, specific, and measurable objectives provides a roadmap for student participants and for facilitators. The intended learner outcomes inform the simulation learning experience components (e.g., scenarios, fidelity, facilitation) selected. For example, if interpersonal communication is a primary intended outcome, standardized patients may be selected as the method of simulation. Whereas, a task trainer manikin with a tracheostomy may be selected to meet the intended psychomotor learner outcome of performing tracheostomy care and suctioning. Successful simulation learning experiences require clear alignment among learning outcomes and simulation methodology.

Evaluation of Student Performance

Evaluation is a tool that can provide insight as to the level of performance that a student has achieved in an individual topic, course, or with any simulation activity. Data can be collected during or at the end of a course or objective thus monitoring their progress as they proceed in meeting the objectives of the course or activity (Kulasegaram and Rangachari, 2018). In simulation, assessments can be used to demonstrate learning outcomes in a situation that is as close to the real world as possible. This can be done through the use of either formative or summative evaluations. Through these evaluations, both the instructor and the learner share the responsibility for having a successful outcome. The instructor is responsible for the design and implementation of the learning environment but it is the learner who is responsible for the learning within that environment, therefore learning and assessment are connected (Black & Wiliam, 2009; Kulasegaram & Rangachari, 2018).

Formative/Summative Evaluations

Summative assessments are the most common or primary assessment of learning (Kibble, 2017). This type of assessment includes final exams or grades and are used to rank, approve a student's skills or determine if they have achieved their learning goals (Sadler, 1998). Formative assessments are assessments that provide feedback during the learning process and allow students to improve their own learning and achievement (Sadler, 1998). This type of assessment can be used by instructors to identify a student's ability to understand the information and guide and support their progress (NRC, 2011), therefore reinforcing and enhancing learning.

The use of simulation can allow students to monitor incremental improvement in a skill (Formative assessment), and faculty can assess clinical proficiency in that skill (Summative assessment) and determine if remediation is required. An example of this model is the use of an otoscopy trainer, which uses a self-guided method to enhance the student's knowledge of a variety of conditions found in the ear canal and tympanic membrane. It provides information that the student can study to learn about the problem and then allows them to visualize it through an otoscope in an ear simulator. It then provides them with a self-assessment tool to determine if they are understanding the material. Once they have completed those tasks, the otoscopy trainer can be utilized as part of a more comprehensive skills check or proficiency exam in combination with a standardized patient as a part of a mentored assessment.

Rubrics

Instructors use rubrics as a tool to define their expectations for an assignment or project. Within the rubric are the different criteria to be evaluated and the desired quality to aspire. These include three components: (1) evaluation criteria or the different criteria required to complete the assignment; (2) quality definitions or a rating scale or marker to determine quality or demonstration of a skill; and, (3) a scoring strategy or the points or scoring for each criterion (Reddy and Andrade, 2010). The expectations are set by the instructor and are determined by the criteria, from this the student has a clear expectation of what is required to demonstrate proficiency of the material. Rubrics can be used for any course assignment as either a summative or formative assessment. In formative assessments, they can easily lead to remediation opportunities by evaluating the steps required to meet each criterion and having the student self-assess and develop their own remediation plan to move them to fulfillment of the rubric.

Evaluation of the Simulation Experience

Student impressions and facilitator impressions are critical for effectively evaluating and continuously improving simulation experiences. In a recent survey of simulation in communication sciences and disorders, Dudding and Nottingham (2018) reported that 42% (n=29) of the programs collected student ratings of simulation experiences. Student impressions of simulation learning experiences are recommended for continuous quality improvement. Student feedback can be useful for gauging student impressions of the plan that is implemented and for revising simulation experiences based on that input. Student surveys may include Likert scales or open-ended questions. The Simulation Effectiveness Tool (Leighton, Ravert, Mudra, & Macintosh, 2015) was recently updated for consistency with the INACSL℠ Standards of Best Practice and resulted in the SET-M with Pre-briefing, Learning, Confidence, and Debriefing subscales. While designed for nursing simulation, most of the questions apply to speech-language pathology and audiology students. Additional published simulation scales and questionnaires include The Simulation Design Scale, Educational Practices Questionnaire, and the Student Satisfaction and Self-Confidence in Learning (Jeffries & Rizzolo, 2006). Focus groups or interviews may also be used to collect additional qualitative data on student perceptions of the simulation learning experience. Student impressions may be related to the psychomotor, cognitive, or affective domains. Feedback on specific aspects of the simulation learning experience is also informative (e.g., "Debriefing and group discussion were valuable," or "Interacting with a standardized patient improved my clinical interviewing skills").

In addition, it is important to gather facilitator impressions to reflect on strengths and weaknesses of the simulation learning experiences and to improve the quality of future simulations. There are several approaches to gathering this information. If working alone, write a brief reflection on the experience focusing on what went well, what did not go well, and how you would change future simulations. Then, access that reflection as you plan subsequent simulations. When working with a team, information may be gathered in a face-to-face meeting, with a survey, or through written reflections by team members. Consider designating a time immediately following the simulation learning experience for a face-to-face meeting of those involved. Discuss the strengths and weaknesses, as well as proposed changes. Take notes and review prior to the next simulation. Alternatively, create a survey for those involved in facilitating the session to obtain their impressions and insights.

Best practices for simulation in communication sciences and disorders include a multi-pronged evaluation plan. Effective simulation planning begins with clear learner outcomes that are appropriate for the students and align with overall program outcomes and evidence-based practice. Formative and/or summative evaluations may be utilized with simulation to improve student learning and measure student learning outcomes.
Also, simulation experiences are continuously improved through evaluation by participants and facilitators.

Task trainer for ear mold impression

Chapter 5—Simulations in Interprofessional Education

The emerging U.S. healthcare landscape is one that will focus on eliminating health care disparities and attaining accessible, high-quality, and affordable health care for all (Rogers, 2013). To successfully navigate this landscape, the future workforce of speech-language pathologists and audiologists will need to be equipped with "new ways of relating to patients and each other" (Institute of Medicine, 2001, p. 19). This emerging landscape is increasing the demand for healthcare professionals to work collaboratively and to adopt patient-centered approaches to improve healthcare outcomes (Zraick, Harten & Hagstrom, 2014, p. 39). Two such approaches are Interprofessional Education (IPE) and Interprofessional Collaborative Practice (IPCP).

Interprofessional education (IPE) is a model of collaborative education which has been defined as "…students

…students from two or more professions learn[ing] about, from and with each other to enable effective collaboration and improve health outcomes.

from two or more professions learn[ing] about, from and with each other to enable effective collaboration and improve health outcomes" (WHO, 2010, p. 7). IPE could, for example, include Communication Sciences and Disorders students taking a head and neck anatomy class with students in medicine, nursing, and physical or occupational therapy and actively interacting/collaborating with them on assignments/projects related to the class. Under an IPE framework, students are deliberately exposed to interactive learning opportunities with those outside their professions, and learn to collaborate with other professionals to improve education and service provision outcomes.

Interprofessional collaborative practice (IPCP) is a model of collaborative service delivery which has been defined as "… multiple health workers from different professional backgrounds work[ing] together with patients, families, careers, and communities to deliver the highest quality of care" (WHO, 2010, p. 7). IPCP addresses the Triple Aim framework proposed by the Institute for Healthcare Improvement (http://www.ihi.org/Engage/Initiatives/TripleAim/Pages/default.aspx) whose aims include: (1) improving the patient experience of care, including satisfaction; (2) improving the health of the population; and, (3) reducing the per capita cost of care.

An interprofessional perspective was evident in the formation of the American Speech-Language-Hearing Association from its inception in 1925 (Seymour & Nober, 1998). Since at least 2006, ASHA and related organizations such as the Council on Academic Programs in Communication Sciences and Disorders (CAPCSD) have supported IPE and IPP in the delivery of services in medical and education settings (ASHA, 2016; Johnson, 2016; Prelock & Apel, 2013; Zraick et al., 2014). In 2013, ASHA formed the Ad Hoc Committee on Interprofessional Education which was charged with developing recommendations for including core competencies of IPE into current knowledge and skills associated with CSD graduate education and linking the core competencies to collaborative practice issues such as models of reimbursement (ASHA, 2013). Work from this group was presented to the ASHA membership in a summit at the 2013 ASHA Convention that was later summarized in *The ASHA Leader* (Rogers & Nunez, 2013). A second ASHA initiative was to join the Institute of Medicine's (IOM) 2013 Global Forum on Innovation in Health Professional Education. This group hosts workshops and publishes workshop summaries that focus on changes in best practices in health care provision through education and commissions studies to investigate outcomes within communities (IOM, 2013).

ASHA's *Envisioned Future: 2025* (ASHA, 2015a) states that, "An interprofessional education approach to training and educating new professionals has resulted in access to a broader supply of qualified faculty to meet the teaching, scholarly research, and technological needs of academic programs as they strive to enhance the scientific base of the discipline and educate qualified speech-language pathologists and audiologists to meet consumer needs. Members engage in interprofessional collaborative practice." To achieve the goals of ASHA's Envisioned Future 2025, the Association established a 10-year *Strategic Pathway to Excellence* (ASHA, 2015b) plan comprising eight strategic outcomes. Strategic Objective #2 is to Advance Interprofessional Education and Interprofessional Collaborative Practice (IPE/IPCP). The desired outcome of this objective is that by 2025, academic programs are using IPE approaches to personnel preparation and that both students and ASHA members are engaging in interprofessional collaborative practice. In 2017, ASHA joined the Interprofessional Education Collaborative (IPEC) (https://www.ipecollaborative.org/about-ipec.html). This collaborative consists of 20 national education associations of schools of health professions, formed to promote and encourage constituent efforts that would advance substantive interprofessional learning experiences to help prepare future health professionals for enhanced team-based care of patients and improved population health outcomes.

Accreditation agencies and professional organizations are increasingly including standards and guidelines for IPE. To date, accrediting agencies for medicine, occupational therapy, pharmacy, physician assistant, and physical therapy programs include standards related to IPE (http://guides.lib.unc.edu/c.php?g=8377&p=3420169).

Barriers to IPE: conflicting schedules, clinical preceptor availability, reimbursement guidelines, and access to patient populations.

Programs implementing interprofessional education experiences utilize a variety of learning contexts including topical modules inserted into new or existing curricula, common curriculum with shared courses, parallel on-line modules, and clinical practice-placements (Thistlethwaite, 2012). While IPE experiences are often developed based on pragmatic factors such as scheduling, available facilitators and ease of implementation, it is important to consider authenticity of the learning experiences and the alignment between IPE experiences and clinical practice environments. When developing IPE learning experiences, a clear focus on areas of common practice or disorders served by the professions involved yields meaningful student interactions. The logistical issues associated with bringing students from multiple professions together in clinical settings are often difficult to overcome given conflicting schedules, clinical preceptor availability, reimbursement guidelines, and access to patient populations of interest. Human patient simulation provides an authentic, realistic context for IPE, while reducing many of these barriers.

Simulation-enhanced IPE (Sim-IPE) provides teams of students from multiple professions the opportunity to address relevant cases in a supportive context. Sim-IPE has been defined as "when participants and facilitators from two or more professions engage in a simulated health care experience to achieve shared or linked objectives and outcomes" (Decker, et al., 2015, pg. 294). A variety of simulation platforms, such as standardized patients, high-fidelity mannequins, task trainers and virtual worlds, may be used. Simulation-based IPE cases are tailored to achieve student learning outcomes specific to each profession and to promote communication, professionalism, and teamwork among the professions. In a simulation-based IPE experience, students receive direction and feedback, while developing clinical skills in a low-risk environment. During post-simulation debriefing interprofessional teams reflect and critique team interactions, individual performance, and patient care.

Decker and colleagues (2015) provided guidelines indicating that Sim-IPE should be theory-based, follow simulation and IPE best practices, address institutional and local issues and include evaluation planning. Ultimately, Sim-IPE is designed to promote high-quality patient care as knowledge, skills, collaboration, and teamwork are improved among the professions involved. Those interested in developing Sim-IPE opportunities should visit the Center for Health Sciences Interprofessional Education and Research (https://collaborate.uw.edu/about-us/) for resources including IPE activities, toolkits and training opportunities. In CSD education, Sim-IPE is a meaningful context for speech-language pathology and audiology students to learn from and with other students as they work together to solve realistic clinical cases.

Due to the innovation and leadership of our colleagues, there are a number of examples of IPE using simulation technology (i.e., Sim-IPE) in Communication Sciences and Disorders. One such example is the use of avatars in a virtual world known as Secondlife. Graduate students from Communication Sciences and Disorders, Psychology and Nursing at James Madison University participated in interprofessional case management with faculty and each other on complex cases involving patients with multiple chronic conditions, such as brain injury, congestive heart failure and stroke. For more information, read the article Simulated Patients, Real IPE Lessons available at http://leader.pubs.asha.org/article.aspx?articleid=2578626 (Dudding, Hulton & Stewart, 2016) and view a demonstration video at https://www.youtube.com/watch?v=eGFEoV0Enpo.

In addition, a Sim-IPE experience has been utilized at the University of South Alabama to train nursing, respiratory therapy, and speech-language pathology students on tracheostomy care and Passy Muir Valve readiness and placement (Estis, Rudd, Pruitt, & Wright, 2015). Interprofessional teams of students provided care for Stan (a high-fidelity manikin) in a realistic acute care setting with a standardized patient portraying a family member. The student teams worked together to assess and treat Stan, and they provided education to the patient and his family member. Another Sim-IPE at South Alabama brings nursing, audiology, and speech-language pathology students together to evaluate potential communication, swallowing, and balance disorders resulting from common medications with standardized patients.

Simulated interview with standardized patient

Summary

This paper goes beyond a review of the types of simulation technologies. The reader is frequently reminded that simulations are more than a technology. They are a learning tool with the potential to positively impact the clinical education of our students when guided by carefully constructed learning objectives. The use of a pre-brief and debrief session, as well as the systematic evaluation of both learner outcomes and the simulation experience, are identified best-practices in meaningful simulation experiences.

This paper represents a starting point for an informed discussion about the appropriate use of simulations in Communication Sciences and Disorders. This paper provides an overview of the research evidence from within and outside of our disciplines. It outlines key pedagogical principles and hallmarks of a quality simulated learning experience. In addition, this paper offers guidance in integrating simulations within graduate and undergraduate curricula.

The authors encourage those considering the use of simulations for clinical education to seek out high quality training in all aspects of simulation. Those currently engaged in simulations are encouraged to build on the work of our colleagues in other disciplines and add to the evidence base by conducting research in their own programs. Lastly, the authors encourage readers to advocate for the effective and integrated use of simulations in CSD.

Instructors observing pediatric dysphagia simulation

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