International Journal of Healthcare Simulation

ORIGINAL RESEARCH

Prioritizing healthcare distance simulation educators' technological competence: descriptive analysis of qualitative interviews

Maria Bajwa[1], Janice Palaganas[1,2], Rami Ahmed[1,3], Susan M. Seibold-Simpson[4]

[1]Health Professions Education, MGH Institute of Health Profession (MGH IHP), Boston, Massachusetts, USA
[2]Health Professions Education, MGH IHP; Anesthesia Department, Critical Care, Harvard Med School, Boston, Massachusetts, USA
[3]Division of Simulation, Department of Emergency Medicine, Indianapolis, Indiana, USA
[4]School of Nursing at Delhi, State University of New York (SUNY) Delhi, New York, USA

Corresponding author: Maria Bajwa, maria1bajwa@gmail.com

https://ijohs.com/article/doi/10.54531/EBTN3915

ABSTRACT

Introduction:
Since the beginning of the pandemic, the community spread of COVID-19 and the unavailability of clinical instructional sites led to heavy dependence on distance simulation to continue health professions education. The challenges faced by educators, combined with the lack of established parameters to prepare simulationists for distance simulation, prompted scholars to find a solution to fill this gap. In the absence of practical guidelines or parameters for healthcare educators to use emerging simulation technologies, this study explored the technological competencies of an ideal distance simulation educator at the basic and advanced level in light of the proposed Distance Simulation Educator Guidelines v3.0 (DSEG).

Methods:
This qualitative descriptive study used deductive content analysis of interviews with distance simulation experts using the DSEG as a codebook for deductive analysis.

Results:
Nine experts with a diverse healthcare professions background and distance simulation experience were interviewed. The identified main categories included a dual set of competencies, technological and non-technological. The non-technological competencies included professional values and applied principles of simulation and learning. Eight generic categories (competencies of the DSEG) emerged for basic- and advanced-level educators.

Discussion:
Although several key findings were expected, this descriptive analysis study prioritized the competencies of basic- and advanced-level distance simulation educators. It also provided insight into how the DSEG could be applied in the real world. Further research is recommended for these preliminary findings.

What this study adds

- Validates that distance simulation is different from in-person simulation necessitating focused education and training of professionals for its use.
- Proposes a dual set of technological competencies needed for distance simulation for both basic- and advanced-level educators.
- Prioritizes eight 'essential' technological sub-competencies currently practiced out of three hundred plus proposed distance simulation educator sub-competencies for both basic- and advanced-level distance simulation educators.
- Indicates that the wording of these agreed-upon competencies for distance simulation educators might be the same as in in-person simulation; however, their application evolves in the distance setting.
- Identifies that facilitating or running a scenario is a basic-level competency while developing a scenario is an advanced-level competency for a distance simulation educator.

Introduction

Background

Distance simulation has become one of the mainstream educational techniques with the changing healthcare education landscape of the twenty-first century [1]. This paradigm shift became more apparent during the pandemic, although distance simulation has been around for several decades [1]. Using technology to circumvent the distance among distance simulation participants introduces several unique situations and nuances [1–4]. More often than not, these unique situations can become challenging if not handled appropriately [1–4]. The pandemic has revealed how the deficiencies in distance simulation skills have led to challenges for both learners and educators [2,5], warranting the formal development of educators for the execution of distance simulation training [1–3]. Although the field of distance simulation is still being developed as a distinct educational method [6], the need for educators' technological training was recommended even before the pandemic [7–9]. Before arranging such education and training for simulationists, we needed to determine the necessary competencies required for distance simulation.

In our prior study, we created the Distance Simulation Educator Guidelines v3.0 (the DSEG) [10], to address distance simulation educator competencies. We decided to use the Certified Healthcare Simulation Educator (CHSE) [11] curriculum to shape the identified competencies since this is the standardized examination curriculum for becoming a simulation educator. Following the CHSE structure, the DSEG [10] has four domains and 59 competencies divided into 196 basic- and 182 advanced-level sub-competencies. The sheer volume of that document led to further research on its application. We designed the current study focusing primarily on technological competencies required for distance simulation educators at the basic and advanced levels, and to explore how they were applied in the real world. While there are three other domains in the DSEG, namely *Professional values and capabilities, Healthcare and simulation knowledge and principles* and *Educational principles applied to distance simulation*, our focus on technology was because of its foundational value in connecting all participants in a distance simulation setting. Therefore, we considered technology's impact on educators' ability to teach in distance setting foundational. We accepted the definitions of *basic* and *advanced* from the DSEG document [10] as two levels of competency: the basic or competent level, which every distance sim educator should aim to possess when executing any distance simulation activities, and the advanced or expert level, which a distance sim educator may strive for in the future with continuous professional development.

Study aim

This study aims to explore the depth and criteria of technological knowledge needed to conduct optimal distance simulation. We considered a distance simulation *optimal* when session objectives were met while keeping participants' psychological safety intact in distance environments. We considered *expertise* as a collective skillset developed from educational and professional background, work experience and duration of work in the relevant field(s). Following Cheng et al. [3], we preferred the word *educator* in this paper. [See Table 1 for the definitions.]

Study Questions:

1. In a healthcare distance simulation, how much additional technological knowledge, skill, and ability (KSAs) should a distance simulation educator have at the basic level, compared to in-person simulation knowledge, as perceived by simulation experts with different levels of expertise?
2. In a healthcare distance simulation, how much additional technological knowledge, skill, and ability (KSAs) should a distance simulation educator have at the advanced level, compared to in-person simulation knowledge, as perceived by simulation experts with different levels of expertise?

Methods

Study design

We used a descriptive qualitative design with a deductive approach to direct content analysis of one-on-one semi-structured interviews of the experts. We considered a descriptive qualitative design appropriate for this study due to the subjective nature of the problem and participants' different experiences and applied the content analysis method to this design because it is the most common approach to such studies [12]. We chose to use a deductive approach to content analysis because we wished to explore the existing data, the DSEG, in a new context of application in the real world from an expert's perspective [12,13]. The DSEG was used as a coding guidebook for the deductive analysis of the interviews [13,14]. The DSEG resulted from a rigorous literature search, job analyses, available gold standards certifications and matriculated and non-matriculated degree programs, with the first version published online [15]. In alignment with CHSE [11], the DSEG [10] has four domains and 59 competencies divided into 196 basic- and 182 advanced-level competencies.

Sampling strategy and recruitment

We used a purposeful sampling strategy to include experts from relevant fields (e.g. simulation education, simulation operations, instructional designing, online learning, simulation technologies and industry partners in distance simulation). We aimed to maximize heterogeneous participant sampling since maximum variation sampling is particularly useful in qualitative descriptive research [12,13]. Inclusion criteria comprised: a healthcare simulationist working in any capacity of constructing, facilitating, debriefing, evaluating and/or from the simulation industry. We identified and invited eight people from the total participants of the Distance Simulation Collaboration Summit [16], and two participants through a snowball sampling technique. One person declined, and ultimately nine participated.

Data collection

We conducted nine semi-structured online interviews (mid-February to early April 2022) using the videoconferencing platform, Zoom [17]. Each interview lasted between 45–60 minutes. All interviews were video and audio recorded with participants' permission. MB, JP and SMS-S developed interview questions to provide additional information based on the gaps in knowledge from previous work [15,18]. Demographic data were collected using Google Forms [19]. MB conducted the interviews while SMS-S observed while both taking notes. MB and SMS-S met after each interview to compare notes and discuss themes they constructed individually, and determine if additional prompts were needed. See Table 2 for the interview questions.

The audio and the video of these interviews were stored in the MGH Institute's Zoom [17] Cloud account and transcribed by its automatic transcription service. For the confidentiality of data and participants, data were de-identified and stored at the institute's secure site. The data was password-protected, and only MB and JP had access to the data.

Data analysis

We used the DSEG for deductive content analysis as a code book.

Data Preparation: MB prepared the data which consisted of (1) review of the transcripts, comparison of the transcripts with the recording and making any necessary corrections for any incomprehensible data points; (2) data de-identification [20] and (3) data uploading into MGH Institute system, Partners Dropbox [21].

Data Analysis: Analysis was done according to the best practices [13,20]: (1) Each author read the transcripts independently multiple times for full immersion and established preliminary themes; (2) All authors met and discussed preliminary themes; (3) MB and SMS-S independently coded the data against the DSEG deductively, compared the transcripts line by line; (4) Disagreements were discussed until consensus was achieved; (5) RA resolved coding conflicts and also provided additional clarification as to definitions; (6) We accepted the competency stems as definitions of generic categories; (7) We decided on competency to be a generic category if any of its sub-competencies (individual codes) appeared in five out of nine interviews. We chose the number five due to the heterogeneous professional background and knowledge of the participants; (8) Following Elo and Kyngäs [13], we decided on the use of an abstraction process to analyse the data using the DSEG as a 'categorization matrix', due to its unique structure; the 'subcategories' nested within 'generic categories', which were arranged into 'main categories'; (9) We separated the subcategories into basic and advanced to answer the research questions; (10) We are reporting at the level of subcategory as basic or advanced if its concurrence was five or more out of nine interviews; and (11) We accepted the definitions of 'basic' and 'advanced' from the DSEG document as two levels of competency: the *basic or competent* level, which every distance sim educator should aim to possess when executing any distance simulation activities, and the *advanced or expert* level, which a distance sim educator may strive for in the future with continuous professional development.

Reliability and Validity: To maximize reliability and validity, several steps were taken [20]. Data were carefully collected and constantly compared as part of an iterative process and analysed by two researchers while a third researcher resolved the coding conflicts. MB and SMS-S were subject matter experts for healthcare simulation and nursing education, respectively; to be engaged in the research reflexively, they maintained journal notes and reviewed the questions and transcriptions frequently to be clear about their roles and positions in the phenomena being studied and the context being explored [12]. These steps helped us with the interview quality, preliminary theme generation against the DSEG, and determining the sufficiency of data when new themes stopped constructing [22].

Table 1: Essential definitions

Terms	Definition
Distance simulation	Distance simulation is implementing a simulation or training at a physical distance from the participant(s) (Lioce, 2020).
Distance simulation- an umbrella term (for this project)	We adopted the definition of distance simulation as an umbrella term that encompasses any individual or hybrid form of distance, tele-, remote, and extended reality (immersive technologies such as virtual, mixed, and augmented reality) simulations (Buléon, et al., 2022). In short, the simulation in which the participants are engaging in real time but are not geographically or cognitively present in the same space will be included in the umbrella term of distance simulation.
Distance simulation educator	A distance simulation educator is a person who uses simulation methods for healthcare professionals in real time in a virtual, online or digital environment, utilizing evidence-based practices and strategies to educate participants to the highest standards of care in the skill of patient management (Palaganas, 2022).
Competency	A competency is an expected level of performance that integrates knowledge, skills, abilities, and judgment. The integration of knowledge, skills, abilities, and judgment occurs in formal, informal, and reflective learning experiences. (American Nurses Association, 2018)
KSA (knowledge, skills, abilities/attitude)	According to ANA Competency Model (American Nurses Association, 2018): Knowledge encompasses thinking, understanding of theories, professional standards of practice, and insights gained from context, practical experiences, personal capabilities, and leadership performance. Skills include communication, interpersonal, and problem-solving skills. Ability is the capacity to act effectively. It requires listening, integrity, self-awareness, emotional intelligence, and openness to feedback.

Ethical concerns

Since the interaction with people was for their interviews and de-identified information, it was deemed exempt (Category 2(i), protocol 13466) from the Indiana University Institutional Review Board. Informed consent was obtained through email before interviews, and verbal consent was obtained again at the beginning of each interview.

Results

Demographic data

We interviewed nine participants with a range of simulation experience from 5 to 20 years. The majority had earned (5) or were in the process of earning (4) doctorate degrees in their fields (simulation, simulation-based interprofessional education and instructional designing in distance learning). One participant was of Asian ancestry while the rest were Caucasian, all working in America and Canada, making this one of the study's limitations. All of them had experience working with distance simulation (see Table 3).

Key findings

Even though the focus of the interview question was clearly on the technological aspects of distance simulation, a major component of the fourth domain of the DSEG, *Simulation resources and environments*, the analysis resulted in findings that were not limited to technology. Following our content analysis methodology [12(p.449),13(p.112)], we abstracted the data into two main category types: (1) *Technological*; and (2) *Technology-affiliated (Non-technological)* competencies.

Technological includes competencies from *Domain 4: Simulation Resources and Environments* of the DSEG. *Technology-affiliated (Non-technological)* includes competencies from Domains 1 and 3 of the DSEG. Findings did not reveal any competencies from Domain 2. *Technology-affiliated (Non-technological)* competencies are arranged into two main categories: (1) Professional values and capabilities, and (2) Applied principles of simulation and education (see Figure 1 for categories).

The findings suggested that levels of skills, *basic* and *advanced*, for any distance simulation educator depend on possessing certain competencies. Participants agreed that at a *basic* level, distance simulation educators should be competent in executing distance simulation. According to them, at the *advanced* level, distance simulation educators should expertly handle complex simulations and situations such as constructing distance simulations, learning, and executing alternatives for technological breakdown, consoling or managing a distressed or difficult learner, and data security.

To answer the research questions, we are dividing the key findings on the concurrence of concepts for both basic- and advanced-level educators [13], into two groups: 'highly supported categories', or concepts frequently mentioned (seven or more interviewees) and 'less supported categories', or concepts not frequently mentioned (five or six interviewees). Participants emphasized that for advanced levels, all basic competencies should be expanded while acquiring other skills (see Table 4).

Technological competencies

Technological knowledge and skills

Consistent with being the focus of this study, participants unanimously agreed that distance simulation educators need to have a functional knowledge of the technology required to execute basic simulations. The generic categories for the basic level included two competencies out of nine: (1) Identifying and employing appropriate technologies; and (2) Managing technical and material problems.

For the advanced level, the only generic category recognized was acquiring multimedia skills.

Table 2: Interview question guide

Setting the Stage; Introduction
1. Time/Date/Place/Introduction of: Interviewer/Observer 2. Interviewee introduction and position/ work 3. Brief Description of the project: The aim of this study is to explore the extent and criteria of technological knowledge needed to conduct distance simulation optimally for a distance simulation educator. 4. Definitions of the terms used 5. Questions
Semi-structured Interview Questions
1. How are the technological competencies different for a simulation educator who does distance simulation as compared to in-person? 2. What is the degree of technological knowledge a distance simulation educator should have to conduct distance simulation sessions to meet the outcomes optimally? Prompting questions: a. If a distance sim educator is working alone, how would they do it? b. If they are working in teams, how would they do it? What would they need to know? (proposed later after doing a couple of interviews) c. Is there a hierarchy when working in the team? (proposed later after doing a couple of interviews) 3. What should the professional development courses contain to help evolve a simulation educator to distance simulation educators? 4. How can the technical and technological competencies for distance simulation educators be evaluated? 5. [Specifically for an educational technologist: What knowledge the educators do not know, and they should know?] 6. How did you learn distance simulation (how do they develop their skills? Are they transferable to others? If you are training faculty members who are interested, how would you train them? (proposed later after doing a couple of interviews) 7. What is the ideal team who deals with distance simulation? What and how? (proposed later after doing a couple of interviews)

Highly Supported Generic Categories

1. Identifying and Employing Technologies

Basic Subcategories

In the generic category, participants consistently recognized 'identifying and acquiring basic technological knowledge' (one out of five sub-competencies of the DSEG) as an essential basic sub-competency for basic-level distance simulation educators. Participants discussed that technology was continuously evolving, and distance simulation educators needed to keep pace with that evolution. Participants noted that distance simulation educators must be able to navigate different platforms or software used for distance simulations. They provided examples such as managing rooms and virtual background and connectivity in Zoom [17]; setting up or managing an audio-visual system in remote simulation situations, or being able to identify basic internet or device requirements for facilitating a distance simulation session.

For identifying basic knowledge, one participant said:

> *You need to know what the learners need, what technology they need... Optimally, you should have the entire toolset of technological knowledge so that you can actually choose and serve your learners best in, you know, whichever topic you end up choosing. (Participant 5)*

And:

> *Familiarity with tech will help with anxiety, so be familiar with it. (Participant 9)*

No advanced competencies were recognized to which five or more participants agreed.

2. Managing Technical and Material Problems

Basic Subcategories

Another highly supported (8/9 interviews) generic category was managing technical and material problems. Participants included issues like connectivity, bandwidth assessment, cabling needs, data storage and retrieval in this category. Participants agreed that a basic-level distance simulation educator should be able to apply problem-solving skills to resolve issues during the session.

As one participant said:

> *You also have to possibly even troubleshoot that equipment as well. (Participant 2)*

And:

> *You need to know... how to troubleshoot for every person involved. (Participant 5)*

There were no advanced-level subcategories recognized in this generic category.

Less Supported Generic Categories

1. Acquiring Multimedia Skills

Advanced Subcategories

Participants considered multimedia skill proficiency an essential generic category for an advanced distance simulation educator. They included creating and integrating existing extended reality (XR) items, such as XR spaces, into distance simulation settings and cases. While

Table 3: Participants' demographic data for interview study

N=9 (par = participant)						
ID	**Gender**	**Age**	**Occupation / Field of work**	**Type of Workplace**	**Number of Distance Simulation (sessions)**	**Combined Experience in Respective Field (in years)**
Par1	Female	31-40	Instructional Designer/ sim education program coordinator	Academic setting (University)	6-10	6-10 years
Par2	Female	51-60	Nurse/ Simulation Director/ Simulation Educator	Academic setting (University)	11-15	21 years or more
Par3	Male	41-50	Nurse / Nurse Practitioner / Sim director/ educator/ past sim operator	Hospital / Healthcare setting, Academic setting	40 +	15 years
Par4	Female	51-60	Nurse Practitioner, Nurse educator/ Simulation educator	Academic setting (University)	31-40	15 years
Par5	Female	41-50	Emergency Medicine Physician/ Simulation Educator	Hospital/Healthcare setting; Academic setting (University)	40 +	15 years
Par6	Male	31-40	Simulation Director/ past Simulation Operation Director/ Simulation Educator/ EMT	Academic setting (University)	31-40	6-10 years
Par7	Male	51-60	Nurse / Nurse Practitioner, Instructional Designer, Simulation Educator	Hospital / Healthcare setting, Academic setting (vocational, technological), Other	31-40	21 years or more
Par8	Female	21-30	Simulation Industry / Simulation Educator	Simulation Industry	31-40	6-10 years
Par9	Female	31-40	Pediatric Emergency Medicine Physician / Simulation Educator	Hospital / Healthcare setting	5 and under	11-15 years

discussing XR, participants expressed that this competency should be a part of the advanced simulation educator toolbox.

> *A basic educator is going to say, "put the headset on and go through this program," right? The advanced person is thinking, "this doesn't match, this isn't realistic, this is not a necessary step, that's how I see it." (Participant 3)*

Another participant stated:

> *And then I really think the biggest thing from an expert educator I would look for related to XR, VR, MR, AR, would be their ability to help imagine and develop new content and so we've moved beyond the direct education and then more into expanding the actual possibilities [that] are there. (Participant 6)*

There were no basic skills identified within this generic category.

Technology-affiliated (non-technological) competencies

Participants recognized a few technology-affiliated (non-technological) competencies essential when technologies are introduced into the instructional methodologies. Considering these participants were experienced in the in-person simulation modality, one participant said:

> *A distance simulation educator is going to be more versed in the psychology and the sociology of education than necessarily any technical aptitude. (Participant 6)*

Another stated:

> *They have to have.... socio-behavioral kind of competencies, and those are a little bit different. For example, when you're in a video conference or web conferencing arena; there are cognitive load stressors that occur from being on camera and seeing yourself versus just being in front of somebody. (Participant 2)*

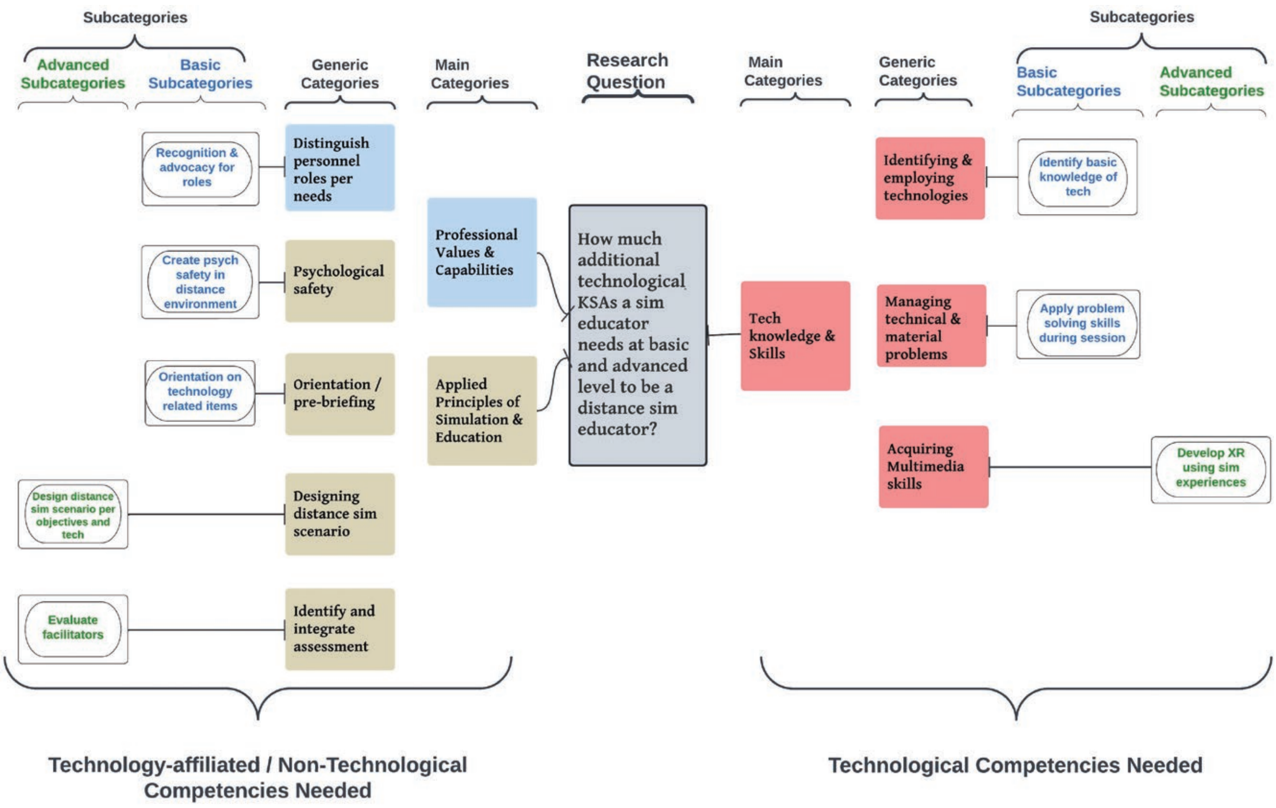
The two technology-affiliated non-technological main categories were:

1. Professional values and capabilities
2. Applied principles of simulation and education

Professional values and capabilities

There was no highly supported generic category. Participants recognized only one less supported generic category, which

Figure 1: Main, generic and subcategories derived from deductive analysis. The names of levels of categories are derived from the DSEG staying in the vicinity of the original data as recommended by Doyle (2018); Elo & Kyngäs (2008).



was part of Domain 1 of the DSEG, *Distinguishing roles of personnel involved in distance simulation.*

Distinguish Among Various Personnel Roles

Basic Subcategories

In this generic category, participants recognized one of two basic subcategories: Recognizing and advocating for various and evolving professional roles in distance simulation.

The need to have multiple people on a distance simulation team came up several times, including from a small program perspective, with a limited number of people on the team. Nonetheless, for the sustainability of programs, participants thought educators should be able to recognize and advocate for various and evolving roles. Identifying different roles and advocating for those roles to the institutional leadership was considered significant. As one said:

> *... Now, all of a sudden, with distance simulation, we're back to being in charge of everything... But for people, the space is still new enough that you don't have that support, right? and so I think there is all of a sudden this requirement of technology support. (Participant 7)*

Another participant pointed out the need to have required competencies in team members instead of individual roles for 'small shops':

> *It would be more a matter of, what is the reality of the world that you work in? Which set of competencies do you need? But all the competencies would need to be present in a team. (Participant 6)*

There were no competencies recognized for advanced-level educators.

Applied principles of simulation & education
Participants considered the knowledge of traditional simulation and educational principles essential for distance simulation educators. Analysis revealed four generic categories within this main category: (1) Integrating appropriate assessment methods into distance simulation; (2) Designing the case/scenario applicable to distance simulation; (3) Preparing orientation and prebriefing; and (4) Recognizing and applying principles of psychological safety.

Highly Supported Generic Category

1. Identify and Integrate Assessment Methods in Distance Sim

Advanced Subcategories

In response to the question of assessing distance simulation educators, participants consistently identified that an advanced-level educator should be able to evaluate other distance simulation educators or fellow facilitators using evidence-based practices.

As one said:

> *There is value in a peer or a co-facilitator evaluating them and providing them feedback. I believe, to my limited*

Table 4: Mapping of study findings to the DSEG sub-competencies & their frequency

Domain 1: Professional Values and Capabilities	Basic	Advanced	Frequency (out of 9 participants)	Sub-competencies
6. Distinguish among the various roles of personnel involved in distance simulation	6.1.1.		6/9	6.1.1. Recognize and advocate for various and evolving professional roles in distance simulation
Domain 3: Educational Principles Applied to Distance Simulation				
30. Identify and integrate assessment methods pertinent to distance simulation		30.2.4.	7/9	30.2.4. Evaluate the facilitators of distance simulation using evidence-based practices
31. Prepare orientation and prebriefing/briefing for participants and simulation team for distance simulation	31.1.1.		5/9	31.1.1. Provide orientation for learners to simulation platforms, equipment, and virtual spaces for the distance simulation-based experience
34. Design the case/scenario applicable to distance simulation		34.1.1.	7/9	34.1.1. Design or curate a scenario or case for distance simulation-based experience which is deliverable within the limitations of that particular technology or learning environment (e.g., XR) and given timeframe and intended outcomes or objectives
42. Create and maintain a psychologically safe distance simulation environment	42.1.2.		6/9	42.1.2. Create and maintain a psychologically safe distance environment for learning
Domain 4: Simulation Resources and Environments				
51. Identify and employ appropriate technologies (technological architecture) in distance simulation	51.1.1.		9/9	51.1.1. Identify and acquire basic knowledge of the elements of distance simulation technologies according to organizational needs (e.g., application software, operating systems, learning management systems, devices, audiovisual components, virtual environment technologies, 2D and 3D applications, etc.)
54. Acquire skills in multimedia in distance simulation in accordance with localized and institutional needs and desires		54.2.1.	5/9	54.2.1. Devise, create, activate and integrate virtual and augmented-reality spaces, characters and objects for distance simulation-based learning experiences
56. Manage distance simulation technical and material problems (e.g., connectivity, video capture, simulator failures, supplies, technical requirements)	56.1.1.		8/9	56.1.1. Apply problem-solving skills to assist learners by resolving issues in the distance simulation setting

knowledge, we can utilize something similar to DASH. (Participant 9)

About assessment and evaluation-related abilities of the educators:

In the advanced level course, we are going to talk about... how you measure your effectiveness. Whereas in the basic-level course, we would make sure that they were aware of the importance of assessment. But in the advanced level course, we would make sure that they knew how to assess. (Participant 3)

2. Designing cases for Distance Simulation Sessions

Basic and Advanced Subcategories

According to participants, the ability to facilitate a distance simulation session was considered a basic-level competency, and to develop was considered an advanced-level competency. This unexpected finding (7/9 participants) contrasts with the DSEG competency 34, 'Design the case/ scenario applicable to distance simulation'. This also is in contrast with CHSE Blueprints [11], which require the simulation educators to be able to develop a simulation scenario at the basic level.

As one participant said:

I think a basic educator will be able to take what we made and implement it, but I think coming up with the process of doing it is the advanced level.... I've created the whole program. I'm going to give it to them, and they need to implement it... I'm the one who's going to tell them when to do it and how to do it. (Participant 3)

And:

Some of the basics are more aligned with being able to use the tools, use the tools appropriately *at the right time for the right environment, and have some knowledge of what's out there to be used and how it might or might not fit in, versus someone who was more advanced might be writing and developing it. (Participate 2)*

Also:

If you are a course director, then you should know the advanced part... At a basic level, maybe for you is enough to run just the simulation scenario. (Participant 9)

Less Supported Generic Categories

1. Prepare Orientation and Prebriefing

Basic Subcategories

Participants considered preparing orientation a necessary part of technological competencies for distance simulation educators. In this generic category, (1) Providing orientation to the technology being used; (2) Establishing principles or values needed for that environment related to ethics, inclusivity and professional etiquettes; and (3) Specific instructions to navigate that particular technological platform were included in both basic- and advanced-level educators only with more emphasis for the advanced-level educators.

Participants discussed the significance, methods and content of orientation in distance simulation. For orienting to technology, one participant said:

So, if you're just using augmented reality with someone in a remote space, [orientation is] going to be different than what you're going to do with someone who's got a head-mounted display on, which is going to be different than if you're doing branching scenario with a group of people. (Participant 2)

Another participant said:

I think there's some pre-work that needs to be put into that which is different because you need to communicate ahead of time, the type of environment they should be in, noise-wise, technology-wise, things they should troubleshoot, really setting the stage for that environment is a lot more involved. (Participant 8)

Participants did not recognize any advanced subcategories for orientation and prebriefing.

2. Create and maintain psychological safety
Basic subcategories

Creating psychological safety in distance simulation environments was considered essential for both basic- and advanced-level educators, with more depth and breadth to the knowledge and skill at an advanced level. The most concurrent subcategory included was: Creating and maintaining psychologically safe environments.

To create psychological safety, one participant said:

I think "basic" to any educator is setting a safe container for psychological safety...For the distance simulation *educators, specifically, it's teaching the additional concerns... so that they have an understanding of why there is this difference in this environment aka difficult unique concerns to psychological safety. (Participant 8)*

Another participant said:

Ensuring psychological safety, making sure everybody there is sort of safe. But that psychological safety *is technological actually, having some sort of way of communicating into your sim. If something's going wrong, like what do you do if there's a distressed learner technologically, how do you get to them? It's not just about running the sim. It's really about this holistic simulation experience that is happening. We have to think about a lot of tricks. (Participant 5)*

Discussion

Although many of these key findings are not novel, the study further supports that teaching using distance simulation is inherently different from teaching in the in-person simulation setting [5,6,15]. What was present before in the physical, cognitive and emotional vicinity of another human being is replaced by virtual and online presence as human interactions are digitized in new modalities. It warrants that educators, the learning environment's gatekeepers, are equipped to deal with the nuances of technology and its psycho-social impact on participants. This study delineates the original findings of the DSEG [10] that there are a distinct set of competencies that are directly and indirectly associated with technology, leading us to identify them as 'technological' and 'technology-affiliated' (non-technological) competencies, respectively, for basic- and advanced-level distance simulation educators. Buléon et al. [2] pointed out the need for having two axes of formal training for theory and technology in distance simulation, and this study echoes those findings. Additionally, this study prioritized eight competencies among 59 and eight sub-competencies from 300 plus that current distance simulation educators find essential in basic- and advanced-level distance simulation educators. No new competencies outside the 300 plus sub-competencies in the DSEG were identified.

Comprehensive understanding of technology

The technological competencies included having deep technological knowledge, troubleshooting capabilities and being proficient in multimedia skills. Participants' emphasis on understanding and leveraging technological skills for obtaining intended outcomes is understandable since technology utilization is significantly more used in distance settings. For example, one of the simplest forms of simulation, role play in an in-person environment, has several more technology-related nuances if done in a distance setting. Examples of these nuances included internet speed and connection stability, device capabilities, learners' and educators' online presence [3], recognition and mitigation of stressors of being on the camera [23] and dealing with a shift in psychological safety [3,4].

Ongoing technology evolution and utilization in education have led to recommendations for educators' technology training in the past [8,9,24]. With the recent tremendous growth in technology and its utilization, constant technological upskilling of healthcare educators is essential [1,2,15,18]. The differences between the two modalities of simulation (in-person versus distance simulation) from a technology perspective not only lie in the case design specific to the distance setting but also in matching the correct modality and technology with the learning objectives and outcomes [25,26]. Not paying attention to such details or not training the educators to do so may lead to challenges for both learners and educators [2], and concerns for academic integrity, validity and reliability [1].

Additionally, having an appropriate technological fund of knowledge and skills in this environment helps educators better manage the intrinsic and extrinsic cognitive load associated with this approach [27,28]. Technology knowledge also increases educators' self-efficacy leading to better educational delivery to learners [29], in online learning. We recommend further exploration of distance simulation educators' cognitive load, self-efficacy and distance simulation training.

The focus of this study was technological competencies for distance simulation educators. An interesting observation was that participants only discussed three of nine competencies mentioned in the DSEG Domain 4 [10], which houses most technology-related competencies. Further research is needed to know why participants focus on only three competencies. It is possible that focused distance simulation training in the future might reveal more competencies from the fourth or other domains.

Technology-affiliated or non-technological skills

It was an unexpected finding that almost all participants considered a few non-technological skills a part of the technological skills training. These technology-affiliated non-technological skills were related to overarching professional values, education and simulation-related knowledge. The competencies endorsed organically from the conversation with participants included identifying the need for various roles in the distance simulation team and catering to the learners' psychological safety and orientation needs. Participants agreed that exhibiting these technology-affiliated skills was essential for distance simulation educators, validating the previous work [2,5,15,30]. For in-person simulation settings, following best practices enhances learning and psychological safety [31,32]. By extension of studies on in-person simulation and online learning, we can assume this would be the case for distance simulation. More work is needed to verify this finding for the distance simulation setting.

This 'dual competency set' of technological and technology-affiliated competencies has been discussed from different perspectives in related fields, including human-system interaction from human factors science [33], Technology, Pedagogy, And Content, Knowledge (TPACK) model from instructional designing [34] and Community of Inquiry model from online learning [3,35]. The connection between knowledge, content and technology is evident in online instruction through the application of the TPACK model [29]; however, its role and significance in distance simulation are unknown. Further research in this area might help explain the relationship between the two sets of competencies found in this study for distance simulation.

It was unexpected for us to find participants considering non-technological skills essential to technological training; we noticed a lack of discussion around training for distance (virtual) debriefing skills compared to prebriefing. It could be because they did not consider debriefing a part of technological skills. Another reason could be that they considered debriefing such an integral part of any simulation that they did not need to mention it frequently for it to be a generic category. This opens another avenue for future research, especially after focused training for conducting distance simulation to see if trained participants' opinions change and how it would impact their own distance debriefing.

Developing distance simulation cases

An unexpected finding for us was that most participants agreed for the basic-level distance simulation educators to facilitate and not develop simulation sessions. It is not in line with the CHSE blueprint [11], and the DSEG. These two documents advocate for basic-level simulation educators to be able to develop a simulation session. The findings of this paper suggest that in the absence of the physical presence of the participants, managing a distance environment for teaching is not simple. It consists of multiple layers of skills such as driving and manipulating technology, carefully watching the learners for psychological safety concerns and conveying knowledge, among others, all taxing the educators' cognitive capacity. Being cognizant of their cognitive load and managing it appropriately is positively related to teaching and learning for educators in general [36]; being aware of and managing the learners' cognitive load improves learning outcomes in in-person settings [37,38]. Participants argued that at the basic level, distance simulation educators might still be learning the application of technological and behavioural skills in distance simulation environments. With more knowledge of and experience with the abovementioned factors, they become advanced-level educators as they learn how to manage their intrinsic and extrinsic cognitive loads [28]. This can be another prompt for distance simulation educator training. We recommend further research for this preliminary finding.

Strengths and limitations

A key strength of this study was the heterogeneous sample of participants. Participants were from diverse professional backgrounds with a wide range of in-person and distance simulation experience, showing that the findings were ubiquitous in several professions. Participants were from different age groups to reflect the generational gap in learning styles as it influences the evolution and application of learning [7]. Another strength was the use of direct content analysis in the qualitative description, which provided flexibility with the rigor required of a qualitative study [13], to understand the phenomenon. Additionally, having a nurse educator with more than three decades of teaching and leadership experience who was not a simulationist in the research team ensured the maintenance of reflexivity during data collection, analysis and interpretation.

The diverse sample was also a limitation; we could not explore deeply within one specific healthcare profession. Additionally, although we obtained the data sufficiency level [22] during data collection, participants' simulation knowledge and experience were non-linear and unequally distributed in various aspects of the field. This might have led to an inability for certain concepts to be established as generic categories because they were not prevalent enough. Another limitation is the inclusion of participants only from North America despite our efforts to diversify the sample. It might have limited the findings of the study. Additional studies with simulation educators from other countries could confirm if these are genuinely essential competencies.

Conclusion

We set out to find the additional KSAs for distance simulation educators, and this study provided that to us in the form of eight essential technological and technologically affiliated competencies for basic and advanced distance simulation educators. This study also provided evidence that in-person simulation education knowledge is critical to build the skill of constructing and conducting distance simulation sessions. It also validated that because of inherent differences between distance and in-person simulation, these competencies take unique forms in distance environments, even if the wording of these competencies stays the same. Although many of our key findings were expected, this descriptive analysis study provided insight into how these competencies could be applied in the real world while providing preliminary validation to the technological competencies of the DSEG.

Declarations

Acknowledgements

The authors would like to thank the participants for their time and for sharing their expertise in developing the content of this paper. The authors would also like to thank Dr. Suzan (Suzie) Kardong-Edgren for reviewing this paper and providing valuable suggestions for improvements. The authors also thank the Distance Simulation Collaboration and MGH Institute of Health Professions for generously supporting this study.

Authors' contributions

MB, JP and SMS-S participated in the conceptualization, planning and design of this paper. MB and SMS-S conducted data collection. MB, SMS-S, JP and RA conducted the analysis. All authors contributed to the writing of the manuscript. All authors have followed the instructions for authors and have read and approved the manuscript.

Funding

This study was not funded by any entity.

Availability of data and materials

None declared.

Ethics approval and consent to participate

This study was deemed exempt (Category 2(i), protocol 13466) from the Indiana University Institutional Review Board. Informed consent was obtained through email before interviews, and verbal consent was obtained again at the beginning of each interview.

Competing interests

The researchers do not have any financial, personal or other conflicts which may affect the information, research, analysis or interpretation presented in the manuscript.

References

1. Jeffries PR, Bushardt RL, DuBose-Morris R, et al. The role of technology in health professions education during the COVID-19 pandemic. Academic Medicine. 2022 Feb 23;97(3):S104–S109.
2. Buléon C, Caton J, Park YS, et al. The state of distance healthcare simulation during the COVID-19 pandemic: results of an international survey. Advances in Simulation. 2022 Dec;7(1):1–1.
3. Cheng A, Kolbe M, Grant V, et al. A practical guide to virtual debriefings: communities of inquiry perspective. Advances in Simulation. 2020 Dec;5(1):1–9.
4. Mosher CJ, Morton A, Palaganas JC. Perspectives of engagement in distance debriefings. Advances in Simulation. 2021 Dec;6(1):1–3.
5. Gross IT, Clapper TC, Ramachandra G, et al. Setting an agenda: results of a consensus process on research directions in distance simulation. Simulation in Healthcare. 2022 Apr 2. doi: 10.1097/SIH.0000000000000663.
6. Duff J, Kardong-Edgren S, Chang TP, et al. Closing the gap: a call for a common blueprint for remote distance telesimulation. BMJ Simulation & Technology Enhanced Learning. 2021;7(4):185.
7. Hopkins L, Hampton BS, Abbott JF, et al. To the point: medical education, technology, and the millennial learner. American Journal of Obstetrics and Gynecology. 2018 Feb 1;218(2):188–192.
8. National Academies of Sciences, Engineering, and Medicine. How people learn II: learners, contexts, and cultures. National Academies Press. 2018.
9. Fulton K. Technology training for teachers: a federal perspective. Educational Technology. 1989 Mar 1;29(3):12–17.
10. Bajwa M, Ahmed R, Lababidi H, et al. Development of distance simulation educator guidelines in healthcare: a Delphi method application. Simulation in Healthcare. 2023 Jan 5. doi: 10.1097/SIH.0000000000000707.
11. Society for Simulation in Healthcare. Certified healthcare simulation educator examination blueprint [2018

version]. Available from: https://www.ssih.org/Portals/48/Certification/CHSE_Docs/CHSE_Examination_Blueprint.pdf [Accessed 15 February 2022].
12. Doyle L, McCabe C, Keogh B, Brady A, McCann M. An overview of the qualitative descriptive design within nursing research. Journal of Research in Nursing. 2020 Aug;25(5):443–455.
13. Elo S, Kyngäs H. The qualitative content analysis process. Journal of Advanced Nursing. 2008 Apr;62(1):107–115.
14. Assarroudi A, Heshmati Nabavi F, Armat MR, Ebadi A, Vaismoradi M. Directed qualitative content analysis: the description and elaboration of its underpinning methods and data analysis process. Journal of Research in Nursing. 2018 Feb;23(1):42–55.
15. Palaganas J, Bajwa M, Lababidi H, et al. The creation of healthcare distance simulation faculty development guidelines (phase I). The Institute for Interprofessional Innovations and the Healthcare Distance Simulation Collaboration. 2022. Available from: https://healthsciences.nova.edu/pde/forms/sim-white-paper.pdf [Accessed 1 March 2022].
16. *Healthcare Distance Simulation Collaboration*. Available from: https://www.healthcaredistancesim.com/ [Accessed 20 July 2022].
17. Zoom.us. Version 5.11.1 (8356). 2022. https://zoom.us/ [Accessed 23 July 2022].
18. Kirkpatrick AJ, Palaganas J, Ahmed R, et al. 2021 Healthcare distance simulation summit proceedings - looking into the distance: paving the way toward a sustainable future. The Healthcare Distance Simulation Collaboration. 2022. Available from: https://www.healthcaredistancesim.com/projects [Accessed 29 May 2022].
19. Google forms. Available from: https://www.google.com/forms/about/ [Accessed 15 February 2022].
20. Creswell JW, Poth CN. Qualitative inquiry and research design: choosing among five approaches. Sage Publications. 2016.
21. Dropbox (122.4.4867). San Francisco, CA: Dropbox, Inc. 2021.
22. Varpio L, Ajjawi R, Monrouxe LV, O'Brien BC, Rees CE. Shedding the cobra effect: problematising thematic emergence, triangulation, saturation and member checking. Medical Education. 2017 Jan;51(1):40–50.
23. Raake A, Fiedler M, Schoenenberg K, De Moor K, Döring N. Technological factors influencing videoconferencing and Zoom fatigue. arXiv preprint arXiv:2202.01740. 2022 Feb 3.
24. Muttappallymyalil J, Mendis S, John LJ, Shanthakumari N, Sreedharan J, Shaikh RB. Evolution of technology in teaching: blackboard and beyond in medical education. Nepal Journal of Epidemiology. 2016 Oct;6(3):588.
25. Pottle J. Virtual reality and the transformation of medical education. Future Healthcare Journal. 2019 Oct;6(3):181.
26. Ahmed S, Shehata M, Hassanien M. Emerging faculty needs for enhancing student engagement on a virtual platform. MedEdPublish. 2020 Apr 23;9(75):75.
27. Kilic F. Awareness and cognitive load levels of teacher candidates towards student products made by digital storytelling. Turkish Online Journal of Distance Education. 2014 Jul 1;15(3):94–107.
28. Young JQ, Van Merrienboer J, Durning S, Ten Cate O. Cognitive load theory: implications for medical education: AMEE Guide No. 86. Medical Teacher. 2014 May 1;36(5):371–384.
29. Corry M, Stella J. Teacher self-efficacy in online education: a review of the literature. Research in Learning Technology. 2018;26.
30. Hardie L, Lioce L. A scoping review and analysis of simulation facilitator essential elements. Nursing & Primary Care. 2020;4(3):1–13.
31. Decker S, Alinier G, Crawford SB, Gordon RM, Jenkins D, Wilson C. Healthcare simulation standards of best practice™: the debriefing process. Clinical Simulation in Nursing. 2021 Sep 1;58:27–32.
32. Rudolph JW, Raemer DB, Simon R. Establishing a safe container for learning in simulation: the role of the presimulation briefing. Simulation in Healthcare. 2014 Dec 1;9(6):339–349.
33. Bannon LJ. From human factors to human actors: the role of psychology and human-computer interaction studies in system design. In: Baecker RM, Grudin J, Buxton WAS, Greenberg S, editors. Interactive technologies, readings in human–computer interaction. Morgan Kaufmann. 1995. p. 205–214. doi: 10.1016/B978-0-08-051574-8.50024-8.
34. Mishra P, Koehler MJ. Technological pedagogical content knowledge: a framework for teacher knowledge. Teachers College Record. 2006 Jun;108(6):1017–1054.
35. Lambert JL, Fisher JL. Community of inquiry framework: establishing community in an online course. Journal of Interactive Online Learning. 2013 Mar 1;12(1):1–6.
36. Blackley C, Redmond P, Peel K. Teacher decision-making in the classroom: the influence of cognitive load and teacher affect. Journal of Education for Teaching. 2021 Aug 8;47(4):548–561.
37. Leppink J. Cognitive load theory: practical implications and an important challenge. Journal of Taibah University Medical Sciences. 2017 Oct 1;12(5):385–391.
38. Josephsen J. Cognitive load theory and nursing simulation: an integrative review. Clinical Simulation in Nursing. 2015 May 1;11(5):259–267.
39. Lioce L, Lopreiato J, Downing D, et al. The terminology and concepts working group: healthcare simulation dictionary. 2nd edition. Rockville, MD: Agency for Healthcare Research and Quality, AHRQ Publication No. 20-0019. 2020. Available from: https://doi.org/10.23970/simulationv2.
40. MedlinePlus: Telehealth. 2020. Available from: https://medlineplus.gov/telehealth.html [Accessed 11 March 2022].
41. Oztemel E, Ozel S. Technological competency assessment. International Journal of Services Technology and Management. 2019;25(2):138–159.
42. Cdc.gov. The importance of KSA's (knowledge, skills and abilities). n.d. Available from: https://www.cdc.gov/hrmo/ksahowto.htm [Accessed 11 March 2022].
43. American Nurses Association. ANA leadership competency model. 2018. Available from: https://www.nursingworld.org/~4a0a2e/globalassets/docs/ce/177626-ana-leadership-booklet-new-final.pdf [Accessed 15 March 2022].
44. Maaleki A. The ARZESH competency model: appraisal & development manager's competency model. Chișinău: LAP Lambert Academic Publishing. 2018.
45. Dreyfus SE. The five-stage model of adult skill acquisition. Bulletin of Science, Technology & Society. 2004 Jun;24(3):177–181.
46. Bradshaw C, Atkinson S, Doody O. Employing a qualitative description approach in health care research. Global Qualitative Nursing Research. 2017 Nov 21;4:2333393617742282.Appendix 1

Glossary of Terms / Definitions

Distance Simulation Related Definitions [39]

Distance Simulation: Distance simulation is implementing a simulation or training at a physical distance from the participant(s)

Telesimulation: A telesimulation platform utilizes communications technology to provide mannequin-based simulation education between learners and instructors located remotely from one another. A telesimulation platform utilizes communications technology to provide mannequin-based simulation education between learners and instructors situated remotely. Or Telesimulation uses the Internet to link simulators between an instructor and trainee in different locations.

Remote Simulation: Simulation performed with either the facilitator, learners, or both in an offsite location separate from other members to complete educational or assessment activities

Virtual Reality Simulation: Simulations that use a variety of immersive, highly visual, 3D characteristics to replicate real-life situations and health care procedures; virtual reality simulation is distinguished from computer-based simulation in that it generally incorporates physical or other interfaces such as a computer keyboard, a mouse, speech and voice recognition, motion sensors, or haptic devices

Gamification: The application of game design elements (conceptual building blocks integral to building successful games) to traditionally nongame contexts

Distance Simulation (Umbrella Term used for this project): For this study, we included different modalities or their combinations, conducted live or synchronously where participants are not physically or cognitively present in the same environment. It would consist of distance simulation, remote simulation, telesimulation, virtual reality, and all other types of immersive technologies and extended reality simulations [2].

In other words: "Distance simulation is live, not-in-person, and synchronous healthcare simulation when the participants of a simulation are geographically, cognitively, or environmentally apart from each other but participating in the simulation in real-time."

Telehealth: The use of electronic information and telecommunication technologies to provide care when the patient and the doctor are not in the same place simultaneously [40].

Technology: The concept of technology is contextual. It is described by Wright and Smith (1989) as the integration of people, knowledge, tools, and systems to improve people's lives [41].

Technical: It means "relating to a particular subject, art, or craft, or its techniques," or "of, involving or concerned with applied and industrial sciences."

KSA: According to CDC [42]:

Knowledge statements refer to an organized body of information, usually of a factual or procedural nature which, if applied, makes adequate performance on the job possible.

Skill statements refer to the proficient manual, verbal or mental manipulation of data or things. Skills can be readily measured by a performance test where quantity and quality of performance are tested, usually within an established time limit. Examples of proficient manipulation of things are skills in typing or operating a vehicle. Examples of proficient manipulation of data are skill in computation using decimals, skill in editing for transposed numbers, etc.

Ability statements refer to the power to perform an observable activity at present.

KSA: According to the ANA Competency Model [43]:

Knowledge encompasses thinking, understanding of theories, professional standards of practice, and insights gained from context, practical experiences, personal capabilities, and leadership performance.

Skills include communication, interpersonal, and problem-solving skills.

Ability is the capacity to act effectively. It requires listening, integrity, self-awareness, emotional intelligence, and openness to feedback.

Competency: is an expected level of performance that integrates knowledge, skills, abilities, and judgment. The integration of knowledge, skills, abilities, and judgment occurs in formal, informal, and reflective learning experiences [43].

Competency: Competency is a series of knowledge, abilities, skills, experiences, and behaviors which leads to the effective performance of an individual's activities. Competency is measurable and could be developed through training [44].

Competent: "To achieve competence, people learn, through instruction or experience, to devise a plan or choose a perspective that then determines those elements of the situation or domain that must be treated as important and those that can be ignored. This leads to a few of the vast number of possibly relevant features and aspects, and easier decision making." A competent performer seeks rules and reasoning procedures to decide which plan or perspective to adopt. But such practices are not as easy to come by [45].

Expert: The proficient performer, due to their vast repertoire of situational discriminations, is immersed in the world of skillful activity, sees what needs to be done immediately, and decides how to do it. Thus, the ability to make more subtle and refined discriminations is what distinguishes the expert from the proficient performer [45].

Qualitative descriptive design: A qualitative descriptive design is a qualitative research study design that recognizes the subjective nature of the problem, and the different experiences participants have and will present the findings in a way that directly reflects or closely resembles the terminology used in the initial research question [46].