

Article

Health Assessment in the Light of 360° Immersive VR Video Simulation Technologies: A Case Study

Bojan Lazarevic ^{1,*}  and Michael D. Bumbach ² ¹ School of Teaching and Learning, College of Education, University of Florida, Gainesville, FL 32610, USA² Department of Family, Community and Health System Science, College of Nursing, University of Florida, Gainesville, FL 32601, USA; mbumbach@ufl.edu

* Correspondence: blazarevic@ufl.edu; Tel.: +1-845-891-4001

Abstract

This exploratory research investigates the perceived educational potential of visual, spatial, and auditory immersions as integral components of innovative healthcare simulation technologies. The study examines user experiences in learning health assessment concepts through purposefully designed 360° immersive virtual reality video (360° IVRV). Utilizing a case-study approach, insights were gathered from four subject-matter experts and four doctoral students regarding the perceived effectiveness of 360° IVRV for instructional activities focused on patient health assessment, commonly known as the Onset, Location, Duration, Characteristics, Aggravating/Alleviating factors, Related symptoms, Treatment, and Severity method (OLD CARTS). The research aimed to enhance the accessibility of learning materials by optimizing 360° IVRV content for personal phones and mobile devices, accommodating both online and traditional instructional formats. Interviews were transcribed and analyzed using qualitative data analysis software, with results categorized into subthemes, themes, and perspectives. The findings highlight the distinct perceived advantages of immersive technologies in advancing teaching methods for nursing practitioners. The discussion addresses concerns related to integrating 360° IVRV simulation technology in nursing education and the limitations of current instructional interventions. Practical implications for future research, design, and development of immersive learning materials and their integration with instructional design elements are emphasized.

Keywords: health assessment; nursing education; simulation; virtual reality; immersive 360 video; instructional design; emerging learning technologies



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1. Introduction

Instructional advancements in nursing education often rely on utilizing a wide array of emerging learning technologies and multimedia environments. Simulations are among the most notable approaches that require interdisciplinary considerations involving principles of instructional design and development of digital-based immersive learning environments in conjunction with specific subject needs. Undoubtedly, simulations play a critical role in nursing education by bridging the gap between theoretical knowledge, concepts, or procedures and real-world clinical practice. By utilizing simulated learning environments, nursing students can experience clinical settings in a controlled and safe manner while gaining knowledge and skills that can be translated to a real clinical setting, or more precisely, to their interactions with patients, providing an opportunity to engage in realistic simulated

scenarios that replicate authentic work environments. More importantly, this allows them to develop professional competence before entering actual hospitals, ambulances, or labs.

Contemporary researchers [1] note that there is no consensus on the precise definition of simulations within the field of nursing. However, it is evident that they tend to include various tools or environments, ranging from static mannequins or anatomical models to standardized patient simulation to high-fidelity models or digital environments such as virtual or augmented reality.

This research intends to explore specifically only one type of simulated learning environment that aspires to replicate an authentic clinical technique for collecting thorough and relevant patient history—the Onset, Location, Duration, Characteristics, Aggravating/Alleviating factors, Related symptoms, Treatment, and Severity method (OLD CARTS) method [2]. The study introduces the standard OLD CARTS method to nursing students with a novel 360° IVRV simulation approach.

The integration of VR animated simulation has been increasingly present in nursing education [3–5]; however, not much attention has been placed on integrating 360° IVRV educational content. We specifically focused on the 360° IVRV simulation modality due to the foreseen advantages over more popular commercial VR animated simulation content. Advantages such as ease of use, low cost, less time-consuming simulation content development, usability and affordability of hardware (smartphone), minimal or no maintenance requirements, and above all, the ability of 360° IVRV simulation to convey high-fidelity and authentic clinical settings attracted the researchers' attention. Therefore, the purpose of this exploratory case study is to provide an in-depth description of learning experiences supported by immersive 360° IVRV video technology while seeking a more comprehensive understanding of perceived potential instructional conditions and elements that may reinforce the integration of the 360° IVRV simulation approach in nursing education.

2. Literature Review

Virtual reality (VR), specifically 360-degree immersive videos, is increasingly being utilized in nursing education. With developing technology, fidelity, and ease of use, 360° IVRV can offer a transformative approach that can offer a realistic and interactive experience that links theory to clinical practice. While the use of 360° IVRV has significantly expanded over the past several decades to mainstream clinical education, there are some important caveats that must be considered for the successful integration of 360° IVRV into nursing education.

Using several large databases, we aimed to explore the current state of 360° IVRV in nursing education with the goal of defining and evaluating this use of pedagogical technology within a clinical curriculum. By means of PubMed, Google Scholar, and the SciSpace databases, and employing deep search methods with AI assistance, we constructed a narrative literature review. The inclusion criteria associated with this literature review included: the use of 360° IVRV in nursing education or practicing nurses as participants, research studies, studies evaluating learning outcomes or educational perceived effectiveness, English language, and publications from 2010 onwards. The articles excluded were those that featured traditional 2D virtual reality or desktop simulation only, non-nursing healthcare professions, VR for patient treatment rather than education, and non-empirical publications. The objective of this narrative literature review is to synthesize current evidence on 360° IVRV applications in nursing education, examining perceived effectiveness, implementation strategies, learner experiences, and identifying research gaps to substantiate the use of 360° IVRV. Overall, we found that, despite the growing body of research on the use of 360° IVRV in nursing education, there is a lack of qualitative studies on smartphone-based 360-degree videos in this context. Specifically, our review of the literature suggests that

there is a paucity of studies that explore the 360-degree video use on smartphones as a tool for teaching the health assessment OLD CARTS technique. Furthermore, we were unable to find any evidence on the experiences of faculty members who use this technology in their teaching practices.

2.1. Defining 360° IVRV

360° IVRV is a technology that allows a user to experience a fully immersive environment by providing a panoramic view in all directions. Alammery and collaborators [6] described 360° IVRV as the use of video for virtual reality with the use of a head-mounted display (HMD); otherwise, with the non-use of HMD, it would be considered “non-immersive VR” and is usually associated with screens, television screens, and 2-dimensional mechanisms. There are several applications of this technology including entertainment and gaming, education, healthcare, military training, and broadcasting and media [7]. The hallmark feature of 360° IVRV is the immersion, presence, and interactivity associated with technology, which is only found in the realm of virtual reality [6]. For educational purposes, 360° IVRV has been used to promote immersive learning, the promotion of multiple perspectives, situated experiences, or the transfer of knowledge [8].

2.2. 360° IVRV for Nursing Education

The use of 360° IVRV has been noted across several different nursing education modalities, including both simulation and/or specialty competency-based skill acquisition [9,10]. Overall use of 360° IVRV was focused on simulations where realistic environments were important or accessibility to other simulation modalities was a limitation [11].

Competency-based skill acquisition was also an important use of 360° IVRV. One example includes competency-based skills; for 360° virtual care reality, there was a significant effect ($p = 0.004$) on increasing standard precaution compliance for nursing students, where in-person/patient practice with these techniques is impractical [12]. Another use of 360° IVRV was the use of medication administration, where a safe environment is offered to learners without the real-world consequences [13].

2.3. Strengths of 360° IVRV

Most notably, 360° IVRV has been found to have high levels of interest, engagement, enjoyment, or the perception of benefit from participants who have experienced this learning modality [8]. The feeling of immersion in the learning environment was perceived as a strength of 360° IVRV, which provided a strong sense of being present in the scenario. Choi and collaborators [14] concluded that immersive VR or augmented reality (AR) in nursing education could significantly improve learned knowledge (SMD = 2.64, 95% CI) and skills (SMD = 0.58, 95% CI).

2.4. Weaknesses of 360° IVRV

While 360° IVRV is widely regarded as a valuable tool in nursing education, its successful implementation into curricula requires careful consideration of several important elements. Compared to 2D video, Snelson and Hsu [8] found no support in favor of 360° IVRV for learning in participants. Reasons cited included lower concentration and high levels of distraction in participants caused by the immersive technology. Some of these distractions are common and can include motion sickness and/or physical discomfort, inadequate video quality, or limited access to the necessary equipment for the 360° IVRV. Further, Alammery and collaborators [6] noted there is a lack of diversity in scenario design and theoretical frameworks associated with 360° IVRV.

Overall, 360° IVRV is increasingly utilized in nursing education, offering innovative training methods that enhance both theoretical and practical skills. The integration of 360°

IVRV allows nursing students to engage in realistic simulations, improving their learning experiences and preparing them for real-world scenarios. However, there are no studies on the use of 360° IVRV for the health assessment interview technique of OLD CARTS. Hence, our study aims to address these gaps in the literature by exploring the experiences of both faculty and students who use 360° IVRV training. We believe our study will contribute to a deeper understanding of the perceived potential benefits and challenges of 360° IVRV as a technology used in nursing education and can provide insights into how this modality can be integrated into curricula.

3. Methods

3.1. Research Design

The proposed research employed a qualitative case-study approach, reinforcing the in-depth exploration of students' experiences with immersive healthcare simulation technologies. The popularity of case-study research has grown as a way to address issues in the field of health sciences in general and specifically related to various simulation platforms [15–17]. There is a plethora of contemporary authors who employ the case-study approach with notable differences reflecting their overall philosophical assumptions, including ontological and epistemological views. According to Yazan [18] and Anthony and Jack [19], case-study approaches span from postpositive perspectives [20,21] on one side to utilizing a more constructivist point of view [22,23] or a combination of constructivist and existentialist approaches on the other side of the spectrum [24,25]

This investigation employed a case-study design following Stake's [26–28] framework. Specifically, it is an instrumental case study, chosen to illuminate broader curricular implications of 360° IVRV use in nursing education. An instrumental case permits an in-depth, contextual analysis of the instructional intervention while generating insights that can inform larger-scale studies. This method aligns with our aim to identify generalizable instructional conditions.

Considering the intent of this research, we adopted Stake's [26,27] approach in conducting a case study as it allows a holistic understanding of an explored phenomenon within a real-life context from the perspective of those involved in experiencing the phenomenon. Furthermore, Stake's method highlights empirical, emphatic, and interpretative means in exploring the study issue, which fully aligns with the scope and purpose of the research at hand. Specifically, we employed the instrumental case-study type, which, as defined by Stake [28], is instrumental "... if a particular case is examined mainly to provide insight into an issue or to redraw a generalization (p. 137)." An instrumental case study leading toward a more in-depth understanding of a larger issue, which is, in our case, the instructional perceived effectiveness of immersive 360° virtual reality video simulation technologies applied in the field of nursing and healthcare.

The methodological framework, in conjunction with the overall study intent, suggests flexibility in framing the study outcome. The researchers' expectations were two-fold: (a) to describe student and faculty experiences with immersive video technology and (b) to try to identify perceived potential elements or contexts that may contribute to the process of elevating immersive technologies into nursing education. Following these two general aims, ideally, it is the researchers' intention to utilize qualitative case-study results for conceptualizing future mixed-method studies or hypothesis testing. Therefore, the study is guided by the following research questions:

1. How do students describe their learning experiences with 360° IVRV-based subject-specific learning content?
2. How do faculty describe their experiences utilizing 360° IVV-based subject-specific learning content in instruction?

3. What are the instructional conditions and elements that may elevate the integration of VR technology across the field of nursing and related specific subject areas?

3.2. Context and Intervention

Foundational experience in healthcare education is immersion into clinical scenarios and conversations. One technique for collecting thorough and relevant patient history is the use of the OLD CARTS mnemonic method. The use of OLD CARTS has allowed for a standardized model of clinical communication and information gathering. A vital component of patient care is gathering information from the patient and further communicating this information from provider to provider. Immersion into a clinical environment where standardized communication can be practiced before going into a 'real' clinical environment could increase the healthcare student's confidence and overall experience, positively affecting the patient care experience.

The intervention is an online 360° IVRV video available both on desktop and 360° immersive video on students' smartphones with a cardboard VR adaptor. The participants were able to experience both the 2-dimensional and the 360° IVRV formats, where they watched a healthcare provider in a primary care clinical setting utilizing the OLD CARTS information-gathering method. The total 360° IVRV experience was less than 10 min. The study participants were able to toggle their view within the 360° IVRV environment, which put them in the middle of the primary care clinical patient room setting. All participants followed the same study procedure.

3.3. Participants and Sampling

Participants were recruited through a purposeful convenience strategy (N = 8, four faculty and four students). The depth of qualitative insight obtained from this homogenous group aligns with established conventions for case-study research. During iterative coding, we found that additional interviews produced no new codes after the last couple interviews. Consequently, we describe the thematic saturation as preliminary thematic sufficiency with the scope of this case study. This cautious wording reflects both the depth of analysis and the limited sample size, while acknowledging that the findings primarily illuminate the specific content examined.

Inclusion criteria (see Table 1) ensured that participants possessed relevant clinical and instructional backgrounds. A total of eight participants, including four graduate students and four faculty members, provided data sufficient to reach preliminary thematic saturation, which is typically characterized by recurring patterns in participants' responses and the absence of new codes in the final interviews [26,29,30].

Table 1. Inclusion criteria for selecting the study participants.

Inclusion Criteria for Selecting the Study Participants
(a) Active graduate student in the field of Nursing Education
(b) Active graduate student in the field of Educational Technology
(c) Nursing Education faculty with at least five years of teaching experience
(d) Educational Technology faculty with at least five years of teaching experience

The case in this study was established by identifying several boundaries as follows: (a) the main unit of analysis, the case, is a group of faculty and students that can be labeled as early technology adopters with notable interest in exploring the perceived educational potential of integrating immersive technologies in online instruction; (b) all participants

have experience either teaching or learning at large public universities; (c) in terms of geographical boundaries, all participants were located in the Southeast region of the US; (d) in terms of physical location, the study featured a fully online approach in delivering immersive content; in other words, all participants experienced the study intervention by using their personal mobile phones from the comfort of their homes; and finally, (e) all participants have been exposed to and have a certain level of prior experience with using 360° IVRV technology. Therefore, the case defined in this study undoubtedly aligns with the proposed research question and the overall intention of this exploratory investigation.

Based on the proposed inclusion criteria, the recruited participants represent a well-balanced sample for the proposed purpose of this exploratory study. The following table (Table 2) summarizes the main participant characteristics in terms of (a) gender, (b) age, (c) academic background, (d) teaching and/or learning experience, geographical distribution, (e) prior experience with using 360° IVRV technology, and (f) higher education institution type.

Table 2. Summary of the study participants.

Summary of the Study Participants		Overall	
Characteristic	Category	No.	%
Gender	Male	5	62.5%
	Female	3	37.5%
Age	20–30	4	50%
	30–40	3	37.5%
	40–50	1	12.5%
Academic background	Nursing	4	50%
	Educational technology	4	50%
Geographical location	Florida	7	87.5%
	Georgia	1	12.5%
Experience with 360° IVRV	No prior experience	0	0%
	Minimal exposure	2	25%
	Comfortable with using	2	25%
	Able to design and develop	4	50%
Institution type	Public university	8	100%
	Private university	0	0%
	Liberal Arts College	0	0%
Sample Subsets		Faculty	Students
Gender	Male	3 (75%)	2 (50%)
	Female	1 (25%)	2 (50%)
Age	20–30	0 (0%)	4 (100%)
	30–40	3 (75%)	0 (0%)
	40–50	1 (25%)	0 (0%)
Academic background	Nursing	2 (50%)	2 (50%)
	Educational technology	2 (50%)	2 (50%)
Faculty teaching experience in higher education	5–10	2 (50%)	0 (0%)
	10–15	2 (50%)	0 (0%)

Table 2. *Cont.*

Sample Subsets		Faculty	Students
Student years of learning in higher education	1–2	0 (0%)	1 (25%)
	2–3	0 (0%)	2 (50%)
	3–4	0 (0%)	1 (25%)
Geographical location	Florida	3 (75%)	4 (100%)
	Georgia	1 (25%)	0 (0%)
Experience with 360° IVRV	No prior experience	0 (0%)	0 (0%)
	Minimal exposure	0 (0%)	2 (50%)
	Comfortable with using	2 (50%)	0 (0%)
	Able to design and develop	2 (50%)	2 (50%)
Institution type	Public university	4 (100%)	4 (100%)
	Private university	0 (0%)	0 (0%)
	Liberal Arts College	0 (0%)	0 (0%)

3.4. Research Instruments, Data Collection and Analysis

The study utilized a semi-structured interview to provide a comprehensive and contextually rich understanding of students' and faculty experiences with 360° IVRV learning content [31]. An interview protocol was used to direct the interviews, while the structure of these interviews was designed to provide flexibility while asking open-ended questions to elicit candid participant responses. The interview guide was adjusted for the students or the faculty participants. The student participants responded to 16 questions, while the faculty had to address the main protocol and two additional questions pertaining to instructional design and educational use of the given intervention.

The observational protocol was also utilized to collect data regarding participants' immediate response and/or reaction to the given 360° IVRV intervention. This observational protocol was purposefully tailored to capture the following aspect of students and faculty non-verbal interaction with the immersive simulation: (a) the researchers recoded necessary time to initiate the immersive simulation via participants' personal phone; (b) perceived potential challenges with 360° IVRV navigation (video rewinding, pauses, etc.); (c) overall emotional reaction; and (d) facial expression (excitement, confusion, etc.). The data collection procedure took place during the academic years 2022–2024 at the University of Florida; institutional review was completed (IRB201903035).

The recordings from each participant were initially transcribed automatically by using Zoom AI assistant and subsequently refined by the researchers of this study. Common thematic analysis was performed by the researchers, and from this, codes of similar concepts, ideas or words were assessed. All audio recordings were stored in a secure and encrypted external hard drive and safely placed in the PI's office in a locked cabinet. Once the recordings were transcribed, the transcriptions were de-identified. Pseudonyms were assigned to participant transcripts. Original interview audio files were deleted.

The coding scheme was developed inductively, allowing themes to emerge from the data without preconceived notions or biases. To facilitate the initial data analysis, we utilized a qualitative AI data analysis software package, Notebook LM. This tool enabled us to identify general patterns in participants' responses and create flowcharts to visualize the study findings.

However, the primary data analysis and interpretation were conducted by the researchers through an iterative and categorical aggregation approach. This approach implies

continuous refinement of codes, categories, themes, or perspectives as response patterns emerge. Specifically, we employed the following steps: (1) Initial coding: we began by coding the data using Notebook LM, which helped us identify primary patterns and themes. Notebook LM was used to run automatic initial keyword and semantic-clustering analysis for the initial analysis. The clustering output served as a suggestion for the data analysis, with the output verified by the researchers. (2) Data familiarization: We then immersed ourselves in the data, reading and re-reading the transcripts to gain a deeper understanding of the participants' responses. (3) Coding refinement: As we became more familiar with the data, we refined our codes, categories, and themes, ensuring accuracy and the essence of the participants' experiences. The AI-generated code list served as a reference; final codes were adopted only after all researchers reviewed and agreed on them. (4) Theme development: Through an iterative process, we developed and refined our themes, ensuring that they were grounded in the data and accurately represented the perspectives of the participants. (5) Data validation: Finally, we validated our findings by checking them against the original data, ensuring that our themes and interpretations accurately reflected the given experiences.

3.5. Subjectivity Statement

Considering the characteristics of the utilized research design, a case study, it is imperative to highlight the researchers' context and background. According to Creswell and Poth [31], a qualitative researcher's experiences, philosophical perspectives, and overall worldviews play a significant role in understanding, interpreting, and presenting the final study findings. Some authors [32] argue that qualitative analysis is cyclical in nature, where the meaning of the obtained data is permanently refined and re-iterated in the light of a study or researcher's context, rather than having the rigorous methodological constraints associated with quantitative research.

Furthermore, as suggested by numerous qualitative inquiry experts [33,34], researchers' reflexivity is one of the critical aspects that shape qualitative data interpretation. Braun and Clarke [35] argue that researchers should invest significant effort and keep themselves open to embracing new insights as themes emerge during the data analysis process.

In alignment with the reflexive practices advocated by Roulston [33] and Saldaña [34], both authors recognize that their interpretation of the data regarding immersive 360° IVRV is not a neutral act, but one shaped by their own pedagogical assumptions and technical background. Both authors acknowledge that their presence and their enthusiasm or skepticism toward virtual reality functions as a lens through which the participants' experiences are filtered.

Following the guidance of Braun and Clarke [36], the authors have committed to an organic and iterative thematic analysis. Rather than forcing the data into pre-existing categories regarding "technological efficiency," The authors have remained open to the "messiness" of the learning process. This required a conscious effort to set aside our expectations of how nursing students should feel in a 360° IVRV environment to instead embrace the emergent insights, such as sensory overload or unexpected emotional distancing that became apparent during the analysis. By maintaining this reflexive stance, we ensure that the resulting themes are a co-constructed reality between the participants' lived experiences and their own evolving understanding of immersive pedagogy.

4. Findings

The researchers of the present study conducted a thematic analysis after a careful examination of the prepared interview transcripts and obtained initial codes assembled by the AI qualitative data analysis software. Gibson and Brown [37] pointed out that a

thematic analysis “provides a way of linking diverse experiences or ideas together” (p.129). Furthermore, these two authors also state that thematic analysis is primarily focused on “pooling together all the materials across a dataset that has something in common” (p.128). Given the extent of the current study and based on the in-depth analysis of the available qualitative data, five themes emerged, including several subthemes and two overarching perspectives. Therefore, the study findings could be presented within the following themes: (a) Realism and observational learning, (b) usability makes a difference, (c) accessibility: nonissues and issues, (d) please advise: suggestions for improvements, and (e) challenges: are there any? In addition to the identified themes, two general perspectives were recognized: (a) Development and evaluation of immersive VR simulation tools, and (b) what is coming next: future research directions.

A visual representation of the established themes, subthemes and perspectives is provided below in Figure 1.

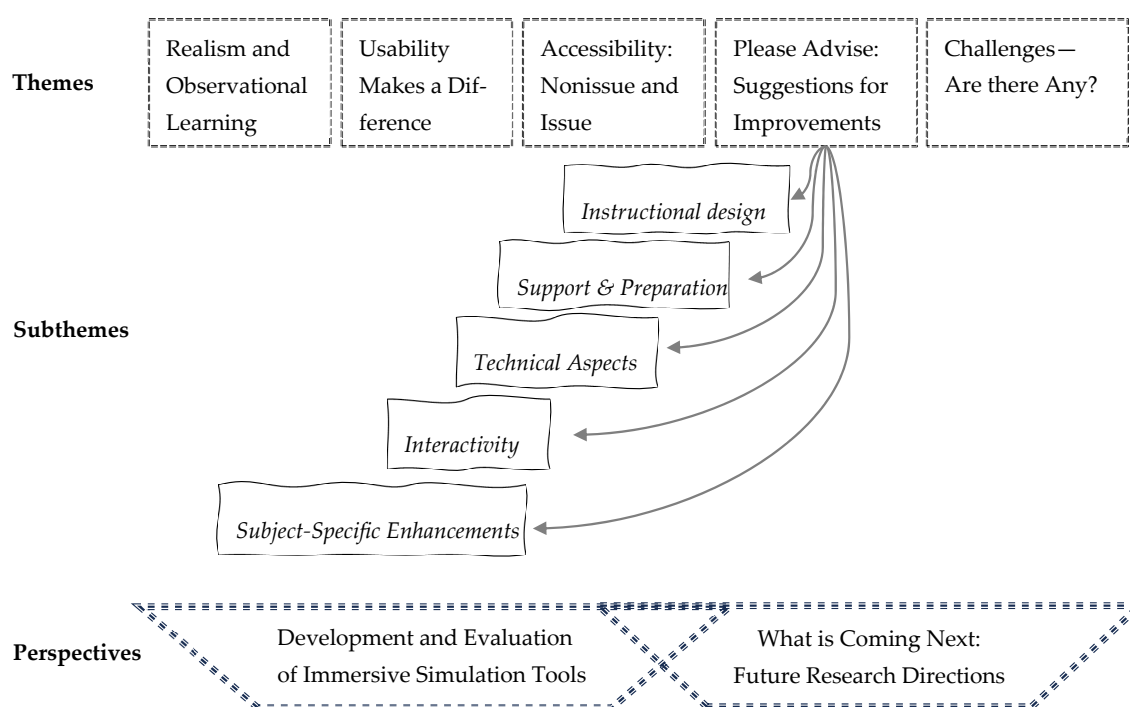


Figure 1. Synthesized themes, subthemes, and perspectives

4.1. Realism and Observational Learning: They Were Actually Humans

One of the most profound themes that emerged from various participants’ statements highlights the substantial value of a realistic context and conversation between a doctor and patient presented within the immersive simulation intervention. This realism stems from the nature of 360° video content, which has not been enhanced or modified with additional animated elements or AI-generated media but entirely relies on footage captured through regular camera lenses. The participants described this experience as being like “sitting on the exam table” or being placed “in the room, watching” the interaction between the patient and provider. Jack, one of the participants, compared this experience with being “like a fly on the wall”, observing the interaction in a doctor’s office without being interrupted by features of the used tool or the quality of the immersive media.

Amanda, a nursing graduate student, pointed out a stunning insight pertaining to the very nature of composed intervention. She stated, “they were actually humans, versus like avatars. I think you can connect with that a little bit more. The ability to swivel and look around the room was interesting and to look at the patient but also to be able to turn

around look at the provider. If you're a student, probably, it would be helpful, even to see like the providers posture and, you know, how they approach the patient nonverbally."

Another nursing student respondent, Tom, highlighted the capacity of 360° IVRV to convey an authentic clinical setting. Tom particularly liked being able to "watch the provider go through all the questions" and observe "how he is explaining it," as well as the "interaction between him and the patient." This experience was described as "real-life" participation without direct involvement. As identified by respondent(s), the use of 3360° IVRV as a learning material undoubtedly elicits observational learning, which was a highly valued aspect of the present instructional intervention. This is particularly seen as a significant benefit, especially for remote students who cannot be physically present in a doctor's office or lab, providing an "experiential component."

4.2. Usability Makes a Difference

Nearly all study respondents commented on the usability aspects of the utilized simulation. The instructional intervention was delivered via mobile phones, while the immersive media was purposefully designed to be simple and prevent experiences of visual overload. Considering the purpose of this study, the researchers adopted the usability concept as defined by the International Organization for Standardization (ISO) [38]: "the extent to which a system, product or service can be used by specified users to achieve specified goals with perceived effectiveness, efficiency and satisfaction in a specified context of use."

Several participants expressed their enthusiasm for being able to use their personal phones instead of purchasing expensive stand-alone VR headsets to view the instructional materials. The participants also appreciated this delivery modality due to the "portability" of mobile phones and "cost efficiency" that was derived from the fact that the given intervention was playable from any phone, regardless of device brand or operating system. Students were also satisfied with the simplistic interface, including effective navigation, which was, in essence, based on the device's positioning, as the produced intervention utilized a motion detection feature. In other words, by simply pointing a phone at a certain angle, the viewer of this immersive video was able to see all "corners" of the room without using any additional features or options. Furthermore, while viewing immersive content via a mobile phone was generally perceived as an effective experience, participants suggested that using a VR headset would enhance the immersive effect and reduce distractions from their immediate environment.

4.3. Accessibility: Nonissue and Issue

Accessibility in general, or a lack of accessibility features in the given intervention, was a frequently commented-upon aspect by students and faculty study respondents. The study participants highlighted that being able to view immersive learning content through a personal mobile phone and without the necessity of purchasing high-end VR technology was an excellent instructional approach that fully reinforces the accessibility concept in education. Tom stated, "[phone] is that make it easy for me to get this information, instead of having to have in headsets. So, for me, that is the first advantage that we have here, because we can use 360° environments by phone, to get access to this resource."

Several participants reflected on the lack of accessibility features in the given intervention. The main suggestion was centered around closed captioning to make the immersive content more accessible to a wider audience, including learners with hearing impairments.

Furthermore, a faculty respondent raised a concern that a high level of accessibility may be a challenging task to accomplish due to the nature of the devices used (a relatively small phone screen) and the media (video, which is predominantly a visual medium). The

participant pointed out that some students are “visually impaired” or have “significant sight problems.”

In summary of this theme, accessibility was perceived as an issue, for instance, regarding a lack of closed captions, or as an advantage that reflects the affordability of the used devices, which provides an opportunity for a broad educational audience to access and view the immersive learning content via their personal smartphones.

4.4. Please Advise: Suggestions for Improvements

One of the most profound themes that emerged after careful examination of all interview transcripts demonstrates participants’ interest in taking a proactive approach while reflecting on the educational value of the ongoing intervention. In other words, the study participants were keen on providing constructive suggestions for improvements of the utilized immersive 360° environment. This, a slightly broader theme, was subsequently divided into five subthemes which offer detailed recommendations for enhancing various aspects of the intervention’s quality and practical educational utility. All interview participants, both students and faculty, were involved in proposing possible improvements for the next, more advanced, iteration of the study intervention. The following subthemes focused on future areas of improvement were identified: (a) instructional design, (b) support and preparation of users, (c) technical improvements, (d) interactivity, and (e) subject-specific improvements.

4.4.1. Instructional Design

Several valuable ideas were received highlighting several aspects of the immersion video that may be alternated or differently developed. First, breaking the video into “smaller segments” was a comment received from both students and faculty. Although the video was under 10 min long, both groups of respondents felt that segmenting the video intervention (e.g., each segment should be approximately 2 min long) may enhance its practical utility while keeping an optimal learner’s attention.

Another suggestion, also related to the instructional design aspect of the given intervention, refers to introducing follow-up questions that students will be able to answer while or after watching the video. A faculty respondent suggested the following: “...students experience video for two minutes, and they come out, and then they complete some questions online, maybe in terms of what they should have been learning by that point, and then they go back in and continue [watching].”

Additionally, a student noted that developing an “introductory piece of the video” pointing out critical points that will introduce learners to the main video content, as well as a brief video summary of the main video at the end, may contribute to the overall learning experience.

Finally, it was argued by a faculty respondent that providing “learning objectives” associated with the given video topic may be beneficial for students and faculty who intend to use this type of learning material.

4.4.2. Support and Preparation: Technology Competencies

A single recommendation that stood out from the researchers’ perspective as critical for the success of an overall instructional approach was provided by a nursing student respondent. The student suggested that “some headway, or some training on how to” would be beneficial to a user’s ability to gain an optimal viewing experience and successfully manage technology requirements and software options or settings. Moreover, creating a user guide that clarifies technical requirements and settings is consistent with best practices for designing and delivering educational content through contemporary technology.

4.4.3. Technical Aspects of 360° IVRV

Remarkable input was identified by the researchers pertaining to the technical aspects of video production. These straightforward ideas may be loosely grouped within the following three categories: (a) camera positional and adjustments, (b) visual clean-up, and (c) audio quality.

- (a) **Camera Positioning and Adjustments.** A few participants noted that camera positioning may be improved by elevating camera lenses higher off the ground, which would enable the camera to capture the video actors at “the eye level”. These participants indicated that the camera position felt “a bit low,” potentially impacting the point of view. Similarly, participants suggested zooming out the camera or move it further back to capture both the doctor and patient in one composition frame. Recommendations also included adjusting the camera’s position for a wider “pan view” or “landscape view” to provide a more comprehensive view of the entire context.
- (b) **Audio Quality.** Although the researchers found numerous comments pointing to the good quality of sound, one student commented, “her voice [the patient’s] was quieter, so in a way, I wish I had been able to turn up the volume on her voice, but I was able to hear it.” The follow-up examination of the developed footage indeed revealed a slightly lower level of the soundtrack that represented the patient’s voice.
- (c) **Visual Clean-Up.** As noted by the study, removing visual distractors would contribute to the perceived effectiveness of the immersive learning video material. Deleting visual elements such as the tripod legs marked from the 360° IVRV content would enhance not just visual appeal but also eliminate unnecessary items that do not add additional value to the learning experience. In the same vein, a faculty respondent commented that a paper calendar that was hung on the doctor’s office wall shows a funny picture with many cats, which was highly distracting and unnecessary from a learning standpoint.

4.4.4. Interactivity

Deeply intertwined with the rest of the participants’ comments, the researchers identified learners’ call for a more interactive, immersive learning environment. It is interesting that both student and faculty participants expressed a desire for more interactivity, such as the ability to “ask any questions,” or “interact with the patient myself,” or “click on the door and move away from the room,” or “be closer to the doctor to get a different perspective, maybe looking at his notes.” It appears that all participants had little to no understanding of the characteristics of the media format used (360° IVRV) for delivering the learning content. Furthermore, based on the holistic insights from all interview transcripts, there are indications that the selected participants anticipated that the given intervention would utilize a more advanced simulation environment or VR headsets, which was not the original intention of this research.

4.4.5. Subject-Specific Enhancements

The in-depth analysis of the two study participant subgroups, (a) nursing students and faculty and (b) educational technology students and faculty, yielded valuable insights reflecting the subject-specific commentary focused on improving the present intervention. Nursing study respondents recommended including more comprehensive patient information that may be relevant to the current health condition. A study participant stated that they “would have liked to have seen a little bit about her social history”. Another suggestion was to emphasize the necessity of knowing current drug prescriptions, allergies, or smoking status. According to the participant, providing this information may contribute to a more comprehensive understanding of the presented doctor–patient conversation

or patient health condition, including future treatment. The suggestion did not specify how this information should be presented, whether within the video itself or through the supplemental learning materials, such as through worksheets or similar forms.

On the other hand, educational technology experts stressed out the importance of proper management of cognitive overload. According to their comments, immersive environment users can be “easily overwhelmed” by the amount of auditory, visual, and spatial input imposed by highly dynamic media, such as 360° IVRV. This suggestion was given not as a reflection on the current video composition, which, according to the participants, does not impose significant cognitive overload, but more as preventative advice for future video designers and developers.

4.5. Challenges—Are There Any?

The set of data obtained surprisingly suggests only a few challenges associated with the study intervention. Both student and faculty respondents indicated that a latent challenge may arise from the very nature of the intervention itself—an immersive environment that places a student in a dynamic and motion-based virtual location that is entirely different from a location where the 360° video recording was viewed. As noted by a faculty respondent, “it might be quite powerful for some people while it might be quite disorientating for some people.” David, another faculty member, noted that immersive video has the potential to cause dizziness, which may be an uncomfortable experience for some learners.

In response to the researcher’s question, “Do you feel the difficulties and maybe the cons of immersive virtual reality experience?” a student participant responded by voicing a concern related to a viewer’s ability to use technology in general. Sara, a nursing student, stated the following: “Maybe users might have different proficiency or competencies with technology, so that might be a little bit of a challenge, but that [using phone] was very easy; it seemed pretty intuitive to use it.”

Beyond these two explicitly stated challenges, the researchers concluded that participants were largely supportive of the proposed instructional intervention.

4.6. Perspectives

Along with the five main themes and subsequent subthemes, the researchers were able to distinguish broader viewpoints that participants share regarding the observed educational intervention. These insights were presented in the format of two perspectives that span and interlink findings across the study themes discussed above. The identified perspectives reflect a more holistic view of the study findings, aiming to address underlying commonalities within each theme. As a result, the researchers propose two study perspectives as follows: (a) Development and evaluation of immersive simulation tools, and (b) future research directions.

4.6.1. Development and Evaluation of Immersive Simulation Tools

The overarching perspective across participant responses, faculty and students, underscores the necessity for future development of immersive learning materials based on the use of 360° video technology. The study participants feel and think that the given or any future similar immersive intervention will have significant perceived potential for elevating perceived learning effectiveness in the field of nursing education in general. This format of instructional material could be particularly beneficial for learning procedures and protocols associated with patient health assessment. The participants clearly voiced their opinions about the necessity for future development of immersive learning materials that would feature real-world context, including unmodified human (doctor–patient) interaction. Thus,

the overall researchers' impression was that future development and advancements in 360° IVRV simulation are expected by the study participants.

Along with the development efforts, it is notable that the study respondents pointed out the need for continuous evolution of this or a similar instructional tool. Evaluation as a complex process, in this case, would involve an ongoing examination of the critical aspects of the instructional tools, including but not limited to usability, accessibility, sustainability, or perceived instructional effectiveness in general. The permanent process of evaluation also calls for a certain amount of product standardization, which was also recognized by the researchers as a critical aspect of this pilot project.

4.6.2. What Is Coming Next: Future Research Directions

The second perspective was formed based on the responses received from the faculty subset sample. Four faculty members in total, two nursing experts and two educational technology experts, expressed their ideas regarding the future research directions of this instructionally driven pilot project and study. Incorporating a permanent process of refining the immersive product grounded in evidence-based judgment about its perceived effectiveness is the essence of this perspective. In that regard, two valuable ideas were discussed.

First, the faculty suggested that it would be instrumental for future project development to conduct research focused on tracking user gaze. Although the faculty respondents were aware of the limitations of the current hardware and that personal phones cannot support the collection of data through a gaze-tracking approach, they suggested that tracking eye gaze could help this study's researchers understand where learners are focusing their attention.

Another very interesting suggestion underlines the need for a comparative research approach. According to the faculty, future research should compare the perceived effectiveness of the present 360° IVRV intervention format against existing learning materials to assess if it leads to faster, different, or longer-lasting learning outcomes.

5. Discussion

The researchers' overarching intent in this study was to provide an in-depth description of learning experiences supported by immersive video technology while seeking a more comprehensive understanding of perceived instructional conditions and elements that may reinforce the integration of 360° IVRV simulation in nursing education. The obtained findings provide valuable insights into student and faculty motivation towards, and preferences and observed challenges and benefits of, utilizing immersive learning content. The following Discussion Section reflects on these findings through the lens of the research questions proposed in this study.

5.1. How Do Faculty and Students Describe Their Experiences

The realism of the immersive simulation content appeared to be one of the essential affordances of the learning environment described by the study participants. Conveying an authentic, real-world environment by featuring *real humans* and a clinical setting (a doctor's office) was the most striking feature of the study intervention. The ability of 360° IVRV technology to capture and present an environment in a realistic form has been pointed out by other researchers. A study conducted by Yang and his collaborators [39] demonstrates that immersive 360° video enhances learner familiarity with the learning context and reduces anxiety while learning. This study further compared 360° video simulation with animated and interactive VR content, which yielded significantly stronger outcomes in supporting learning procedural performance and skill acquisition. In the same vein, Ranieri's [40] study amplified that 360° video instructional content is conducive to increasing empathy

among the learners for a given clinical scenario, procedures or, specifically in our case, the relationship and interaction between a nurse practitioner and patient while conducting the OLD CARTS method focused on assessment to provide accurate diagnosis. It is also worth pointing out other supporting findings that clearly indicate the role of 360° simulation content in enhancing an emotional component, leading toward the boosting of students' satisfaction and motivation to learn. For instance, Blair, Walsh, and Best [41], in their study on immersive 360° videos in health and social care education, emphasized that emotional response, satisfaction, and motivation are often the most desirable elements of pedagogical frameworks pertaining to improving instructional quality.

The above-mentioned and other similar studies [42,43] support the findings of this research, confirming that 360° immersive simulations in a clinical nursing setting have a strong perceived potential to improve students' familiarity with the environment and elicit a better understanding of a real-world clinical context. Given the noticeable alignment between the findings of this study and other recent research, it can be concluded that the integration of immersive 360° video simulation yields similar instructional affordances in learning subject-specific contexts, such as through the OLD CARTS methods of health assessment.

The usability and accessibility of the smartphone-based 360° IVRV simulation were other aspects of the study intervention described and addressed in-depth by the research participants. The usability aspect as defined by several contemporary authors [8,44] refers to the ease of use and efficiency of a technology system or device utilized in instructional activities, more precisely, clarity of interface, ease of navigation and/or interaction, multiple aspects of efficiency (cost, maintenance, etc.), as well as the overall learners' satisfaction that originates from the experience gained through the process of using the given technology system. These aspects of usability of the present research intervention were also stressed by the participants. The participants emphasized that the simulation intervention was playable on any phone regardless of the device brand or OS, and benefited from the portability of mobile devices and cost efficiency. These aspects of usability, combined with simplistic navigation and the clarity of the video flow, were perceived as extremely positive elements that contributed to overall instructional success.

Accessibility, in terms of owning and maintaining the instructional technology system, in this case a mobile phone, was also highly valued. Considering that the vast majority of students or—we may freely conclude—nearly every student owns a smartphone, this eliminates a digital divide gap issue often present in the educational context when technology has a decisive role in delivering learning content and supporting activities. However, accessibility from the standpoint of whether all students, regardless of their abilities or limitations, can use the given simulation content or participate in the educational experience is questionable. Several participants reflected on the lack of accessibility features, especially the closed captioning feature. Furthermore, visually impaired learners or learners with significant sight problems may not be able to utilize this type of educational content. Finally, it should be considered that accessibility aspects also refer to the very nature of immersive environments. A certain portion of immersive simulation users experience disorientation or even dizziness while experiencing this learning environment. A myriad of researchers [45–47] identify the present accessibility challenges when utilizing 360° IVRV simulation content across various academic disciplines. These and similar studies further confirm the validity of the obtained findings in this research.

5.2. Instructional Conditions and Elements Relevant to 360° IVRV-Supported Learning

The study findings strongly suggest that certain instructional contexts and elements may enhance the perceived effectiveness of 360° IVRV-supported learning in nursing educa-

tion. Specifically, our findings indicate that faculty and student preparation for using 360° IVRV simulations may be critical to their success. Training and professional development aimed at increasing technology competencies, combined with auxiliary technology support provided by the educational institution, have been strongly reiterated as necessary by the study participants. These much-needed conditional requirements were noted in the body of the literature, where authors [48,49] discuss the benefits of conducting orientation and (technology) training sessions aimed at improving usability and learning outcomes in virtual environments.

Furthermore, the participants described that their learning experiences may be different, or perhaps more positive, if several elements of the given intervention were differently designed and/or developed. For instance, based on several study responses, the 360° IVRV simulation content may be improved by applying the segmenting principle of multimedia design. According to prominent authors [50–52], the application of the segmenting principle in designing multimedia implies that people learn better when a multimedia message is presented in user-paced segments rather than as a continuous unit. Undoubtedly, the application of this evidence-based design principle would augment the usability aspect of the present simulation intervention. From a production standpoint, enhancing audio and video quality would further contribute to the perceived effectiveness of the simulation.

Beyond the multimedia design and development aspect, the participants' narratives suggest the necessity of framing and delivering this intervention as a stand-alone learning module. This particular finding calls for introducing broader instructional design elements, such as (a) measurable learning objectives followed by (b) learning activities and (c) assessment. These three critical instructional design components should be in alignment with the learning content, which is, in this case, the given study intervention—360° IVRV. Based on proven instructional design models [53,54] in educational practice, alignment between measurable learning objectives, learning content, which is the study intervention, instructional activities and assessment is the essential element that leads to a more successful learning outcome.

5.3. Alignment Between Research Questions and Findings

To conclude this discussion, the authors find it suitable to present a sample demonstrating the alignment between the study's research questions, identified themes, participant groups and provided quotes. Considering the robust nature of qualitative data, the table below (Table 3) shows only a tiny fraction of findings based on the abundance of data collected and analyzed in our effort to answer the proposed research questions.

Table 3. Themes and perspectives and participant quotes.

RQ	Themes and Perspectives	Groups	Sample of Quotes
#1	- Realism and Observational Learning	Students	"They were actually humans." "Like a fly on the wall."
	- Usability Makes a Difference		"[Phone] is that make it easy for me to get this information, instead of having to have in headsets. So, for me, that is the first advantage that we have here, because we can use 360° environments by phone, to get access to this resource."
	- Please Advise: Suggestions for Improvements		"Her voice [the patient's] was quieter, so in a way, I wish I had been able to turn up the volume on her voice, but I was able to hear it."
	- Challenges—Are There Any?		"Maybe users might have different proficiency or competencies with technology, so that might be a little bit of a challenge, but that [using phone] was very easy; it seemed pretty intuitive to use it."

Table 3. *Cont.*

RQ	Themes and Perspectives	Groups	Sample of Quotes
#2	- Please Advise: Suggestions for Improvements	Faculty	"...students experience video for two minutes, and they come out, and then they complete some questions online, maybe in terms of what they should have been learning by that point, and then they go back in and continue [watching]."
	- Challenges—Are There Any?		"...it might be quite powerful for some people while it might be quite disorientating for some people."
#3	- Development and Evaluation	Students & faculty	"Some headway, or some training on how to would be beneficial."
	- What is Coming Next		Although there are no specific quotes available, both students and faculty address the need for future research focused on eye-tracking and compare the perceived effectiveness of the present immersive 360° IVRV intervention format against existing learning materials. These research efforts should lead toward evidence-based evaluation of the given intervention.

6. Limitations

The study's sample of eight participants is relatively modest. Though small sizes are acceptable in qualitative case-study designs, they restrict the extrapolation of results. We have therefore framed our results for thematic sufficiency rather than absolute saturation. Future work with larger or more diverse cohorts will be necessary to test the robustness of these themes across broader educational settings. Furthermore, the uniqueness of the study context, location, conducted procedures and purposefully selected participants causes a lack of replicability, which may be considered as another study limitation.

Beyond limited replicability and generalizability, the authors of this study acknowledged inherent challenges associated with the subjective nature of qualitative data analysis and interpretation. Researcher bias may influence data interpretation, as each of the two authors have their own set of personal beliefs and worldviews. Additionally, researchers also acknowledge potential participant bias as the study subjects were purposefully selected based on availability and willingness to interact with immersive learning environments such as 360° IVRV technology. Also, participants could alter their intervention behavior and responses as they were observed during the research intervention. To address these limitations within the present study, a few validation strategies were employed, including member checking and reflective journaling. These measures strengthened the trustworthiness of the findings and supported the overall rigor of the case study.

7. Conclusions and Closing Thoughts

This research proposed an exploratory approach to understanding faculty and student experiences with 360° IVRV simulations. Furthermore, the study was also designed to reveal auxiliary instructional conditions and elements that may play an important role in delivering 360° IVRV simulation learning content. The research findings revealed that study participants perceived a strong instructional potential in a 360° IVRV environment for delivering subject-specific learning content in the field of nursing education.

Specifically, both subsets of participants, faculty and students, expressed positive views on the integration of 360° IVRV content into the course curriculum while providing a few suggestions for the future improvement of the given intervention. From a curriculum development perspective, several profound study findings should be highlighted as follows: (a) 360° IVRV simulations strongly support the observational learning approach by providing realistic insight into clinical settings and procedures. (b) Delivery of the immersive simulations via smartphones appeared to be a significant advantage over standardized

VR headsets due to increased levels of usability of immersive media and affordability of the required hardware. Accessibility in terms of ensuring that students with disabilities and learning limitations can use the given simulation intervention content remains an open question. However, with a few technical adjustments such as closed captioning, this present issue may be fully resolved. (c) A number of valuable suggestions for the intervention improvements were identified (e.g., framing a future iteration of the simulation as a stand-alone learning module, pre-training or technology professional development for using this type of hardware and media, providing necessary technology support or instructions, or more subject-specific suggestions such as providing history of health conditions for patients featured in the simulation, etc.) which indicate a high level of faculty and student expectations about the next iteration of this instructional product. These suggestions for improvement seem realistic and feasible to accomplish from conceptual, design, and development standpoints.

In conclusion, the researchers highlight the need for future development of the proposed simulation approach based on the findings presented in this study. Additionally, continuous evaluation of future 360° IVRV product iterations is a mandatory component for optimizing the quality of this specific instructional content modality. Finally, faculty and nursing practitioners, including students, should consider this specific simulation delivery modality to enhance learning associated with clinical competencies, specifically the OLD CARTS procedure for gathering a thorough history of present illness from a patient.

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Abbreviations

The following abbreviations are used in this manuscript:

OLD CARTS	The Onset, Location, Duration, Characteristics, Aggravating/Alleviating Factors, Related Symptoms, Treatment, and Severity Method
360° IVRV	360-Degree Immersive Virtual Reality Videos
HMD	Head-Mounted Display
VR	Virtual Reality
AR	Augmented Reality

References

1. Sim, J.J.M.; Rusli, K.D.B.; Seah, B.; Levett-Jones, T.; Lau, Y.; Liaw, S.Y. Virtual simulation to enhance clinical reasoning in nursing: A systematic review and meta-analysis. *Clin. Simul. Nurs.* **2022**, *69*, 26–39. [[CrossRef](#)] [[PubMed](#)]
2. Narasimman, A.; Choudhari, S.G. Redefining clinical skills in history taking in association with epidemiological assessment of risk factors, and diagnosis of patients with cardiovascular diseases with A special emphasis on COVID-19. *Cureus* **2023**, *14*, e30829. [[CrossRef](#)] [[PubMed](#)]

3. Anako, C.; Johnson, K.; O'Brien, J. Virtual reality simulation in nursing education: A call for integration in nursing curricula. *J. Compr. Nurs. Res. Care* **2025**, *10*, 211. [\[CrossRef\]](#)
4. Chen, X.; Deng, J. Modeling the evolution of virtual reality in nursing education. *BMC Nurs.* **2025**, *24*, 1332. [\[CrossRef\]](#) [\[PubMed\]](#)
5. Chang, W.; Lin, C.C.; Crilly, J.; Lee, H.L.; Chen, L.C.; Han, C.Y. Virtual reality simulation for undergraduate nursing students for care of patients with infectious diseases: Mixed methods study. *JMIR Med. Educ.* **2025**, *11*, e64780. [\[CrossRef\]](#) [\[PubMed\]](#)
6. Alammery, M.A.; Halliday, L.; Konstantinidis, S.T. 360-degree virtual reality utilizing head-mounted devices in undergraduate nursing and midwifery education: A scoping review. *Virtual Worlds* **2023**, *2*, 396–421. [\[CrossRef\]](#)
7. Shreenikesh, N. 360-degree virtual reality. *Int. Sci. J. Eng. Manag.* **2023**, *2*. [\[CrossRef\]](#)
8. Snelson, C.; Hsu, Y.-C. Educational 360-degree videos in virtual reality: A scoping review of the emerging research. *TechTrends* **2020**, *64*, 404–412. [\[CrossRef\]](#)
9. Fugate, J.M.B.; Tonsager, M.J.; Macrine, S.L. Immersive extended reality (i-xr) in medical and nursing for skill competency and knowledge acquisition: A systematic review and implications for pedagogical practices. *Behav. Sci.* **2025**, *15*, 468. [\[CrossRef\]](#) [\[PubMed\]](#)
10. Plotzky, C.; Loessl, B.; Kuhnert, B.; Friedrich, N.; Kugler, C.; König, P.; Kunze, C. My hands are running away—Learning a complex nursing skill via virtual reality simulation: A randomized mixed methods study. *BMC Nurs.* **2023**, *22*, 222. [\[CrossRef\]](#) [\[PubMed\]](#)
11. Lario Women in Research. Immersive virtual reality technology on nursing students in higher education institutions: A systematic review. *JMIR Prepr.* **2025**, 1–29. [\[CrossRef\]](#)
12. Triyanto, E.; Kusumawardani, L.H.; Jauhar, M.; Ayu, G.A.; Rohana, P.D.; Rachmawati, U. Effect of virtual reality in 360 degrees video to improve standard precautions compliance amongst nursing students. *J. Keperawatan Soedirman* **2024**, *19*, 108–115. [\[CrossRef\]](#)
13. Johansen, F.; Toft, H.; Stalheim, O.R.; Løvsletten, M. Exploring the potential of virtual reality in nursing education: Learner's insights and future directions. *Adv. Simul.* **2025**, *10*, 7. [\[CrossRef\]](#) [\[PubMed\]](#)
14. Choi, G.W.; Woo, M.; Ryu, A.; Kim, J. The effectiveness of nursing education using immersive virtual reality or augmented reality: Systematic review and meta-analysis. *J. Korean Acad. Soc. Nurs. Educ.* **2024**, *30*, 197–211. [\[CrossRef\]](#)
15. Ford, L. Exploring how undergraduate BSc (Hons) nursing (child) students learn about end of life care through simulation—A descriptive case study. *Int. J. Pract.-Based Learn. Health Soc. Care* **2023**, *11*, 78–91. [\[CrossRef\]](#)
16. Sanford, N.; Raleigh, M.; Dickinson, T. A case study of a five-day virtual clinical simulation with pre-licensure nursing students. *J. Am. Nurses Assoc.-N. Y. (JANANY)* **2023**, *3*, 14–21. [\[CrossRef\]](#)
17. Sollars, E.D.; Xenakis, N. Simulation-based continuing education in health care social work: A case study of clinical training innovation. *Clin. Soc. Work J.* **2021**, *49*, 162–171. [\[CrossRef\]](#) [\[PubMed\]](#)
18. Yazan, B. Three approaches to case study methods in education: Yin, Merriam, and Stake. *Qual. Rep.* **2015**, *20*, 134–152. [\[CrossRef\]](#)
19. Anthony, S.; Jack, S. Qualitative case study methodology in nursing research: An integrative review. *J. Adv. Nurs.* **2009**, *65*, 1171–1181. [\[CrossRef\]](#) [\[PubMed\]](#)
20. Yin, R.K. *Case Study Research: Design and Methods*, 4th ed.; Sage: Los Angeles, CA, USA, 2009.
21. Yin, R.K. *Case Study Research and Applications: Design and Methods*, 6th ed.; Thousand Oaks: Los Angeles, CA, USA, 2018.
22. Merriam, S.B.; Tisdell, E.J. *Qualitative Research: A Guide to Design and Implementation*, 4th ed.; Jossey-Bass Publishers: San Francisco, CA, USA, 2016.
23. Merriam, S.B. *Qualitative Research and Case Study Applications an Education*; Jossey-Bass Publishers: San Francisco, CA, USA, 2001.
24. Stake, R.; Visse, M. Case study research. In *International Encyclopedia of Education*, 4th ed.; Tierney, R.J., Tierney, F., Ercikan, K., Eds.; Elsevier: New York, NY, USA, 2023; pp. 85–91.
25. Stake, R. *The Art of Case Study Research*; Thousand Oaks: Los Angeles, CA, USA, 1995.
26. Stake, R. Case study. In *Handbook of Qualitative Research*; Denzin, N., Lincoln, Y., Eds.; Thousand Oaks: Los Angeles, CA, USA, 1994; pp. 236–247.
27. Stake, R. Qualitative case studies. In *The Sage Handbook of Qualitative Research*, 3rd ed.; Denzin, N.K., Lincoln, Y.S., Eds.; Thousand Oaks: Los Angeles, CA, USA, 2005; pp. 443–466.
28. Stake, R. Case studies. In *Strategies of Qualitative Inquiry*, 2nd ed.; Denzin, N.K., Lincoln, Y.S., Eds.; Thousand Oaks: Los Angeles, CA, USA, 2003; pp. 134–164.
29. Aguboshim, F. Adequacy of sample size in a qualitative case study and the dilemma of data saturation: A narrative review. *World J. Adv. Res. Rev.* **2021**, *10*, 180–187. [\[CrossRef\]](#)
30. Marshall, B.; Cardon, P.; Poddar, A.; Fontenot, R. Does sample size matter in qualitative research? A review of qualitative interviews in is research. *J. Comput. Inf. Syst.* **2013**, *54*, 11–22. [\[CrossRef\]](#)
31. Creswell, J.W.; Poth, C.N. *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*, 4th ed.; Sage: Los Angeles, CA, USA, 2018.

32. Nowell, L.S.; Norris, J.M.; White, D.E.; Moules, N.J. Thematic analysis: Striving to meet the trustworthiness criteria. *Int. J. Qual. Methods* **2017**, *16*, 1–13. [\[CrossRef\]](#)
33. Roulston, K. *Reflective Interviewing: A Guide to Theory and Practice*; Thousand Oaks: Los Angeles, CA, USA, 2010.
34. Saldaña, J. *The Coding Manual for Qualitative Researchers*, 4th ed.; Thousand Oaks-Sage: Los Angeles, CA, USA, 2021.
35. Braun, V.; Clarke, V. Reflecting on reflexive thematic analysis. *Qual. Res. Sport Exerc. Health* **2019**, *11*, 589–597. [\[CrossRef\]](#)
36. Braun, V.; Clarke, V. Using thematic analysis in psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [\[CrossRef\]](#)
37. Gibson, W.J.; Brown, A. *Working with Qualitative Data*; Sage Publications: Los Angeles, CA, USA, 2009.
38. ISO 9241-210:2010; Ergonomics of Human-System Interaction—Part 11: Guidance on Usability. International Organization for Standardization: Geneva, Switzerland.
39. Yang, J.; Guo, M.; Corona, E.A.; Daniel, B.; Leuze, C.; Baik, F. VR MRI training for adolescents: A comparative study of gamified VR, passive VR, 360° video, and traditional educational video. In Proceedings of the 2025 IEEE International Symposium on Mixed and Augmented Reality (ISMAR), Daejeon, Republic of Korea, 8–12 October 2025. [\[CrossRef\]](#)
40. Ranieri, M.; Luzzi, D.; Cuomo, S.; Bruni, I. If and how do 360° videos fit into education settings? Results from a scoping review of empirical research. *J. Comput. Assist. Learn.* **2022**, *38*, 1199–1219. [\[CrossRef\]](#)
41. Blair, C.; Walsh, C.; Best, P. Immersive 360° videos in health and social care education: A scoping review. *BMC Med. Educ.* **2021**, *21*, 590. [\[CrossRef\]](#) [\[PubMed\]](#)
42. Aydin, M.Y.; Curran, V.; White, S.; Peña-Castillo, L.; Meruvia-Pastor, O. A comparative study of the use of extended reality simulation in neonatal resuscitation training. *Adv. Simul.* **2025**, *10*, 15. [\[CrossRef\]](#) [\[PubMed\]](#)
43. Sultan, L.; Abuznadah, W.; Al-Jifree, H.; Khan, M.A.; Alsaywid, B.; Ashour, F. An experimental study on usefulness of virtual reality 360° in undergraduate medical education. *Adv. Med. Educ. Pract.* **2019**, *10*, 907–916. [\[CrossRef\]](#) [\[PubMed\]](#)
44. Serrano, B.; Baños, R.M.; Botella, C. Virtual reality and stimulation of touch and smell for inducing relaxation: A randomized controlled trial. *Comput. Hum. Behav.* **2016**, *55*, 1–8. [\[CrossRef\]](#)
45. Blok, A.; Bach-Stante, D.; Merlotti, A.; Schoville, R.; Jones, H.; Davis, K.; Sicard, A.; Aebbersold, M. Educational 360-video development for clinical practice improvement toward deaf and hard-of-hearing populations. *Clin. Simul. Nurs.* **2023**, *83*, 101436. [\[CrossRef\]](#)
46. Boudouaia, A.; Li, Y.; Shadiev, R.; Xie, Y. Navigating virtual English learning horizons: A study on students' use of 360° videos in self-directed learning. *Educ. Inf. Technol.* **2024**, *29*, 24223–24254. [\[CrossRef\]](#)
47. Rosendahl, P.; Wagner, I. 360° videos in education: A systematic literature review on application areas and future potentials. *Educ. Inf. Technol.* **2024**, *29*, 1319–1355. [\[CrossRef\]](#)
48. Hamilton, D.; McKechnie, J.; Edgerton, E.; Wilson, C. Immersive virtual reality as a pedagogical tool in education: A systematic literature review of quantitative learning outcomes and experimental design. *J. Comput. Assist. Learn.* **2021**, *37*, 887–901. [\[CrossRef\]](#)
49. Han, X.; Luo, H.; Wang, Z.; Zhang, D. Using virtual reality for teacher education: A systematic review and meta-analysis of literature from 2014 to 2024. *Front. Virtual Real.* **2025**, *6*, 1620905. [\[CrossRef\]](#)
50. Clark, R.C.; Nguyen, F.; Sweller, J. *Efficiency in Learning: Evidence-Based Guidelines to Manage Cognitive Load*; John Wiley & Sons: New York, NY, USA, 2006.
51. Mayer, R.E. *Multimedia Learning*; Cambridge University Press: Cambridge, UK, 2001.
52. Mayer, R.E.; Pilegard, C. Principles for managing essential processing in multimedia learning: Segmenting, pre-training, and modality principles. In *The Cambridge Handbook of Multimedia Learning*, 2nd ed.; Mayer, R.E., Ed.; Cambridge University Press: Cambridge, UK, 2014; pp. 316–344. [\[CrossRef\]](#)
53. Dick, W.; Carey, L.; Carey, J. *The Systematic Design of Instruction*; Pearson Publishing: Boston, MA, USA, 2015.
54. Ritzhaupt, A.D.; Covello, S. *ADDIE Explained*; University of New Hampshire Press: New Hampshire, NH, USA, 2017. Available online: <https://pressbooks.usnh.edu/addieexplained> (accessed on 1 January 2026).

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