

Appendix 1: Summary of Original Studies Included in the Review

Study	Study design	Participants	Study purpose	Data collection	Analysis	Intervention	Control	Outcomes
Akhu-Zaheya et al. (2012) Jordan	Quasi-experimental pre-post-test design	N = 121 2nd-year nursing students	Examine the effect of high fidelity basic life support (BLS) simulation on knowledge acquisition, knowledge retention, and self-efficacy of Jordanian nursing students.	BLS multiple-choice knowledge test extrapolated from the AHA (2010); BLS exam and the Flinders University BLS exam; BLS knowledge acquisition test of the AHA (2010); Self-efficacy questionnaire developed by Arnold et al. (2009) and modified by the authors of the article to include items on students' self-efficacy in performing BLS skills	Using of Statistical Package for Social Sciences (SPSS) Version 16 for Windows. Descriptive values based on the level of measurement were used to describe the sample and the study variables. An independent t test was used to compare the mean difference in the study outcomes between the experimental and the control group	HFS BLS scenario on knowledge acquisition, knowledge retention, and self-efficacy	58 (53%) were in the control group and received only traditional teaching of BLS	<ul style="list-style-type: none"> • An increase in knowledge acquisition and retention for both the experimental and the control group. However, the results of the independent t test for BLS knowledge acquisition mean differences between the experimental (M = 9.1) and the control group (M = 8.6) showed that there was no significant difference (t=1.6, df=108, p=.1). • Significant difference in self-efficacy in BLS between the experimental (M = 84.4) and the control group (M = 75.1; t = 3.91, df = 108, p = .001); • No significant difference on BLS knowledge retention (after 1 month) between the experimental (M = 8.29) and the control group (M = 8.28; t = 0.03, df = 108, p = .97).
Amod & Brysiewicz (2017) South Africa	Exploratory sequential mixed methodology	N = 10 midwifery experts N = 43 4 th year under-graduate midwifery students	Develop, implement and evaluate a simulation learning package on post-partum haemorrhage for undergraduate midwifery students	<ul style="list-style-type: none"> • Focus group • Survey • Evaluation Checklist for Experts of Scriven (2011), adapted • Student Satisfaction Survey of Nevin et al, (2014), amended. 	SPSS Version 23.0 for quantitative data; Content analysis for results of the open-ended questions and the focus group sessions	Developing, implementing and evaluating a simulation learning package on post-partum haemorrhage	–	<ul style="list-style-type: none"> • Active learning; • Teamwork; • Pre-simulation support: improves clinical skills, knowledge, critical thinking, self-confidence and satisfaction;

			using HFS without risks to real-life patients					<ul style="list-style-type: none"> • SLP: improves the student's perception of his clinical competence, stimulates critical thinking and increases self-confidence
Amod & Brysiewicz (2019) South Africa	Descriptive qualitative research approach	N = 43 4 th year undergraduate midwifery students	Describe how HFHPS can promote experientially learning following the management of post-partum haemorrhage as a midwifery clinical emergency	Focus group Open-ended questions guide	Recordings of the focus groups were transcribed; Transcriptions were analyzed using content analysis as described by Graneheim et al, (2017)	Promoting experiential learning following the management of post-partum haemorrhage as a midwifery clinical emergency	–	<ul style="list-style-type: none"> • Managing of complex real-life emergencies; • Promoting reflection by allowing student midwives to reflect or review their roles, decisions and skills; • Allowing student midwives to learn from their own experiences.
Badir et al. (2015) Turkey	Case study	N = Senior nursing students	Understand students' perceptions of the use of HFS as a learning strategy in an undergraduate intensive care course	Focus group Semi-structured interview guide	Qualitative analysis. Coding process suggested by Corbin and Strauss: Interview notes were transcribed and organized for analyzing the data; Then worked on list of codes to create the core categories to make sense of the data; Identification of categories; Determination of 5 categories and subcategories	Students' perceptions of the use of HFS as a learning strategy in an under-graduate intensive care course	–	<ul style="list-style-type: none"> • Gaining familiarity through well-structured preparation; • Maximizing the learning experience through debriefings; • Improving knowledge and skills and building confidence through experiential learning; • Raising professional awareness; • Enhancing the strength of high-fidelity simulations to make them more useful for learning.
Crafford et al. (2019) South Africa	Qualitative descriptive, explorative and contextual study	N = 61 1 st -year basic nursing students	Explore the experiences of first-year basic nursing students about their learning in simulated environments	Survey Open-ended questionnaires	Qualitative analysis. Transcripts of the open-ended questions were read and reread; Coding was done by coloured marker pens to group sections together. The researchers marked different sections of the data as relevant to the	Assessing of first-year nursing students' experiences of learning in simulation	–	<ul style="list-style-type: none"> • Level of satisfaction concerning simulation laboratory • Confidence before doing nursing procedures in real patient situations • Positive experience regarding reinforcement/

					themes. Phrases, sentences and paragraphs which participants used, were coded, while exploring themes more closely.			repetition of skills in the simulation laboratory
Cura et al. (2020) Turkey	Randomized controlled experimental study design	N = 266 Undergraduate nursing students	Compare the effect of different simulation modalities on knowledge, skill, stress, satisfaction, and self-confidence levels of students receiving undergraduate education in three nursing schools	Student knowledge test, skill checklist; Virtual Analog Scale (VAS) stress level; Student Satisfaction and Self-Confidence in Learning Scale.	Quantitative analysis using the SPSS 22.0; The Kolmogorove-Smirnov test was performed to determine whether the data were normally distributed or not. One-way analysis of variance, and t test were used because the intragroup and intergroup comparisons for continuous variables were normally distributed. The Scheffé test was performed as a post hoc test.	Comparison of the effect of different simulation modalities on knowledge, skill, stress, satisfaction, and self-confidence levels of students receiving undergraduate education in three nursing schools	–	<ul style="list-style-type: none"> • Significant difference between the test scores of the three groups before and after the practice ($p < .05$). • Pre-test results of knowledge levels of the three groups were similar ($F = 0.731, p = .484$). After the practices, post-test results of knowledge levels of the three groups were also found to be similar ($F = 1.48, p = .231$). • VAS stress scores of the three groups were similar before the practice ($F = 0.821, p = .442$). After the practices, there was a significant difference between the groups in terms of VAS stress scores ($p = .012$). After the practice, the stress level of the standardized patient group was standardized significantly higher than that of the other two groups ($p < .05$). In the practices performed with the high-fidelity manikin and partial task trainer, there was a

								<p>significant difference between the groups in terms of VAS stress scores before and after the practice, and pre-practice stress levels of both groups decreased after the practice ($p < .05$). VAS stress scores of the students were similar before and after the practice performed with the standardized patient ($t = 132$, <i>standardized</i>)</p> <ul style="list-style-type: none">• Significant difference between skill scores of the students that were assessed during the practice ($p < .05$). In the practice which was performed with the standardized patient, skill scores of the students were significantly lower during the practice compared with high fidelity and partial task trainer ($p = .001$).• Significant difference between the groups in terms of the scores of satisfaction in learning ($p < .05$). After the practice, satisfaction mean scores of the standardized patient group were found to be significantly higher than those of the other two groups ($p < .05$).• Significant difference
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								between the groups in terms of the students' scores of self-confidence in learning ($p = 001$). In the practice which was performed with the partial task trainer, the students' scores of self-confidence in learning were significantly lower than those of the other groups ($p = 001$).
Gudayu et al. (2015) Ethiopia	Cross-sectional study	N = 144 Midwifery students	Assess self-efficacy, learner satisfaction, and associated factors of SBE among Midwifery students in Gondar University,	Self-administered questionnaire. Five-scale Likert survey questions which were adopted from National League for Nursing; Structured and pretested questionnaire adopted from NLN	SPSS version 20 statistical software used for analysis; Binary and multivariable logistic regression analysis done to assess associations of explanatory variables with outcome variables. Strength of association determined by adjusted odds ratio with 95% confidence interval and p value < 0.05.	SBE	–	The proportion of satisfaction and confidence in simulation learning was 54.2% and 50.7% among participants. Students who perceived instructors' assistance during skill practice as "good" showed statistically significant satisfaction, while those students who were satisfied and perceived instructors' assistance as "good" showed statistically significant confidence during skill practice
Karabacak et al. (2019) Turkey	Semi-experimental study	N = 65 1st-year nursing students	Evaluate the effects of simulation-based learning on the self-efficacy and performance of first-year nursing students	General Self-Efficacy Scale; Proficiency Assessment Form; Objective Structured Clinical Assessment checklist; Performance evaluation checklist.	<ul style="list-style-type: none"> • Data analyzed using the SPSS for Windows version 18.0. • Data normality tested using the Kolmogorov–Smirnov test. • Descriptive statistics presented using the arithmetic mean and standard deviation, 	Simulation-based training	–	<ul style="list-style-type: none"> • The mean self-efficacy score of students was 52.68 (± 10.19) before the scenario and 49.59 (± 12.90) post-scenario ($p = .001$). • With regard to their scenario objectives, a decrease was observed in students' proficiency

					<p>minimum–maximum, frequency, and percentage.</p> <ul style="list-style-type: none"> • Results compared using student's t-test, Pearson correlation and Bonferroni correction. 			<p>in their post-scenario self-assessment of competence. The decrease was only statistically significant in the "Establishing a safe patient unit" objective (t=2.27; p=.03)</p>
<p>Nyamu et al. (2018) Kenya</p>	<p>Descriptive cross-sectional research design</p>	<ul style="list-style-type: none"> • N1=400 nursing students • N2=30 nurse tutors 	<p>Assess the perceptions of nursing students and tutors on utilization of simulation as a teaching and learning strategy with a view of improving the utilization of the simulation strategy</p>	<p>Survey Structured questionnaires</p>	<p>Data coded and entered into a database; Quantitative data analysis conducted using the SPSS software version 24 for windows; Both descriptive and inferential statistics particularly the T test statistics were used in data analysis; Responses to qualitative data thematically analyzed.</p>	<p>Assessing of the perceptions of nursing students and tutors on utilization of simulation as a teaching and learning strategy</p>	<p>–</p>	<ul style="list-style-type: none"> • Nursing student perception on simulation as a learning strategy: 51% strongly agreed on simulation-enhancing confidence and satisfaction. On simulation enables meeting learning outcomes, 50% agreed. 52% agreed on laboratory skills being adequately prepared before simulation. On instructors/tutors offer support during simulation sessions, 48% agreed. • Perception of simulation benefit: the majority (55%) strongly agreed on Skill performance being enhanced by simulation. Most (56%) strongly agreed on simulation reduce anxiety and fear to practice. On whether beneficial knowledge is gained, 42% strongly agreed while 51% agreed. On whether simulation promotes

								critical thinking, 41% strongly agreed while 46% agreed. As pertaining to simulation enhancing learner satisfaction, 44% strongly agreed while 40% agreed. On simulation promotes communication skills, 49% agreed. <ul style="list-style-type: none"> • Simulation Models Applied in Teaching by Tutors: Full-body mannequins or Integrated Simulators was adopted to a large and very large extent (69%). Partial task trainers were applied to a large extent and a very large extent (69%). Computerized simulators had a small extent of adoption (46%). • Nursing Tutors Perceptions on Simulation Models: The majority of the respondents (85%) strongly agreed on simulation enables students to meet their learning outcome. 54% agreed on there being adequate preparation and executing simulation time.
Sarmasoglu et al. (2016) Turkey	Quasi-experimental design	N = 87 Nursing students	Examine the effects of using standardized patients for the	Observation • "Arterial Blood Pressure	• Data analyzed using IBM SPSS Statistics for Windows, Version 20.0; Assessing of the	Using standardized patients for the psychomotor skills development of	Students randomly assigned to the control (n =	• The mean performance score for the measurement of arterial blood pressure

			<p>psychomotor skills development of nursing students</p>	<p>Measurement Performance Observation Form"</p> <ul style="list-style-type: none"> • "Subcutaneous Injection Administration Performance Observation Form" • "Standardized Patient-Student Interaction Assessment Form" 	<p>performance of the students by using the performance observation forms and checking whether the student followed correct steps of procedures. Scoring of performances by assigning a point value of 3 for "completely performed" to 1 for "could not be performed" for each step of the observation forms.</p> <p>The Mann-Whitney U test used to analyze the total performance scores obtained by the control and experimental groups for arterial blood pressure measurement, and a t test used to analyze the total performance scores of the 2 groups on subcutaneous injection administration.</p> <ul style="list-style-type: none"> • The SPs' evaluations regarding the interaction and communication skills of the students in the experimental group expressed in terms of numbers and percentages. Students' answers on the First Real-Life Practice Evaluation Forms grouped based on common themes. 	<p>nursing students</p>	<p>43) and experimental (n = 44) group</p>	<p>was 76 ± 7.6 for the control group and 83 ± 3.1 for the experimental group ($P < .001$). The groups' mean performance scores were close to each other for subcutaneous injection administration (control [62 ± 6.4], experimental [62 ± 4.5])</p> <ul style="list-style-type: none"> • During the performance evaluations of arterial blood pressure measurement, the majority of SPs (88.1%) reported that almost all the students were respectful and made them comfortable. The rate at which the students asked the SPs meaningful and reasonable questions during arterial blood pressure measurement was 88.1%. However, that rate decreased to 53.7% during subcutaneous injection administration. More than half of the students (61.9%) addressed the patients with their names while performing arterial blood pressure measurements, whereas only 43.9% did so during subcutaneous injection administration. • During the clinical
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								<p>practice, only a few of the control group students reported their positive feedback about their learning experiences in the laboratory. In contrast, students in the experimental groups reported that laboratory practices were effective in improving their arterial blood pressure measurement skill (n = 29) and subcutaneous injection skill (n = 32). Some of the students commented: "Practicing in the laboratory with SPs reduced my anxiety and improved my self-confidence."</p> <ul style="list-style-type: none">• Students' feelings regarding their first measurement of arterial blood pressure and subcutaneous medication administration on a real patient were positive in both of the groups. Eighteen students in the control group and 24 students in the experimental group stated that they were comfortable during their first arterial blood pressure measurement in the clinical setting. Twenty-two students in the control group and 25 students in the
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								experimental group stated they felt comfortable during administration of subcutaneous injections.
Souza et al. (2020) Brazil	Descriptive study	N= 52 Undergraduate nursing students	Examine the impact of using SPs on the development of skills relating to arterial blood pressure measurements and subcutaneous injection administration among beginning nursing students	Survey "Student Satisfaction and Self-Confidence with Learning Scale"; "Satisfaction with Simulated Clinical Experiences Scale (ESECS)"	Data were entered and analyzed using Microsoft Office Excel 2016, using descriptive and inferential statistics. The items on the Student Satisfaction and Self-Confidence with Learning Scale analyzed by mean, standard deviation, absolute and percentage frequencies. The ESECS items analyzed by mean, standard deviation, median, maximum and minimum values. Spearman's correlation test used to assess the existence of correlation between the "Self-confidence" and "Satisfaction" constructs, considering a CI of 95%.	Evaluating "satisfaction" and "self-confidence" constructs in nursing students who underwent simulated clinical experiences in semiology and semio-technique disciplines	–	Most were more satisfied (overall average = 4.18) than self-confident (overall average = 4.12). Spearman correlation test identified a significant and positive association between the "satisfaction" and "self-confidence" constructs
Teni et Gebretensaye (2019) Ethiopia	Quantitative study	N = 103 Nurse educators	Assess the knowledge and perception of nurse educators toward clinical simulation and associated factors with the practice of clinical simulation in nursing.	Self-administration semi-structured questionnaire Semi-structured questionnaire	Coding of responses; Analyzing using IBM SPSS Statistics for Windows version 20; Descriptive statistics were used for describing variables and analysis was run to identify associations such as relationships between the components of the dependent variables as-well-as between the dependent and	Assessing knowledge and perception of nurse educators toward clinical simulation and associated factors with the practice of clinical simulation in nursing	–	• 87(87.9%) of the 99-respondent claimed that they are familiar with clinical simulation. Of those who claimed they are familiar with clinical simulation 63(63.7%) thinks they are knowledgeable. This study later found that 59(59.6%) of the respondent to have adequate knowledge about clinical

					independent variables; Bivariate and multivariate regression analysis computed to assess the statistical association between variables.			simulation. <ul style="list-style-type: none"> • 74(74.7%) of the respondent have a positive perception toward clinical simulation; • Almost all participant 95(94.9%) perceived that clinical simulation will improve a student's knowledge, critical thinking, and confidence; • Three-fourths of participants agreed that skills gained through clinical simulation can be transferred into the real clinical setting.
Tuzer et al. (2016) Turkey	Mixed-method explanatory sequential design	4 th -year nursing students	Compare the effects of the use of a high-fidelity simulator (HFS) and standardized Patients (SPs) on the knowledge and skills of students conducting thorax-lungs and cardiac examinations, and to explore the students' views and learning experiences	Survey Focus group <ul style="list-style-type: none"> • "Evaluating the Level of Knowledge on Thorax, Lung, and Cardiac Examination" • "Skills Assessment Form" • "Debriefing Form" • "Focus Group Form". 	<ul style="list-style-type: none"> • Data analyzed using IBM SPSS Statistics for Windows, Version 21.0. Pre-test and post-test scores of the patients and performance scores converted into percentile values, and Shapiro Wilk test used to test their conformity to normal distribution. • Paired t-test used to compare the knowledge and performance of the students for both education methods, and independent samples t-test used to evaluate differences in the scores of Group 1 and Group 2. • Audio recordings of focus groups transcribed into text, content analyzed after grouping the 	Using HFS and SPs	Students randomly assigned to the HFS (n = 26) and the SPs (n = 26) groups	<ul style="list-style-type: none"> • Knowledge and performance scores of all students increased following the simulation activities; • The students that worked with standardized patients achieved significantly higher knowledge scores than those that worked with the high-fidelity simulator; • No significant difference in performance scores between the groups. • Students who studied with HFS and SPs expressed that simulation improved their communication skills, the professional approach facilitated the

					responses, and quotations from the students used in the text.			learning process, raised awareness by improving skills and reduced anxiety before clinical practice. Finally, they were very satisfied.
Tyer-Viola et al. (2012) Zambia	Quasi experimental design	N = 41 Midwifery students	Evaluate the use of simulation on knowledge, satisfaction with learning and self-confidence in midwifery students attending a school of midwifery in Sub Saharan Africa	Focus group Questionnaire for knowledge assessment; Student satisfaction and self-confidence in learning scale; Open response questions used rather than multiple choice questions	<ul style="list-style-type: none"> • Items comprising the subscales were aggregated to produce composite scores. • IBM SPSS v20 was employed to perform a Hotelling's multivariate analysis of variance (MANOVA) with independent samples t-tests as follow ups. • The Behrens-Fisher version of the t-test was invoked to compare differences between groups if the assumption of equal variances was violated. Alpha was set at $p < 0.05$. 	Use of simulation on knowledge, satisfaction with learning and self-confidence in midwifery students	Students randomly assigned to participate in standard instruction group (control) or standard instruction group with simulation instruction (intervention)	<ul style="list-style-type: none"> • No significant differences between the pre and post test scores between groups. • Pretest scores of knowledge ranged from 7-22 overall with a mean of 15.22 (SD = 3.41). Post test scores ranged from 3-22, with a mean of 14.26 (SD = 3.53). • Satisfaction with learning and self-confidence scores in total ranged from 35-63, with a mean of 55.53(SD = 6.40). The five questions related to satisfaction with learning ranged from 7-25 with a mean of 20.93(SD = 3.98). The eight questions related to confidence ranged from 28 to 40 with a mean of 34.32 (SD = 2.93).
Wang et al. (2016) China	Randomized controlled trial	N = 55 Undergraduate nursing students	Implement an interprofessional simulation-based education (IPSE) program for nursing students and evaluate the influence of this	Survey • Readiness for Interprofessional Learning Scale (RIPLS) designed by Parsell and Bligh was used to measure the attitudes toward	• The Wilcoxon signed-rank test was used to analyze the differences in the individual question responses of nursing students' attitudes toward IPE before and after the IPSE program. After the course, the differences in	Implementation and evaluation of an IPSE program for undergraduate nursing students in OR nursing education	Random number table used to assign the nursing students to the IPSE group (n = 28) or traditional course group	• Readiness for interprofessional learning scale: A positive response to Questions 1–9 and 13–16 is associated with a positive attitude to IPE, and a negative response to Questions 10–12 and

			<p>program on nursing students' attitudes toward interprofessional education (IPE) and knowledge of operating room (OR) nursing</p>	<p>interprofessional teams and readiness for interprofessional education.</p> <ul style="list-style-type: none"> • This questionnaire included open-ended questions. • The 20-item questionnaire was used to explore the nursing students' knowledge about infection control, patient safety, quality assurance, and professional accountability in OR nursing. 	<p>the nursing students' knowledge about OR nursing between the IPSE and traditional course group were analyzed using independent samples t-tests. A P value less than 0.05 was considered statistically significant.</p> <ul style="list-style-type: none"> • Statistical analyses were performed using SPSS Statistics for Windows, Version 17.0 (SPSS, Chicago, IL, USA). • Participant responses to the open-ended question were analyzed using qualitative methods. 		<p>(n = 27)</p>	<p>17–19 is associated with a negative attitude to IPE. No significant difference in the responses to questions on the Readiness for Interprofessional Learning Scale (RIPLS) was found between nursing students from the traditional course group and IPSE group before intervention. However, in nursing students from the IPSE group, there was a significant difference in the post-intervention questionnaire for Questions 3 (p = 0.046), 7 (p = 0.040), 13 (p = 0.023) and 14 (p = 0.013), which reflects more positive responses. These results demonstrated the improved attitudes toward teamwork and collaboration, and professional identity after the IPSE course.</p> <ul style="list-style-type: none"> • Responses to open-ended question: From the participants' responses it is evident that they highly valued the IPSE experience. Qualitative analysis of the IPSE experience revealed four themes: communication with medical students, role awareness, a better way
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								<p>of learning, and future IPSE.</p> <ul style="list-style-type: none">• OR nursing knowledge questionnaire: On the total sum knowledge scores, nursing students in the IPSE group showed significantly higher scores (Mean [SD]: 83.50 [8.45]) compared to those in the traditional course group (Mean [SD]: 77.00 [7.33]; $p < 0.05$). Findings suggest that for these two groups, there were differences in the level of knowledge of OR nursing after the IPSE or control program.
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Appendix 2: Summary of Studies' characteristics Included in the review

Study design		Studies concerned
Qualitative studies (3)		Badir et al., 2015; Amod & Brysiewicz, 2019; Crafford et al., 2019
Quantitative studies (10)	Randomized controlled trials (2)	Wang et al., 2015; Cura et al., 2020
	Quasi-experimental studies (4)	Akhu-Zaheya et al., 2012; Tyer-Viola et al., 2012; Sarmasoglu et al., 2016; Karabacak et al., 2019
	Descriptive quantitative studies (4)	Gudayu et al., 2015; Nyamu et al., 2018; Teni & Gebretensaye, 2019; Souza et al., 2020
Mixed methods studies (2)		Tuzer et al., 2016; Amod & Brysiewicz, 2017
Study setting		Studies concerned
Turkey (5)		Badir et al., 2015; Sarmasoglu et al., 2016; Tuzer et al., 2016; Karabacak et al., 2019; Cura et al., 2020
South Africa (3)		Amod & Brysiewicz, 2017, 2019; Crafford et al., 2019
Ethiopia (2)		Gudayu et al., 2015; Teni & Gebretensaye, 2019
Jordan		Akhu-Zaheya et al., 2012
Kenya		Nyamu et al., 2018
Zambia		Tyer-Viola et al., 2012
Brazil		Souza et al., 2020
China		Wang et al., 2015
Student-level outcomes measured		Studies concerned
Knowledge (10)		Akhu-Zaheya et al., 2012; Tyer-Viola et al., 2012; Badir et al., 2015; Wang et al., 2015; Tuzer et al., 2016; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020
Attitudes (13)		Akhu-Zaheya et al., 2012; Tyer-Viola et al., 2012; Badir et al., 2015; Gudayu et al., 2015; Wang et al., 2015; Tuzer et al., 2016; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Karabacak et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020; Souza et al., 2020
Skill performance (9)		Badir et al., 2015; Sarmasoglu et al., 2016; Tuzer et al., 2016; Amod & Brysiewicz, 2017, 2019; Nyamu et al., 2018; Karabacak et al., 2019; Teni & Gebretensaye, 2019; Cura et al., 2020
Satisfaction (8)		Tyer-Viola et al., 2012; Gudayu et al., 2015; Tuzer et al., 2016; Amod & Brysiewicz, 2017; Nyamu et al., 2018; Crafford et al., 2019; Cura et al., 2020; Souza et al., 2020

Appendix 3: Reporting the Results of the MMAT

Studies	Criteria from the Mixed Methods Appraisal Tool																								
	1. Qualitative					2. Quantitative randomized controlled trials					3. Quantitative non-randomized					4. Quantitative descriptive					5. Mixed methods				
	1.1.	1.2.	1.3.	1.4.	1.5.	2.1.	2.2.	2.3.	2.4.	2.5.	3.1.	3.2.	3.3.	3.4.	3.5.	4.1.	4.2.	4.3.	4.4.	4.5.	5.1.	5.2.	5.3.	5.4.	5.5.
Akhu-Zaheya et al. (2012)											1	1	1	?	1										
Amod & Brysiewicz (2017)																					1	1	1	0	1
Amod & Brysiewicz (2019)	1	1	1	1	1																				
Badir et al. (2015)	1	1	1	1	1																				
Crafford et al. (2019)	1	1	1	1	1																				
Cura et al. (2020)						1	1	1	?	1															
Gudayu et al. (2015)																1	1	1	1	1					
Karabacak et al. (2019)											1	1	1	1	1										
Nyamu et al. (2018)																1	1	1	1	1					
Sarmasoglu et al. (2016)											1	1	1	1	1										
Souza et al. (2020)																1	1	1	1	1					
Teni et Gebretensaye (2019)																1	1	1	1	1					
Tuzer et al. (2016)																					1	1	1	0	1
Tyer-Viola et al. (2012)											1	1	1	?	1										
Wang et al. (2016)						1	1	1	?	1															

Appendix 4: Summary of Simulation Pedagogy Outcomes

Kirkpatrick level of evaluation		Level 1: reaction	Level 2: learning				Level 3: behaviour	Level 4: outcomes
Outcome measured		Satisfaction	Knowledge	Attitudes	Skills			
Study	Groups	Satisfaction	Knowledge	Self-confidence/ self-efficacy	Critical thinking	Behaviours/ competence /performance	Transfer of skills to clinical setting	Patient care results
Akhu-Zaheya et al. (2012)	<ul style="list-style-type: none"> • Experimental group (traditional teaching BLS and high-fidelity BLS simulation) • Control group (traditional teaching of BLS) 	–	Neither knowledge acquisition nor knowledge retention showed any significant differences between the groups	Self-efficacy showed significant differences between the groups	–	–		
Amod & Brysiewicz (2017)	One high fidelity simulation (HFS) group	Adequate and helpful pre-simulation support ↑ Satisfaction at post-simulation	↑ Knowledge at post-simulation	↑ Self-confidence at post-simulation	↑ Critical thinking at post-simulation	↑ Student's perception of their clinical competence		
Amod & Brysiewicz (2019)	Two high-fidelity human patient simulation	–	–	–	Reflexion on the experience; Thinking about	• Experiencing and managing of real-life emergencies;		

	(HFHPS) focus group				the learning experience	• Act/try out what was learned		
Badir et al. (2015)	Five HFS focus groups	–	↑ Knowledge	Building confidence through experiential learning		↑ Learning experience through debriefings ↑ Skills		
Crafford et al. (2019)	One learning in the simulation group	↑ Satisfaction	↑ Cognitive learning	↑ Self-confidence	–	–		
Cura et al. (2020)	Three groups: Standardized patient (SP), HFS, partial task trainer	Significant difference of the satisfaction in learning' scores (p < .05)	Knowledge levels were similar (F = 0.731, p = .484) at pre-test Knowledge levels were similar (F = 1.48, p = .231) at post-practices	Significant difference of the students' scores of self-confidence in learning (p = 001) + Virtual Analog Scale (VAS) stress scores of 3 groups similar at pre-practice (F = 0.821, p = .442). + Significant difference between groups in terms of VAS stress scores (p = .012) at post-practices	–	Significant difference between skill scores of the students assessed during the practice (p < .05)		
Gudayu et al. (2015)	One Simulation-Based Education (SBE)	The proportion of satisfaction in simulation	–	The proportion of confidence in simulation learning	–	–		

	group	learning was 54.2%; Statistically significant satisfaction during skill practice		was 50.7%; Statistically significant confidence during skill practice; The level of self-efficacy of SBT is low				
Karabacak (2019) et al.	One Simulation-Based Learning (SBL) group	–	–	The mean self-efficacy score was 52.68 (± 10.19) at pre-scenario, 49.59 (± 12.90) at post-scenario ($p = .001$).	–	The decrease observed in students' proficiency in post-scenario self-assessment of competence		
Nyamu et al. (2018)	One simulation as a Teaching and Learning Strategy group	51% of students strongly agreed that participating in simulation enhances satisfaction; 44% of respondents strongly agreed, while 40% agreed on	42% strongly agreed, while 51% agreed on whether beneficial knowledge is gained	51% of students strongly agreed that participating in simulation enhances confidence; + Most (56%) strongly agreed on simulation reduce anxiety and fear to practice	41% strongly agreed, while 46% agreed on whether simulation promotes critical thinking	<ul style="list-style-type: none"> Majority (55%) strongly agreed on Skill performance being enhanced by simulation; 49% agreed that simulation promotes communication skills. 		

		simulation enhancing learner satisfaction						
Sarmasoglu et al. (2016)	Experimental group (EG) and Control group (CG)	–	–	–	–	<ul style="list-style-type: none"> • EG performance in blood pressure measurement significantly higher than that of the CG • No significant difference in the administration of subcutaneous injections • SPs can be used for developing psychomotor skills 		
Souza et al. (2020)	One simulated clinical experiences group	<ul style="list-style-type: none"> • Most were more satisfied (overall average = 4.18) than self-confident (overall average = 4.12) • Significant and positive 	–	<ul style="list-style-type: none"> • Most were more satisfied (overall average = 4.18) than self-confident (overall average = 4.12) • Significant and positive association between satisfaction and self-confidence 	–	–		

		association between satisfaction and self-confidence						
Teni et Gebretensaye (2019)	One clinical simulation group	–	Most of the respondents (83.8%) agreed that clinical simulation improves students' knowledge	Most of the respondents (83.8%) agreed that clinical simulation improves students' confidence.	Most of the responders (83.8%) agreed that clinical simulation improves students' critical thinking	Most of the respondents (83.8%) agreed that clinical simulation improves students' skill		
Tuzer et al. (2016)	Two groups: HFS group and SPs group	↑ Satisfaction with both simulation techniques	↑ Knowledge score of all students • Significantly higher knowledge scores among SPs students than HFS students	↑ Confidence in performing the applications • Reduced anxiety before clinical practice	–	↑ Performance score of all students following the simulation activities; • No significant difference in performance scores • Mean performance scores on real patients significantly higher compared to the post-simulation assessment scores (p < 0.001);		

						<ul style="list-style-type: none"> • Students who studied with HFS and SPs expressed that simulation improved their communication skills; the professional approach facilitated the learning process, raised awareness by improving skills. 		
Tyer-Viola et al. (2012)	<p>Two groups:</p> <ul style="list-style-type: none"> • Simulation instruction and standard instruction group (Intervention); • Standard instruction group (Control) 	<p>Satisfaction with learning and self-confidence scores in total ranged from 35-63, with a mean of 55.53(SD = 6.40). Five questions related to satisfaction with learning ranged from 7-25 with a</p>	<p>No significant difference between the pre and post-test scores. Pre-test scores of knowledge ranged from 7-22 overall with a mean of 15.22 (SD = 3.41). Post-test scores ranged from 3-22, with a mean of 14.26 (SD = 3.53).</p>	<p>Satisfaction with learning and self-confidence scores in total ranged from 35-63, with a mean of 55.53(SD = 6.40). The eight questions related to confidence ranged from 28 to 40 with a mean of 34.32 (SD = 2.93).</p>	–	–		

		mean of 20.93(SD = 3.98).						
Wang et al. (2016)	Two groups: Interprofessional SBE group and traditional course group	–	Significant improvement in knowledge among SBE group nursing students about OR nursing	Statistically different responses of nursing students in the SBE interprofessional group to 4 of 19 questions on the Readiness for Interprofessional Learning Scale, reflecting a more positive attitude toward interprofessional learning	–	–		