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Use of Screen-Based Simulation in Nursing Schools in France: A National, Descriptive Study

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Nursing students;
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nursing schools

Abstract

Background: Clinical simulation is a major component of undergraduate healthcare training. However, data are lacking regarding simulation modalities used in Europe. The purpose of this national study is to describe how screen-based simulation (SBS) is being used as well as identify the barriers to its use in nursing schools in France.

Methods: This study employed a descriptive design with 207 nursing schools in France. Nursing school leaders (Deans, Heads of School, Simulation Coordinators or Leaders) were asked to complete an online survey.

Results: Traditional simulation was used in 92% of the nursing schools, but only 41% used SBS. Most nursing schools used SBS in a face-to-face format with students paired at a computer followed by a debriefing or alone at home. SBS is used mostly to teach decision making and clinical reasoning. SBS

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was used to complement traditional clinical time rather than replace it. Barriers included cost of SBS solutions, lack of recent computer equipment, high-speed internet network and training of the trainers. SBS is more frequently used in small nursing schools or large nursing schools where leaders are trained in simulation.

Conclusion: Although simulation is broadly adopted by nursing schools in France, the use of SBS remains limited. Nurse leaders in mid-size nursing schools (with 100-200 nursing students) should consider investing more resources in SBS. A post-pandemic assessment is warranted.

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Introduction

In nursing education, clinical simulation as a pedagogy is well recognized (Bogossian et al., 2018; Kable et al., 2018; National Council of State Boards of Nursing, 2016). Not only does it promote learning in a safe environment (Cant & Cooper, 2017; Cooper, Sussex, & Bogossian, 2019; Peddle, Mckenna, Bearman, & Nestel, 2019), it enhances learning outcomes for healthcare students such as nurses (Hayden, Smiley, Alexander, Kardong-Edgren, & Jeffries, 2014). Simulation replicates clinical scenarios and engages students to foster clinical competence (Lioce et al., 2020). In general, simulation has been found to be an effective learning tool (Cant & Cooper, 2017) and is endorsed by professional organizations with guiding standards (INACSL Standards Committee, 2021).

Screen-Based Simulation

With various terms being utilized, screen-based simulation (SBS), serious games, web-based, online, or virtual simulations play an important role in healthcare education as a tool to complement or replace face-to face training (Donovan, Argenbright, Mullen, & Humbert, 2018; Wang, DeMaria, Goldberg, & Katz, 2016).

SBS captures the attention of students by adapting technological innovations to healthcare education. This technology allows the learner to practice while playing (Koivisto, Multisilta, Niemi, Katajisto, & Eriksson, 2016). Similarly, SBS promotes the development of new skills in a safe environment (Petit dit Dariel, Raby, Ravaut, & Rothan-Tondeur, 2013). Finally, the SBS allows the student to train in an unlimited way and to self-correct due to the feedback mechanisms. In recent years, confusion has risen around virtual simulation terminology due to heterogeneity and lack of consensus of definitions (Cant et al., 2019). Pre-pandemic interest and awareness of virtual simulation modalities (Gorbanev et al., 2018; Maheu-Cadotte et al., 2018), and the new paradigm of virtual learning imposed by COVID 19 (Tyerman, Luctkar-Flude, & Baker, 2021) have contributed to the "terminological chaos." Foronda (2021) defined virtual simulation as "the use of partial immersion through a digital learning environment (e.g., computer, tablet, phone, screen, etc.) to foster a perceived lived experience for an intended outcome (e.g., learning, entertainment, etc.)" (p. 8). Between 2020 and 2021, the use of "virtual simulation" as a term in publications increased by 5% (Luctkar-Flude & Tyerman, 2021). Efforts have been made by leading professional organizations in simulation to improve clarity with definitions (Lioce et al., 2020). The Healthcare Simulation Dictionary's definition of screen-based simulation is used to describe the modality of interest for this study. Screen-based simulation refers to "a simulation presented on a computer screen using graphical images and text, similar to popular gaming format, where the operator interacts with the interface using keyboard, mouse, joystick, or other input device" (Lioce et al., 2020, p. 43).

A review of the literature showed the added value of screen-based simulation in the training of health professionals to improve student learning outcomes (Foronda, Fernandez-Burgos, Nadeau, Kelley, & Henry, 2020; Gentry et al., 2019; Gorbanev et al., 2018; Verkuyl et al., 2022). SBS was widely used during the lockdowns imposed by the pandemic of COVID-19 (World Health Organization, 2020) to attempt for pedagogical continuity. Many schools of nursing tried substituting traditional face-to-face simulation with virtual simulation and synchronous, virtual activities (Schiavenato, Edwards, Tiedt, & Owens, 2022; Tyerman et al., 2021; Verkuyl, Djafarova, Mastrilli, & Atack, 2022). Despite the virtual component of SBS, debriefing is recommended (Cheng et al., 2020; Dale-Tam, Thompson, & Dale, 2021; Decker et al., 2021; Luctkar-Flude et al., 2021)

Screen-Based Simulation Prior to the Pandemic

SBS was studied in a national survey in North America (e.g., Tranel, Johanneck, Thompson, & Campbell, 2021). However, in the pre-pandemic period, there was a paucity of literature on systematically collected descriptive data surrounding SBS in Europe and especially in France. France's healthcare governance body encourages the use of simulation both for undergraduate and lifelong training (Granry & Moll, 2012). SoFraSimS (French Society for Simulation in Healthcare) made a report about SBS in a limited number of educational simulation institutions (Blanié, Rihane, Decormeille, & Benhamou, 2020). The sample consisted of 40 simulation centers and 16 nursing schools. Blanié found 45% of responds (n = 25) were using serious games (all media) most of the time including a debriefing with an instructor to compliment traditional teaching. Among the 31centers not using serious games, 17 were considering it.

Data are still lacking on the implementation and perception of SBS in nursing schools in France. Study is necessary to explore the extent and approaches to how SBS is implemented into the curriculum. This information could guide future curriculum development, such as defining hours accepted for clinical replacement, and influence administrative decisions. The purpose of this national study is to describe how screen-based simulation is being used as well as identify the barriers to its use in nursing schools in France.

Materials and Methods

This study employed a descriptive design using surveys. The national study was conducted from June 01, 2019 to September 01, 2019. The study obtained written ethical permission N°227933 of the French declaration of conformity in health study and complied with both French and European (GDPR) data protection laws.

A 29-item questionnaire was sent via email to French nursing educators and leaders through the databases of the following professional organizations: The French Association of Care Directors (AFDS), Nursing and Executive Education Agreement Committee (CEFIEC) and National Association of Paramedical School Directors (ANDEP). Any of the nursing school leaders (deans, heads of school, simulation leads or coordinators) could complete the survey. However, the survey specified that only one response per nursing school could be submitted.

Survey

The survey was developed by the lead researcher (G.D.) based off of the literature and adapted from the SoFraSimS Serious Games National Survey (Blanié et al., 2020). Permission was received to adapt and use the instrument. The final version of the questionnaire was reviewed by the research team and approved by the SoraASimS team members.

The survey had 29 items exploring nursing schools' characteristics (location, number of students), different simulation modalities used, SBS, and nursing school leaders' perceptions. The questions widely explored the following topics in the context of SBS: the modalities and frequency of use, the educational objectives addressed, the duration of SBS scenario, the use of the feedback reports and scores provided by SBS software, and debriefing use. The last questions elicited nursing school leaders' perceptions of the potential of SBS in undergraduate and lifelong education. Questions included Likert-style, closed-ended, single or multiple choice, and number-scale formats. Nursing schools were classified in three groups according to their use of SBS. The nursing schools using SBS are named uSBS, the nursing schools considering to use SBS are named cSBS and nursing schools not considering to use SBS are named nSBS. The survey was built using Qualtrics (Qualtrics, Provo, UT) software and contains instructions describing: the target population, inclusion criteria, study details, and an agreement to participate prior to beginning. All responses were de-identified and shared only within the research team.

Data Analysis

Data from the survey questions were exported from Qualtrics (Qualtrics, Provo, UT) into Microsoft Excel (Microsoft, 2019), coded and uploaded into the free software Jamovi 1.1.9.0 (version 1.8) (The jamovi project, 2021). Descriptive statistics were calculated. Independent *t*-test was applied to compare the pedagogical approach of SBS conducted by the nursing schools using SBS and considering using SBS. To establish a correlation on the simulation training level of the simulation school leaders and SBS implementation, Spearman's rank correlation coefficient was carried out followed by linear regression. Multinomial logistic regression was carried out to establish a comparison between the different sizes of nursing schools (factors) that use and consider using SBS (dependent variable). The cut-off score for the significance level of statistical tests was set at alpha = 0.05.

Results

Among the 323 French nursing schools, 98% of leaders or simulation coordinators completed the survey. Of note, 36% surveys were excluded as they were not fully completed or were duplicate (Figure 1). A total of 207 analyzable records were kept in the dataset (64%). Nursing schools were exposed by location (regions) (Figure 2) and the rate of nursing school responders versus nursing school

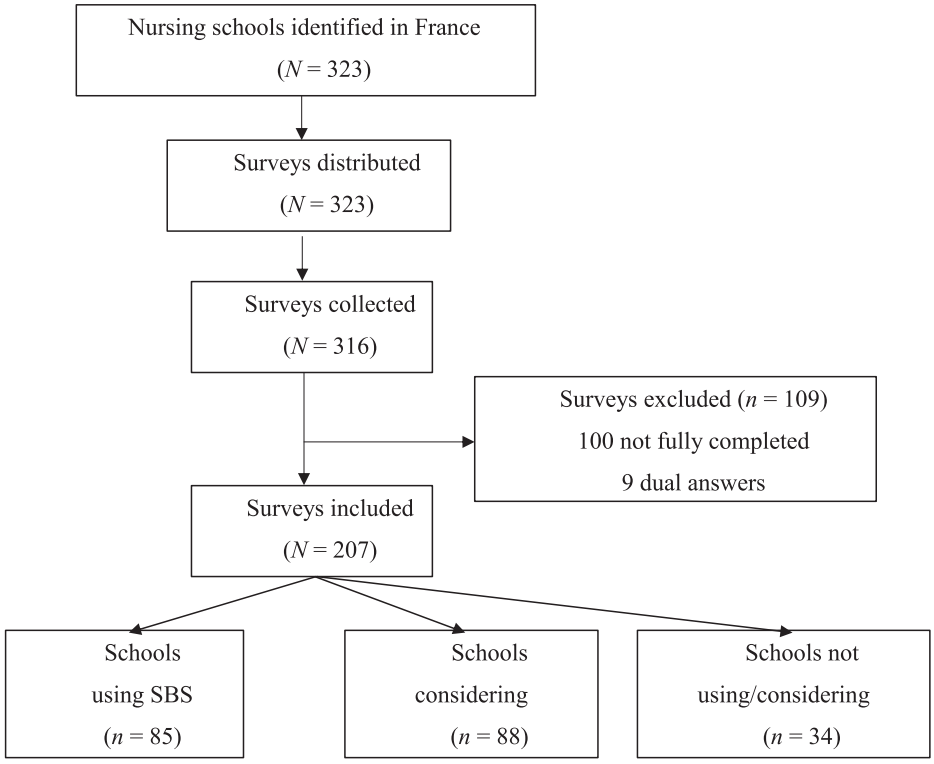


Figure 1 Study Flow Chart.

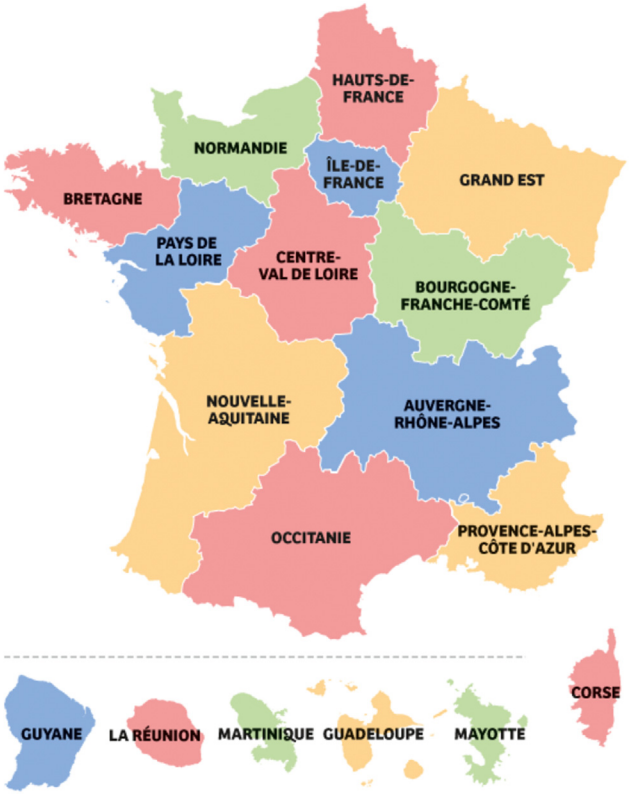


Figure 2 Description of responding nursing schools by regions across France.

non-responders were compared by location (Figure 3). Of the nursing schools' leaders who responded, 77% of them indicated having formal simulation training as instructors.

Demographic Data (N = 207)

Table 1 shows the distribution of the nursing schools according to their size, the different simulation modalities used, the use of SBS or not considered and finally, the level of training in simulation of the nursing school leaders. Most of the nursing schools that replied to the survey had less than 150 students per academic year (81%) The most frequent simulation modalities used in nursing schools were role play (67%), standardized patient (66%), technical skills simulator (58%), SBS (41%), manikin-based simulation (39%) and hybrid simulation (33%). Among all nursing schools, 42% were considering using SBS (n = 88) and 16% were not considering to use SBS (n = 34). Just 13% of nursing schools' leaders were not simulation instructors (Table 1).

How SBS is Pedagogically Approached

Results about how SBS is pedagogically approached or intended to be approached in France by nursing schools is indicated in Table 2. The major findings are illustrated below. How to use SBS: The nursing schools' leaders considered that SBS should be implemented across all semesters. The majority of nursing schools' leaders agreed that the use of

Name of French Region	Total of nursing schools by region N = 323	Total of nursing schools answered N = 207(%)
Auvergne Rhône Alpes	37	29 (78%)
Bretagne	14	11 (78%)
Bourgogne Franche-Comté	18	14 (77%)
Occitanie	25	19 (76%)
Hauts de France	35	25 (71%)
Normandie	17	12 (70%)
Grand Est	30	19 (63%)
Centre Val de Loire	13	8 (61%)
Nouvelle Aquitaine	27	16 (60%)
Pays De Loire	15	9 (60%)
Ile de France	59	30 (58%)
Corse	2	1 (50%)
Provence Alpes côte d'Azur	24	12 (50%)
Départements Outres Mer	7	2 (28%)

Figure 3 Nursing schools answering the survey compared to the total of nursing schools by region (N = 207/323, 64%).

SBS is done with the presence of a trainer ($p < .001$) and the best time for using SBS is during dedicated simulation time rather than on personal time ($p < .001$). The ideal length of the scenario is 30-60 minute. Also of note, the most common use of SBS was by pairing two students together at the computer rather than in a large group or plenary session ($p < .001$) or alone at home ($p < .001$).

Debriefing: Both groups indicated that debriefing is essential using SBS (81%) as well as those considering to use SBS (83%), when compared to optional debriefing ($p < .001$). Only three nursing schools use automated debriefing through the game without complementing with an educator or debriefer (Table 2).

Skills taught using SBS: SBS is used mainly to teach clinical reasoning (54%), followed by decision making (49%) and lastly, leadership (10%). In both groups, SBS is generally thought to promote learning of behavior and cognitive skills ($p < .001$) and 100% of those using SBS consider that SBS can be used for training behavioral and cognitive skills. Table 3 shows the ranking of the use of 13 behavioral and cognitive skills items.

Undergraduate Training: One hundred sixty-six of the leaders (80%) thought that SBS could complement a traditional simulation activity. Only 9% thought that the use of SBS could replace a traditional simulation activity. Fourteen leaders considered that SBS could be used as an assessment tool with undergraduate nursing students. Only one nursing school leader did not find that nursing students had adequate opportunity to train on SBS during their undergraduate training.

Lifelong training: Seven percent of leaders considered the use of SBS "not important" in continuing education for nursing professionals and their presence in undergraduate education within five years.

Barriers to Implementation of SBS

Nursing school leader's simulation training level

A significant correlation on the simulation training level of the simulation school leaders and SBS implementation was found in undergraduate training (r = -0.248, $p < .001$). Leaders who were trained in simulation implemented more or were more likely to implement SBS than untrained leaders (R^2 = 0.381, $p < .001$), 95% CI [2.33-2.52].

The size of nursing schools

The multinomial logistic regression shows that nursing schools <100 nursing students (per criteria provided) use more SBS compared to the larger nursing schools having 100-150 nursing students, OR = 4.1, 95% CI [1.5, 11.2], $p = .005$ and 150-200, OR = 9.2 [2.3, 37.2], $p = .002$, except for those with >200 nursing students OR = 0.9, 95% CI [0.6, 1.4], $p = .91$. On the other hand, no difference

Table 1 Demographics of nursing schools with modalities of simulation per group)

		All (N = 207) N (%)	Using SBS (n = 85) n (%)	Considering to Use SBS (n = 88) n (%)	Not Using SBS (n = 34) n (%)
What is the size of the nursing school (students per promotion/cohort)?	<100 students	98 (47)	46 (54)	45 (51)	7 (20)
	Between 100 and 150	70 (34)	27 (32)	26 (29)	17 (50)
	Between 150 and 200	24 (11)	5 (6)	12 (14)	7 (20)
	>200	15 (7)	7 (8)	5 (6)	3 (9)
What simulation modalities do you use (or willing to use)? (Yes)*	Role play with actor	139 (67)	59 (69)	64 (8)	16 (47)
	Standardized patient	137 (66)	63 (74)	60 (68)	14 (41)
	Technical training simulator	121 (58)	51(60)	58 (66)	12 (35)
	Screen based simulator	85 (41)	85 (100)	NA	NA
	Mannikin-based simulator	81(39)	40 (47)	34 (39)	7 (20)
	Hybrid	69 (33)	36 (42)	26 (29)	7 (20)
Are you using (or considering to use) SBS for undergraduate training in your NS?			85 (41)	88 (42)	34 (16)
Are you formally trained as a simulation instructor?	Yes	147 (71)	68 (80)	71(80)	8 (23)
	No	27 (13)	1 (1)	1 (1)	25 (73)
	I would like to be	33 (16)	16 (19)	16 (18)	1(3)

Note. SBS = Screen-Based Simulator; NA = Not Available; NS = Nursing School
* Multiple choice question

was found according to the using SBS group compared to the considering to use SBS group with respect to the size of the nursing school, OR = 0.9, 95% CI [0.6, 1.4], p = .92.

Other limiting factors

The leaders indicated some limiting factors. These factors included costs (34%), training of trainers (26%), computer equipment and internet networks (21%), educational innovation and resistance to change (16%), and lacking time for implementation (3%).

Discussion

America Compared to Europe: Different Cultural Perceptions

This is the first national study in Europe to assess the use of SBS as a teaching tool before the pandemic. The study revealed that although simulation, and more specifically SBS, is used by 41% of nursing schools or is ready to be used by 42.5% of nursing schools, its diffusion remains limited in France. Conversely, nurse leaders in North America have shown a pronounced interest in SBS and its use has raised exponentially in the last five years (Gentry et al., 2019; Gorbanev et al., 2018; Maheu-Cadotte et al., 2020; Maheu-Cadotte et al., 2018). It is likely that this trend may spread similarly in Europe in the future. In this study, most of the 206 leaders (99%) consider that SBS is interesting for undergraduate training, and 93% of leaders indicated SBS will play an important role in nursing lifelong training in years to come. Although current discussions about replacing traditional clinical practice hours with SBS are occurring in North America, (Killam & Luctkar-Flude, 2021; Leighton, Kardong-Edgren, & Gilbert, 2021), in Europe, these discussions are less frequent with clinical replacement not having been formally approached. Among all leaders surveyed, 80% declared that SBS could be used to complement traditional simulation activities (n = 166), and only 18 leaders (9%) declared that SBS could replace traditional simulation activities. Considering the new educational paradigm imposed by COVID-19, simulations completed virtually at home may become more commonplace in nursing education when obstacles for in-person clinical experiences are present (Luctkar-Flude & Tyerman, 2021).

Educators in both North America and Europe share the perception that virtual simulation may be a cost-effective way to provide standardized education to a large group of students and offer several advantages in comparison to in person-simulation (Tyerman et al., 2021; Verkuyl, Phc, & Hughes, 2019). From the cost perspective, SBS or virtual simulation could be more affordable than manikin-based simulation. Although the cost of creating a virtual scenario is still high, the ratio of cost, human resources and number of people targeted is lower compared to training nurses with manikins. Learning via SBS versus using mannikins was shown to be cost-effective ($10.89 vs. $36.55/student) (Haerling, 2018) and less consuming of human resources. This constitutes an advantage for larger nursing schools because these virtual solutions make it possible to ensure a harmonized distribution of educational content at the same time to a large group (Tyerman et al.,

Table 2 Comparison between nursing schools that Use Screen-Based Simulator (uSBS) and nursing schools Considering to use Screen-Based Simulator (cSBS) (N = 173)

Items		uSBS (N = 85) N (%)	cSBS (N = 88) N (%)	*p*-value
Which semester are you using SBS?	Semester 1-2	5 (6)	7 (8)	.99
	Semester 3-4	6 (7)	4 (4)	
	Semester 5-6	1(1)	0 (0)	
	All semesters	73 (86)	77 (87)	
What time do you use the SBS?	On a supervised simulation time with a trainer	58 (68)	51 (58)	***
	On the student's personal working time at NS	14 (16)	9 (10)	
	One e-learning time at home	13 (15)	7 (8)	
	I don't know	0 (0)	21 (24)	
Length of a scenario of SBS	30 to 60 min	44 (52)	NA	NA
	15 to 30 min	26 (30)	NA	NA
	Less of 15 min	8 (9)	NA	NA
	> 60min	7 (8)	NA	NA
• Which modalities are you using SBS?	2 students by computer with a trainer	56 (66)	35 (40)	***
	Student alone at home	56 (66)	27 (31)	***
	1 student by computer with a trainer	44 (53)	20 (23)	***
	Plenary session with a trainer	20 (23.5)	16 (18)	.38
	> 2 students by computer with a trainer	18 (21)	6 (7)	**
	2 students by computer without a trainer	4 (4)	3 (3)	0.66
	1 student by computer without a trainer	3 (3)	10 (11)	*
	> 2 students by computer without a trainer	0 (0)	0 (0)	NA
Relevance or importance of debriefing in SBS	Essential	69 (81)	73 (82)	.21
	Optional	16 (19)	15 (17)	.21
Which modalities of debriefing into the SBS	Automated debriefing in-game as well as a debriefing with a trainer	55 (65)	52 (59)	.59
	Debriefing with a trainer but without an automated debriefing of the game 3	26 (30)	24 (27)	.33
	I do not know	3 (4)	10 (11)	*
	Automated debriefing in-game but without debriefing with a trainer	1 (1)	2 (2)	.81
Learning goal improve behavior and cognitive skills	Yes	85 (100)	68 (77)	***
	I don't know	0 (0)	20 (23)	
Is the game used for the purpose of inter-professionalism?	Yes	44 (52)	40 (45)	**
	No	41 (48)	26 (29)	
	I don't know	0 (0)	22 (25)	
How do you use the score (Yes)*	Individual score	84 (98.8)	88(100)	.31
	Auto-scoring	70 (82)	80 (90)	0.09
	Information for trainer	69 (81)	82 (93)	*
	Learning curve	69 (81)	84 (95)	**
	Validation European credit	38 (45)	37 (42)	.72
	Picking-up	22 (26)	23 (26)	.90
	Integration new score	16 (19)	24 (27)	.19
	Replace evaluation clinical practice	7 (8)	20 (23)	**
	Same score for alone group	0 (0)	0 (0)	NA

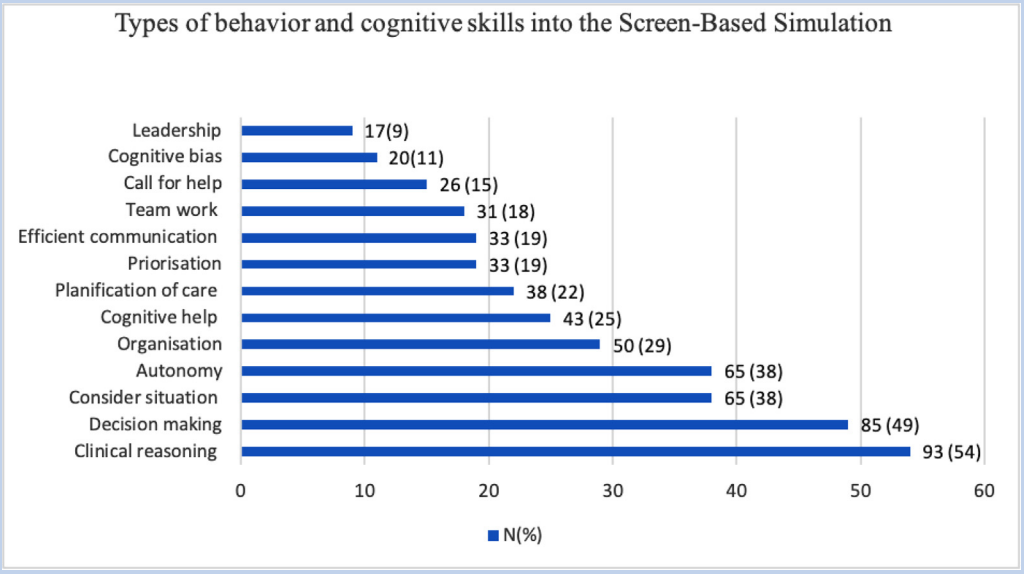
Note. SBS = Screen Based Simulator, NA = Not Available

* $p < .05$,

** $p < .001$,

*** $p < .0001$, *(Multiple choice question)

Table 3 Nursing schools answering the survey compared to the total of nursing schools by region (N = 207/323, 64%)



2021). All students can participate in the simulation unlike with a mannequin and can train according to their rhythm and level. Students can train in addition to class hours at the most opportune times. In addition, reassuring feedback allows them to have immediate answers. However, the initial purchase investment is still considered just as expensive (Luctkar-Flude & Tyerman, 2021). In accordance, our results showed that leaders perceived that the price remains a major barrier to implementation. In addition, the cost of teacher training or faculty development can be another barrier, as found in the national study by Kardong-Edgren, Willhaus, Bennett, and Hayden (2012). The results revealed that SBS is used more by trainers who are trained in simulation. These data can be used to assist decision making regarding the current and future uses of simulation.

SBS- a Key for Behavioral and Cognitive Skills

The study showed that SBS is perceived by nursing school leaders as a modality to improve behavioral and cognitive skills such as clinical reasoning or decision-making for students. Current evidence establishes that these skills can be obtained through simulation (Couarraze et al., 2021; LaManna et al., 2019; Levett-Jones et al., 2011; Maheu-Cadotte et al., 2020) and have been supported as a method to train and transfer clinical reasoning cognitive processes into the real world (Petit dit Dariel et al., 2013). Behavioral and cognitive skills such as clinical reasoning or decision making are among the most difficult skills for nursing students to acquire, but they play a crucial step to achieve clinical competence (Psiuk, 2019).

SBS- Key Reflective Tool in a Safe Environment

The pre-pandemic results revealed that SBS was used with two students per computer rather than in a group session or alone at home. Working in pairs promotes socio-constructivism – an experience sharing and reflecting on practice through face-to-face exchanges (Vygotsky, 1980). A non-threatening learning environment is necessary to promote learning and leads to better outcomes (Rudolph, Raemer, & Simon, 2014). SBS generates a safe psychological setting where students can make mistakes without feeling embarrassed about their performance (Luctkar-Flude & Tyerman, 2021) and without harming patients (Borg Sapiano, Sammut, & Trapani, 2018). Additionally, the presence of the instructor promotes psychological safety (Cheng et al., 2020). In fact, instructor feedback showed a positive effect on learners' use of deep and shallow cognitive strategies as well as on learning efforts (Zhang, Lin, Zhan, & Ren, 2016). Finally, the use of debriefing SBS in this study is perceived as essential by 82% of the leaders (N = 142). This is consistent with what is reflected in the literature about virtual simulation (Dale-Tam et al., 2021; Luctkar-Flude et al., 2021).

Challenges with SBS in France

The results of the study reveal how SBS is used and provide insight about the perceptions of nurse leaders about SBS. The largest concern, not surprisingly, was about cost of licenses. However, use of SBS may arguably be more cost-effective and accessible than traditional simulation (Haerling, 2018; Kalkman, 2012). Tyerman et al. (2021))

has shown that the experience of CAN-SIM in this field of use is important for both creation and use (Keys, Luctkar-Flude, Tyerman, Sears, & Woo, 2021). The lack of training of educators and the fear of change when integrating new technologies are the main barriers to use. Nevertheless, additional research is needed to understand the acceptance of SBS as a pedagogical tool and its impact on learning outcomes (Cant & Cooper, 2014) both at the level educational and clinical practice level and in pre-simulation preparation (Keys et al., 2021).

Limitations

This study had some limitations. The study is based only on the opinions and perceptions of the nursing school leaders who completed the surveys. However, the excellent response rate and the large sample size likely offered a reliable representation of the leading perceptions about SBS in France. Further, the study explored SBS in a broad context and there may have been differences in the products and experiences of SBS amongst schools. Last, this study was carried out in 2019 before the COVID-19 pandemic. A comparison study post-pandemic would be useful with similar surveys from other European countries.

Conclusion

This study revealed that traditional simulation is used by a large number of nursing schools in France. However, SBS has not been widely adopted yet. The use of SBS remains limited due to the costs of supplies and faculty development or training. Given the lessons learned from the pandemic, nursing school leaders, especially those of mid-size schools, may wish to request future funding for use of innovation and technologies including SBS. Future work surrounding faculty development, cost-benefit analyses, and comparison of SBS modalities to student learning outcomes is recommended.

Declaration of Competing Interest

This study has not received funding, and is part of a PhD series of papers about Virtual Simulation approved by the University of Toulouse (Ref N°227933). The principal researcher of the study Guillaume Decormeille works as a technical specialist for Simforhealth a simulation company which sells virtual simulation products.

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