



## Students and teachers' satisfaction and perspectives on high-fidelity simulation for learning fundamental nursing procedures: A mixed-method study

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### ABSTRACT

**Background:** High-fidelity clinical simulation enables skills to be acquired safely and securely by bridging the gap between theory and clinical practice. This method has traditionally been used to address complex clinical scenarios. Students often report high levels of satisfaction and self-confidence, as this method allows them to put techniques and procedures into practice in a safe environment. Most studies assess simulation solely from the students' perspective, disregarding the opinions of teaching staff.

**Objectives:** To assess the implementation of high-fidelity simulation as a teaching tool for fundamental nursing procedures from the perspectives of students and teachers.

**Design:** A two-phase mixed-methods study.

**Setting:** A simulation centre environment at the University of the Balearic Islands (Spain) during the 2018 academic year.

**Participants:** Second-year nursing students and staff teaching practical classes on basic patient assessment and monitoring of vital signs.

**Methods:** Satisfaction with clinical experience simulation scale, including an open-ended question for students, was used. A focus group session was also held with teachers.

**Results:** A total of 91 students completed the scale, yielding an overall satisfaction score of 9.3 out of 10. The practical dimension attained the highest scores. Motivation to attend class was the lowest-rated aspect of this dimension, although students' expectations and satisfaction increased during the class. In the open-ended question and the debriefing session, students described the simulation as a playful learning method allowing them to put their theoretical knowledge into practice and helping them to manage their fears before coming into contact with real care settings. In the focus group session, teachers analysed their own experiences and described how they perceived students' satisfaction and practical skills.

**Conclusions:** High-fidelity simulation produces good academic outcomes and is highly satisfying for students and teachers.

### 1. Introduction

Clinical placements are often a stressful and distressing experience for nursing students. Levels of stress and anxiety in this context have

been described as moderately high (Hernández Ortega et al., 2020), especially among students who are about to start their placements (López-Medina and Sánchez-Criado, 2005). Academic and clinical stressors include lack of professional knowledge and skills, helplessness,

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uncertainty, caring for patients, and fear of causing harm (Hernández Ortega et al., 2020; Lestander et al., 2016; Pulido-Martos et al., 2012). To better cope with these stressful circumstances, Pulido-Martos et al. (2012) recommends improving students' skills with hands-on training.

Clinical simulation (CS) is a learning method that can help students to make contact with the clinical setting before starting their placements. CS is an effective educational tool providing an initial guided experience by evoking real aspects involved in patient assessment, diagnosis, and care (Gaba, 2004). It bridges the gap between classroom knowledge and actual clinical experience, and enables skills to be acquired in a safe and controlled manner (Jeffries and Rizzolo, 2006; Shin et al., 2015).

CS has proven to be effective for the acquisition of skills in settings as diverse as critical care, community health education, midwifery training, palliative care, and the promotion of collaborative practice (Bartlett et al., 2014; Cant and Cooper, 2017; Cooper et al., 2012; Luctkar-Flude et al., 2015; Nyström et al., 2016; Smith and Barry, 2013). CS can involve differing degrees of realism, ranging from low-fidelity simulation, normally used for practising specific technical skills, to high-fidelity simulation (HFS), which is often used in more complex scenarios (Meakim et al., 2013). To ensure an effective experience, standardised recommendations should be used to plan the simulation and adapted to the institution's learning objectives (INACSL Standards Committee, 2016).

Students tend to report high levels of satisfaction and self-confidence with CS, as it allows them to practise techniques and procedures without the risk of harming patients, which is a common concern in clinical placements (Au et al., 2016; Castillo Arcos and Maas Góngora, 2017). CS is a method that improves students' psychomotor skills (Shin et al., 2015) and promotes critical thinking in a fun and enjoyable way (Lapkin et al., 2010; Shin et al., 2015). Students feel that this teaching method allows them to learn a number of procedures and improve their prioritisation and decision-making skills (Alconero-Camarero et al., 2020; Lestander et al., 2016). Among the aspects most highly rated by students are the possibility of relating theory to practice and re-enacting real-life situations through the scenarios proposed (Alconero-Camarero et al., 2020; Lestander et al., 2016). Student satisfaction, which is closely related to the degree of fidelity of the simulation (Baptista et al., 2016; Jeffries and Rizzolo, 2006), is associated with greater engagement and motivation, which in turn facilitates the learning process (Alconero-Camarero et al., 2020; Baptista et al., 2014; Lapkin et al., 2010). Specifically, HFS stimulates students' cognitive, psychomotor, and affective skills (Baptista et al., 2016) and allows them to make self-assessments and reflect on their recent experiences (Castillo Arcos and Maas Góngora, 2017; Omer, 2016).

Most studies assess simulation solely from the students' perspective, disregarding the opinions of teaching staff. However, a number of studies recognise the importance of teacher education and training for successful HFS implementation (Abelsson and Bisholt, 2017; Alconero-Camarero et al., 2020).

## 2. Background

Low-fidelity simulation activities, known as practical classes, have traditionally been included in the nursing degree at the University of the Balearic Islands, Spain. In the 2016–2017 academic year, a Laerdal SimMan 3G dummy was purchased and incorporated into some of these classes as an educational tool for HFS in response to teaching innovation needs (ANECA, 2004). Specifically, it was included in the training of second-year students prior to the start of their clinical placements, so that they could learn basic patient assessment and monitoring of vital signs, incorporating nursing techniques into the overall process of clinical judgement in nursing (Lapkin et al., 2010). These skills are set out in the *White Paper on Nursing Degrees* which governs nursing curricula across Spain (ANECA, 2004). To carry out these activities, three scenarios with measurable objectives were designed according to

INACSL Standards (2016). As a pre-briefing, students were provided with the objectives of the activity and the necessary techniques' procedures to address the scenarios. At the beginning of the activity, students' questions were answered and they practised the procedures with one another. During the simulation itself, one teacher, who took a facilitative approach, spent 2 h working with groups of 5–6 students in the simulation rooms. Students should wear their uniforms to increase their sense of realism and help them to envisage themselves as professionals (INACSL Standards Committee, 2016; Lubbers and Rossman, 2017). They must work in pairs on three scenarios requiring them to make clinical assessments and monitor vital signs. Upon completion, the session is analysed in an unstructured debriefing.

The primary objectives of the scenarios are as follows (Table 1):

- To measure and assess basic vital signs: body temperature, heart rate, respiratory rate, blood pressure, pain, level of consciousness, and orientation.
- To identify the most relevant issue affecting the patient.
- To identify the priority activities that should be carried out immediately to address the situation.
- To practise clinical assessment and communication skills.

### 2.1. Objectives

To assess the implementation of HFS as a teaching tool for fundamental nursing procedures.

- To ascertain the degree of satisfaction of second-year nursing students with the HFS implemented in practical classes.
- To explore how teachers perceive the inclusion of HFS as a teaching method.

**Table 1**  
Learning indicators for the clinical scenarios.

Scenario	Scenario 1: Older adult with delirium, at risk of hypothermia	Scenario 2: Patient with postoperative pain	Scenario 3: Patient with suspected respiratory infection and fever
Monitoring	Measuring pulse rates, HR, RR, BP, SpO <sub>2</sub> , BT <sup>a</sup> , level of consciousness <sup>a</sup> , and orientation <sup>a</sup>	Measuring pulse rates, HR <sup>a</sup> , BP <sup>a</sup> , RR, SpO <sub>2</sub> <sup>a</sup> and BT.	Measuring pulse rates, HR, BP, RR <sup>a</sup> , SpO <sub>2</sub> <sup>a</sup> , BT <sup>a</sup> , and bilateral auscultation of the lungs <sup>a</sup>
	Asking the patient if they feel comfortable and if they need anything.	Asking the patient how they feel and the level of pain they are experiencing (using a visual analogue scale)	Asking the patient how they feel, especially if they have dyspnoea or difficulty breathing
Intervention	Introducing oneself to reorient the patient	Sitting the patient up	Sitting the patient up in Fowler's or high Fowler's position
	Covering the patient with a blanket	Administering painkillers	Administering supplemental oxygen and antipyretic drugs
	Assessment of the effectiveness of the activities performed		

HR: Heart rate.

RR: Respiratory rate.

BP: Blood pressure.

SpO<sub>2</sub>: Oxygen saturation.

BT: Body temperature.

<sup>a</sup> Key performance indicators.

### 3. Methods

A mixed-methods design was used to fulfil the aforementioned objectives.

#### 3.1. Design of the quantitative phase

A cross-sectional, descriptive study was conducted using a validated questionnaire once the HFS had been completed. All second-year nursing students enrolled in the first clinical placement during the 2017–2018 academic year were included. Student satisfaction was measured using the satisfaction with clinical experience simulation scale (the ESECS scale) by Baptista et al. (2014). This instrument includes 17 items to be rated by students using a 10-point Likert scale, with 1 indicating the lowest level of satisfaction and 10 the highest level of satisfaction. The items, grouped into three dimensions (practical, realistic, and cognitive), address student satisfaction with the activity, method used, teachers, equipment, simulation space, peer interaction, and difficulty of the activity. An open-ended question was also included, in which students could comment or reflect openly on any aspect they considered relevant. Upon completion of the HFS, students were asked to complete the ESECS questionnaire, which was administered in paper format by the teachers. To ensure the anonymity of the respondents and minimise any potential biases, students were instructed to leave their questionnaires in a designated space that would only be accessible after all sessions had ended. Data collection took place between February and March 2018. A descriptive analysis of the data was performed using SPSS 22.0. A content analysis of the responses given to the open-ended question was also conducted.

#### 3.2. Design of the qualitative phase

In a second phase, a qualitative study was carried out to address the second study objective by holding a focus group session with teachers. The participants for this phase were the teaching staff who had led the previous activity (two women and one man). All three were clinical nurses with more than 5 years' teaching experience in practical classes on vital signs. The focus group session, led by two of the researchers in the study, was held at the end of the academic year. An inductive/deductive content analysis of the focus group transcript was performed. Results were then triangulated by members of the research team and subjected to a member checking process with the teachers.

#### 3.3. Ethical considerations

The processing, communication, and transfer of the personal data belonging to all participants were carried out in compliance with the Declaration of Helsinki and the provisions of Spanish Organic Law 3/2018. The activity described was part of a simulation project undertaken by the Faculty of Nursing and Physiotherapy at the University of the Balearic Islands.

The confidentiality of the data and the anonymity and privacy of both students and teachers were preserved at all times in accordance with current Spanish legislation. Only members of the research team had access to personal information. Every student and teacher voluntarily participated in the study. Participation in the study did not involve any academic compensation for students or financial compensation for any of the participants.

### 4. Results

Firstly, we present the results obtained from students via the questionnaire and, secondly, the results of the focus group session held with teaching staff.

#### 4.1. Student satisfaction

Eighty-eight percent of students enrolled in the subject completed the questionnaire ( $n = 91$ ). A number of students failed to complete the survey because the activity lasted longer than planned in two of the groups and the resultant lack of time prevented questionnaire administration. The mean age of the participants was 23.7 years ( $SD = 8.3$ ). Their overall satisfaction with the activity, as measured via the ESECS, was 9.3 out of 10. Table 2 shows the scores for each item, which range from 8.38 to 9.78.

Students were highly satisfied with the practical dimension, which attained a mean score of 9.37, making it the highest rated dimension. Motivation to attend the class was the lowest rated aspect in the category. During the activity, students' expectations and satisfaction increased, with interaction with teaching staff being the most highly rated aspect of all dimensions.

Overall satisfaction with the realism dimension attained a mean score of 9.2 out of 10, the second most highly rated dimension. Students rated the quality of the patient simulator very highly. Credibility while performing the scenarios was one of the poorest rated items in the entire questionnaire, despite scoring almost 9.

The mean student satisfaction with the cognitive dimension was 9.07. Specifically, they rated the relevance to the topics covered in the practical classes higher than the connection between the scenarios used and the theory.

In the open-ended question and during the debriefing, students expressed their satisfaction and fears when facing real-life scenarios. Firstly, students acknowledged that this type of activity offers them a better insight into the reality of healthcare by allowing them to apply and make sense of the theoretical knowledge they have acquired. Secondly, it is a good way to incorporate the theory of different subjects into individual clinical cases. Thirdly, this activity helps them to deal with the fears they have when they first come into contact with the clinical environment. In summary, it is a productive activity for students that allows them to acquire new skills and abilities in an engaging way. Among the areas for improvement, students requested greater and earlier use of clinical simulation. Table 3 shows the ideas obtained from the open-ended questions.

**Table 2**  
Results of the student questionnaire.

(N = 91)		
Indicator	Score (1–10)	Standard deviation
Satisfaction with the practical dimension		
A1. Overall satisfaction with practical classes	9.63	0.71
A2. Satisfaction with learning achievements	9.32	0.87
A3. Motivation to attend the class	8.39	1.44
A4. Dynamism of the practical class	9.49	0.69
A5. Active participation in the scenarios performed	9.42	0.89
A6. Interaction with peers	9.74	0.60
A7. Interaction with teaching staff	9.78	0.58
A8. Satisfaction with the degree of difficulty of the scenarios	9.09	0.97
A9. Productivity during the practical class	9.52	0.73
Satisfaction with the realism dimension		
B1. Realism of the scenarios performed	9.10	1.07
B2. Credibility while performing the scenarios	8.91	1.20
B3. Quality of the materials used in the practical classes	9.21	1.05
B4. Quality of the equipment used in the practical classes	9.32	0.91
B5. Quality of the simulator	9.45	0.87
Satisfaction with the cognitive dimension		
C1. Connection between scenarios and theory	8.87	1.17
C2. Relevance to the topics covered in the practical classes	9.29	0.90

**Table 3**  
Codes and verbatims obtained from the open-ended questions.

Applying theoretical knowledge	<i>"It's a good opportunity to deal with a real case."</i> (S15) <i>"The experience has been very satisfying for me, as the simulator looked like a real person, with the topics covered during the course."</i> (S24)
Managing their fears before coming into contact with the care setting	<i>"I really liked using the simulator because it allowed me to break the ice before the actual clinical practice. I felt a bit disorientated though."</i> (S25) <i>"I think it was a good way for us to get into a real situation with a patient. It also helps us to get over our fears about our placements a bit."</i> (S89)
Playful learning	<i>"It's been very productive and educational."</i> (S16) <i>"So much fun!"</i> (S58)
Areas for improvement	<i>"It should be used from the first week of the first year."</i> (S5) <i>"I wish the simulator could be used in theoretical subjects so that we're able to let all that information sink in and gain more experience."</i> (S24)

4.2. Teachers' perceptions

Firstly, the teachers described their perceptions of students' satisfaction and experience. On the one hand, teachers considered that HFS was highly rewarding for students, generating anticipation and acquainting them with the reality of healthcare system. On the other hand, they also observed that students were stressed by the circumstances they faced, regardless of the level of difficulty of the clinical scenario.

Secondly, the teachers reflected on the skills that students put into practice. HFS offers the possibility of working on many of the skills that students must acquire in a very short period of time in a comprehensive way, allowing them to apply theory to a clinical scenario. In this sense, the teachers felt that HFS facilitates the comprehensive assessment of patients, beyond simply monitoring their vital signs. In addition, HFS creates an environment that increases students' awareness of the importance of clinical safety and the consequences of making mistakes in healthcare practice. According to teachers, students realise the importance of communicating and interacting with patients while respecting their feelings, dignity, and privacy. HFS helps them to work as a team and to discover the autonomous, interdisciplinary role of nursing practice. In addition, students must make decisions and prioritise the activities to be carried out. This prompts them to reflect on their own abilities and skills.

Thirdly, they analysed their own experience from the perspective of their role as teachers. They were satisfied and motivated when teaching these classes; however, this method generates greater stress for them due to its dynamic, unpredictable nature. They felt that this type of activity promotes the establishment of more cooperative and horizontal relationships between students and teachers. Nonetheless, from a self-critical point of view, they explained that there were areas for improvement, especially during the debriefing session. They also called for further continued professional development to receive additional training in the handling and programming of the simulator and demanded greater recognition of the time required to prepare the scenarios.

Table 4 shows the categories and codes obtained from this qualitative analysis, with several representative teachers quotes by way of example.

5. Discussion

In this study, HFS has proven to be a highly satisfying learning method for students and teachers alike, with great potential for training

**Table 4**  
Categories, codes and representative teachers quotes obtained from the focus group session with teachers.

Teachers' perceptions of students' satisfaction and experience	
Student satisfaction	<i>"I see them leave [the classroom] very, very happy, even though they realise where they've got themselves into. They're so excited when they leave!"</i> (T1) <i>"They love it! And if any piece of information ever leaks out, they come [to class] in anticipation: 'When do we get to see the dummy?'"</i> (T2)
An insight into reality	<i>"They become aware of this for the first time and, on top of that, they get to have fun and enjoy themselves... You have to see their sheer, genuine excitement!"</i> (T1) <i>"It's so realistic that they experience it as if it was real."</i> (T1)
Stressful situation	<i>"And you see how their expressions change and they start getting anxious, and you see them having a hard time."</i> (T1) <i>"We help them to put the pressure on."</i> (T2)
Skills that teachers felt that students put into practice	
Overall patient assessment	<i>"More precisely, what simulation allows them to do is add value to the blood pressure and vital sign readings they're taking, it allows them to see that they're not just numbers."</i> (T2) <i>"It goes beyond taking vital sign readings (...). They become aware of all the things they have to monitor; they see that they have to cover a patient, check if he's sitting up..."</i> (T3)
Relationship with the patient (emotional and ethical dimensions)	<i>"This activity brings emotions to the fore (...). We work with people, and people have feelings and emotions."</i> (T2) <i>"They realise they can't lie to patients."</i> (T2)
Decision-making	<i>"Decision-making, prioritising, what you have to do, what's most important... They haven't thought about any of that until they get there. I think it's the first time they become aware of that."</i> (T1) <i>"When they're there, they realise that what they have to do is analyse, observe, assess, prioritise, make decisions, and, above all, act swiftly."</i> (T1)
Teamwork	<i>"Sometimes I do the 'Ask the audience' thing (...) and, oddly enough, students who are just watching are calmer and more aware of things; [simulation] is helpful for both participants and audience."</i> (T2) <i>"We get to know each other little by little, and when hours go by, they get carried away (...) they've made a team."</i> (T1)
Autonomous, interdisciplinary role	<i>"It allows us to see that there are nursing practices that are autonomous, because many call the doctor right away, to cover the patient, to heat the room..."</i> (T2) <i>"It helps them a lot to get their bearings, to orient themselves when it comes to roles."</i> (T1)
Students' reflections	<i>"It goes way beyond taking vital sign readings. You're assailed by doubts like 'Will I know how to do that? How am I doing?' or 'Will I be able to do it? Look at all the things I have to keep an eye on so that nobody dies on me!'"</i> (T3)
Teachers' own experiences	
Teacher satisfaction	<i>"I had so much fun!"</i> (T2) <i>"It really improves the practical classes and takes you out of your comfort zone."</i> (T3)
Stress caused by the activity	<i>"At first I was very anxious looking at the notes for the scenario at home [thinking] 'Will I forget how to operate the simulator?'"</i> (T3) <i>"Even though we've been doing this for years, you're always on edge the first couple of days [thinking] 'have I had a good look at it? Have I gone over it properly?'"</i> (T1)
Relationship with students	<i>"Some of them give me a peck on the cheek when they leave; it moves them. I find it quite</i> <i>(continued on next page)</i>

Table 4 (continued)

Teachers' perceptions of students' satisfaction and experience	
Areas for improvement	<i>surprising... because I'm very old-fashioned."</i> (T2)
	<i>"Everyone [teachers and students] is sharing [the experience]. The teacher's role and the student's role become blurred. (...) There's a really good atmosphere!"</i> (T3)
	<i>"I think that it would be very important to record the debriefing [on video] because there are always gestures, glances that you may have missed."</i> (T3)
	<i>"We [teachers] need more time to work together on scenarios so that new teachers are already trained in case anyone gets sick."</i> (T2)
	<i>"We should get paid for the time spent in meetings to design the scenarios."</i> (T2)

future nurses. Our results are in line with studies analysing students' perceptions of HFS implementation and encourage us to further develop HFS in nursing studies (Alconero-Camarero et al., 2020; Au et al., 2016; Baptista et al., 2014, 2016; Castillo Arcos and Maas Góngora, 2017; Lestander et al., 2016; Omer, 2016; Shin et al., 2015). After an initial analysis of the questionnaire data, we suspected potential obsequiousness bias. However, the high level of student satisfaction was also perceived by the teaching staff. Regarding teachers' satisfaction, a study by Alconero-Camarero et al. (2020) points in the same direction, although teachers' perceptions remain understudied to date.

The scale validated by Baptista et al. (2014) was very useful in measuring student satisfaction and ascertaining levels of motivation. In our work, the practical dimension was the most highly rated. However, in a study by Baptista et al. (2014), satisfaction regarding the cognitive dimension attained the highest mean values, while practical satisfaction scored the lowest.

On the other hand, the decision to include an open-ended question enabled us to better understand the students' experiences. Some of the emerging categories or themes, such as stress among students, beginning to understand and implement nursing knowledge to assess patients' needs, and prioritising decision-making, can also be found in other studies, such as Lestander et al. (2016). Looking ahead to future studies, we are considering expanding our knowledge of student satisfaction by using qualitative techniques (Lestander et al., 2016) or other scales, such as Alconero-Camarero et al. (2016), which also explores students' assessments and perceptions of the skills they worked on and acquired through the simulation.

Among the aspects most highly rated by students was the quality of the simulator, which can be partly explained by the high fidelity of the simulator used and by students' fascination with technology, which was also perceived by teachers. In the same vein, Baptista et al. (2016) concluded that the realism of HFS contributes to student satisfaction. Another of the most satisfying aspects for students was interaction with teachers and peers, which is in consonance with teachers' assessment that HFS encourages comradeship and teamwork. This teaching methodology also puts teacher-student relationships on an equal footing, blurring pre-established roles.

Students demanded greater use of HFS from the beginning of their academic training. However, this methodology requires students to have some degree of basic theoretical knowledge to implement it. In addition, teachers explained that this type of activity requires greater preparation and effort, as each scenario must be available and updated using the simulator software (Jeffries and Rizzolo, 2006; Meakim et al., 2013).

In the focus group session, teachers stressed the importance of receiving feedback from students, which helped them to identify areas for improvement. This interaction usually takes place during debriefing (Lapkin et al., 2010). We agree with the points made by Abellson and Bisholt (2017) regarding the importance of the teacher's role in the activity and the influence it will have on student learning. Teachers' ability

to moderate the debriefing is key to gaining a deeper understanding of students' knowledge, creating opportunities for critical thinking, and guiding students in the pursuit of teaching goals.

Our results coincide with other studies advocating the use of CS over other methodologies to work on skills relating to human relationships and practical aspects (Alconero-Camarero et al., 2020; Lapkin et al., 2010; Shin et al., 2015). Specifically, HFS facilitates clinical assessment, care planning, decision-making, and teamwork, essential skills set out in the *Spanish White Paper on Nursing Degrees* (ANECA, 2004). The primary objective of the activity was to provide training in monitoring vital signs; nonetheless, teachers felt that it would also be useful to include the procedure in holistic care and work on other aspects, such as patient assessment, communication with patients, and promoting respect for patients (Bartlett et al., 2014). In addition, teachers acknowledged the potential of HFS to improve emotional skills, which were also highlighted by instructors in a study by Alconero-Camarero et al. (2020). The potential of HFS to go beyond taking vital sign readings was also addressed in other studies, such as Lestander et al. (2016). Other aspects relating to patient safety, decision-making, and professional ethics emerged in both students' and teachers' comments, coinciding with other studies, most notably Castillo Arcos and Maas Góngora (2017). Moreover, our study revealed opinions on the immediate sense of usefulness provided by CS and the advantages of linking theory and practice, which is often difficult for students (Alconero-Camarero et al., 2020; Au et al., 2016; Lestander et al., 2016). Furthermore, students rated the insight into reality offered by HFS very highly, explaining that it helped them to shed their fear of the unknown. Teachers also observed that students viewed CS positively and believed that it could help them control the stress and anxiety caused by clinical placements (Au et al., 2016; Hernández Ortega et al., 2020; Lestander et al., 2016; López-Medina and Sánchez-Criado, 2005; Pulido-Martos et al., 2012). Finally, after the HFS, students reflected on and self-assessed their skills and abilities, as described in other studies (Castillo Arcos and Maas Góngora, 2017; Omer, 2016).

### 5.1. Limitations

Our results were obtained using different techniques, which makes it difficult to make interpretative comparisons between students and teachers. In order to better analyse the similarities and differences between the two groups, it would be helpful to explore students' perspectives in greater depth using qualitative techniques.

## 6. Conclusion

High-fidelity simulation brings students closer to real-life scenarios, bridges the gap between theory and practice, and offers students an insight into the healthcare system, which is unknown to them and represents a source of significant stress. As a result, they become aware of their responsibilities and of the importance of effective, relevant decision-making when addressing the health problems of patients and their families. Creating experiences in a parallel reality encourages reflection on those experiences with the aim of learning not only the theory of technical procedures but also their implementation as part of a comprehensive approach to care, which is a key element in nursing studies. In addition, students assessed the team relationships they established with their teachers and peers during the activity very positively. In summary, high-fidelity simulation is a teaching method that produces good academic outcomes and is highly satisfying for students and teachers.

Further studies are needed to explore teachers' perceptions of high-fidelity simulation implementation and to compare them with those of students in order to further improve performance.

## CRedit authorship contribution statement

**Carrero-Planells, Alba:** Conceptualization, Methodology, Project administration, Writing – Original Draft, Writing – Review & Editing. **Pol-Castañeda, Sandra:** Methodology, Data curation, Formal analysis, Writing – Original Draft, Writing – Review & Editing, Updating bibliographic research. **Alamillos-Guardiola, MC:** Conceptualization, Investigation, Curation data, Writing – Review & Editing. **Prieto-Alomar, Araceli:** Conceptualization, Investigation, Writing – Review & Editing. **Tomás-Sánchez, Marc:** Conceptualization, Investigation, Writing – Review & Editing. **Moreno-Mulet, Cristina:** Conceptualization, Methodology, Supervision, Project administration, Writing – Original Draft, Writing – Review & Editing.

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## Declaration of competing interest

None.

## References

- Abelsson, A., Bisholt, B., 2017. Nurse students learning acute care by simulation – focus on observation and debriefing. *Nurse Educ. Pract.* 24, 6–13. <https://doi.org/10.1016/j.nepr.2017.03.001>.
- Alconero-Camarero, A.R., Gualdrón-Romero, A., Sarabia-Cobo, C.M., Martínez-Arce, A., 2016. Clinical simulation as a learning tool in undergraduate nursing: validation of a questionnaire. *Nurse Educ. Today* 39, 128–134. <https://doi.org/10.1016/j.nedt.2016.01.027>.
- Alconero-Camarero, A.R., Sarabia Cobo, C.M., González-Gómez, S., Ibáñez-Rementería, I., Alvarez-García, M.P., 2020. Descriptive study of the satisfaction of nursing degree students in high-fidelity clinical simulation practices. *Enferm. Clin.* 30, 404–410. <https://doi.org/10.1016/j.enfcle.2019.07.007>.
- ANECA, 2004. White Paper on Nursing Degrees. ANECA, Madrid.
- Au, M.L., Lo, M.S., Cheong, W., Wang, S.C., Van, I.K., 2016. Nursing students' perception of high-fidelity simulation activity instead of clinical placement: a qualitative study. *Nurse Educ. Today* 39, 16–21. <https://doi.org/10.1016/j.nedt.2016.01.015>.
- Baptista, R., Martins, J., Pereira, F., Mazzo, A., 2014. Students' satisfaction with simulated clinical experiences: validation of an assessment scale. *Rev. Lat. Am. Enfermagem* 22, 709–715. <https://doi.org/10.1590/0104-1169.3295.2471>.
- Baptista, R., Paiva, L., Gonçalves, R., Oliveira, L., Pereira, M., Martins, J., 2016. Satisfaction and gains perceived by nursing students with medium and high-fidelity simulation: a randomized controlled trial. *Nurse Educ. Today* 46, 127–132. <https://doi.org/10.1016/j.nedt.2016.08.027>.
- Bartlett, J.L., Thomas-Wright, J., Pugh, H., 2014. When is it okay to cry? An end-of-life simulation experience. *J. Nurs. Educ.* 53, 659–662. <https://doi.org/10.3928/01484834-20141023-02>.
- Cant, R.P., Cooper, S.J., 2017. The value of simulation-based learning in pre-licensure nurse education: a state-of-the-art review and meta-analysis. *Nurse Educ. Pract.* 27, 45–62. <https://doi.org/10.1016/j.nepr.2017.08.012>.
- Castillo Arcos, L. del C., Maas Góngora, L., 2017. Perception of satisfaction of students in the use of clinical simulation. *Ra Ximhai* 13, 63–76. <https://doi.org/10.35197/rx.13.02.2017.05.lc>.
- Cooper, S., Cant, R., Porter, J., Bogossian, F., McKenna, L., Brady, S., Fox-Young, S., 2012. Simulation based learning in midwifery education: a systematic review. *Women Birth* 25, 64–78. <https://doi.org/10.1016/j.wombi.2011.03.004>.
- Gaba, D.M., 2004. The future vision of simulation in health care. *Qual. Saf. Heal. Care* 13, 2–11. <https://doi.org/10.1136/qshc.2004.009878>.
- Hernández Ortega, R., González Pascual, J., Fernández Araque, A., 2020. Stress and anxiety in nursing students at the start of their clinical practice. *Metas Enferm* 23, 50–58. <https://doi.org/10.35667/MetasEnf.2019.23.1003081613>.
- INACSL Standards Committee, 2016. INACSL standards of best practice: simulation. *Simulation design. Clin. Simul. Nurs.* 12, S5–S12. <https://doi.org/10.1016/j.ecns.2016.09.012>.
- Jeffries, P.R., Rizzolo, M.A., 2006. Designing and Implementing Models for the Innovative Use of Simulation to Teach Nursing Care of Ill Adults and Children: A National, Multi-Site, Multi-Method Study. National League for Nursing, New York.
- Lapkin, S., Levett-Jones, T., Belchambers, H., Fernandez, R., 2010. The effectiveness of using human patient simulation manikins in the teaching of clinical reasoning skills to undergraduate nursing students: a systematic review. *JBI Libr. Syst. Rev.* 8, 661–694. <https://doi.org/10.1016/j.jecns.2010.05.005>.
- Lestander, Ö., Lehto, N., Engström, Å., 2016. Nursing students' perceptions of learning after high fidelity simulation: effects of a three-step post-simulation reflection model. *Nurse Educ. Today* 40, 219–224. <https://doi.org/10.1016/j.nedt.2016.03.011>.
- López-Medina, I.M., Sánchez-Criado, V., 2005. Perception of stress in nursing students during clinical practice placements. *Enferm. Clin.* 15, 307–313. [https://doi.org/10.1016/S1130-8621\(05\)71136-0](https://doi.org/10.1016/S1130-8621(05)71136-0).
- Lubbers, J., Rossman, C., 2017. Satisfaction and self-confidence with nursing clinical simulation: novice learners, medium-fidelity, and community settings. *Nurse Educ. Today* 48, 140–144. <https://doi.org/10.1016/j.nedt.2016.10.010>.
- Luctkar-Flude, M., Tyerman, J., Wilson-Keates, B., Pulling, C., Larocque, M., Yorke, J., 2015. Introduction of unresponsive patient simulation scenarios into an undergraduate nursing health assessment course. *J. Nurs. Educ.* 54, 281–285. <https://doi.org/10.3928/01484834-20150417-06>.
- Meakim, C., Boese, T., Decker, S., Franklin, A.E., Gloe, D., Lioce, L., Sando, C.R., Borum, J.C., 2013. Standards of best practice: simulation standard I: terminology. *Clin. Simul. Nurs.* 9, S3–S11. <https://doi.org/10.1016/j.ecns.2013.04.001>.
- Nyström, S., Dahlberg, J., Edelbring, S., Hult, H., Abrandt Dahlgren, M., 2016. Debriefing practices in interprofessional simulation with students: a sociomaterial perspective. *BMC Med. Educ.* 16, 148. <https://doi.org/10.1186/s12909-016-0666-5>.
- Omer, T., 2016. Nursing students' perceptions of satisfaction and self-confidence with clinical simulation experience. *J. Educ. Pract.* 7, 131–138. <https://doi.org/10.13140/RG.2.1.2104.2800>.
- Pulido-Martos, M., Augusto-Landa, J.M., Lopez-Zafra, E., 2012. Sources of stress in nursing students: a systematic review of quantitative studies. *Int. Nurs. Rev.* 59, 15–25. <https://doi.org/10.1111/j.1466-7657.2011.00939.x>.
- Shin, S., Park, J.-H., Kim, J.-H., 2015. Effectiveness of patient simulation in nursing education: meta-analysis. *Nurse Educ. Today* 35, 176–182. <https://doi.org/10.1016/j.nedt.2014.09.009>.
- Smith, S.J., Barry, D.G., 2013. The use of high-fidelity simulation to teach home care nursing. *West. J. Nurs. Res.* 35, 297–312. <https://doi.org/10.1177/0193945911417635>.