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Article

Effectiveness of Simulation Strategies and their Transfer to the Clinical Practice in the Nursing Course: A Cross Sectional Study

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Abstract: Implementing the methodology of clinical simulation in the nursing degree course is a necessity in the European framework of higher education to acquire competences. The objectives of this research were to evaluate the strategies and techniques used during the simulations, identify the contents learned, and determine which of them are transferred to the nursing practice. We performed an observational, descriptive, and cross-sectional study from the nursing students' perspective during the 2020-21-year course. On the one hand, our results show that the DASH scale helped us to obtain an internal validity of the simulations obtaining a mean score of 6.61 out of 7. On the other hand, the Ad Hoc scale, based on the competences were acquired in the simulations were transferred to the care practices. In conclusion, it is possible to improve care practices by integrating knowledge through clinical simulations.

Keywords: simulation; nursing students; clinical practice; knowledge; nursing education and skills

1. Introduction

Learning, as established by the Spanish health educational system in 1977, is based on acquiring skills or abilities to carry out the nursing healthcare practice with the necessary quality and preserving patient safety [1]. The introduction of new health teaching technologies based on competency areas was necessary in the new teaching framework of the European Higher Education Area since 2000 [2]. Reflecting on one's own professional practice is a crucial step in the experiential learning process, as it helps students to develop and integrate knowledge from direct experience into subsequent actions [3–5]. Currently, simulation is being used in different fields with the purposes to anticipate, expand, deepen, and improve professional practice, minimizing errors and driving professionals to excellence.

In nursing degree, the clinical simulation methodology allows the interaction of knowledge, skills, and human factors [6]. Currently, it is being used in different areas with a single purpose: to anticipate, expand, deepen, and improve professional practice to minimize errors and drive professionals to excellence. As a result of this, we use different types of simulation scenarios, which are called zones, ranging from 0 to 4 [from less to more complex][7], where participants are instructed with different strategies to work with specific content. According to C. J. Roussin & Weinstock, in the present study, zones 2 and 3 were considered the most appropriate to obtain the necessary information to meet the objectives, where nursing students were able to participate in simulations with real scenarios, designed by experts and to develop previously acquired clinical skills [7].

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In 2000, under the framework of the Fundació Universitària del Bages [FUB], zone 2-3 cases were generated within the training plan. However, it was not until 2014, with the curriculum of the Universitat de Vic-Universitat Central de Catalunya, that simulation became one of the main methodologies to prevent and reduce mistakes and obtain continuous improvement in healthcare practice. During the years of the degree course, different simulation scenarios are presented. This finally allows providing adequate professional care based on the detected needs, in accordance with the levels of safety and quality established in the legal and ethical standards.

Since the emergence of simulations, researchers have focused on investigating the satisfaction of the participants.

On the one hand, scientists at the Center for Medical Simulation in Boston validated the Debriefing Assessment for Simulation in Healthcare [DASH] scale to validate whether the simulations were correct based on the work objectives determined. This is focused on the debriefing part as a relevant element to clarify and consolidate the learning acquired [8]. The researchers differentiated three different perspectives: of the student, of the evaluator, and of the instructor, in an extended or abbreviated DASH version. Different elements were evaluated according to a Likert scale from 1 [extremely ineffective/detrimental] to 7 [extremely effective/excellent]. Six main elements were analyzed [Appendix 1]:

- Establishment of an engaging learning environment.
- Maintenance of the participatory learning environment.
- Structuring of the debriefing in an organized manner.
- Generation of stimulating discussions.
- Identification and exploration of performance problems.
- Help in achieving or maintaining good performance in the future.

On the other hand, Negrão et al. [9], validated a scale based on the satisfaction of fourth-year nursing students, after conducting several simulation sessions. In this case, each element was evaluated using a Likert scale from 1 [lowest level of satisfaction] to 10 [highest level of satisfaction], in a population of 181 students. Three elements were analyzed [Appendix 2]:

- Satisfaction with the practical dimension [9 items]: overall satisfaction; learning achieved; motivation; dynamism; participation; interaction among students; interaction of students with teachers; satisfaction with the simulation scenarios; and productivity of the practical part.

- Satisfaction with the realism dimension [5 items]: realism of the simulation scenarios; credibility; and quality of material, equipment, and simulators.

- Satisfaction with cognitive dimension [3 items]: debriefing; connection between simulation scenarios and theory; and adequacy of the subject matter developed in the theoretical and practical classes.

Both the DASH scale and the Satisfaction with Simulated Clinical Experiences scale [9], serve as a starting point, but neither of them assesses the competencies[1] that nursing students should achieve at the end of their studies, so we have chosen the DASH scale to achieve the first objective. In this context, this study aimed to know the students' perception just after finishing the simulations, based on the six items included in the DASH scale, in its abbreviated version [Appendices 1]. We wanted to assess if the strategies for the simulations in nursing degree of the 2020-2021 academic year provided the necessary learning thanks to the abilities of the instructor in the following: favoring an appropriate environment; knowing how to maintain it; structuring the reflection session; generating

[1] Ability to respond to complex demands, through a combination of practical skills, knowledge, motivation, ethical values, attitudes, emotions, and other social and behavioral components that are mobilized together to achieve effective action (Key Competencies - | Ministry of Education and Vocational Training, n.d.)

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deep discussions; and identifying the options to improve and maintain these items in real life. Learning, as already established in our nursing educational system in 1977, is based on acquiring skills or abilities to carry out healthcare practice with the necessary quality and preserving patient safety [1]. Reflecting on one's own professional practice is a crucial step in the experiential learning process, as it helps students to develop and integrate knowledge from direct experience into subsequent actions [3–5].

Nursing studies have always wanted to encourage and promote efficient and safe professional practices. In 2000, under the framework of the Fundació Universitària del Bages [FUB], zone 2-3 cases were generated within its training plan, although it was not until 2014, with the curriculum of the University of Vic-Universitat Central de Catalunya, where simulation became one of the main axes as a methodology with the aim of preventing, reducing errors and obtaining continuous improvement in healthcare practice, through a process of analysis and reflection on professional activity. Simulation allows the training of general, transversal, and specific competences required in the profession. During the different years of the degree, different scenarios are carried out to improve skills, techniques and/or communication, which allow to provide adequate professional care based on the detected altered needs, in accordance with the levels of safety and quality established in the legal and ethical standards.

Therefore, there is growing interest in exploring the knowledge about simulation. For this reason, the general objectives of this study were to evaluate the strategies and techniques used in simulations during the 2020-2021 academic year of the nursing degree, using the DASH, from the students' perspective, and to identify the contents learned during the simulations and transferred to the nursing practice in the general and specific competencies areas during the 2020-2021 academic year of the nursing degree, using Ad Hoc survey, from the students' perspective.

2. Materials and Methods

Interventionary studies involving animals or humans, and other studies that require ethical approval, must list the authority that provided approval and the corresponding ethical approval code.

An observational, descriptive, and cross-sectional quantitative methodology was used to analyze the nursing students' perception after performing the simulations.

The study population was composed of 428 students, including all the students enrolled in any nursing degree courses at the Universitat de Vic-Universitat Central de Catalunya, Manresa campus [UManresa] that were performing internships. The final sample was of 281 students. We performed a convenience sampling including only those who had done simulations and internships during the 2020-2021 academic year, and it was collect the following information: gender, course, academic year, and the simulation case performed.

At the beginning of the academic year, we performed the DASH survey, and it was digitalized, specifically of the abbreviated student version of the model Evaluation of Debriefing for Simulation in Health [EDSS] [10] to the REDCap [Research Electronic Data Captures] platform [Appendix 1]. Before doing that, we obtained the permission from the center that created the DASH scale. To facilitate the access of the students, we created a link and a QR code, and the latter was even printed on paper. The access of the DASH scale was indicated in the classroom itself and the instructor oversaw reminding the students of its completion after the simulation.

Simultaneously, another digitalized survey was developed and agreed with the research group on teaching innovation, simulation, and patient safety [GRInDoSSeP] [11], and with the teaching team of the Department of Nursing at the Manresa Campus. We wanted to find out which knowledge were acquired during the simulation and transferred to the care practices from first to fourth course. Then each student had to complete our ad hoc survey at the end of the nursing practice period.

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All analyses were performed using the statistical program STATA, version 17. They consisted in the description of each the demographic variable and in the calculation of means and confidence intervals of the surveys' variables. This allowed determining the students' perception of the transfer of knowledge acquired in the simulation to the healthcare practices. Each demographic variable was described globally by course and specifically for each simulation, also it was described the competences were acquired in the simulations were transferred to the care practices.

3. Results

Regarding the first objective, students evaluated each simulation they participated in, by rating the six elements of the DASH survey [Appendix 1] from 1 to 7.

A total of 675 surveys were answered from the 281 students, since from the second year of the nursing degree onwards they participate in more than one simulation. The surveys answered were 99 [81 from females and 18 from males] in the first year; 309 [257 from females and 52 from males] in the second year; 149 [123 from females and 26 from males] in the third year; and 118 [90 from females and 28 from males] in the fourth year.

For all the simulations throughout the four courses, the overall mean score obtained for the six DASH elements was 6.61 out of 7.00 [6.56 - 6.65]. This highlighted that the instructor's debriefing skills were consistently effective. Second-year students rated the simulations the best for all the elements, with a mean of 6.69 out of 7.00. In particular, the simulations on nutrition [6.80, 6.68 - 6.93] and therapeutic communication [6.77, 6.70 - 6.84] were the highest rated. Fourth-year students rated the simulations the worst, with an average of 6.59 out of 7.00, very close to the first-year students, with an average of 6.51 out of 7.00 [Table 1].

TABLE 1 - Description of the DASH results

Course	Simulation	mean	Std. Err.	IC95	n	Total %
First	Communication skills	6.51	0.08	[6.36 - 6.66]	99	14.70%
Second	Cardiology	6.58	0.09	[6.39 - 6.76]	309	45.80%
	At Home	6.62	0.07	[6.49 - 6.67]		
	Nutrition	6.80	0.06	[6.68 - 6.93]		
	Therapeutic Communication	6.77	0.03	[6.70 - 6.84]		
Third	Hematology	6.62	0.05	[6.51 - 6.72]	149	22.00%
	Well-child assessment	6.54	0.09	[6.37 - 6.71]		
	SVI	6.49	0.31	[5.88 - 7.00]		
Fourth	Pediatric	6.56	0.17	[6.23 - 6.89]	118	17.50%
	Adult ALS	6.79	0.15	[6.49 - 7.00]		
	PCC/MACA	6.43	0.08	[6.26 - 6.60]		
Total		6.61	0.03	[6.56 - 6.65]	675	100%

For each specific element throughout the 4 courses, the first ["The instructor set stage for an engaging learning experience "] obtained the lowest score, with a mean of 6.47 out of 7.00. On the contrary, the second "The instructor maintenance for engaging learning experience " obtained the highest score, with a mean of 6.64. In addition, the best rated sub-element was "the focus was on learning and not on making people feel bad about making mistakes ", with a mean of 6.82; and the worst rated sub-element was "the instructor used video or recorded data to support analysis and learning", with a mean of 5.78.

Regarding the second objective, when the students finish the clinical practice, it was evaluated the transfer from simulation to the nursing practice in the general and specific competencies areas during the 2020-2021 academic year of the nursing degree, using Ad

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Hoc survey, from the students' perspective. It was obtained 221 surveys were answered in full and 60 incomplete surveys were answered by 281 students. The surveys answered were 45 (38 from females and 7 from males) in the first year; 84 (66 from females and 18 from males) in the second year, 61 (53 from females and 8 from males) in the third year, and 31 (27 from females and 4 from males) in the fourth year.

The Areas of cross-cutting competencies evaluated by course were the following: patient safety, communication, teamwork, and leadership [Table 2].

TABLE 2: Areas of cross-cutting competencies by course

Areas of competencies	Total							
	First (n=45)		Second (n=84)		Third (n=61)		Fourth (n=31)	
	%	IC95	%	IC95	%	IC95	%	IC95
Patient Safety	85.2%	[80.72 - 89.68]	75.4%	[71.88 - 78.95]	83.6%	[79.09 - 88.12]	85.1%	[79.56 - 90.58]
Communication	97.3%	[95.63 - 99.04]	95.5%	[93.52 - 97.43]	94.1%	[92.07 - 96.13]	94.8%	[91.97 - 97.71]
Teamwork	.	.	.	.	90.5%	[86.94 - 94.04]	95.5%	[92.45 - 98.52]
Leadership	.	.	.	.	.	.	88.3%	[82.89 - 93.72]

A mean of 81% [78.77 - 83.28] of the total respondents agreed that what learned on patient safety during simulation was transferred to practice. In the second course, only 75.40% [71.88 - 78.95] of the students agreed with that. Specifically, the handrails were placed by the aspects that were considered less transferrable [69%, 59.05 - 79.05], bringing the bell closer to the patient [54.8%, 43.99 - 65.53] and asking about the existence of allergies [40.5%, 29.86 - 51.09]. Communication obtained the lowest rate among the students of the third course, with 94.1% [92.07 - 96.13] of them considering this skill transferrable. Specifically, the transfer of the understanding between the different members of the care team was considered appropriate by 88.5% of the students [80.42 - 96.63] and needs to be improved. Teamwork [TW], only evaluated in the third and fourth years, obtained an average transfer rate of 92.2%. There was a clear difference between the two courses: 90.5% [86.94 - 94.04] of the third-year students positively valued the transfer, in comparison to 95.5% [92.45 - 98.52] of the fourth-year students; in both cases, the cause is related to the ability to integrate the concepts worked on TW during the simulations. Finally, the transfer of leadership was investigated among fourth-year students, and 88.3% of them positively valued it. The elements that were transferred the least were the following: "recognizing the figure of the leader" and "being able to correctly follow his orders", with 71% [54.04 - 87.89] and 67.7% [50.31 - 85.17] of the students positively evaluating the transfer, respectively.

The results obtained for the Areas of specific competencies by course are presented in Table 3.

TABLE 3: Areas of specific competencies by course

Course	Have the simulations helped you?			Have you been able to apply the knowledge/skills?		
	n	%	IC95	n	%	IC95
First	.	.	.	43	83.7%	[73.37 - 94.07]
Second	78	79.6%	[72.81 - 86.49]	79	79.5%	[79.51 - 92.11]
Third	55	70.9%	[60.60 - 81.21]	55	78.2%	[68.89 - 87.48]
Forth	27	70.1%	[54,32-85,80]	27	80.2%	[66,56-93,94]

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In the first course, we only analyzed the simulation of therapeutic communication and obtained a transfer rate of 83.7% [73.37 - 94.07]. In the second course, we analyzed four simulations and obtained a total transfer rate of 79.6% [72.81 - 86.49]. Specifically, the least scored simulation was the one on cardiological patients, with 69.3% [57.96 - 80.73] of the students considering it transferrable, as it seems to be very specific and not all students have the opportunity to see it in the practical training. The simulation on dietary recommendations showed the highest impact, with 85.5% [76.47 - 94.50] of the students considering it transferrable. In the third course, we analyzed three simulations and obtained a total transfer rate of 70.9% [60.60 - 81.21]. Specifically, the hematology simulation scored worse with 66.7% [50.49 - 82.84] of the students considering it transferrable compared to 69.4% [56.01-82.76] for pediatric simulation. The reason for this is that, during the practical training, the students did not have the possibility to observe specific actions, such as an adverse reaction [39.6% [25.23-53.93]], while the lowest rated item in pediatrics, action on the vaccination schedule, scored 52% [37.66-66.34]. In the fourth course, we analyzed five simulations. The total transfer rate was 70.1% [54.32 - 85.80]. Specifically, the Adult Immediate Life Support [ILS] simulation was considered transferrable by the lowest percentage of students: 66.7% [28.23 – 100]. This simulation has as a relevant fact that the assistance practices are carried out one year after the simulation, in any case the student considers it useful with a 77.8% [43.88 - 100] and maintains a high transferability, despite the time elapsed. The simulations with the highest transfer rate [100%] were Pediatric Advanced Life Support (PALS).

Finally, independently of the transfer from the simulation to the clinical practice, most of the participants considered that the learning obtained in the simulations was useful to develop their nursing role: 79.5% [79.51 - 92.11] in the second year; 78.2% [68.89 - 87.48] in the third year; and 80.2% [66.56 - 93.94] in the fourth year.

4. Discussion

Several studies in nursing [Hernández et al., 2017; Rosabel Roig Vila, 2020] obtained the same results for the DASH survey: on the one hand, there is a need for improvement in the introduction at the beginning of a simulation activity [item 1]; on the other hand, item 2 ["the instructor's ability to maintain a participatory learning environment"] was positively valued. Moreover, other studies [12–15] obtained a total DASH value like ours [6.61, 6.56 - 6.65], ranging between 6 and 6.5. This indicates that debriefing skills were consistently effective/very good.

Previous studies indicate that simulations represent an advantage for healthcare professionals as they progress in reflective learning, clinical judgment, and decision making. In addition, simulation scenarios represent a close, safe, and non-punitive environment, where the learner can practice techniques in a controlled, supervised, and error-prone manner, with unlimited repetition [16–23]. Our work shows that patient safety, communication, teamwork, and leadership simulations are beneficial and transferrable for nursing students.

Finally, this is the first study providing scientific evidence of the effectiveness and transfer to the care practices of knowledge acquired with simulations in the nursing degree course.

5. Conclusions

The DASH allowed us to obtain the internal validity of our curriculum, in our university, based on simulation, with the option to improve the next editions of the nursing degree. The experience and specific training in simulation methodology of the teaching staff was an important element for the final satisfaction of our students. The post-practicum survey revealed that, at the competence level, simulation helps to integrate knowledge and improve care practices for more than 79% of the participants, as we obtained in the second grade. This learning seems to be sustained over time, even one year later, as in the case of ILS, where students maintain transfer levels above 66%, as we

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observed in third grade. Simulations with lower transfer rates tended to be too specific and unlikely in real life, making it difficult for the student to put the acquired knowledge into practice.

In any case, specificity without taking it to the extreme was considered necessary, since greater transfer was observed in the care area. To determine the degree of specificity, all the simulation cases were taken to consensus by the group of experts of the Nursing Department.

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Appendix A.1: shortened DASH, student version

Debriefing Assessment for Simulation in Healthcare (DASH) Student Version©

Directions: Please summarize your impression of the introduction and debriefing in this simulation-based exercise. Use the following scale to rate each of six "Elements." Each Element comprises specific instructor behaviors, described below. If a listed behavior is impossible to assess (e.g., how the instructor(s) handled upset people if no one got upset), don't let that influence your evaluation. The instructor(s) may do some things well and some things not so well within each Element. Do your best to rate the ***overall effectiveness*** **for the whole Element** guided by your observation of the individual behaviors that define it.

Rating Scale

Rating	1	2	3	4	5	6	7
Descriptor	**Extremely Ineffective / Detrimental**	Consistently Ineffective / Very Poor	Mostly Ineffective / Poor	Somewhat Effective / Average	Mostly Effective / Good	Consistently Effective / Very Good	**Extremely Effective / Outstanding**

Element 1 assesses the introduction at the beginning of a simulation-based exercise.

Skip this element if you did not participate in the introduction.
If there was no introduction and you felt one was needed to orient you, your rating should reflect this.

Element 1
The instructor set the stage for an engaging learning experience.

Overall Rating Element 1 _____

- The instructor introduced him/herself, described the simulation environment, what would be expected during the activity, and introduced the learning objectives.
- The instructor explained the strengths and weaknesses of the simulation and what I could do to get the most out of simulated clinical experiences.
- The instructor attended to logistical details as necessary such as toilet location, food availability, schedule.
- The instructor made me feel stimulated to share my thoughts and questions about the upcoming simulation and debriefing and reassured me that I wouldn't be shamed or humiliated in the process.

Elements 2 through 6 assess a debriefing.

Element 2
The instructor maintained an engaging context for learning.

Overall Rating Element 2 _____

- The instructor clarified the purpose of the debriefing, what was expected of me, and the instructor's role in the debriefing.
- The instructor acknowledged concerns about realism and helped me learn even though the case(s) were simulated.
- I felt that the instructor respected participants.
- The focus was on learning and not on making people feel bad about making mistakes.
- Participants could share thoughts and emotions without fear of being shamed or humiliated.

Element 3
The instructor structured the debriefing in an organized way.

Overall Rating Element 3 _____

- The conversation progressed logically rather than jumping around from point to point.
- Near the beginning of the debriefing, I was encouraged to share my genuine reactions to the case(s) and the instructor seemed to take my remarks seriously.
- In the middle, the instructor helped me analyze actions and thought processes as we reviewed the case(s).
- At the end of the debriefing, there was a summary phase where the instructor helped tie observations together and relate the case(s) to ways I can improve my future clinical practice.

Element 4
The instructor provoked in-depth discussions that led me to reflect on my performance.

Overall Rating Element 4 _____

- The instructor used concrete examples—not just abstract or generalized comments—to get me to think about my performance.
- The instructor's point of view was clear; I didn't have to guess what the instructor was thinking.
- The instructor listened and made people feel heard by trying to include everyone, paraphrasing, and using non verbal actions like eye contact and nodding, etc.
- The instructor used video or recorded data to support analysis and learning.
- If someone got upset during the debriefing, the instructor was respectful and constructive in trying to help them deal with it.

Element 5
The instructor identified what I did well or poorly – and why.

Overall Rating Element 5 _____

- I received concrete feedback on my performance or that of my team based on the instructor's honest and accurate view.
- The instructor helped explore what I was thinking or trying to accomplish at key moments.

Element 6
The instructor helped me see how to improve or how to sustain good performance

Overall Rating Element 6 _____

- The instructor helped me learn how to improve weak areas or how to repeat good performance.
- The instructor was knowledgeable and used that knowledge to help me see how to perform well in the future.
- The instructor made sure we covered important topics.

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Appendix A.2: Satisfaction with Simulated Clinical Experiences scale

	ESECS
1	Satisfacción global con las clases prácticas
2	Satisfacción con el aprendizaje alcanzado
3	Motivación para la asistencia a las clases prácticas
4	Dinamismo de las clases prácticas
5	Participación activa en los escenarios desarrollados
6	Interacción con el grupo de trabajo
7	Interacción con los docentes
8	Satisfacción con el grado de dificultad de los escenarios
9	Satisfacción con la discusión post escenario
10	Conexión de los escenarios a la teoría
11	Adecuación a las temáticas desarrolladas en las clases teóricas
12	Productividad durante las clases prácticas
13	Realismo de los escenarios desarrollados
14	Credibilidad durante el escenario
15	Calidad del material utilizado en las prácticas
16	Calidad del equipo utilizado en las prácticas
17	Calidad de los simuladores

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