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## Research Article

# Enhancing Cardiac Arrest Skills: Exploring Student Nurses' Journey through Mental Simulation to Self-efficacy

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## Abstract

**Objective:** This study explores mental simulation (MS) as a potential tool for enhancing skill acquisition and readiness among student nurses in life-saving procedures, particularly in high-stress, time-sensitive situations like cardiac arrest. It aims to investigate the impact of MS on learning life support skills and creating self-efficacious students in nursing education.

**Methods:** The study combines a theoretical framework grounded in social constructionism with qualitative research methods. We utilize a qualitative reflexive thematic analysis approach. Eleven pre-registration student nurses participated in interview-based investigations after engaging in a 4-week MS program. Data collection utilized open-ended questions, allowing participants to express their experiences and perceptions regarding MS for life support skill acquisition.

**Results:** The research identified six key themes and sub-themes: “Motivation to learn”, “emulating reality”, “emulating real-world intensity”, “emotional resonance”, “harmonizing reflective practice”, and “empowering confidence”. Participants reported using MS to address self-efficacy challenges, creating vivid simulated experiences, inducing real-world intensity, personalizing visualizations, fostering reflective practice, enhancing team understanding, and demystifying cardiac arrest skills, ultimately empowering confidence in employing their cardiac arrest skills.

**Conclusion:** The findings underscore MS's potential as a valuable training tool in nursing education. MS not only bridges knowledge gaps but also prepares student nurses for real-life scenarios, demystifying cardiac arrests and enhancing self-efficacy. The study advocates for the integration of MS alongside traditional training methods to enhance preparedness and confidence among student nurses in critical life support situations. Further research could explore the broader implications of MS across various healthcare contexts.

**Keywords:** cardiac arrest, cognitive simulation, basic life support, MS, mental imagery, student / trainee student nurse

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## 1 INTRODUCTION

In healthcare, the ability of student nurses (trainee nurses) to proficiently perform life-saving procedures, especially in the high-stress context of cardiac arrest situations, is crucial. This article explores the experiences of student nurses who have utilized mental simulation (MS) for learning cardiac arrest skills outside of the simulation laboratory. MS involves creating vivid mental images of hypothetical events and has shown potential in healthcare education<sup>[1]</sup>. Student nurses often face the stress and anxiety associated with real-life resuscitation efforts<sup>[2]</sup>, and self-efficacy plays a pivotal role in their ability to execute skills with confidence<sup>[3]</sup>. This article seeks to provide qualitative insights into how a period of structured MS is experienced by students to enhance learning, alleviate stress, and boost self-efficacy during cardiac arrest emergencies. We discuss the methods used, the theoretical framework, and key themes that emerged from the study, shedding light on the potential of MS as a valuable training tool in nurse education.

### 1.1 Stress and Anxiety in Cardiac Arrest Situations

MS has potential to play a crucial role in improving skill acquisition and preparedness for emergency situations, especially critical for student nurses who must adeptly perform life-saving procedures during high-stress situations when required. White<sup>[4]</sup> defines life support proficiency as: *"The technical and non-technical knowledge, skills, and attitudes required to participate as a team member in providing life-saving measures in a cardiac arrest"*.

Cardiac arrest's unique nature induces stress, while the responsibility of performing real-world life support can evoke anxiety in students due to its critical, time-sensitive nature<sup>[5]</sup>. Healthcare practitioners often feel the weight of this responsibility, as confirmed by studies utilizing biochemical markers and self-reporting<sup>[6,7]</sup>. These heightened arousal states detrimentally impact performance<sup>[8]</sup>, potentially compromising the delivery of effective life-support skills<sup>[9]</sup>. Thus, considering stress and anxiety is paramount when discussing life support performance.

Hunziker et al.<sup>[2]</sup> emphasize the pronounced stress associated with real-world life support and its crucial role in performance assessment. They further argue that the act of delivering life support skills can induce stress, potentially leading to lapses in attention and increased distractibility.

This, in turn, could potentially result in misjudged priorities and delays in life support skill execution, perpetuating a cycle of mental stress. The decline in task focus is a consequence of compromised attention and recall, resulting in cognitive overload<sup>[10]</sup> and diverting attention from the immediate task at hand.

### 1.2 The Role of Self-efficacy in Life Support Skills

Even seasoned student nurses may find applying their knowledge and skills challenging without confidence in their abilities<sup>[11]</sup>. Self-efficacy holds paramount importance for student nurses, influencing their belief in performing life-saving skills effectively, particularly under pressure<sup>[12,13]</sup>. Studies establish a link between self-efficacy and the delivery of psychomotor skills in life support. Some student nurses may lack confidence in executing life support skills during emergencies<sup>[14]</sup>. Bandura<sup>[3,15]</sup> defines self-efficacy as the belief in one's capacity to perform specific tasks across different circumstances, predicting behaviour. Turner et al.<sup>[13]</sup> argue that it is not enough for student nurses to have the "knowledge" (know), "skills" (able to), and "attitude" (prepared to). They also need to believe in their ability (dare to) to perform high-quality cardiopulmonary resuscitation (CPR) and life-support under pressure, highlighting the significance of factoring in self-efficacy when teaching aspiring nurses.

### 1.3 What Is MS?

MS is akin to cognitive visualization, and involves mental replication of actions without physical movement<sup>[1]</sup>. This process constructs vivid mental images, encompassing visual, emotional, and kinaesthetic elements<sup>[16,17]</sup>. Often referred to as "imagery", "mental imagery", or "motor imagery", MS enables nurses to vividly explore hypothetical scenarios<sup>[18-21]</sup>.

MS forms stored representations that influence real-world activities<sup>[22]</sup>. The theory of "functional equivalence" proposes a direct link between simulated mental experiences and subsequent performance<sup>[23]</sup>, engaging neural networks overlapping with cognitive functions<sup>[24]</sup>. Neuroimaging studies show parallels between mentally simulated and physically executed actions<sup>[25,26]</sup>, signifying MS's potential in improving real-world performance.

Extensively effective in sports, exercise sciences<sup>[27,28]</sup>, and surgical skill enhancement<sup>[29]</sup>, MS aids skill acquisition. Though enhanced with physical training<sup>[30-33]</sup>, MS alone

facilitates skill acquisition by generating motor plans<sup>[33]</sup>.

In nursing education, MS complements physical simulation, addressing the dearth of purposeful practice opportunities beyond structured environments. Positioned as a complementary tool, MS compensates for the lack of practice available outside physical simulation laboratory.

#### 1.4 MS and Life Support Training in Nursing

A recent study by Fountouki et al.<sup>[34]</sup> investigated CPR skill enhancement through MS. In a comparative control study involving fifty-two nursing assistant students, the MS intervention group exhibited fewer mistakes compared to the control group (instructional video). The study found a mean of 4.2 CPR mistakes in the MS group versus 5.5 in the control, all statistically significant ( $P < 0.05$ ). Additionally, post-intervention training completion was quicker in the intervention group [6.3min (95% CI = 5.6-6.8min)] compared to the control [8.5min (95% CI = 7.7-9.2min)], also statistically significant ( $P < 0.05$ ). Despite these significant outcomes, the study lacked effect sizes, making it challenging to determine the magnitude of these differences. While these results are promising for MS in life support skill acquisition, the study did not delve into the specific nuances underlying the observed performance enhancement.

#### 1.5 MS, Stress, Anxiety, and Self-efficacy in Nursing

MS shows promise in reducing anxiety and enhancing self-efficacy linked to skill delivery. However, studies on stress levels and MS yield contradictory findings. Ignacio et al.<sup>[35,36]</sup> conducted two studies, observing that both physical and MS positively impacted performance. The 2016 study demonstrated significant performance improvement after MS but failed to show statistically significant reductions in stress levels due to a methodological flaw - lacking a control group for comparison.

Similarly, Saeidikia et al.<sup>[37]</sup> performed a randomized control trial with nursing and midwifery students, finding no statistically significant difference in self-efficacy between MS and physical practice groups. This suggests MS could serve as another form of mastery experience in enhancing self-efficacy<sup>[15]</sup>, however, more research is required.

Quantitative evidence from nursing and sports sciences supports MS's ability to improve skill acquisition, while limited evidence suggests its potential to reduce stress and enhance self-efficacy. However, its impact on anxiety reduction remains understudied. Addressing this gap, this qualitative research seeks to explore perspectives of student nurses using MS for life-support skill acquisition.

## 2 METHODS

### 2.1 Theoretical Framework

The application of social constructionist theory<sup>[38]</sup> enriched our comprehension of the experiences of pre-

registration student nurses in relation to cardiac arrest and MS. In the social constructionist perspective, meaning is not something stumbled upon but actively formed - rather than discovering it, the participants and researcher engage in the active construction of meaning. Crotty<sup>[39]</sup> emphasizes that the significance we attribute to our world is a product of collective construction through social interactions, relationships, and cultural influences.

As Gergen<sup>[40,41]</sup> postulates, our vocabularies, assumptions, and worldview emerge from these interplays, shaping our perspectives. This interplay constitutes a pivotal element within research design. This theoretical perspective informed the interview-based investigation into MS within nursing education, unveiling the way participants' encounters unfolded.

### 2.2 Ethical Considerations

The ethical procedures within the study align with the Declaration of Helsinki<sup>[42]</sup> and British Educational Research Association (BERA). The ethical framework designed for this study was primarily based on Sheffield Hallam University Research Ethics Committee (UREC) policies. The UREC is based on the principles of respect for the person, knowledge, democratic values, the quality of educational research and academic freedom<sup>[43]</sup>. These BERA guidelines on which this study is based incorporate voluntary participation, openness and disclosure, the right to withdraw, the right to privacy and full disclosure. Specifically, the research received approval from the UREC. Participants were duly informed about the study's objectives and their voluntary participation rights, including the option to withdraw, and written consent was acquired from all participants. Moreover, a meticulous risk assessment was conducted to address potential psychological impacts stemming from discussions on cardiac arrest, with measures in place to ensure the psychological well-being of participants. Throughout the study, pseudonyms were consistently used to maintain confidentiality.

### 2.3 MS Script (Phase 1)

Phase 1 of our study focused on crafting a MS protocol rooted in the esteemed physical, environmental, task, timing, learning, emotion, and perspective (PETTLEP) framework, renowned for its efficacy in sports<sup>[44]</sup>. PETTLEP amplifies the potency of mental imagery and simulation across diverse domains<sup>[45]</sup>. Our protocol, comprised of six crucial elements detailed in Table 1, aimed to heighten image vividness and emulate real-life experiences for participants.

At the core of our protocol lay a carefully developed script. An audio script, divided into basic and advanced tiers, formed its foundation. While the basic script focused on CPR fundamentals, the advanced version delved into intricacies of advanced life support. The protocol can be found here: <https://shura.shu.ac.uk/30491/>

**Table 1. Overview of Mental Simulation Protocol**

Mental Simulation Protocol (Based on PETTLEP)	Description
Instructions for use	Provides an overview of the protocol's utilization, outlining step-by-step guidance on its application and usage.
Basic and advanced audio scripts	Two distinct audio scripts are provided. The basic script focuses on visualizing chest compressions, while the advanced script engages the cardiac arrest team's arrival and subsequent actions.
First-person film of cardiac arrest scenario	A recorded scenario depicting a cardiac arrest from a first-person perspective, offering an immersive experience for learners and helping them visualize the scenario.
Basic and advanced life support algorithms	Algorithmic frameworks illustrating both basic and advanced life support procedures, aiding students' comprehension and practical application.
Glossary of terms	A comprehensive glossary defining technical terminology used in the audio scripts, aiding students in understanding specialized language.
Patient handover script	A script designed to facilitate the visualization of the patient's background, fostering emotional relevance within the scenario for enhanced learning.

Crafting the script involved a thorough process to ensure precision. An expert colleague, well-versed in advanced life support, reviewed the script for content accuracy. Segmentation of the script into manageable sections ensued, with a dedicated colleague assuming the role of the voice actor. The audio-visual team enriched these recordings with immersive sound effects.

For participant access, the scripts were hosted on Google Drive. In line with the PETTLEP framework, a point-of-view (POV) film was recorded in a simulation laboratory using a GoPro™ camera. Research by Schuster et al.<sup>[46]</sup> highlighted the effectiveness of a first-person perspective integrated with kinaesthetic factors for optimal behavioral results. Our film aimed to create an immersive experience blurring the lines between reality and MS<sup>[47]</sup>, offering students a chance to transcend their limited personal experiences.

The film's production involved collaboration among colleagues, spanning filming, editing, and production phases. Clear instructions accompanied the MS protocol, along with a glossary to aid comprehension of technical jargon. A mock patient case set the stage as a pre-brief for the scenario.

Participants had the flexibility to switch between basic and advanced scripts as they deemed fit, with a cautionary guideline to limit basic script usage within two weeks to avert familiarity and potential attention lapses. Access to additional resources like the POV film was granted to enrich mental imagery vividness. Validation of the script or wider protocol wasn't necessary due to the qualitative nature of our study.

Engagement in MS sessions for 10-15min, thrice a week, was encouraged. While watching the POV film at least once was recommended, participants were free to view it as frequently as desired. Transitioning from the basic to advanced script was at the participants' discretion, outlined within the protocol guidelines.

## 2.4 Study Design: Qualitative Research (Phase 2)

The primary investigator, NW, conducted both data collection and analysis for this inductive qualitative reflexive thematic analysis (QRTA) interview study. This exploration delves into participants' experiences after engaging with MS across a 4-week period. QRTA, which integrates reflexivity as a core aspect<sup>[48,49]</sup>, acknowledges the subjective nature of interpretations in research<sup>[40]</sup>. It involves recognizing the interconnection between the researcher and the research process<sup>[50]</sup>, ensuring transparency<sup>[51]</sup>. The resultant themes in QRTA stem from the researcher's theoretical inclinations, methodological stance, worldview, research inquiries, and the data<sup>[52]</sup>.

This study refrains from adopting a singular theoretical framework to interpret the gathered data, as the complexity of the data cannot be encapsulated within a single theory. Following Dean's perspective<sup>[53]</sup>, the study avoids narrowing its focus when attempting to explain findings through a specific theory. While elements of the MS theory contribute to interpreting certain findings, the study also draws insights from beyond the MS research literature. The chosen methodology was shaped to best address the research question, adopting a pragmatic approach tailored to the study's needs - a bricolage method<sup>[54]</sup> employing available tools not initially designed for this specific purpose.

This qualitative study delves into the use of MS among student nurses to bolster learning, alleviate stress, and enhance self-efficacy amid cardiac arrest emergencies. culminating in the research question: "*What perceptions do pre-registration student nurses hold regarding the utilization of MS for acquiring experience in cardiac arrest and life support?*".

## 2.5 Data Collection

Eleven student nurses were enrolled on to the research program. Flyers were circulated during induction sessions among individuals pursuing Bachelor of Science or



master's programs in the adult field. Open-ended questions covered various aspects of the participants' MS experience, including their overall impressions, the impact on learning life support skills, and the aspects of the script influencing imagery vividness. Follow-up and probing questions were utilized as needed. Recruitment and interviews continued until data saturation was reached, as determined by the authors. Each interview spanned 1-2h, allowing time for building rapport.

## 2.6 Data Analysis

An inductive social-constructionist, QRTA was employed to code and theme the data<sup>[48,52]</sup>. QRTA was a method for identifying and analyzing patterns within the data, aiming to create a narrative that addressed the research question. This method helped organize the dataset and find patterned responses by identifying common threads<sup>[55]</sup>. QRTA focused on what was said rather than how it was said and was compatible with a social constructionist paradigm, considering experience and meaning as socially produced through conversation.

The study followed Braun and Clarke's 6-stage process<sup>[52]</sup>, including familiarization, initial coding, searching for themes, reviewing themes, defining, and naming themes, and writing the report. Familiarization involved transcribing audio recordings into written transcripts and creating memos to note initial thoughts about the data. A method of coding known as eclectic coding was applied, involving the use of diverse and varied code types to categorize the data<sup>[56]</sup>. For instance, codes such as "learner adaptation", "stress reduction", and "script influence" were employed to represent different aspects of the participants' responses. From these codes, candidate themes were then constructed. Themes were confirmed when they had a central organizing concept and provided a succinct element to answer the research question<sup>[52]</sup>. The transcripts were reanalyzed to ensure narrative alignment with the data. Please see Table 2, which is a 15-point checkpoint criteria for good thematic analysis.

## 3 RESULTS

The study revealed six key themes and sub-themes highlighting the effectiveness of MS in life support training. Each theme and sub-theme were defined as per the six stage approach to thematic analysis<sup>[48]</sup> (see Table 3 for theme definitions). Participants used MS to tackle self-efficacy challenges and address anxiety, boosting confidence in handling emergencies. Detailed narration and cues created vivid simulated experiences, resonating with participants, and enhancing training authenticity. Personalized visualizations accommodated diverse learning styles. MS evoked real-world intensity, mirroring cardiac arrest scenarios and fostering reflective practice, reducing anxiety, and enhancing confidence among student nurses. These findings underscore MS's potential as a valuable

training tool, bridging knowledge gaps and preparing for real emergencies. Figure 1 presents a thematic map of codes themes and sub-themes. Figure 2 presents a thematic narrative that visually outlines the story, linking themes, sub-themes. Further sections delve into participant experiences.

### 3.1 Theme: Motivation to Learn

One major motivating factor for participants was the need to overcome a lack of self-efficacy, which had previously led to feelings of anxiety regarding their ability to perform life support measures. John alluded to this when he said, *"I think it would mean that when that did happen to you, you would think it's okay that this is happening. It will go in a second. I think it was good rather than... if you had never heard that I don't know what to do and then you were in a situation, and you didn't know what to do, you would panic and think, 'Oh god, I'm the only one that doesn't know what I'm doing' or 'Why don't I know what I'm doing?'. But hearing someone say actually that happens to all of us is useful"*.

Wendy also described her motivation to improve performance by addressing troubling feelings and avoiding the embarrassment of performing poorly in front of her team, saying, *"I don't know, I think it was just the anxiety thing, it was like... because seeing it is really exciting, and they're like, 'Right, you're doing it now'. You almost feel... you know, it's the first time you're going to do it. It's in front of a group of people who've... the only person I knew was one of the student nurses I'd worked with the day before. So, it's that... it's almost like stage fright, I suppose. 'I've got to perform in front of all these people'. And it's like you don't want to mess it up. You don't want to be, like, 'Their compressions are crap, get off', you know"*.

The study identified that participants were significantly motivated to engage in MS to address self-efficacy challenges related to life support training. The data analysis yielded valuable insights into the presence of low self-efficacy feelings, potentially influencing their reluctance to approach life support situations when necessary. However, these very feelings of low self-efficacy acted as a motivating factor, compelling them to actively engage in personal MS exercises.

### 3.2 Sub-theme: Emulating Reality: Creating Vivid Simulated Experiences

The MS produced a vivid simulated experience, characterized by its ability to generate vivid mental images with clarity and realism. This was achieved through the use of detailed narration and cues that tapped into personal experiences, encompassing real-world, simulated, or audio-visual elements. Participants found the script relatable and authentic, mirroring real-life scenarios. Jack expressed his appreciation for the script's detail, stating, *"You will hear a*

**Table 2. 15-point Checkpoint Criteria for Good Thematic Analysis<sup>[52]</sup>**

Criteria	Criteria and How the Author (NW) Met Said Criteria
1 The data have been transcribed to an appropriate level of detail, and the transcripts have been checked against the tapes for “accuracy”.	The data underwent professional transcription by a third party. Nonetheless, a thorough accuracy check was conducted, ensuring the transcription captured an appropriate level of detail.
2 Each data item has been given equal attention in the coding process.	Initially, equal attention was devoted to each segment of the data during the coding process. Simultaneously, annotation notes (memos) were generated alongside the coding process.
3 Themes have not been generated from a few vivid examples (an anecdotal approach) but, instead, the coding process has been thorough, inclusive, and comprehensive.	At this stage, the formation of themes was deferred. An open-minded approach was maintained throughout the coding process, allowing for flexibility and exploration without preconceived thematic structures.
4 All relevant extracts for all each theme have been collated.	All pertinent extracts linked to relevant themes were extracted.
5 Themes have been checked against each other and back to the original data set.	Candidate themes were initially cross-checked both among themselves and against the original dataset for validation.
6 Themes are internally coherent, consistent, and distinctive.	The generated themes demonstrated internal coherence, consistency, and distinctiveness, with overlapping boundaries conducive to constructing a narrative during the writing phase.
7 Data have been analyzed rather than just paraphrased or described.	Moving beyond mere paraphrasing, the author ventured into interpreting the data - a challenging yet rewarding phase of the process. The author engaged themselves in questioning, aiming to uncover the true intent behind the participant’s statements, which significantly deepened the analytical journey.
8 Analysis and data match each other - the extracts illustrate the analytic claims.	There was a moment where the alignment between the analysis and the data was questioned. Specifically, an examination was conducted to verify if the extracted excerpts correlated with the initial claims proposed.
9 Analysis tells a convincing and well-organized story about the data and topic.	The analysis gradually began to weave a compelling narrative. However, the complete narrative didn’t emerge until after a substantial amount of writing about the data, marking the third iteration of the findings.
10 A good balance between analytic narrative and illustrative extracts is provided.	The quest for a balanced integration between extracted data and interpretative analysis was ongoing, spanning across multiple versions of the analysis.
11 Enough time has been allocated to complete all phases of the analysis adequately, without rushing a phase or giving it a once-over-lightly.	A considerable amount of time was allocated to this process, surpassing initial estimations for completion.
12 The assumptions about ThA are clearly explicated.	The methodology section distinctly outlined the assumptions, elucidating the flexibility of thematic analysis and delineating its underlying methodological assumptions.
13 There is a good fit between what you claim you do, and what you show you have done.	The methods employed were distinctly articulated.
14 The language and concepts used in the report are consistent with the epistemological position of the analysis.	The language employed throughout the article aligns consistently with the author’s social constructionist epistemological standpoint.
15 The researcher is positioned as active in the research process; themes do not just “emerge”.	The article explicitly clarifies that themes do not simply emerge, emphasizing the author’s active involvement in the research process consistently portrayed throughout the text.

*lot of little noises but at the same time, when you compare the script to real life - it was real! The person who was doing the CPR in the script had no idea what was actually happening... especially at the beginning. It felt like that when I was doing it. I had no idea what anyone was saying to me”.*

John also noted the script’s ability to induce a sense of reality, saying, “*The first time I undertook MS, it felt stressful and real, and I felt on edge listening to it the first*

*time... felt frantic and that there was a lot going on, but that was good because that is what real CPR is like, so it did feel more real”.*

The data highlighted the significance of the audio-guided MS in creating a highly realistic experience for the participants. Their positive responses underscored the MS’s effectiveness in evoking real-life emotions and actions, ultimately contributing to the authenticity of the simulation. This finding strengthened the study’s exploration of the

**Table 3. Theme and Sub-theme Definitions**

Theme / Sub-themes	Definition
"Motivation to learn" (theme)	The theme of "Motivation to learn" emerged, indicating participants' lack of confidence in practicing real-life BLS and life support, which served as a significant motivational factor. These drivers, among others, strongly influenced participants to engage in mental simulations.
"Emulating reality: Creating high-fidelity simulated experiences" (sub-theme)	The sub-theme of "Emulating reality: Creating high-fidelity simulated experiences" highlighted the pivotal role of the audio-guided mental simulation script in crafting a high-fidelity simulated encounter. The script's narrative and cues served as the foundation for this realistic simulation experience.
"Emulating real-world intensity" (theme)	The theme "Emulating real-world intensity" reflected participants' inclination to generate visual imagery prompted by the script's language, although with significant individualization. Participants crafted these mental images drawing from their distinct past experiences and memories, providing learners with a personalized glimpse into real-world scenarios of cardiac arrest.
"Emotional resonance" (sub-theme)	The sub-theme "Emotional resonance" highlighted how the script's narration and accompanying sound effects elicited heightened emotional states, closely resembling the intense sensations experienced during a real-world cardiac arrest.
"Harmonizing reflective practice and enhancing team understanding" (theme)	The theme "Harmonizing reflective practice and enhancing team understanding" showcased how mental simulations facilitated reflective intervals, revealing skill and knowledge deficiencies. This process clarified the structure and dynamics of cardiac arrest scenarios, enabling participants to address and bridge these gaps in both skill and knowledge.
"Empowering confidence through mental simulation in life-support training" (sub-theme)	The sub-theme "Empowering confidence through mental simulation in life-support training" emphasized how mental simulation bolstered participants' self-efficacy in clinical performance, instilling a sense of readiness to tackle real-life life-support scenarios.

benefits of MS in life support training and its potential to prepare students for real-life scenarios more effectively.

### 3.3 Theme: Emulating Real-world Intensity

The narration and sound effects within the MS elicited high-arousal states comparable to real-world cardiac arrest scenarios. Claire expressed, *"It gives me the urgency, the buzzer, everything that is there is what a real scene would be. Therefore, it gives me the image of the real thing, that is what we should do in our practical, they should put everything in because when you hear that buzzer, I think you even first panic before you act but the advanced is giving us the real scene how it should look like, so, I think it's good"*.

Jack also experienced the intense impact of the MS, saying, *"Yes. When you go to the patient. When you hear the... when you go to the patient, and you are just about to assess, the adrenaline rush because I also have very sweaty hands. Therefore, my biggest problem is putting the gloves on in an emergency. That's not going to happen. Cause my hands to go straight into sweating, and there is no way I can do like, simple tasks, to put the gloves on. Therefore, when I watched it for the first time, I felt my hand became straight away sweaty and yes"*.

This theme revealed the MS's effectiveness in evoking intense emotional responses from the participants, similar to those experienced during real cardiac arrest situations. The sense of urgency and heightened arousal indicated MS's ability to create a realistic and immersive experience,

providing valuable training for life support scenarios. This finding highlighted the potential benefits of using audio-guided MS as a powerful and impactful training tool for student nurses.

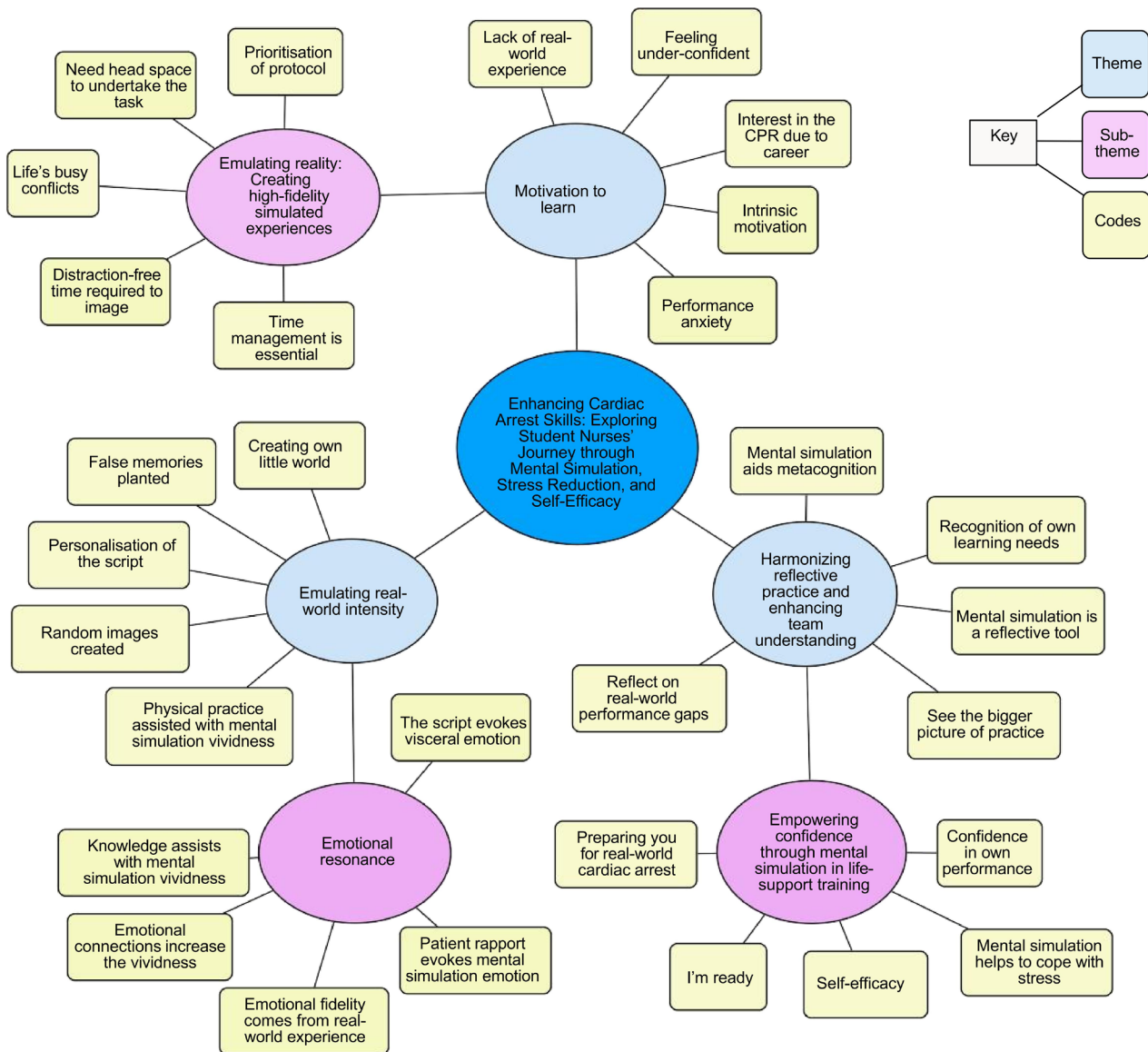
### 3.4 Sub-theme: Emotional Resonance

The data indicated that participants predominantly generated visual images influenced by the language used in MS. However, these mental images were highly personalized, molded by the individual's distinct past experiences and memories. Emerald shared her process, saying, *"Yeah, they were the same on the ward I worked on, the red trolley. Most likely, with the defibrillator a little bit because the defibrillator was different in the two things I was thinking of. It just kind of arrived; I did not think about it getting there. Therefore, maybe I thought about colors and stuff like that and what they actually look like because I never mess around with airways a little bit, we do not truly do a lot with them, so, I was thinking about airways and that kind of thing"*.

Wendy compared the experience to reading a book, expressing, *"Therefore, it is like when you are reading a book you have got your own visualization of what is happening but then somebody else might have a totally different visualization, so, if you put that into a video, like your POV video that you have made would be different from one that I would make"*.

The data emphasized the participants' unique interpretations and personalization of MS. Their individualized





**Figure 1. Thematic map.**

visualizations drew from personal experiences, making the process more meaningful and relevant to each participant. This finding highlighted the potential of MS to cater to individual learning styles and needs, enhancing its effectiveness as a training tool for life support skills.

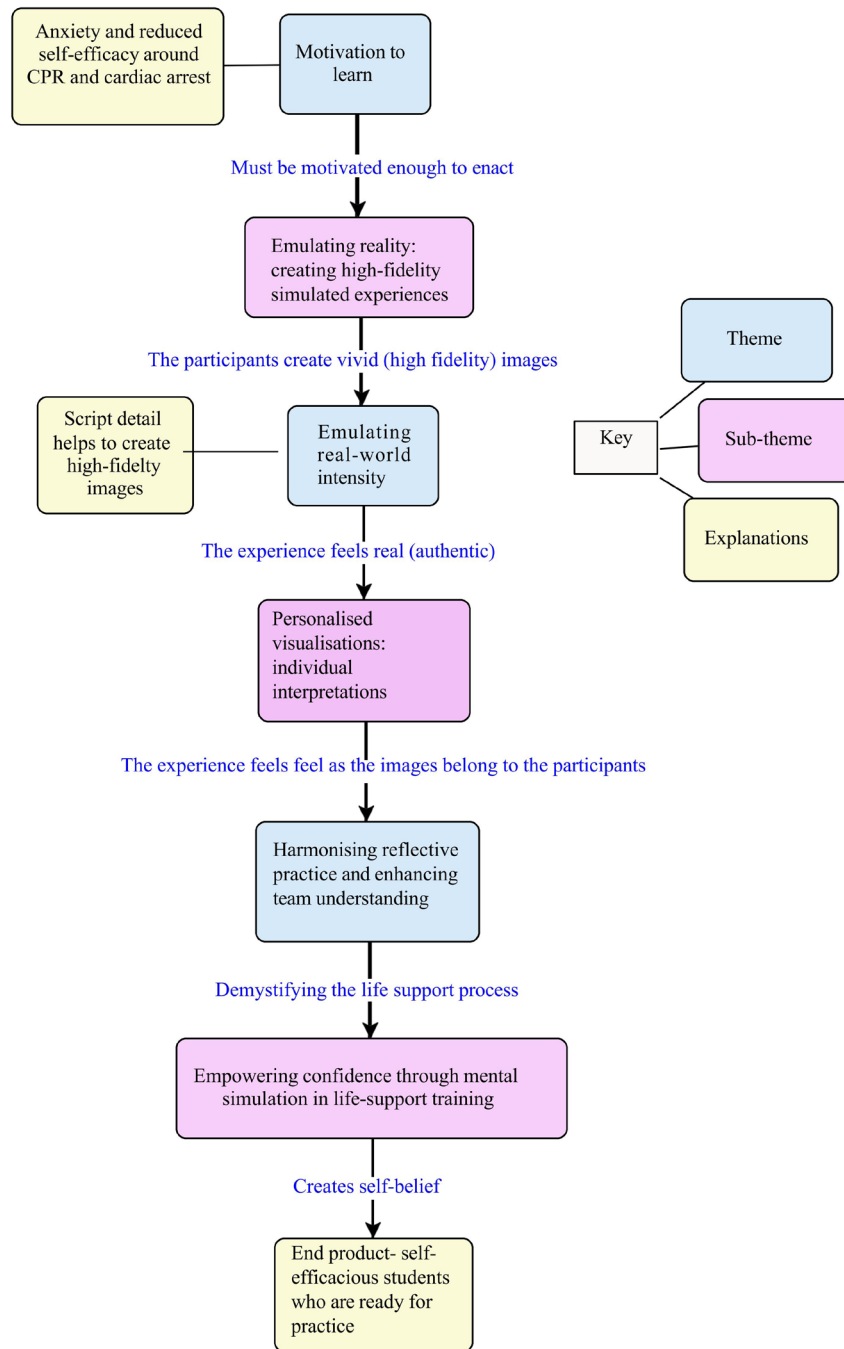
### 3.5 Theme: Harmonizing Reflective Practice and Enhancing Team Understanding

MS facilitated periods of reflective practice, leading to an increased understanding of skill and knowledge gaps related to cardiac arrest procedures. This reflective process helped participants demystify life support and cardiac arrest, filling in knowledge gaps. Amy shared her experience, stating, “Because obviously, when I reflected on myself, and when I was in the CPR situation, my emotions took over me, especially when I had seen it for the first time, so that’s why I just observed for the first time to see what was happening because I didn’t know what to do. Even though I knew what I should have done, it obviously - I just froze. Therefore, MS

helped to provide me with a structure and, as we had talked about before, for my actions to become automated”.

Wendy highlighted how the MS helped her understand and anticipate the actions of other members in the cardiac arrest team, reducing anxiety. She explained, “His was like, ‘Oh yeah, this is happening, and then this person is coming (as part of the cardiac arrest team), and this is gonna happen’, you know - I cannot think of how to describe it. It just made me think of all those - I feel like I would know what everybody else was doing. I think that the stuff that was quite anxiety-inducing for students is, ‘I kinda (sic) know what I’m doing, but I’ve got to fit in with what everybody else is doing’. Therefore, it’s like knowing that prepared me a bit better”.

The theme of harmony revealed the positive impact of MS on reflective practice and the participants’ understanding of cardiac arrest procedures. By addressing skill and knowledge



**Figure 2. Thematic narrative.**

gaps, MS promoted confidence and reduced anxiety in real-life scenarios. The data highlighted the value of MS as a training tool, enabling student nurses to harmoniously work together in high-pressure situations. This finding enhanced the study's exploration of the potential benefits of MS in improving life support performance.

### 3.6 Theme: Empowering Confidence through MS in Life Support Training

MS increased participants' self-efficacy and confidence in their ability to perform life support procedures effectively. They felt well prepared to cope with real-world scenarios. Jack expressed, "Therefore, I felt like I was more confident in doing what I was doing because I had seen - because I

*had heard many times how to check for the pulse, how to check for breathing, bilateral movement, and all of these words stayed in my head, and when I went to do it myself, the same words came into my mind without actually putting much effort into thinking about it, if that makes sense. It had definitely increased. It [MS] gave me more confidence by providing structure, by putting the narrator's voice in my head, which has - that will definitely stay with me. Yeah".*

Claire shared her newfound assurance, stating, "It truly just prepared me. I would never fail! Whatever it is, even if it's a student nurse who falls in front of me, I will do the right thing. Therefore, in practice, in that sense, I am qualified now".

This theme highlighted the positive impact of MS on participants' self-efficacy and confidence in their life support skills. Using MS appeared to demystify life support processes, instilling self-efficacy within the participants. By reinforcing essential procedures and instilling a sense of preparedness, MS empowered student nurses to approach real-life situations with competence and assurance. This finding strengthened the study's exploration of the benefits of MS in building student nurses' confidence and readiness for life-saving interventions.

#### 4 DISCUSSION

The core initial experiences of the participants underscore the necessity for students to embrace motivational learning, enabling them to invest the necessary time and effort in engaging with MS. Nurse educators striving to impact present practices must grasp the integration of MS into students' routines, a focal point outlined within this chapter. During the preliminary phase of preparing for MS, individuals self-motivated as participants established their objectives to improve proficiency in life support skills.

The motivation of participants to engage in MS, as highlighted by the various factors identified, emphasizes the significance of this training approach in student nurse education. Sport-specific research has extensively explored how MS can enhance motivation and cultivate winning mindsets among athletes<sup>[57,58]</sup>. Yet, within healthcare research, there remains a gap concerning how individuals motivate themselves to engage in a MS program. This aspect holds critical significance when introducing a novel self-directed learning technique, such as MS.

The motivation behind engaging in MS often revolves around the stress and anxiety experienced in life support situations. Nurses frequently confront documented challenges concerning stress and anxiety during emergency scenarios<sup>[6,7]</sup>. The overwhelming fear of committing errors or feeling inadequately prepared in critical situations can be profound. Participants were driven by a lack of experience and the anxiety related to performance. Novel or threatening events are known to heighten stress and anxiety levels<sup>[59]</sup>, and cardiac arrests undoubtedly fall within this category<sup>[60]</sup>. Lee and Cha<sup>[61]</sup> describe CPR performance anxiety as common, even among experienced post-registration nurses. They suggest that this anxiety is caused by awareness of the stakes involved. This is a driving factor for participants wanting to improve.

The participants' dedication to MS despite their busy lives emphasizes the value they place on skill enhancement and preparedness for real-world scenarios. This finding resonates with the notion that student nurses recognize the gravity of their responsibilities and actively seek means to improve their abilities<sup>[2]</sup>. Additionally, the appeal of MS to participants without prior cardiac arrest experience

emphasizes its role in offering safe and supportive learning.

As described above, stress can negatively affect performance. Reduced cognitive performance has been empirically linked to the excessive release of stress hormones, corticosteroids and catecholamines that cause arousal<sup>[62,63]</sup>. This also occurred during the MS exercise and appeared to be caused by the task's emotional relevance<sup>[64]</sup>. The emotional relevance meant that the imagery narration in the script held enough propositional content that matched the represented memory concepts - creating vivid images that caused arousal. In some cases this has also been shown to trigger a "somatovisceral response"<sup>[65]</sup>. The autonomic nervous system increases heart rate and endocrine responses<sup>[66]</sup> and this was the case for some participants in this study, for example it resulted in elevated heart rates or sweaty palms. While the script text evoked arousal by creating vivid visual images, there appeared to be an even stronger emotional imagery response to the sound effects embedded within the audio script. The embedded sound effects further created emotional imagery. The embedded sound effects were influential in creating stress exposure<sup>[67]</sup>. The 'industrial sounds' added for such an effect, significantly affecting participants' arousal levels.

The participants' sense of authenticity and immersion appeared to stem from their perception that the MS mirrored professional and clinically relevant real-world practices<sup>[68]</sup>. Authenticity, in this context, resides within the individual's "mind's eye", shaping their perception of reality<sup>[69]</sup>. The evocation of a cardiac arrest within MS aligns with the constraints of reality, contributing to its authenticity. The scripting technique strategically positioned participants within a simulated cardiac arrest team scenario, facilitating this sense of authenticity and this is crucial for potential transfer of skills to practical settings. Participants viewed MS as a representation of their roles as students engaged in real-life life-support scenarios<sup>[68]</sup>.

A fundamental requirement in MS practice is the participants' ability to grasp and comprehend the simulation<sup>[23]</sup>. This comprehension entails imagining scenarios that hold significant relevance<sup>[70]</sup>, striving to create mental images closely resembling real-life situations. Such an approach ensures functional equivalence, a core tenet of the PETTLEP theory underlying the literature review chapter<sup>[23]</sup>. Therefore, the closer the MS experience mirrors reality, the more pivotal it becomes in facilitating effective learning.

As Rushton et al.<sup>[14]</sup> emphasized, student nurses often lack confidence in life support scenarios. Participant responses to MS appeared to serve as an "as-if real" template for rehearsing and adjusting emotional and behavioral reactions to the MS. This imaginal "conquest of fear" led to fear extinction through repetition and desensitization<sup>[71]</sup>,

observed in participants whose emotions waned with repeated exposure. Previous performance strongly relates to self-efficacy<sup>[72]</sup>, granting a sense of successful life support execution. MS can be seen as regulating anticipatory arousal, curbing fear-provoking thoughts and reducing arousal linked to performance concerns<sup>[73]</sup>. MS acted akin to an enactive mastery experience<sup>[3]</sup>, fostering behavioral accomplishments to alleviate fear and bolster self-belief. This led participants to overcome apprehension, cultivating self-efficacy<sup>[71]</sup>. Bandura<sup>[71]</sup> further suggests, such transformation resonates with increased efficacy beliefs for feared tasks which is evident from the data analysis. Participants gained control over potential psychological threats, dispelling perturbing thoughts<sup>[74]</sup>, cultivating a sense of capability.

Reflective practice enabled participants to critically assess their learning process. Through this practice, participants engaged in comparing their current knowledge and performance with their previous levels, drawing on Bandura's concept of self-assessment<sup>[3]</sup>. They self-evaluated and gauged their learning progress against explicit criteria outlined within the protocol. This structured approach effectively closed the gaps in their knowledge and skills, shedding light on the correct procedures.

The protocol provided participants with a holistic view encompassing both technical and non-technical facets of knowledge, skills, and attitudes necessary for effective participation in providing life-saving measures during cardiac arrests. This broader comprehension of life support's intricacies emerges as a distinctive and crucial outcome of MS, encapsulated aptly in the words: "The technical and non-technical knowledge, skills, and attitudes required to participate as a team member in providing life-saving measures in a cardiac arrest"<sup>[4]</sup>.

This deeper understanding of life support knowledge and skills represents a unique and significant contribution resulting from this research. Over time, participants gained clarity in life support practices, fostering self-efficacy in both technical and non-technical skills. MS nurtured a daring attitude<sup>[13]</sup>, instilling confidence in executing required actions. Participants believed in their "exercise of control"<sup>[3]</sup> to function as valued cardiac arrest team members.

This study provides valuable insights into the functioning of MS in this context, addressing gaps in previous quantitative research. MS offers practical applications in simulation education, complementing physical simulation by enabling repeated practice through mental rehearsal. The research's qualitative nature offers an in-depth analysis of student nurses' use of MS, highlighting its unique perspective. However, while participants reported increased self-efficacy, this study offers limited evidence for the transfer of this self-efficacy to practice. This limitation is inherent to the research design, which is appropriate for its

scope and question, but constrains the extent of claims that can be drawn from the study.

Subsequent research should emphasize the exploration of self-efficacy in the context of cardiac arrest. Conducting interviews with individuals who have employed MS and encountered cardiac arrest in clinical practice would offer valuable insights. Further research may be necessary to explore additional factors influencing motivation and the long-term impact of MS on skill retention and application in real-world practice.

## 5 CONCLUSION

This article offers insight into the experiences of student nurses utilizing MS in their education, focusing on enhancing motivation, self-directed learning, and skill acquisition. The use of an audio-guided script creates immersive scenarios mirroring real-life situations, thereby improving adaptability. MS encourages reflective practice, enhances self-described self-efficacy, and further prepares student nurses for delivering life support skills in practice, indicating its significance in training, and advocating its use for further research in this domain.

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## Conflicts of Interest

The authors declared no conflict of interest.

## Author Contribution

White N designed this study and wrote the article; White N and Rumbold J collected the data and performed the data analysis; Garner I revised the papers for important intellectual content. All authors contributed to the manuscript and approved the final version.

## Abbreviation List

CPR, Cardiopulmonary resuscitation

MS, Mental simulation

PETTLEP, Physical, environmental, task, timing, learning, emotion, and perspective

POV, Point-of-view

QRTA, Qualitative reflexive thematic analysis

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