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Article

Transformation and development of simulation-based education and child first aid skills training

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Abstract: Background: Simulation-based medical education is a complex learning methodology in different fields. Exposing children to this teaching method is uncommon as it is designed for adult learning. This study aimed to develop and implement simulation-based education in first aid training of children and investigate the emotions of children in post-simulation scenarios that replicate emergency situations. **Methods:** This was a phenomenological qualitative research study. The participants attended the modified "Little Doctor" course that aims to train children in first aid and, subsequently, completed simulation scenarios. The children attended focus groups and were asked about their experiences of the course and how they felt during the simulation scenarios. **Results:** 12 children (Age 8–11 years old) attended the course, and 10 completed the simulation scenarios and focus groups. The major theme derived from was the simulation experience's effect, which was divided into two subthemes: the emotion caused by—and the behavioral response to—the simulation. The analysis revealed shock and surprise toward the environment of the simulation event and the victim. The behaviors expressed during the simulation scenarios ranged from skill application and empathy to recall and teamwork. **Conclusions:** Simulation scenarios were successfully implemented during the first-aid training course. Although participants reported mixed feelings regarding the experience, they expressed confidence in their ability to perform real-life skills.

Keywords: first aid training; simulation-based education; qualitative study; children education; emotional response

1. Introduction

Simulation-based medical education (SBME) is a complex learning methodology used as a teaching method in various healthcare specialties (Motola et al., 2013; Scalese et al., 2008). The learner participates in a simulation environment that reflects real clinical settings and scenarios (Lopreiato, 2020; Watts et al., 2021). Simulation-based experiences (SBE) expose learners to an experience that replicates real life, enabling them to learn in a safe environment (Alinier, 2008; Alinier and Oriot, 2022). SBME aims to help learners navigate the replication of an actual patient encounter and how they would manage the patient or experience a situation that they might encounter in clinical practice (O'Brien, 2014). SBE—as a learning methodology—was built on cognitive and experiential learning theories, which assume that learners will learn the

skills taught during the simulation by experiencing the scenario presented to them during an activity (Jeffries, 2020).

The SBE is delivered using various simulation modalities that simulate the actual patient and have various levels of technology that reflect an actual patient. Some of those modalities include standardized patients, who are actors trained to act as actual patients; human simulators, which are high-fidelity simulation manikins with many features that the learners can train on; and task trainers manikins, which are considered the lowest fidelity because they are used to train the learners on one skill (Lopreiato, 2020; Watts et al., 2021).

Immersive SBE involves the following three steps: briefing, scenario encounters, and debriefing (Lopreiato, 2020). These immersive scenarios were designed based on real-life patient cases. The simulation scenario mimics actual actions implemented to save or manage the patient's life or situations encountered in their profession to prepare learners for such encounters (Lopreiato, 2020). A facilitator or simulation educator usually leads the simulation experience (Persico et al., 2021). These simulation educators are trained to teach using simulation-based education (SBE) methodologies and to facilitate the simulation experience—from briefing to simulating actual encounters, followed by debriefing (Persico et al., 2021).

In the briefing, the educator prepares the learner and informs them of the activity's learning objectives, provides them with the orientation of the training site and environment, and establishes psychological safety that details that this simulation event is not real; the learners are in a safe learning environment; there are no mistakes, only learning opportunities; and everyone is here to learn (McDermott et al., 2021). These basic assumption statements in the simulation event allow learners to feel safe and are important in establishing a safe container for the SBE (McDermott et al., 2021; Rudolph et al., 2014). Thereafter, learners follow what they learned before the scenario and use their prior knowledge and skills to form a management plan for the patient who, for example, might be suffering a heart attack (Watts et al., 2021). Debriefing is usually performed using established methods and models, such as Plus Delta or advocacy inquiries (Decker et al., 2021). These methods are used to assist the facilitator in debriefing the participants. The debriefing is performed in a friendly and non-threatening manner. Its primary aim is helping learners reflect on their performance during the simulation experience, understand their emotions, and know what went wrong and what they could have done correctly in the future (Decker et al., 2021).

Multiple healthcare specialties use simulations in their undergraduate curricula and postgraduate programs (Motola et al., 2013). Owing to the nature of each healthcare specialty, numerous skills and simulation experiences are designed based on specialty needs and learning objectives (Watts et al., 2021). Exposing children to SBE is questionable as it is predominantly designed for adult learning. Despite the limited literature on this topic, SBE has demonstrated benefits for children's learning. An experimental study exploring immersive simulation for children used a simulation game designed to train 5-year-olds to obey certain traffic safety rules; it found that simulation games that included role-playing games and group dynamics modified the 136 participants' attitudes and behavior. The change was measured based on the child's perception of pedestrian vulnerability to traffic accidents and the child's

perception of the degree of danger that traffic, in general, presents to the pedestrian (Renaud and Suissa, 1989). There are several advantages of using SBME in teaching. (Marc et al., 2018). Simulation encourages critical thinking, improves self-confidence, reduces error, and allows learners to adopt a systematic approach to dealing with situations. There are challenges to implementing simulation in training, including cost and resources, but the advantages outweigh the disadvantages. (Marc et al., 2018).

1.1. Using simulation to teach first aid

One skill that uses SBE in teaching is first aid (Marc et al., 2018), which is defined as helping any person who requires medical intervention until healthcare providers arrive. First aid skills—such as knowing how to assist a choking person, managing active bleeding, and performing cardiopulmonary resuscitation (CPR)—are crucial for saving lives (Abolfotouh et al., 2017; Sidell et al., 2013; Villegas et al., 2020). Approximately 10%–20% of child injuries in the United States occur in school (AlYahya et al., 2019). Dealing with victims when one has limited, or no knowledge is challenging. Thus, first-aid training is recommended for all ages (American Heart Association, 2024). Most importantly, first aid training should be taught to children early, as they learn quickly (Holmberg et al., 1992; Lester et al., 1994; Naqvi et al., 2011). According to Eisenburger and Safar Life-Supporting, including first aid training in school teaching is important. However, the most challenging issue at an early age is the fear of the inability to perform these skills effectively (Bollig et al., 2011).

Most studies have discussed first-aid training's effectiveness among adults—specifically among undergraduates—and less so for children (De Buck et al., 2020). SBME has evolved beyond its use among undergraduates and has extended to postgraduate education and military and airline pilot training. However, the age of the children to whom first aid training can be provided is still debated (Bollig et al., 2011). First aid—usually taught using manikins and task trainers—is traditionally delivered by lecturing the learners and then training them on manikins. This widespread teaching method teaches basic life support (BLS), as developed and provided by the American Heart Association (AHA), which healthcare providers are mandated to take in numerous countries (American Heart Association, 2024). While it usually uses manikins and fully immersive simulation scenarios for adults who are undergraduates or in postgraduate programs, it has not been used to teach children first aid, as most programs teach children using hands-on training on the manikin without exposing them to immersive simulation scenarios (De Buck et al., 2015). Additionally, children demonstrate the ability to learn first-aid skills at different ages (De Buck et al., 2020). The AHA has recommended teaching children from elementary school to those in high school how to apply first-aid skills (Cave et al., 2011).

1.2. Learners' emotions during simulation experiences

Owing to the nature of SBE and the complexity of simulation experiences, learners usually experience multiple emotions during the learning activities (Anine et al., 2022). Several emotion theories are debated among researchers; however, there is agreement that emotions participate in the psychological process and are based on past

experiences and reactions to the current situation. They shape the learner's context of the occurrences in this situation and are expressed through various ways (Izard, 2013).

Several studies have reported that learners' emotions affect their learning, perception of the experience, attention, decision-making, and problem-solving skills (Madsgaard et al., 2022) Further, we must consider the activity's complexity and effect on the stability of emotions because of the nature of the simulation and interactions between multiple parties and the training. Learners usually experience highly intense feelings and weak emotions (Haji et al., 2016).

Numerous studies have supported the perception that emotions impact performance and learning (Immordino-Yang, 2015; LeBlanc et al., 2015). Emotional states affect emotions that are powerful and aligned with processes; they affect attention, memory, and judgment, which are critical factors in the simulation experience and are triggered by the scenarios to which the learners are exposed (LeBlanc and Posner, 2022). Learners are usually affected by their emotions; occasionally, whether their feelings are positive or negative, their emotions may enhance how they interact with the simulation environment (LeBlanc and Posner, 2022).

In simulation experiences, learners experience shifting emotions that change from positive to unpleasant (Anine et al., 2022). One study found that using simulation-based learning invokes positive emotions. By contrast, negative emotions decreased during the educational course. The study used a pre- and post-questionnaire to explore participants' emotional experiences before and after the simulation-based activities (Keskitalo and Ruokamo, 2020). Another study identified two emotional components in 84 first-year students who had experienced simulation scenarios—namely, invigoration and tranquility (Fraser et al., 2012). The study found that increased invigoration and decreased tranquility during summation training were associated with improved cognitive load and reduced likelihood of correctly performing required actions (Fraser et al., 2012).

In adult learners, it was found that they experience various emotions when exposed to simulation scenarios. A recent review by Madsgaard et al. reported the emotions of healthcare students during simulation scenarios (Madsgaard et al., 2022). The themes that emerged from the analysis were simulation as a fearful and stressful situation, variability and emotions experienced during the simulation as a role cluster of emotions, and the wide-ranging effects of feelings on student learning assimilation. It has been shown that students experience various emotions during and after the simulation experience. Additionally, the emotions felt were associated with the student's performance in the targeted learning outcome. Negative and stressful emotions (Anxiety, fear, disappointment, discomfort) had two opposite effects on students' performance. The first effect was improved learning drive (positive effect), and the second was impaired performance (Negative effect) (Madsgaard et al., 2022).

Owing to the existing literature supporting the use of simulation as a learning methodology and its benefit in improving skills, and the evidence showing the effect of the emotional state of the learners on the performance outcome, examining the effect of using this methodology in children is crucial as it is already being used for training first-aid skills. However, the evidence supporting the effect of simulation on children's skills and emotions is limited. There is also a gap in the literature that reports

the effect of utilizing immersive simulation scenarios on children's emotions. Thus, to fill this gap in existing literature, this study aimed to investigate the feelings and emotions of children in post-simulation scenarios, replicating the need for first aid. The study aims to provide insight into the psychological impact of simulation-based first-aid training programs on children's emotions and their confidence in their gained skills. This study's objectives were to pilot a newly developed simulation-based first-aid training program among children, describe the effect of participation in simulation-based first-aid training program on children's emotions, and investigate the impact of involvement in simulation scenarios depicting emergencies requiring first aid on children's feelings and emotions. This study aims to answer the following questions:

- What do children feel when participating in scenarios that depict a patient's need to be saved from an emergency situation?
- What range of emotions do children have when simulation scenarios are used to teach them how to apply first-aid skills?
- Did simulation training and immersive scenarios effectively improve children's confidence in performing lifesaving tasks in emergency situations?

2. Materials and methods

2.1. Research design

This study used a phenomenological approach to synthesize qualitative data to understand the experiences of children who participated in simulation scenarios depicting victims who needed CPR, were choking, or were actively bleeding. Further, it explored children's feelings and emotions toward their experiences of simulation scenarios. This study's theoretical perspective was rooted in Pletcher's theory of emotions (Plutchik, 1980), which proposes a psycho-evolutionary classification approach for eight primary emotional responses that trigger behavior—specifically, anger, fear, sadness, disgust, surprise, anticipation, trust, and joy (Plutchik, 1982).

This theory was selected to explain and encapsulate emotional and behavioral responses to a situation that depicts a person in need. In this study, a simulation scenario with a manikin was used to trigger emotions. The participants were told to imagine that the manikin was a person in need, and they were asked to help them. The theory has 10 assumptions that cause the emotional response to the event (Plutchik, 1982; Plutchik, 1980). Emotional responses were observed during the training and simulation events by the research team and reported by the participants during the focus group. The observation included participants' facial expressions, body language, word choice, and tone of voice. To assist participants in explaining their emotions, a simplified version of Plutchik's wheel of emotions presenting cartoonish faces assisted them in explaining why they felt a particular emotion.

The research team had no prior relationships with the participants. During the data analysis, the research team and coders noted the participants' comments and the researchers' observations during the focus groups. The researchers who attended the focus groups debriefed the participants after the course was concluded and took notes after it was completed.

2.2. Study context

This study was conducted at the Clinical Skills and Simulation Center (CSSC) at Princess Nourah Bint Abdulrahman University (PNU) in Riyadh, Saudi Arabia. The participants attended the modified "Little Doctor" course. The course—conducted by a certified BLS instructor at the CSSC—aimed to educate and train children on first aid and CPR. The course objectives were as follows: raising awareness and providing training on first aid and CPR, understanding the importance of an ambulance, taking children on a tour inside the ambulance to become closely acquainted with it, and identifying important supplies and tools used in emergencies. This course was initially developed and delivered by a BLS-certified instructor and included 90 min of hands-on training on different first-aid skills. The course targeted children aged 7–10 years old. This course has been conducted annually at the CSSC since 2018.

In this study, the course was modified to include three simulation scenarios and hands-on training depicting life-threatening situations (drowning, choking, and bleeding). The simulation scenarios were designed by a certified healthcare simulation educator with BLS training and reviewed by five experts in simulation education with healthcare backgrounds. Props were used to add realism to the scenarios. For the bleeding scenario, the medical moulage (medical makeup) indicated that the victim (manikin) was bleeding, and tools were added to show what had injured the victim. In the CPR scenario, an infant victim (manikin) was placed next to a plastic pool to show how they had drowned. In the choking scenario, a playing mat and small toys placed around the infant showed the participant what the infant had choked on (**Figure 1**). Further, an actor was added to the scenarios to help the participants feel that an adult was present with them and to make the scenario more realistic. Their other role was to provide prompts to the children if they needed help performing the skills required to complete the scenario.

(A) **(B)** **(C)**

Figure 1. Environmental setup of the simulation scenarios. **(A)** shows the 1st scenarios setup (Scenario 2: Choking management in infant); **(B)** shows the 2nd scenario setup (Cardiopulmonary resuscitation in drowning infant); **(C)** shows the 3rd scenario setup (Bleeding management in adult).

After the subjects completed the course's hands-on training component, they were invited to participate in simulation scenarios to demonstrate the emergencies discussed in the course. The participants were oriented toward the environment and briefed about the scenario and the activity's goals. A certified simulation educator from the research team and a BLS instructor who trained them in the course debriefed them regarding their experiences and their performances and how they can improve in

the future. After the children completed the debriefing, they participated in a focus group. They were asked about their experience of being included in the course and how they felt during the simulation scenarios.

The focus group included 3–4 subjects and was moderated by one of the research teams and an assistant moderator. The moderator facilitated the discussions during the focus group, while the assistant moderator tracked nonverbal cues and took notes. After the focus group was concluded, both the moderator and assistant met and drafted a summary of the focus group and emerging topics and recommended ways to improve focus group conduction. **Figure 2** summarizes the study process.

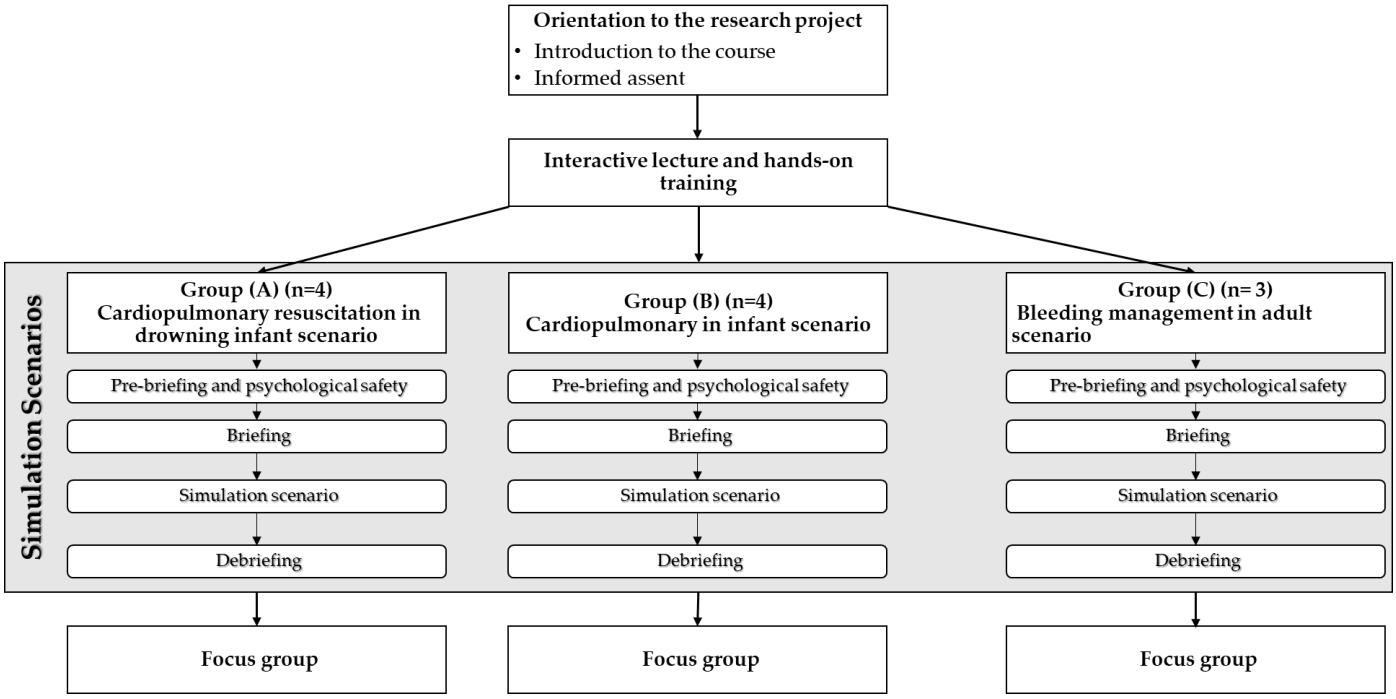


Figure 2. Summary of the study process.

2.3. Sampling strategy

The participants were recruited using a non-probability snowball sampling technique. Parents were contacted and asked to invite relatives or friends. Both parents and children needed to agree to participate in the study. The inclusion criteria were that the participants were 7–11 years old and had not yet been trained in first-aid skills before being recruited. The children must have attended the "Little Doctor" course to be eligible for the focus group. The parents must be Princess Nourah Bint Abdulrahman University (PNU) employees or relatives of employees. The children who did not complete the modified "Little Doctor" course were excluded from the study.

Further, 10 of the 18 participants (5 male, 5 female) who agreed to participate attended the course and completed the focus group. Six participants dropped out of the study because their parents were unable to attend the course. Two children participated in the course's hands-on training component but could not join the scenario or focus group because of language barriers. Parents and guardians attended the first component of the course, which included orientation, lectures, and hands-on training.

However, only the research team and participants were included in the simulation and focus groups.

2.4. Ethical issues pertaining to human subjects

The research team contacted the study participants' parents and relatives and informed them regarding the study's aims and methods. Participants' consent was obtained from both parents or guardians and the child (Assent) before commencing the "Little Doctor" course. This study was approved by the Institutional Review Board (IRB) of PNU (IRB Log Number: 22-0841).

2.5. Data collection methods

The data collection metho used in this study were:

2.5.1. Focus groups

The research team developed a focus group protocol based on previously published studies and study questions. The questions were reviewed and adjusted to be simple and applicable to children. An activity was added to help children express their emotions.

The focus group protocol (Supplementary material) details the focus group requirements, sample scripts, and role distribution. Both simulation scenarios and focus groups were recorded. The participants were informed of the recording; they were shown the camera and how they would look to decrease their anxiety. The focus groups were transcribed into Arabic and translated into English.

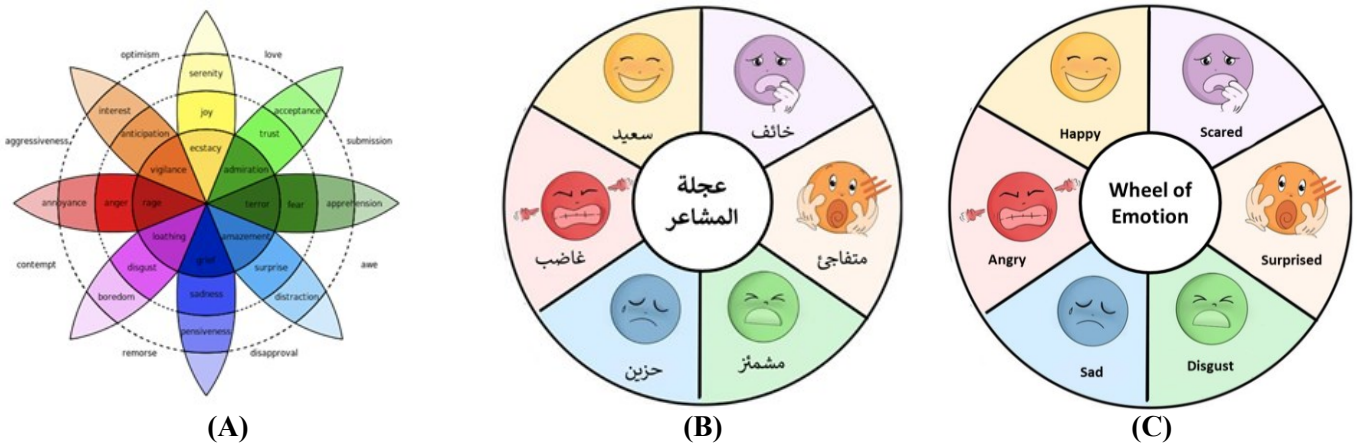
One member of the research team moderated the focus groups, and one member served as an assistant moderator. The moderator facilitated discussions during the focus group, while the assistant moderator tracked the nonverbal cues and noted the interactions, which would be discussed later with the moderator. After the focus group was concluded, both the moderator and assistant met and drafted a summary of the focus group and emerging topics and recommended ways to improve focus group conduction. All the focus groups were videotaped, recorded, and transcribed for analysis by the research team.

The research team conducted follow-up focus groups to clarify the emerging themes and meanings of concepts, such as reactions to the setting's realism. The first focus group following the simulation scenarios took 25–30 min, whereas the follow-up focus group lasted 60 min. Data saturation was discussed by the research team and agreed upon when no new themes emerged from the follow-up focus group. The transcriptions were not returned to the participants for comments or corrections as their age might affect their recall of the focus group discussions.

2.5.2. Arabic translation of Plutchik wheel of emotions

The children were given a simplified Arabic version of the Plutchik Wheel of Emotions (Plutchik, 1982). In 1980, Plutchik proposed the wheel of emotion, a wheel model that describes how emotions are related. He suggested eight primary bipolar emotions—namely, joy (sadness), anger (fear), trust (disgust), and surprise (anticipation). His model connects the idea of an emotional circle to a color wheel (**Figure 3**). Primary emotions can be expressed at different amounts based on color and can be mixed to form different emotions. The modified Arabic wheel presents the

following primary emotion categories: joy, anger, anticipation, fear, surprise, sadness, disgust, and trust—with pictures to express emotions (Plutchik, 1982).



(A) **(B)** **(C)**

Figure 3. Plutchik's wheel of emotions. **(A)** shows the original Plutchik's wheel of emotion (Plutchik, 1982); **(B)** shows the Modified Arabic version of Plutchik's wheel of emotion; **(C)** shows the English version of the Modified Arabic Plutchik wheel of emotion.

The research team reviewed the Arabic version and approved it as a facilitative method for the focus groups.

2.6. Data processing

The themes identified herein were derived from the collected data. Four data coders were involved in data coding. The coding tree was used to illustrate the emotions experienced by the participants during the simulation and their relationship to the behavior they reported acting upon to address the situations they observed during it. The emotions were categorized based on Plutchik's categorization of emotions (wheel of emotions) (Plutchik, 1982).

Constant comparison analysis was used to analyze the focus group transcripts (Onwuegbuzie et al., 2009). In the first stage (open coding), the data were chunked into small units, and each unit was coded. These codes were grouped into categories in the second stage (axial coding). In the third and final stages (selective coding), themes were developed to express each group's content based on the categories and codes from the first and second stages (Onwuegbuzie et al., 2009). The analysis was performed by four researchers and reviewed during and after completion to detect inconsistencies in the findings (Krueger, 1997). To analyze the focus group transcripts, constant comparison analysis was performed (Onwuegbuzie et al., 2009). using the NVIVO program (QSR International Pty Ltd., 2018). The participants were not provided feedback regarding the study findings.

2.7. Techniques to enhance trustworthiness

Audit trials were conducted to enhance the qualitative analysis' trustworthiness. The trials included keeping records of raw data, including focus group recordings, field notes taken during the focus group, and original data transcripts in Arabic and English.

3. Results

Of the 18 children recruited, only 12 attended the "Little Doctor" course, 12 of which completed the simulation scenarios and 10 focus groups. The children's ages ranged 8–11 years old. The follow-up focus group was conducted one month after the first focus group, wherein six children attended. The research team analyzed the focus group transcripts and found 19 initial codes in the first three focus groups; after analyzing the follow-up focus group's transcripts, they were modified to 17 codes. The coding tree method was used to map the codes and their relationships (**Figure 4**). **Table 1** shows the number of participants contributing to the coding.

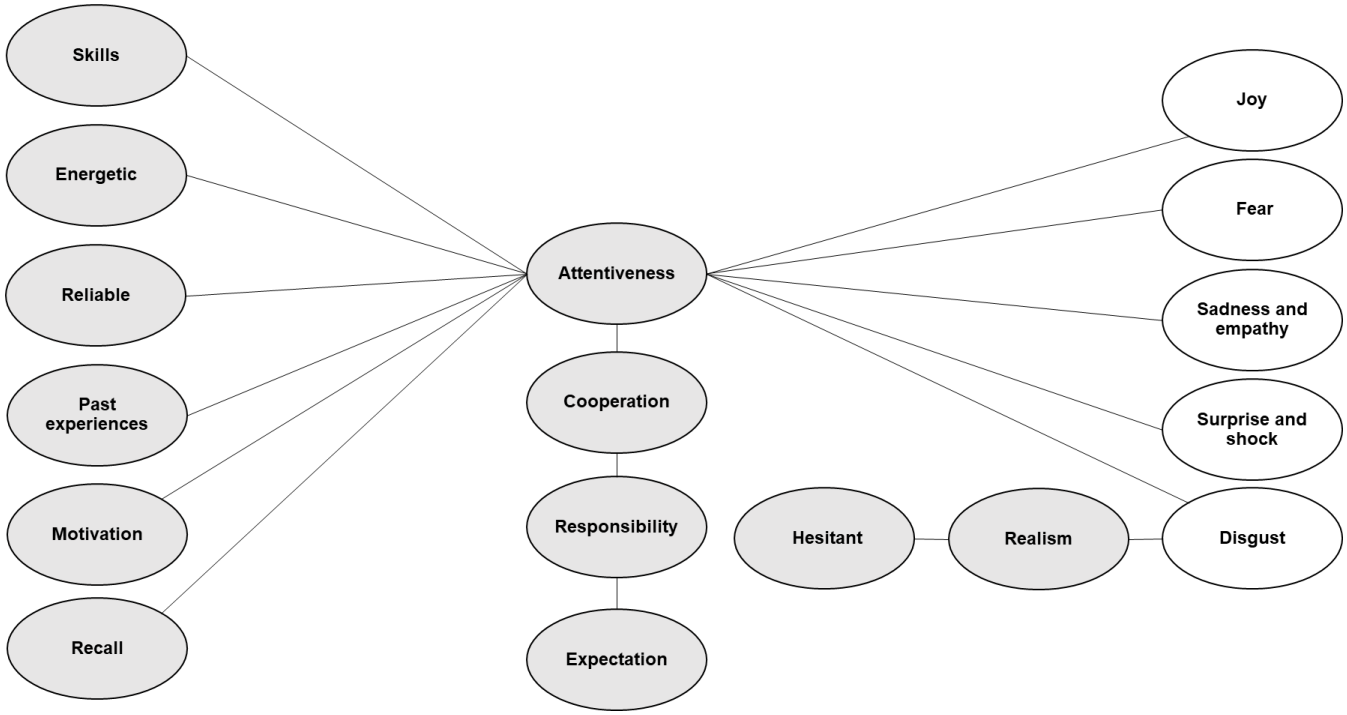


Figure 4. Coding tree.

*Grey bubble = behavior; white bubble = emotion.

Table 1. Grouping of final codes.

	Code	*n* of participants contributing (*N* = 10)
Behavior	Attentiveness	8
	Cooperation	6
	Responsibility	8
	Expectation	6
	Realism	8
	Hesitant	9
	Skills	7
	Energetic	10
	Reliable	10
	Past experiences	6
	Motivation	5
	Recall	10

Table 1. (*Continued*).

	Code	*n* of participants contributing (*N* = 10)
Emotion	**Joy**	**8**
	Fear	3
	Sadness and empathy	5
	Surprised and shock	4
	Disgust	2

We have found a major theme derived from the focus group transcripts, which was the simulation experience's effect. We have divided the major theme into two major themes, specifically, emotion caused by—and behavioral response to—the simulation. **Figure 5** presents the themes and subthemes derived from qualitative analysis.

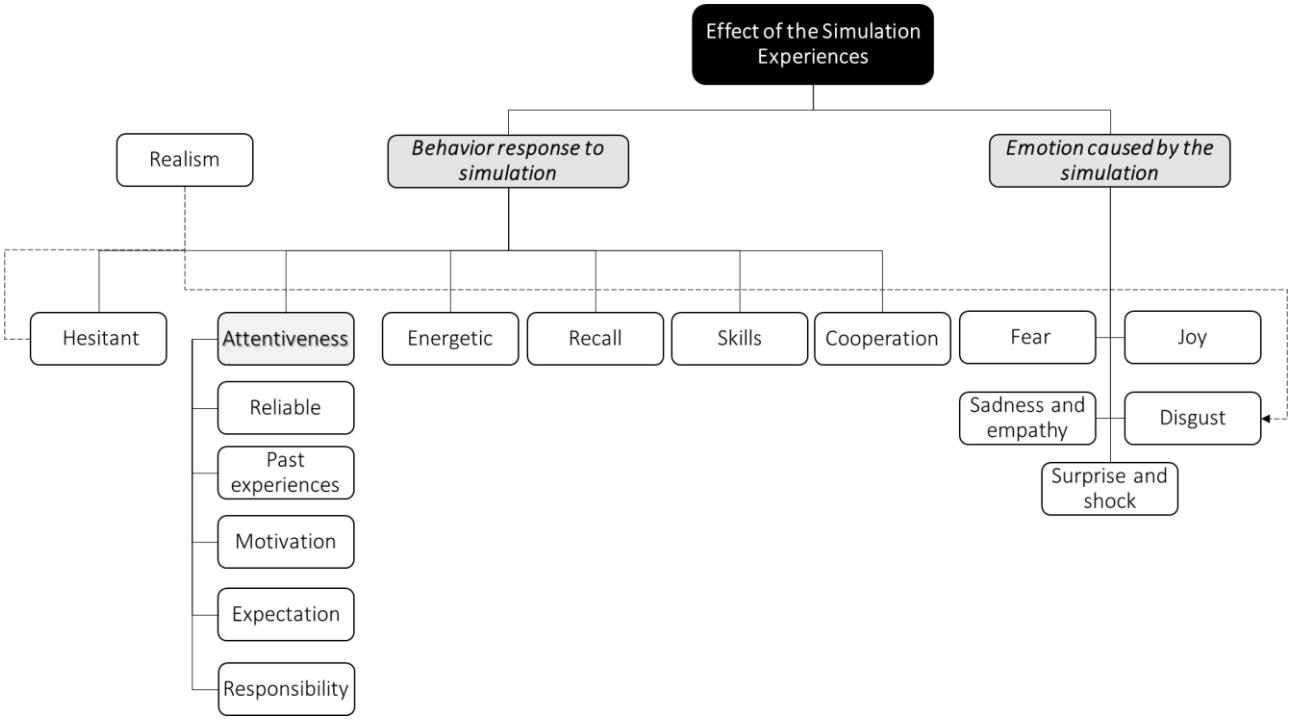


Figure 5. Themes and sub-themes derived from qualitative analysis.
Black rectangle = major theme; grey rectangle = minor theme; white rectangle = codes.

3.1. Major theme: Effect of the simulation experience

The major theme derived from the data was the simulation experience's effect; we have found that the participants reported the effect of simulation on them on two different levels: the first was their emotions, and the second was their behavioral response to the simulation. **Table 2** summarizes the emergent themes and subthemes.

Table 2. Summary of the emergent themes, subthemes, and examples of participant statements.

Theme	Sub-theme	Statement
Effect of the simulation experience	Emotion Caused by the Simulation	"…I first felt happy because I did know what to do and did not need to be nervous..."
		"…The baby is sick and choked on something...".
		"….sad that the person got hurt."
		"…Secondly, I felt surprised because of how big the cut was."
		"I chose disgust…because he was on the ground, and he looked real."
		"…because when I saw him (the manikin) injured, I was shocked."
	Behavior Response to Simulation	"…Because we did it, he is not hurt anymore.…."
		"…I took a course, and the teacher said maybe tomorrow you can help someone".
		"We had to help… If the baby does not spit it, then we call 911."
		"I have to help… Because he was on the ground, we needed to help him on the ground... Because we did it, it does not hurt him anymore."
		"…I have to help people; I can help people."

3.1.1. Sub-theme 1: Emotion caused by the simulation

The emotions caused by the simulation scenario theme were derived based on the feelings reported by the participants related to how they felt regarding the simulation scenario. The initial analysis revealed themes of emotions toward the simulation, including shock and surprise toward the environment of the simulation event and the victim.

Participants in the simulation scenarios reported mixed emotional responses. One emotion felt by the participants was the sadness experienced by the victim in the scenario (manikin), surprise because of the situation, and fear of the victims that they would help. Some children expressed sadness toward the victims, but most expressed happiness because they could help them.

- Participant 3: "Sad because the baby drowned.", "his sister will come looking for him and she will find him drowned".
- Participant 4: "…because when I saw him (the manikin) injured, I was shocked." "… The baby is sick and choked on something...".

Other emotions felt by the participants were joy because of their ability to help the victim and their interest in applying the skills that they had learned during the course's hands-on training component. Moreover, participants felt a sense of achievement in completing the simulation scenarios.

- Participant 6: "…I took a course, and the teacher said maybe tomorrow you can help someone". "…I have to help people; I can help people."
- Participant 7: "Happy. Because we did it, and it doesn't hurt him anymore."
- Participant 8: "…I first felt happy because I did know what to do and did not need to be nervous..." "…Because we did it, he is not hurt anymore.…."

The latter statement above was reported when participants were asked what they felt during the bleeding scenario. Another emotion reported by a participant was disgust. This emotion was conveyed by the group that attended the bleeding management scenario, wherein the manikin was shown to have a cut and was slightly bleeding.

- Participant 7: "I chose disgust…because he was on the ground, and he looked real."
- Participant 8: "…Secondly, I felt surprised because of how big the cut was."

- Participant 8: "I have to help… Because he was on the ground, we needed to help him on the ground... Because we did it, it does not hurt him anymore."
- Participant 6: "We had to help… If the baby does not spit it, then we call 911."
- The participant responded as above when asked about the choking scenario.

3.1.2. Sub-theme 2: Behavior response to simulation

The behaviors expressed during the simulation scenarios ranged from skill application, empathy, and recall to awareness and teamwork. The participants reported that they had recalled certain information and applied the skills that they had learned and practiced during training in the simulation scenarios.

- Participant 6 speaks about choking management in infants: (shows how he is doing the rescue operation) "The first thing I do is hold her face and turn it like this. (Shows how to do back pats). One, two, three, four, five. Then we make her fall and put two fingers one, two, three, four, five…"
- Answering a question regarding the CPR scenario, Participant 3 said: "…we learned that for adults we do (shows how he is doing CPR with his two hands) … And for kids (made the same previous hand gestures) and for babies (shows how he is doing CPR with two fingers) …first we check if he is breathing or not?"
- Participant 4: "First thing, like he said, we raise his leg, then put on the bandage, then we check the person's condition; if he's breathing, then he's fine. But if he faints, we have to call an ambulance."

Further, they were aware of the urgency of the situation during the simulation scenario and worked as a team to address it.

- Participant 5: "food got stuck in his throat. …first we check if he's breathing or not?"
- Participant 7: "If I had a bandage, I would use it, but if I do not, then we would stop the bleeding and ensure the person is conscious; if his breathing was normal, it is good, but if his breathing was not normal, then that is a problem, we must call the ambulance..."
- Participant 8: "Someone holds the leg; I put pressure on it while she wears her gloves and gets the gauze…. We did not coordinate what we were doing; we just did it."

The participants also reported on managing the bleeding scenario.

- Participant 4: "When we did the wound injury, when someone was playing football and he fell on his legs I remember this part."
- Participant 8: "Someone holds the leg, I put pressure on it, while she wears her gloves and gets the gauze."

Moreover, the participants reported that because of their past experiences, they felt empathy for the victim and recalled certain information related to the scenario that they had not learned during the course.

- Participant 1: "My brother he was one years old and he had swallowed something small... My mother and sister helped him."
- Participant 3: "…I was riding something like a car. My mom has a carpet in her room, okay, I, I went and fell... I feel sad because the patient will get a needle, and he will become sad…"

- Participant 4: "When we did the wound injury, when someone was playing football and he fell on his legs I remember this part."

Finally, the simulation environment's realism was linked to the two sub-themes. The meaning of environment in this theme is the scenario setup and props used to make the participants feel immersed in the scenario. The environmental setup caused participants to feel sad about the victims. Additionally, some participants felt disgusted by the blood in the bleeding scenario.

- Participant 1: "…because when I saw him (the manikin) injured, I was shocked… The baby is sick and choked on something...".

4. Discussion

This study aimed to examine the emotions of children who participated in educational activities that simulated patients suffering from conditions requiring first aid intervention. The study team conducted focus groups with children who completed a course teaching them how to deal with or apply first aid in the following skills: CPR and choking management in both adults and other patients. The focus groups found that the children experienced different emotions during and after the simulation. The children were surprised by the scene in the simulation environment; moreover, they felt empathy and sadness toward the victim. They were satisfied with their performances and happy they could help the victims. Further, they reported that they could help future victims learn all the skills that they were taught during the course. Some themes emerged from the focus groups related to their behavioral responses to simulation events, including situational awareness linked to their previous experience, which motivated them to perform effectively during the scenario and respond to the course instructors' expectations.

This study's results align with those of previous studies conducted on learners in healthcare specialties that examined their emotions during simulations. Fraser et al. (2012) assessed the emotions of 84 medical students during simulation training and explored the relationship between their cognitive load and performance (Fraser et al., 2012). After the training, the learners were asked to rate their emotional state and cognitive load. The study identified two components of emotions resulting from clustering the components of emotions—specifically, invigoration (pleasant activation) and tranquility (pleasant deactivation). This study found that both components were associated with cognitive load, and that increased tranquility was associated with cognitive load, thus decreasing the likelihood of performing the scenario accurately. According to Fraser et al. (2012), medical students' inexperience in the clinical field might increase their cognitive load. This problem was avoided in the current study, as the children underwent an interactive lecture with a certified BLS instructor having experience in simulation and were exposed to hands-on training and role-playing before participating in the simulation scenarios (Fraser et al., 2012).

Another recent qualitative study explored a similar aim (Anine et al., 2022): Interviews were conducted to explore students' experiences of emotions during SBE when it was performed as part of a formal curriculum in usual educational settings. The study found that students experienced co-existing and changing emotions during the shifting academic scenes in the simulations. During the briefing, scenario, and

debriefing sessions, the students experienced coexisting pleasant and unpleasant emotions. Unpleasant emotions decreased during the simulation (Anine et al., 2022). Keskitalo and Ruokamo (2020) studied the emotional experiences of 238 participants before and after simulation-based teaching and learning activities using pre- and post-questionnaires. The simulation experience resulted in positive emotions for most participants, whereas negative emotions decreased slightly during the course (Keskitalo and Ruokamo, 2020).

Both studies' findings were similar to what was expressed by the children in this study; however, the negative emotions that the children reported were primarily related to their feelings of empathy and sadness pertaining to the victim, which leads us to believe that the children had little problem suspending disbelief and performing the learned skills to help the victim and were fully immersed in the scenario.

This study reveals that SBE—as a technique—can be applied and taught to children aged 8 to 11 years old. It demonstrates that the children were able to achieve the scenario objectives and felt that they could apply those skills in real life. This is the main aim of simulation—providing confidence to the learners to use the skills that they learn in simulation. Another conclusion is that simulation scenarios can be applied to children in that age group without causing stress to the children because it was presented to them like a game. Here, simulation orientation and safety principles are used to help the children understand that this simulation experience is not real and is done for training purposes only. Further, the availability of instructors who are trained and certified simulation educators during the scenarios conduction and debriefing helped the children feel at ease and made them comfortable to share their feelings, what they did effectively, and what they could improve in the future. Finally, this type of training might be effective in training children and preparing them for future emergencies that they might encounter in real life. Future research is recommended to explore better the modified "Little Doctor" course long-term effects in skills training among children and the effect of such training on different age groups.

Limitations

The study was limited by the small sample of children and the composition of those who participated in the course due to dropping out or not completing the simulation scenarios. It should be noted that not screening the participants for psychological issues during recruitment may have influenced the study results. Furthermore, it's worth mentioning that due to the study's nature, only children affiliated with the university employees were selected to participate. This might have introduced certain biases related to the higher education of the parents and potentially greater health literacy of the children. Further, the scenarios were not piloted before the study. While this is not a limitation, it is preferable to pilot scenarios among a specific target group, such as a group of learners.

5. Conclusions

This study aimed to minimize the effect of applying simulation-based first-aid training courses on children. The study found that applying this course among children was a success, and the simulation scenarios were successfully implemented course.

The simulation scenarios impacted the children's emotions, which were a mix of negative emotions (sadness, shock, fear, disgust) and positive emotions (joy and empathy). Although the participants reported mixed feelings toward the experience, they also exhibited confidence in their real-life skills. The study showed that training using simulation scenarios resulted in the participants' reporting improved confidence in their skills. Further, they stated that their awareness of the situation might be attributable to past experiences that motivated them to perform effectively during the simulation. Further research is recommended to include a larger sample to explore the performance of children from different age groups and quantify their performance levels during simulation events.

Supplementary materials: Supplementary material shows the focus group protocol.

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