Nurse Education Today 98 (2021) 104661

Contents lists available at ScienceDirect

Nurse Education Today

journal homepage: www.elsevier.com/locate/nedt

Review

The role of manikins in nursing students' learning: A systematic review and thematic metasynthesis

Jorunn A. Handeland [a,*], Andreas Prinz [b], Else Mari R. Ekra [c], Mariann Fossum [c]

[a] Department of Health and Nursing Science, Faculty of Health and Sport Sciences, University of Agder, PO Box 509, 4898 Grimstad, Norway
[b] Department of Information and Communication Technology, Faculty of Engineering and Science, University of Agder, Norway
[c] Department of Health and Nursing Science, Faculty of Health and Sport Sciences, University of Agder, Norway

ARTICLE INFO

Keywords:
Education, Nursing
Manikins
Simulation training
Students, Nursing
Systematic review
Qualitative research

ABSTRACT

Objectives: To summarise and synthesise findings from qualitative primary research studies of nursing students' experiences from educational activities using manikins to gain a deeper understanding of the role these manikins play in the students' learning.
Design and data sources: A systematic review and thematic metasynthesis were conducted. Cinahl+, Ovid Medline, ERIC and Embase were searched systematically.
Review methods: Sandelowski and Barroso's framework guided the review process. A comprehensive search to identify qualitative studies of nursing students' experiences from learning with manikins was performed in January 2019 and updated in April 2020. Study selection was guided by six screening questions derived from these inclusion criteria: qualitative primary studies, published from 2008, in English or Scandinavian, presenting findings of undergraduate nursing students' experiences with manikins at all fidelity levels. Thomas and Harden's method for thematic synthesis was followed.
Results: Twenty-eight articles of twenty-seven studies were included. We identified three synthesised analytic themes: *Seeing the manikin as a doll or a patient*, *Experiencing yourself as a nurse caring for a patient*, and *Being a team member*.
Conclusions: When it is perceived as a patient, a manikin can give students a realistic experience of what it means to behave like nurses. Consequently, this realism lets students practice and acquire relational, communicative, and collaborative nursing skills. Using a manikin can facilitate the development of students' professional identity.

1. Introduction

Quite often, considerable amounts of resources are invested in simulation labs to make the learning environment in nursing education resemble real clinical settings. It has become commonplace for educators to integrate human-like manikins into this learning environment. Today's sophisticated manikins offer a multitude of features that can increase the idea of realism (Dunnington, 2014; Nehring and Lashley, 2009; Sanko, 2017). However, independent of the manikin's sophistication, the rationale behind replacing a patient with a manikin is that students can practice and raise their skills and competencies without any risk of harming human patients (Hopwood et al., 2016; Nehring and Lashley, 2009; Sanko, 2017).

Despite extensive research that has provided knowledge about learning outcomes of simulation-based education, knowledge about how students learn from using manikins is scarce (Mariani and Doolen, 2016; Rutherford-Hemming, 2012). This study takes a sociocultural approach to understand the role manikins play in students' learning. By bringing together existing research of students' experiences from activities with manikins, we may gain a deeper understanding of the learning opportunities that lie embedded in education with manikins.

2. Background

Review studies indicate that simulation-based learning with manikins benefits nursing students' knowledge acquisition, critical thinking and problem-solving skills as well as their ability to clinical judgment (Lapkin et al., 2010; Lee and Oh, 2015; Yuan et al., 2012). It has also

* Corresponding author.
E-mail address: jorunn.a.handeland@uia.no (J.A. Handeland).

https://doi.org/10.1016/j.nedt.2020.104661
Received 11 June 2020; Received in revised form 16 October 2020; Accepted 3 November 2020
Available online 12 November 2020

shown an effect on the development of psychomotor skills (Kim et al., 2016; Lee and Oh, 2015; Shin et al., 2015). Research indicates that simulation activities with manikins can enhance students' self-efficacy (Cant and Cooper, 2010; Labrague et al., 2019; Lee and Oh, 2015) and increase their self-confidence (Labrague et al., 2019; Yuan et al., 2012).

Generally, we range manikins' ability to imitate realistic functions in fidelity levels, from low to high (Nehring and Lashley, 2009; Schoenherr and Hamstra, 2017). This grading ranks the manikin's ability to create realistic experiences based on its technological features. Low-fidelity manikins have minimal ability to replicate human responses and are often limited to task-trainers. High-fidelity refers to advanced manikins that can replicate a wide range of human responses (Basak et al., 2016; Lioce, 2020). A related concept is Maran and Glavin's (2003) concept of 'engineered fidelity'.

It is tempting to assume that advanced technology and high-fidelity simulations contribute to the highest learning effect (Dieckmann et al., 2007). However, studies find no significant correlation between fidelity level and learning (Kardong-Edgren et al., 2007; Lavoie and Clarke, 2017; Mok et al., 2016), or when comparing high- and low-fidelity learning activities (Chen et al., 2015; Norman, 2012). Even if both medium- and high-fidelity simulations have shown significant learning effects, the effect is not proportional to the fidelity level (Kim et al., 2016; Shin et al., 2015).

While fidelity and authenticity are related concepts, authenticity can be achieved using low-fidelity equipment. Moreover, it depends on how we use manikins (Bland et al., 2014). Authenticity resembles Maran and Glavin's (2003) concept of 'psychological fidelity', which measures the experienced realism of the situation and the manikin. The perception of realism also depends on the participants' subjective experiences of the manikin. Even if students can learn from the manikin's instant feedback, its' limited ability to exhibit physical changes and lack of nonverbal communication can reduce the sense of authenticity (Lasater, 2007). Nonetheless, social and health care students can value the mere presence of a manikin because it looks like a patient (Aakrog, 2019).

The knowledge surrounding what creates realism and its meaning remains inconclusive (Mariani and Doolen, 2016). Dieckmann et al. (2007) and Schoenherr and Hamstra (2017) warn that a dominant focus on equipment can come at the expense of social aspects integrated into the learning environment. Despite extensive knowledge of manikins' contributions to nursing education, it is challenging to discover what role they play in the students' learning. To our knowledge, there exists no qualitative review-study offering an integrated interpretation of nursing students' experiences from participating in activities using manikins.

3. Methods

3.1. Aims

The aim of this systematic review and thematic metasynthesis study was to summarise and synthesise findings from qualitative primary research studies of nursing students' experiences from educational activities using manikins to gain a deeper understanding of the role these manikins play in the students' learning.

3.2. Design

Sandelowski and Barroso's (2007) framework guided the review process. They emphasise that a metasynthesis must integrate and reinterpret findings from existing qualitative studies. Here, we can take different analytical approaches according to what best suits the study aim. We employed Thomas and Harden's (2008) method for thematic synthesis. A review protocol was registered in PROSPERO (reg. nr.: CRD42019123523).

3.3. Search methods

After formulating the aim, we designed a search strategy from the parameters: *Who*, *What* and *How*, referring to undergraduate level nursing students, use of manikins, and qualitative studies of students' experiences (Table 1). Regarding the parameter *When*, we limited the search to reports published from 2008 because simulation research started to increase from this time (Sanko, 2017). The systematic, comprehensive search was conducted in four databases relevant to nursing education (Cinahl+, Ovid Medline, ERIC, Embase). The search was run in January 2019 and updated in April 2020 (Bramer and Bain, 2017). A PRISMA flowchart illustrates the search and screening process (Fig. 1).

3.4. Screening and search outcomes

Unique reports were transferred to Rayyan (Ouzzani et al., 2016). Inclusion criteria were incorporated into six screening questions (Table 2). Titles and abstracts were screened, first independently and then in collaboration. The full texts were then screened, first independently, then in collaboration. Disagreements were resolved by discussions based on the screening questions. Only studies using individual interviews, focus-groups or written reflections were included because they reflect students' experiences. A manual search of the literature lists in the included reports was conducted. No additional studies were included.

3.5. Quality appraisal

Twenty-nine full-text reports were included for appraisal, twenty-five from the primary search and four from the updated search. Sandelowski and Barroso's (2002, 2007) reading guide formed the basis of the appraisal and was operationalised into ten headings (Table 3). The appraisal was conducted, first individually, then in collaboration until consensus. During the appraisal, we discussed the presence and relevance of the information rendered regarding each study's aim. No reports were excluded based on their appraised quality. However, according to Sandelowski and Barroso's (2003, 2007) typology, one report was classified as a 'topical survey' and was therefore excluded as equivocal as qualitative research.

3.6. Data extraction and synthesis

We performed a thematic synthesis following Thomas and Harden's (2008) three steps (Table 4). The NVivo12 software (QSR International,

Table 1
Structure of search parameters.

Who		What		How
Education, Nursing, Baccalaureate Students, Nursing, Baccalaureate Students, Nursing, Undergraduate Nursing Education Nursing Students	AND	Simulations Patient simulations Simulation training High Fidelity Simulation Training Patient Simulation Models, Anatomic, Manikins Human-like simulators Mannequin/ Manikin	AND	Qualitative studies, research, design Hermeneutics Phenomenological Research Phenomenology Ethnographic Research Grounded Theory Interviews, semi-structured, structured Focus group Experience, Perception, Attitude, Opinion

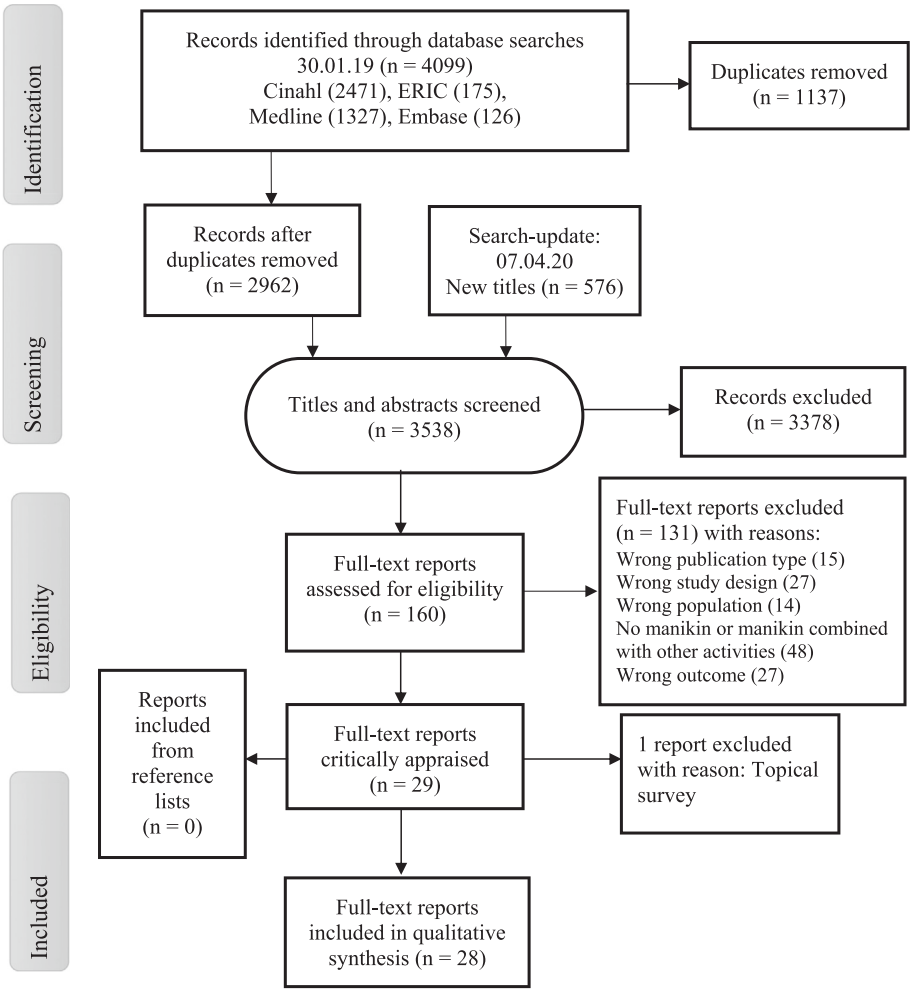

Fig. 1. PRISMA flowchart of screening process.

Table 2
Screening questions.

Instructions:

- All questions are answered yes/no/unclear
- Screen only until one question is answered 'no'
- If any question is answered 'no': exclude

Question	Implication
1. Is the report in English or a Scandinavian language?	If 'no': *Wrong language*
2. Is it a research study?	If 'no': *Wrong publication type*
3. Is it a qualitative research study?	If 'no': *Wrong study design* Exclude: quantitative, mixed-methods and review studies
4. Is the study about nursing students at the baccalaureate, undergraduate or equivalent level?	If 'no': *Wrong population* Exclude: Graduate or continuing students, midwife, Masters. Students from other health educations. Interdisciplinary. Clinical practice. Faculty/instructor/teacher
5. Does the study include a full-size human-like manikin?	If 'no': *No manikin* Exclude: studies that do not specify the use of manikin, or use a manikin in combination with other methods
6. Does the study report findings of students' experiences, feelings, views, or opinions of activities with human-like manikins?	If 'no': *Wrong outcome* Exclude: observational studies, standardised questionnaires, or these in combination with other methods

2018) was used to administer the findings. First, relevant and meaningful findings that pointed to students' experiences with manikins were identified and coded inductively during the reading of each report. The coded findings were grouped into categories. Findings from the reports included after the updated search were coded and integrated into the categories. Secondly, the categories were organised and derived into four descriptive themes. These themes were repeatedly verified with the original reports, representing a synthesis of the findings' recurrence and relevance across the reports. Thirdly, we interpreted the descriptive themes into three analytic themes to understand the role the manikins play in students' learning. Table 5 shows each study's contribution to the analytic themes.

4. Results

4.1. Study characteristics

Twenty-eight reports of twenty-seven studies were included (Table 6). All were published in 2010 or later. Four reports were included after the search update. Three of these were published in 2019. All studies come from industrialised, high-income countries.

The methodological approaches taken were: Hermeneutic Phenomenological (3), Phenomenology (7), Grounded Theory (6). Seven studies used other designs. In four studies, no explicit approach was stated. Four data collection methods were used: focus groups (11), individual interviews (9), written reflective responses (4) or a combination of these three (3).

Table 3
Quality appraisal of the included studies.

Study	Problem, purpose	Methodological orientation	Design, data collection	Analysis techniques	Reflexivity	Limitations	Ethics	Sampling strategy, sample	Findings	Discussion of findings
Christiansen et al. (2015)	+	+	+	+	+	+	+	+	+	+
Cordeau (2010)	+	+	+	+	\	\	\	+	+	+
Cordeau (2012)	+	+	+	+	+	+	+	+	+	+
Dean et al. (2015)	+	\	+	\	\	\	\	+	+	+
DiFederico-Amicone Yates (2013)	+	+	+	+	+	+	+	+	+	+
Dove Ward et al. (2017)	+	+	+	\	\	+	+	+	+	+
Eaton et al. (2012)	+	+	+	+	+	+	+	+	+	+
Eggenberger et al. (2010)	+	+	+	+	\	\	+	+	+	+
Fuselier et al. (2016)	+	+	+	+	+	+	+	+	+	\
Graham and Atz (2015)	+	+	+	+	+	+	\	+	+	+
Hustad et al. (2019)	+	\	+	+	\	+	+	+	+	+
Lanzara (2014)	+	+	+	+	+	+	+	+	+	+
Lee et al. (2019)	+	+	+	+	+	+	+	+	+	+
Lestander et al. (2016)	+	+	+	+	+	+	+	+	+	+
Liaw et al. (2012)	+	+	+	+	\	+	+	+	+	+
McClimens et al. (2012)	+	\	\	\	\	+	\	+	+	+
Miles (2016)	+	+	+	+	+	+	+	+	+	+
Miles (2018)	+	+	+	+	+	+	+	+	+	+
Miller et al. (2016)	+	+	+	+	+	+	+	+	+	+
Najjar et al. (2015)	+	+	+	+	+	+	+	+	+	+
Phillips (2016)	+	+	+	+	+	+	+	+	+	+
Pierazzo et al. (2017)	+	\	+	+	\	+	+	+	+	+
Raman et al. (2019)	+	\	+	\	\	+	+	+	+	+
Roy (2014)	+	+	+	+	+	+	+	+	+	+
Small et al. (2018)	+	+	+	+	+	+	+	+	+	+
Stockmann and Diaz (2017)	+	+	+	+	\	\	+	+	+	+
Sundler et al. (2015)	+	+	\	+	\	+	+	\	+	+
Walton et al. (2011)	+	+	+	+	+	+	+	+	+	+

Sample sizes varied from six to seventy-seven participants. Three studies included associate degree students. Three studies included Bachelor of nursing students from first-year or junior level, two studies included participants from second-year level, and ten studies included participants from third- or fourth-year or senior level. Nine studies collected data from more than one or all study levels. Three studies also focused on specific student groups: students with prior health care experiences (Miller et al., 2016), minority students (Graham and Atz, 2015) and male students (Raman et al., 2019).

High-fidelity manikins were used in eighteen studies. In two studies, medium- and high-fidelity manikins were combined, and one study used only medium-fidelity manikins. In one study, low- and high-fidelity manikins were used. In five studies, the fidelity-level was not explicitly stated.

4.2. Metasynthesis

This thematic metasynthesis of nursing students' experience from activities with manikins revealed three analytic themes: *Seeing the manikin as a doll or a patient*, *Experiencing yourself as a nurse caring for a patient*, and *Being a team member*.

4.2.1. Seeing the manikin as a doll or a patient

This theme was derived from findings of whether the students perceived the manikin as either a doll or a patient. These views were often integrated into the same experience.

Experiencing the manikin as a doll relates to descriptions of it as a dead, plastic equipment. Its' absence of human features, such as body language, nonverbal communication and emotional expressions, emphasise this point (Dean et al., 2015; Dove Ward et al., 2017; Fuselier et al., 2016; Graham and Atz, 2015; Lanzara, 2014; Lee et al., 2019; Liaw et al., 2012; McClimens et al., 2012; Najjar et al., 2015; Phillips, 2016; Raman et al., 2019; Roy, 2014; Stockmann and Diaz, 2017). This experience made it difficult, even unnatural, for some students to practice communication and relational skills with the manikin; skills they regarded as cornerstones of nursing (Christiansen et al., 2015; Dean et al., 2015; Dove Ward et al., 2017; Lanzara, 2014; Lee et al., 2019; McClimens et al., 2012; Miller et al., 2016; Najjar et al., 2015; Phillips, 2016; Roy, 2014; Small et al., 2018; Stockmann and Diaz, 2017). The activity quickly became task-oriented because the manikin encouraged students to focus on technical skills (Cordeau, 2012; Dean et al., 2015; Dove Ward et al., 2017). Consequently, some students felt that the manikin almost hindered learning of what they perceived to be 'real nursing' (Christiansen et al., 2015; Lee et al., 2019; Roy, 2014).

Table 4
Examples from the analysis process and identification of themes.

Coded findings from the included reports	Categories	Descriptive themes	Analytic themes
It gives you a chance to get your technique down, even if you're not actually doing it on a person. (Fuselier et al., 2016, p. 199) *I think a challenge is not receiving feedback from the manikin. Like you can't watch its facial expression, um, or nonverbal cues, um, so that was very challenging.* (Lanzara, 2014, p. 78) *Nursing should be delivered with the heartfelt practice. If a patient is sick, a nurse should be able to feel empathy. Do you think I can learn the feeling during HF-SBL? I have learnt how to provide nursing care to simulators, not humans.* (Lee et al., 2019, p. 12) *We just apply [our practice] to a doll, pretending to do [nursing practice] rather than actually doing it. And [the simulator] doesn't have any feelings, so it doesn't complain of pain. So, I end up handling the simulator harshly.* (Lee et al., 2019, p. 12) *Manikins are cold to the touch and made of rubber and plastic. Their appearance is unnatural, and even with the capability to generate a human voice, there are limits to how real these devices can seem.* (McClimens et al., 2012, p. 24)	Manikins as patient, human being Manikin as doll, plastic Fidelity, realism Learning environment Facilitator, teacher, instructor Feelings regarding simulation: Anxiety	Manikin as plastic doll	Seeing the manikin as a doll or a patient
During the simulation my mind was really changed. Rather than looking at the patient as a plastic mannequin, I really felt as if I was with a human. Having a human voice to interact with and understand was really life-like. (Cordeau, 2010, p. 12) *We had an elderly patient and the operator was doing an elderly man's voice, and that really helped me connect that the patient is an older adult.* (Dove Ward et al., 2017, p. 203) *You're not treating the monitor, your treating the patient… you are listening, you are looking at the vital signs, but your main focus is that patient, getting that patient stable and caring for that patient. You definitely come to care for that patient.* (Eggenberger et al., 2010, p. 27) *Students described a feeling of paralysis during the care of the patient. Fears of failure were linked to the consequences that malpractice could have for the patient.* (Lestander et al., 2016, p. 221) *So, it doesn't matter that it is not real flesh and blood. I still took it as this is a child that has gone into cardiac arrest. (…). Once the child started going into the code… everything was focused now on saving this child.* (Small et al., 2018, p. 149)		Manikin as real patient	
You learn how to communicate and deal with patients because you take the role of the nurse in that same setting. (DiFederico-Amicone Yates, 2013, p. 68) *I feel like simulation gives us more of a chance to, like, actually act as a nurse and do the things like the nurse would do, because it is not a real patient we could practice with that so we are not as limited.* (Miles, 2016, p. 109) *Like in real life, if I was working as a nurse, that is what it felt like. It felt like I was doing this for my patient, or I was saving my patient's life* (Small et al., 2018, p. 149) *Technically, it has increased my confidence and made me realize that you can't sit in the back, especially when you are a nurse. You have to be an advocate for the patient and you have to step out there.* (Walton et al., 2011, p. 306) *The student participants saw themselves as nurses; they were feeling, acting, and thinking as nurses. They were serious about simulation and set their minds to thinking about how they would respond in a situation with a real patient. They looked and acted the role, (…).* (Walton et al., 2011, p. 305)	The nursing role Communication Learning environment	Being a nurse	Experiencing yourself as a nurse caring for a patient
'It depends on the group you're working with if they take it seriously'. (Dean et al., 2015, p.265) *Patient care is a team effort that requires good communication. One student describes feeling "as if a weight was lifted from her chest" when she realized she could call the doctor for help.* (Lestander et al., 2016, p. 222) *Some students wanted their peers to feel comfortable giving them honest feedback, even if not positive, to support continued learning. "…the feedback that you get from your classmates is only to help you and it's not to tear you down"* (Najjar et al., 2015, p. 5) *One participant commented that being able to work in a team was beneficial because it prepared them to function as a member of the healthcare team.* (Phillips, 2016, p. 45) *Students collaborated with one another to provide care: "We were like 'You're gonna do this. You're gonna do this' and we all went in doing it from a physical aspect. (…)." They felt comforted having a partner: "Alone, I don't think I would have gotten the same result."* (Stockmann and Diaz, 2017, p. 743)	Team, group, peers Cooperation Feelings regarding simulation: Stress Debriefing, reflection, feedback	Teamwork	Being a team member

However, the manikin as a doll also had its advantages. It allowed students to practice skills and explore interventions without the fear of hurting anyone. Many felt in control and safe because they could not harm real patients (Christiansen et al., 2015; DiFederico-Amicone Yates, 2013; Dove Ward et al., 2017; Fuselier et al., 2016; Lee et al., 2019; McClimens et al., 2012; Miles, 2016; Miller et al., 2016; Roy, 2014; Walton et al., 2011). The thought of the manikin being a patient almost paralysed some students for fear of making mistakes (Lestander et al., 2016).

Experiencing the manikin as a patient represents a shift in the students' experiences. Realistic scenarios, patient stories, and names could humanise the manikin. When considered together with functioning technology, this could make the idea of the manikin being a patient credible (Cordeau, 2010, 2012; Dean et al., 2015; Dove Ward et al., 2017; Eggenberger et al., 2010; Lestander et al., 2016; Small et al., 2018; Walton et al., 2011). Here, the facilitators played a role. If they convincingly gave the manikin a voice, they contributed to students' regarding the manikin as a patient (Christiansen et al., 2015; Cordeau, 2010; Dean et al., 2015; Dove Ward et al., 2017; Eggenberger et al., 2010; Roy, 2014; Small et al., 2018; Walton et al., 2011). Facilitators strengthened this experience by interacting with the manikin as if it was a patient. This motivated the students to follow suit and treat the manikin as a patient (Cordeau, 2010; Dean et al., 2015; Dove Ward et al., 2017; Eggenberger et al., 2010; Walton et al., 2011).

One consequence of viewing the manikin as a patient was that students felt it was possible to practice communication, caring and

Table 5
Studies' contributions to analytic themes.

Study	Seeing the manikin as a doll or a patient	Experiencing yourself as a nurse caring for a patient	Being a team member
Christiansen et al. (2015)	x	x	x
Cordeau (2010)	x	x	–
Cordeau (2012)	x	x	x
Dean et al. (2015)	x	–	x
DiFederico-Amicone Yates (2013)	x	x	x
Dove Ward et al. (2017)	x	x	x
Eaton et al. (2012)	–	x	–
Eggenberger et al. (2010)	x	x	x
Fuselier et al. (2016)	x	–	–
Hustad et al. (2019)	–	x	x
Graham and Atz (2015)	x	–	x
Lanzara (2014)	x	x	x
Lee et al. (2019)	x	x	x
Lestander et al. (2016)	x	x	x
Liaw et al. (2012)	x	–	–
McClimens et al. (2012)	x	–	–
Miles (2016 & 2018)	–	x	–
Miller et al. (2016)	x	–	–
Najjar et al. (2015)	x	–	x
Phillips (2016)	x	x	x
Pierazzo et al. (2017)	–	–	x
Raman et al. (2019)	x	–	–
Roy (2014)	x	x	x
Small et al. (2018)	x	x	x
Stockmann and Diaz (2017)	x	–	x
Sundler et al. (2015)	–	x	–
Walton et al. (2011)	x	x	x
Studies' contributing	22	17	18

relational skills (Cordeau, 2010, 2012; Dove Ward et al., 2017; Eggenberger et al., 2010; Fuselier et al., 2016; Lestander et al., 2016; Raman et al., 2019; Walton et al., 2011). Descriptions of how emergent situations drew the students into the scenario exemplified this point (Eggenberger et al., 2010; Small et al., 2018). If the manikin represented a critically ill patient, it created an engagement that enabled the students to look beyond the manikin and relate to and feel empathy for the patient it intended to represent (Lestander et al., 2016).

4.2.2. *Experiencing yourself as a nurse caring for a patient*

This theme emerged from findings of how the students perceived themselves when approaching the manikin, and it is intertwined with the first theme.

This theme was linked to the students' experience that they provided real nursing to real patients. If the students regarded the manikin as a patient, this contributed to their feeling like a nurse, which in turn made it easier to behave seriously and engage with the patient (Christiansen et al., 2015; Cordeau, 2010, 2012; Roy, 2014; Small et al., 2018; Walton et al., 2011). If students viewed themselves as nurses, they seemed to, almost automatically, treat the manikins as patients when it came to communication (DiFederico-Amicone Yates, 2013). Students could experience what it was like is to communicate with patients through their interaction with the manikin (Christiansen et al., 2015; DiFederico-Amicone Yates, 2013; Lestander et al., 2016; Sundler et al., 2015; Walton et al., 2011). Students' descriptions of how they fought for patients' lives, felt empathy for them or a feeling of failure if they failed to relieve their patient's sufferings, show that the manikin encouraged them to act as nurses (Lee et al., 2019; Small et al., 2018).

Students described how they got realistic experiences and opportunities to explore the nursing role more freely than they would have been able to in a clinical setting (Christiansen et al., 2015; Cordeau, 2012; Lanzara, 2014; Miles, 2016, 2018; Sundler et al., 2015; Walton et al., 2011). When talking and behaving like nurses in interaction with the manikin, students could understand the responsibilities and skills clinical practice requires. They could enhance qualities to be kept in their future practice, such as prioritising and taking responsibility (Christiansen et al., 2015; Cordeau, 2010, 2012; Eaton et al., 2012; Hustad et al., 2019; Lee et al., 2019; Walton et al., 2011). Other results were increased confidence and independence (Christiansen et al., 2015; DiFederico-Amicone Yates, 2013; Eaton et al., 2012; Lee et al., 2019; Lestander et al., 2016; Miles, 2016, 2018; Walton et al., 2011). In this way, students could prepare for their future practice (DiFederico-Amicone Yates, 2013; Eaton et al., 2012; Lee et al., 2019; Lestander et al., 2016; Roy, 2014).

4.2.3. *Being a team member*

This theme became evident from findings of how students, if they collectively perceived the manikin as a patient, could see themselves as a team providing patient care.

Descriptions of teamwork represent a pivotal experience for many students. Some described it as eye-opening and a relief to realise that they were both allowed and obliged to ask for help (DiFederico-Amicone Yates, 2013; Lestander et al., 2016; Small et al., 2018). As a result, they experienced that patient care is not something they could achieve alone. They were dependent on colleagues to save the patient presented in the form of a manikin (Hustad et al., 2019; Lee et al., 2019; Lestander et al., 2016; Pierazzo et al., 2017; Roy, 2014; Small et al., 2018; Walton et al., 2011).

Much of students' experiences depended on how seriously the team behaved and how realistically they handled the situation together. Group dynamics affected this experience. In mal-functioning groups, students found it challenging to take the situation seriously because the patient was not real (Christiansen et al., 2015; Dean et al., 2015; Lanzara, 2014; Najjar et al., 2015). In functioning groups, students seemed to view each other as nurses who were all acting to treat the manikin as a patient. They realised that saving the patient was their common goal. Consequently, they felt responsible for peers' learning, and they supported each other (Christiansen et al., 2015; Cordeau, 2012; Dean et al., 2015; Eggenberger et al., 2010; Pierazzo et al., 2017; Walton et al., 2011).

Observing peers' performance made students reflect on their own actions, and they learnt from observing others' successes or mistakes when providing patient care (Dean et al., 2015; DiFederico-Amicone Yates, 2013; Dove Ward et al., 2017; Lanzara, 2014; Lestander et al., 2016; Najjar et al., 2015; Roy, 2014). Nevertheless, relating to peers was also considered to be stressful. Many students felt vulnerable if peers observed them during their interactions with the manikin (Dean et al., 2015; Lanzara, 2014; Najjar et al., 2015; Roy, 2014; Walton et al., 2011).

Working with peers provided insight into what teamwork requires. Students became aware of the necessity of collaboration and clear communication (Graham and Atz, 2015; Hustad et al., 2019; Lanzara, 2014; Lee et al., 2019; Lestander et al., 2016; Miles, 2016, 2018; Phillips, 2016; Pierazzo et al., 2017; Roy, 2014; Small et al., 2018; Stockmann and Diaz, 2017). Teamwork gave students opportunities to discuss the patient's condition and the interventions that should be taken (Hustad et al., 2019; Pierazzo et al., 2017; Roy, 2014). The manikin played an essential role in getting the students to realise the importance of teamwork and preparing for future practice (Dove Ward et al., 2017; Lanzara, 2014; Phillips, 2016).

Table 6
Study characteristics.

Author(s) Year Country	Purpose	Design	Sampling strategy	Number of participants, study-level	collection	Manikin's fidelity level
Christiansen et al. (2015) Denmark	To explore students' learning when problem-based learning is used as a pedagogical strategy in simulation-based learning	Hermeneutic phenomenological	Convenience	6 First-year	Individual interviews	Medium
Cordeau (2010) USA	To understand graded simulation from students' perspectives as a basis for the most effective use of simulation and learner-centred teaching	Hermeneutic phenomenological	Purposive	19 Junior	Written descriptions	High
Cordeau (2012) USA	To develop a substantive theory of high-stakes simulation and identify how this theory can be used as a framework to foster situational transition	Grounded theory	Theoretical	30 Baccalaureate	Individual interviews, Written descriptions	High
Dean et al. (2015) Australia	To explore students' experiences of assessing and responding to patients' emotional states, and if and how these skills transferred to manikins	Exploratory case study	Convenience	8 Third-year	Focus groups	Medium and High
DiFederico-Amicone Yates (2013) USA	To explore and gain an understanding of the meaning of the lived experience of associate degree students during a paediatric simulation	Hermeneutic phenomenological	Purposive, criterion, convenience	10 Second-year, Associate	Individual interviews	Not stated
Dove Ward et al. (2017) USA	To investigate and uncover the meaning of the lived experiences of students participating in HFS[a]	Phenomenology	Purposive	31 Senior	Focus groups	High
Eaton et al. (2012) USA	To explore whether end-of-life simulation enhances students' learning in a home health and hospice practicum setting	Phenomenology	Convenience	30 Senior	Written descriptions	High
Eggenberger et al. (2010) USA	To describe how students come to know the person being nursed as caring. To explore how caring is expressed in an emergent situation using a manikin	Not stated	Purposive	77 Baccalaureate	Written descriptions, Focus groups	High
Fuselier et al. (2016) USA	To explore students' perceptions of the use of manikins of colour to determine the effect on their caring for patients of colour	Not stated	Convenience	38 Baccalaureate	Focus groups	Not stated
Graham and Atz (2015) USA	To examine the minority students' perceptions of HFS	Grounded theory	Purposive	16 Junior, senior Minority	Focus groups	Not stated
Hustad et al. (2019)[b] Norway	To explore students' experiences of simulation-based training and how they perceive the transfer of learning to clinical practice	Descriptive	Purposive	32 Second- and third-year	Focus groups	High
Lanzara (2014) USA	To describe the experience of students during medium- to HFS-learning activities	Phenomenology	Purposive	15 Baccalaureate	Individual interviews	Medium and High
Lee et al. (2019)[b] Hong Kong/UK/ USA	To construct a substantive theory of students' HFS-based learning dynamics and identifying factors that influence HFS- based learning	Grounded theory	Purposive	16 Fourth-year	Individual interviews	High
Lestander et al. (2016) Sweden	To explore the value of reflections after HFS by investigating students' perceptions of their learning with a three-step post-simulation reflection model	Descriptive	Convenience	16 Baccalaureate	Written descriptions	High
Liaw et al. (2012) Singapore/ Netherlands/ Australia	To explore students' experiences of how a simulation program has prepared them to transfer their performance in encounters with deteriorating patients	Critical incident techniques	Purposive	15 Third-year	Individual interviews	Not stated
McClimens et al. (2012) UK	To find out about the efficacy of using manikins as an aid to teaching and learning about epilepsy management	Not stated	Convenience	11 First-year	Written descriptions	High
Miles (2016, 2018) USA	To conceptualize the process by which simulation learning transfers to the clinical environment	Grounded theory	Purposive	25 Fourth-year	Individual interviews	High
Miller et al. (2016) USA	To find out paramedics or licensed practical nurses' perceptions regarding their engagement in simulation and how prior experiences influence their learning needs	Phenomenology	Purposive	19 Associate	Individual interviews	Manikins in general
Najjar et al. (2015) USA	To describe students' experience of HFS and to develop a model which explicates this experience	Grounded theory	Purposive	26 Baccalaureate	Focus groups	High
Phillips (2016) USA	To explore students' experiences and confidence levels with and perceptions regarding HFS	Constructivism case study	Purposive homogenous	12 Second-year, Associate	Individual interviews	High
Pierazzo et al. (2017)[b] Canada	To understand students' learning experience in a problem-based learning (PBL) course when HFS- activity was introduced	Case study	Purposive convenience	19 Second-year	Focus groups	High
Raman et al. (2019)[b] Oman	To describe the experiences of Arab male students who were exposed to HFS-training as part of a maternity nursing course	Phenomenology	Purposive	15Fourth-year, Male	Focus groups	High

(*continued on next page*)

Table 6 (*continued*)

Author(s) Year Country	Purpose	Design	Sampling strategy	Number of participants, study-level	collection	Manikin's fidelity level
Roy (2014) USA	To describe students' perceptions of simulation and how simulation influenced their development of clinical judgment	Descriptive naturalistic	Purposive convenience	34 Junior, Senior	Focus groups	Low and High
Small et al. (2018) Canada	To learn about students' lived experience of HFS of paediatric cardiopulmonary arrest	Phenomenology	Purposive	12 Third-year	Individual interviews	High
Stockmann and Diaz (2017) USA	To explore undergraduate students' experiences providing mental health care for a transgender client through simulation	Not stated	Criterion	20 Senior	Focus groups	High
Sundler et al. (2015) Sweden	To explore and analyse undergraduate students' experiences when examining knowledge, skills and competences in simulation laboratories.	Phenomenology	Not stated	23 Second-year	Focus groups	High
Walton et al. (2011) USA	To gain an understanding of how students learn through simulation to identify basic social processes and supportive teaching strategies	Grounded theory	Convenience	26 Senior	Individual interviews, Focus groups	High

[a] HFS: high-fidelity simulations.
[b] Included after search-update, April 2020.

5. Discussion

This metasynthesis provides insight into nursing students' experiences from working with manikins. We elaborate on these experiences in order to understand the role manikins play in students' learning. Concepts from the sociocultural learning tradition are brought into the discussion to deepen this understanding (Parker and Myrick, 2012; Rutherford-Hemming, 2012; Säljö, 2010).

The manikin is central in the students' experiences as a 'mediating tool'. Mediating tools are instruments we use to communicate and develop knowledge during social interaction (Säljö, 2010; Wertsch, 1991). For these students, the manikin has appeared as both a doll and a patient incarnated in one object. This object represents a dualism that makes the manikin unique as a tool because it evokes different learning opportunities. If perceived as a doll, it encouraged students to practice psychomotor skills. Similarly, students found it challenging to express care and apply relational skills because the manikin had limited abilities to promote empathy (Dean et al., 2015; Dove Ward et al., 2017; Lee et al., 2019). Dunnington (2014) explains this in manikins' inability to capture human nature and lack of human reactions. However, our synthesised findings do not fully support this explanation. Many students felt it was possible to practice relational skills if they regarded the manikin as a patient. So, if perceived as a patient, the manikin can facilitate students' practice of caring and relational skills.

The manikin's duality allowed the students to move back and forth between two roles. The students seemed to stay in the student role if they perceive it as a doll. But if perceived as a patient, the manikin allowed them to experience the nursing role. Hopwood et al. (2016) support this assertion when arguing that students simulate themselves as nurses when interacting with the manikin. Therefore, each student's learning will depend on his/her ability to immerse himself/herself into the experience of acting, thinking and feeling as if they were nurses (Ashley and Stamp, 2014; Berragan, 2013; McNiesh, 2015; Roberts and Greene, 2011). Students that experienced themselves as nurses seemed to forget themselves as students. They became less self-conscious, which enabled them to focus on the patient and the task at hand. When feeling and behaving like nurses, they seemed to get access to knowledge inherent to the nursing role (Berragan, 2014; Johannesson et al., 2013; Miles, 2018), such as responsibility and independence. Christiansen et al. (2015) and Berragan (2014) stress that this experience can influence the development of a professional identity.

The experience of being a team member visualises how simulated patient care is a collective activity where students act together as nurses in their efforts to comfort the patient in the manikin (Hopwood et al., 2016). Despite its unrealistic reactions, the manikin triggered real emotions. This was especially prominent in situations where they had to fight together to save dying patients. These experiences can make imprints on the students' minds and increase their awareness of professional responsibility (Dunnington, 2014; Lasater, 2007). The manikin seems to place the students in the scenario and connects them in a community of practice (Lave and Wenger, 1991; Wenger, 1998). It is debatable whether a group of students can be defined as a community of practice, as they are not professionals. To solve this ambiguity, Cordeau (2012) calls this relationship a *community of learners* (p. E100). We agree with this, as we find similarities between these two communities: the participants develop a shared understanding of the situation and a common goal (Lave and Wenger, 1991; Wenger, 1998). The manikin can introduce the students to a community where they can enhance their skills in communication, collaboration, and leadership.

Considering our synthesised findings, we view grading fidelity in levels based on the manikin's technological features somewhat limited. We believe it is more relevant to describe the students' performance with the manikin (Aakrog, 2019; Nyström et al., 2016). If students choose to act as if the situation is not real, the learning experience collapses. It seems like something happens when students discover the patient beyond the plastic doll. Similarly, they can experience what it means to behave like nurses. If students all act like nurses that treat the manikin as a patient, they support each other in this experience. Together, they can create an immersive and expansive learning environment where they can experience realistic nursing. We argue that this is about realism, and we choose to call it 'relational realism', one which permeates the findings as realism that rises among the students. As we see it, here lies much of the learning potential in simulated learning activities with manikins.

5.1. Limitations

We have considered this study through the 'Enhancing transparency in reporting the synthesis of qualitative research statement' (ENTREQ) (Tong et al., 2012). We find possible limitations in the sensitivity and specificity of the search. Relevant reports in non-English or non-Scandinavian languages that could have affected the results were not detected. The included studies are culturally homogenous, so the results may not apply to other cultural contexts. The fact that no studies using low-fidelity manikins were included can be explained if the search strategy was not appropriate for detecting such studies. As descriptive themes emerged during the extraction of findings, these may have influenced the focus for the reading of the remaining reports. There is a risk that the themes became self-affirmative, so that other relevant findings were unintentionally ignored. The last included studies have inevitably been read in light of the first studies' analysis. We cannot state anything about differences between manikins, as most of the included

studies addressed only high-fidelity manikins. We can only conclude from the fact that manikins were used.

6. Conclusion

Upon completing this study, we can better understand the role human-like manikins play in nursing students' learning, regardless of fidelity-level and learning activity. The sociocultural perspective firmly places the study in a theoretical tradition and enhances the understanding of manikins as mediating tools.

Supported by our findings, we would state that nursing students' learning with human-like manikins is a deeply social experience. If experienced as patients, manikins can introduce students to other aspects of nursing than psychomotor skills. It is in relation to a patient that the students can get a realistic understanding of what it means to behave like a nurse. Through this relation, students can practice relational and caring skills, as well as responsibility and independence. Students can create and increase a sense of realism if they relate to each other as nurses whom all treat the manikin as a patient. Subsequently, they can practice communicative and collaborative skills and understand more of the complexity surrounding the nursing role. Together they create and share a profoundly relational realism. A manikin may play the role as a facilitator who supports the development of the students' professional identity.

6.1. Implications for nursing education and research

The significance of this study lies in its challenge to educators to create learning methods that amplify the students' experience of manikins as patients and themselves as nurses. We believe this may be obtained by integrating patient scenarios that personalise the manikin and situates the students in a specific situation. This way, even skill trainers or low-fidelity manikins may appear as 'real patients' for the students. Regularly use of human-like manikins throughout the nursing program may contribute to increased engagement, so the students become familiar with the manikin as a learning tool. Learning methods should invite students to actively experiment with their skills and knowledge as it may increase their understanding of the nurse's role. Educators should view the students as active participants in the simulated learning activity.

Another challenge raised is to design methods that make use of manikins' ability to promote teamwork, leadership, and collaboration. This can be achieved in learning activities where the students are encouraged to find solutions together. Learning activities can be designed to facilitate and encourage, e.g. peer learning and critical thinking. Lastly, this study can increase educators' awareness of how they, through their interaction with manikins, affect the students' experienced realism. Each time a manikin is used, the educators should be consistent in how they refer to and approach the manikin. Educators should agree whether they should highlight the manikin as a doll or a patient in a way that harmonises with the learning objective.

This metasynthesis mainly provides insight into medium- and high-fidelity manikins. Future research should investigate ways to increase the authenticity of low-fidelity manikins. Using less costly manikins more effectively may be of significant interest for many educational institutions. In order to develop manikin-based learning to its full potential, future research should explore the learning opportunities found in the students' interactions with the manikins. This study calls for an investigation of the meaning and implications of the relational learning environment in nursing students' education.

Ethical approval

Not applicable.

Funding statement

This study did not receive any grant from funding agencies in the public, private, or non-profit sectors.

CRediT authorship contribution statement

The four authors have made substantial contributions to the manuscript and have given final approval of this version of the manuscript to be published. They have agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This manuscript has not been published or presented elsewhere in part or in entirety and is not under consideration by another journal.

Declaration of competing interest

There are no conflicts of interest to declare. The authors declare that they have no conflicting interests in the study.

Acknowledgements

Thanks to Ellen Sejersted, Senior Librarian, University of Agder, for helping us develop the search strategy.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.nedt.2020.104661.

References

Aakrog, V., 2019. 'The mannequin is more lifelike': the significance of fidelity for students' learning in simulation-based training in the social-and healthcare programmes. Nordic Journal of Vocational Education and Training 9 (2), 1–18. https://doi.org/10.3384/njvet.2242-458X.19921.

Ashley, J., Stamp, K., 2014. Learning to think like a nurse: the development of clinical judgment in nursing students. J. Nurs. Educ. 53 (9), 519–525. https://doi.org/10.3928/01484834-20140821-14.

Basak, T., Unver, V., Moss, J., Watts, P., Gaioso, V., 2016. Beginning and advanced students' perceptions of the use of low- and high-fidelity mannequins in nursing simulation. Nurse Educ. Today 36, 37–43. https://doi.org/10.1016/j.nedt.2015.07.020.

Berragan, L., 2013. Conceptualising learning through simulation: an expansive approach for professional and personal learning. Nurse Educ. Pract. 13 (4), 250–255. https://doi.org/10.1016/j.nepr.2013.01.004.

Berragan, L., 2014. Learning nursing through simulation: a case approach towards an expansive model of learning. Nurse Educ. Today 34 (8), 1143–1148. https://doi.org/10.1016/j.nedt.2014.03.005.

Bland, A.J., Topping, A., Tobbell, J., 2014. Time to unravel the conceptual confusion of authenticity and fidelity and their contribution to learning within simulation-based nurse education. A discussion paper. Nurse Educ. Today 34 (7), 1112–1118. https://doi.org/10.1016/j.nedt.2014.03.009.

Bramer, W., Bain, P., 2017. Updating search strategies for systematic reviews using EndNote. Journal of the Medical Library Association 105 (3), 285–289. https://doi.org/10.5195/jmla.2017.183.

Cant, R.P., Cooper, S.J., 2010. Simulation-based learning in nurse education: systematic review. J. Adv. Nurs. 66 (1), 3–15. https://doi.org/10.1111/j.1365-2648.2009.05240.x.

Chen, R., Grierson, L.E., Norman, G.R., 2015. Evaluating the impact of high- and low-fidelity instruction in the development of auscultation skills. Med. Educ. 49 (3), 276–285. https://doi.org/10.1111/medu.12653.

Christiansen, S., Buus Bøje, R., Frederiksen, K., 2015. The use of problem- and simulation-based learning: the student's perspective. Nordic Journal of Nursing Research 35 (3), 186–192. https://doi.org/10.1177/0107408315591777.

Cordeau, M. A. (2010). The lived experience of clinical simulation of novice nursing students. International Journal for Human Caring, 14(2), 9–15. doi:10.20467/1091-5710.14.2.8.

Cordeau, M.A., 2012. Linking the transition: a substantive theory of high-stakes clinical simulation. Adv. Nurs. Sci. 35 (3), E90–E102. https://doi.org/10.1097/ANS.0b013e318262614f.

Dean, S., Williams, C., Balnaves, M., 2015. Practising on plastic people: can I really care? Contemp. Nurse 51 (2), 257–271. https://doi.org/10.1080/10376178.2016.1163231.

Dieckmann, P., Gaba, D., Rall, M., 2007. Deepening the theoretical foundations of patient simulation as social practice. Simulation in Healthcare: Journal of the Society for

Simulation in Healthcare 2 (3), 183–193. https://doi.org/10.1097/sih.0b013e3180f637f5.
DiFederico-Amicone Yates, A., 2013. The Lived Experience of Associate Degree Nursing Students Following a Pediatric Simulation Experience: A Phenomenological Inquiry. Barry University School of Nursing. Retrieved from. http://proxy.library.mcgill.ca/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=rzh&AN=109859900 (Doctoral dissertation).
Dove Ward, G., Robinson, L., Jowers Ware, L., 2017. The lived experience of nursing students participating in high-fidelity simulation at a school grounded in caring. International Journal for Human Caring 21 (4), 200–207.
Dunnington, R.M., 2014. The nature of reality represented in high fidelity human patient simulation: philosophical perspectives and implications for nursing education, 15 (1), 14–22. https://doi.org/10.1111/nup.12034.
Eaton, M.K., Floyd, K., Brooks, S., 2012. Student perceptions of simulation's influence on home health and hospice practicum learning. Clinical Simulation in Nursing 8 (6), e239–e247. https://doi.org/10.1016/j.ecns.2010.11.003.
Eggenberger, T., Keller, K., and Locsin, R. C. (2010). Valuing caring behaviors within simulated emergent nursing situations. International Journal for Human Caring, 14 (2), 23–29. doi:10.20467/1091-5710.14.2.22.
Fuselier, J., Baldwin, D., Townsend-Chambers, C., 2016. Nursing students' perspectives on manikins of color in simulation laboratories. Clinical Simulation in Nursing 12 (6), 197–201. https://doi.org/10.1016/j.ecns.2016.01.011.
Graham, C.L., Atz, T., 2015. Baccalaureate minority nursing students' perceptions of high-fidelity simulation. Clinical Simulation in Nursing 11 (11), 482–488. https://doi.org/10.1016/j.ecns.2015.10.003.
Hopwood, N., Rooney, D., Boud, D., Kelly, M., 2016. Simulation in higher education: a sociomaterial view. Educ. Philos. Theory 48 (2), 165–178. https://doi.org/10.1080/00131857.2014.971403.
Hustad, J., Johannesen, B., Fossum, M., Hovland, O.J., 2019. Nursing students' transfer of learning outcomes from simulation-based training to clinical practice: a focus-group study. BMC Nurs. 18 (1) https://doi.org/10.1186/s12912-019-0376-5.
Johannesson, E., Silén, C., Kvist, J., Hult, H., 2013. Students' experiences of learning manual clinical skills through simulation. Adv. Health Sci. Educ. 18 (1), 99–114. https://doi.org/10.1007/s10459-012-9358-z.
Kardong-Edgren, S., Anderson, M., Michaels, J., 2007. Does simulation fidelity improve student test scores? Clinical Simulation in Nursing 3 (1), e21–e24. https://doi.org/10.1016/j.ecns.2009.05.035.
Kim, J., Park, J.-H., Shin, S., 2016. Effectiveness of simulation-based nursing education depending on fidelity: a meta-analysis. BMC Medical Education 16 (1). https://doi.org/10.1186/s12909-016-0672-7.
Labrague, L.J., McEnroe-Petitte, D.M., Bowling, A.M., Nwafor, C.E., Tsaras, K., 2019. High-fidelity simulation and nursing students' anxiety and self-confidence: a systematic review. Nurs. Forum 54 (3), 358–368. https://doi.org/10.1111/nuf.12337.
Lanzara, S., 2014. A Phenomenological Study Exploring Baccalaureate Nursing Students' Experiences in Simulation. Indiana University of Pennsylvania. Retrieved from. http://ezproxy.vid.no/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=109786566&site=ehost-live (Doctoral dissertation).
Lapkin, S., Levett-Jones, T., Bellchambers, H., Fernandez, R., 2010. Effectiveness of patient simulation manikins in teaching clinical reasoning skills to undergraduate nursing students: a systematic review. Clinical Simulation in Nursing 6 (6), e207–e222. https://doi.org/10.1016/j.ecns.2010.05.005.
Lasater, K., 2007. High-fidelity simulation and the development of clinical judgment: students' experiences. J. Nurs. Educ. 46 (6), 269–276. https://doi.org/10.3928/01484834-20070601-06.
Lave, J., Wenger, E., 1991. Situated Learning: Legitimate Peripheral Participation. Cambridge University Press, Cambridge.
Lavoie, P., Clarke, S.P., 2017. Simulation in nursing education. Nursing 2018 47 (7), 18–20. https://doi.org/10.1097/01.NURSE.0000520520.99696.9a.
Lee, J., Oh, P.-J., 2015. Effects of the use of high-fidelity human simulation in nursing education: a meta-analysis. J. Nurs. Educ. 54 (9), 501–507. https://doi.org/10.3928/01484834-20150814-04.
Lee, J.J., Yeung, K.C.Y., Clarke, C.L., Yoo, J., 2019. Nursing students' learning dynamics and perception of high-fidelity simulation-based learning. Clinical Simulation in Nursing 33, 7–16. https://doi.org/10.1016/j.ecns.2019.04.008.
Lestander, O., Lehto, N., Engstrom, A., 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.
Liaw, S.Y., Chan, S.W.-C., Scherpbier, A., Rethans, J.-J., Pua, G.G., 2012. Recognizing, responding to and reporting patient deterioration: transferring simulation learning to patient care settings. Resuscitation 83 (3), 395–398.
Lioce, L., 2020. Healthcare Simulation Dictionary – Second Edition. Agency for Healthcare Research and Quality, Rockville, MD. https://doi.org/10.23970/simulationv2. Retrieved from. https://www.ssih.org/dictionary (January 2020, AHRQ Publication No. 20-0019).
Maran, N.J., Glavin, R.J., 2003. Low- to high-fidelity simulation - a continuum of medical education? Med. Educ. 37, 22–28. https://doi.org/10.1046/j.1365-2923.37.s1.9.x.
Mariani, B., Doolen, J., 2016. Nursing simulation research: what are the perceived gaps? Clinical Simulation in Nursing 12 (1), 30–36. https://doi.org/10.1016/j.ecns.2015.11.004.
McClimens, A., Lewis, R., Brewster, J., 2012. The anatomy lesson of Dr Nicolaes Tulp: what can it teach us today? J. Intellect. Disabil. 16 (1), 17–27. https://doi.org/10.1177/1744629512438037.
McNiesh, S.G., 2015. Cultural norms of clinical simulation in undergraduate nursing education. Global Qualitative Nursing Research 2. https://doi.org/10.1177/2333393615571361.
Miles, D.A., 2016. Simulation learning and transfer to the clinical environment in undergraduate nursing students. (Doctoral dissertation), Loyola University Chicago. Retrieved from. https://ecommons.luc.edu/cgi/viewcontent.cgi?article=3289&context=luc_diss.
Miles, D.A., 2018. Simulation learning and transfer in undergraduate nursing education: a grounded theory study. J. Nurs. Educ. 57 (6), 347–353. https://doi.org/10.3928/01484834-20180522-05.
Miller, B.A., Kimble, L.P., Sudia, T., Gee, R.M., 2016. A phenomenological inquiry of the perceptions of simulation among ADN students with prior health care experience. Teach. Learn. Nurs. 11 (4), 189–193.
Mok, H.T., So, C.F., Chung, J.W.Y., 2016. Effectiveness of high-fidelity patient simulation in teaching clinical reasoning skills. Clinical Simulation in Nursing 12 (10), 453–467. https://doi.org/10.1016/j.ecns.2016.06.003.
Najjar, R.H., Lyman, B., Miehl, N., 2015. Nursing students' experiences with high-fidelity simulation. Int. J. Nurs. Educ. Scholarsh. 12, 1–9. https://doi.org/10.1515/ijnes-2015-0010.
Nehring, W.M., Lashley, F.R., 2009. Nursing simulation: a review of the past 40 years. Simul. Gaming 40 (4), 528–552. https://doi.org/10.1177/1046878109332282.
Norman, J., 2012. Systematic review of the literature on simulation in nursing education. The ABNF Journal: Official Journal of the Association of Black Nursing Faculty in Higher Education 23 (2), 24–28.
Nyström, S., Dahlberg, J., Hult, H., Dahlgren, M.A., 2016. Enacting simulation: a sociomaterial perspective on students' interprofessional collaboration. Journal of Interprofessional Care 30 (4), 441–447. https://doi.org/10.3109/13561820.2016.1152234.
Ouzzani, M., Hammady, H., Fedorowicz, Z., Elmagarmid, A., 2016. Rayyan- a web and mobile app for systematic reviews. (version 5:210). Retrieved from. https://rayyan.qcri.org/welcome.
Parker, B.C., Myrick, F., 2012. The pedagogical ebb and flow of human patient simulation: empowering through a process of fading support. J. Nurs. Educ. 51 (7), 365–372. https://doi.org/10.3928/01484834-20120509-01.
Phillips, T.M., 2016. Using simulation to improve clinical confidence in associate-degree nursing students. (Doctoral dissertation), USA, Walden University. Retrieved from. http://ezproxy.vid.no/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=124413666&site=ehost-live.
Pierazzo, J., Allan, M., McLaren, G., Baby, D., 2017. Using case study to examine simulation in a problem-based course. Quality Advancement in Nursing Education - Avancées en Formation Infirmière 3 (2), 1–10. https://doi.org/10.17483/2368-6669.1077.
QSR International Pty Ltd, 2018. NVivo Qualitative Data Analysis Software (Version 12).
Raman, S., Labrague, L.J., Arulappan, J., Al-Zaabi, O.A.M., Natarajan, J., Cyril Vincent, S., 2019. Experiences of Arab male nursing students during high fidelity maternity simulation training. Nurs. Forum 2019, 1–7. https://doi.org/10.1111/nuf.12402.
Roberts, D., Greene, L., 2011. The theatre of high-fidelity simulation education. Nurse Educ. Today 31 (7), 694–698. https://doi.org/10.1016/j.nedt.2010.06.003.
Roy, L., 2014. Baccalaureate nursing students' perceptions of simulation and the development of clinical judgment. (Doctoral dissertation), Widener University. Retrieved from. http://search.ebscohost.com/login.aspx?direct=true&db=c8h&AN=109828656&site=ehost-live.
Rutherford-Hemming, T., 2012. Simulation methodology in nursing education and adult learning theory. Adult Learning 23 (3), 129–137.
Säljö, R., 2010. Learning in a sociocultural perspective. In: Peterson, P., Baker, E., McGaw, B. (Eds.), International Encyclopedia of Education, 3 ed. Elsevier Science, pp. 498–502.
Sandelowski, M., Barroso, J., 2002. Reading qualitative studies. Int. J. Qual. Methods 1 (1), 74–108. https://doi.org/10.1177/160940690200100107.
Sandelowski, M., Barroso, J., 2003. Classifying the findings in qualitative studies. Qual. Health Res. 13 (7), 905–923. https://doi.org/10.1177/1049732303253488.
Sandelowski, M., Barroso, J., 2007. Handbook for Synthesizing Qualitative Research. Springer Publishing Company, United States.
Sanko, J.S., 2017. Simulation as a teaching technology: a brief history of its use in nursing education. Quarterly Review of Distance Education 18 (2), 77.
Schoenherr, J.R., Hamstra, S.J., 2017. Beyond fidelity: deconstructing the seductive simplicity of fidelity in simulator-based education in the health care professions. Simul. Healthc. 12 (2), 117–123. https://doi.org/10.1097/sih.0000000000000226.
Shin, S., Park, J.-H., Kim, J.-H., 2015. Effectiveness of patient simulation in nursing education: meta-analysis. Nurse Educ. Today 35 (1), 176–182. https://doi.org/10.1016/j.nedt.2014.09.009.
Small, S.P., Colbourne, P.A., Murray, C.L., 2018. High-Fidelity simulation of pediatric emergency care: an eye-opening experience for Baccalaureate nursing students. The Canadian Journal of Nursing Research. Revue Canadienne de Recherche en Sciences Infirmieres 50 (3), 145–154. https://doi.org/10.1177/0844562118767786.
Stockmann, C., Diaz, D.A., 2017. Students' perceptions of the psychological well-being of a transgender client through simulation. J. Nurs. Educ. 56 (12), 741–744. https://doi.org/10.3928/01484834-20171120-07.
Sundler, A.J., Pettersson, A., Berglund, M., 2015. Undergraduate nursing students' experiences when examining nursing skills in clinical simulation laboratories with high-fidelity patient simulators: a phenomenological research study. Nurse Educ. Today 35 (12), 1257–1261. https://doi.org/10.1016/j.nedt.2015.04.008.
Thomas, J., Harden, A., 2008. Methods for the thematic synthesis of qualitative research in systematic reviews. BMC Medical Research Methodology 8 (1), 45, 1–10. https://doi.org/10.1186/1471-2288-8-45.
Tong, A., Flemming, K., McInnes, E., Oliver, S., Craig, J., 2012. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ. BMC Med. Res. Methodol. 12 (1), 181. https://doi.org/10.1186/1471-2288-12-181.

Walton, J., Chute, E., Ball, L., 2011. Negotiating the role of the professional nurse: the pedagogy of simulation: a grounded theory study. J. Prof. Nurs. 27 (5), 299–310. https://doi.org/10.1016/j.profnurs.2011.04.005.
Wenger, E., 1998. Communities of Practice: Learning, Meaning, and Identity. Cambridge University Press, Cambridge.
Wertsch, J.V., 1991. Voices of the Mind: A Sociocultural Approach to Mediated Action. Harvard University Press, Cambridge, Massachusetts.
Yuan, H.B., Williams, B.A., Fang, J.B., 2012. The contribution of high-fidelity simulation to nursing students' confidence and competence: a systematic review. Int. Nurs. Rev. 59 (1), 26–33. https://doi.org/10.1111/j.1466-7657.2011.00964.x.