



The effectiveness of a simulation game on nursing students' self-evaluated clinical reasoning skills: A quasi-experimental study

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Safe patient care requires strong expertise and professional competence as well as constant practice

Background

- Nursing students should be able to practice clinical reasoning (CR) regularly (Furze et al. 2015).
- Educational games are effective methods to engage students in learning activities since such games promote concentration, interest, motivation, satisfaction and enjoyment (Hamari et al. 2016).
- Simulation games refer to 'artefacts (software) that replicate decision making processes in real-world situations' (Koivisto, 2017).
- Simulation games combine learning objectives, simulation pedagogy and game elements (Koivisto et al., 2018).
- Simulation games can be used with mobile phones, tablets, computers, and VR headsets.
- The use of several game elements in nursing simulation games is still rare (Havola ym. 2020).

VR technologies in healthcare

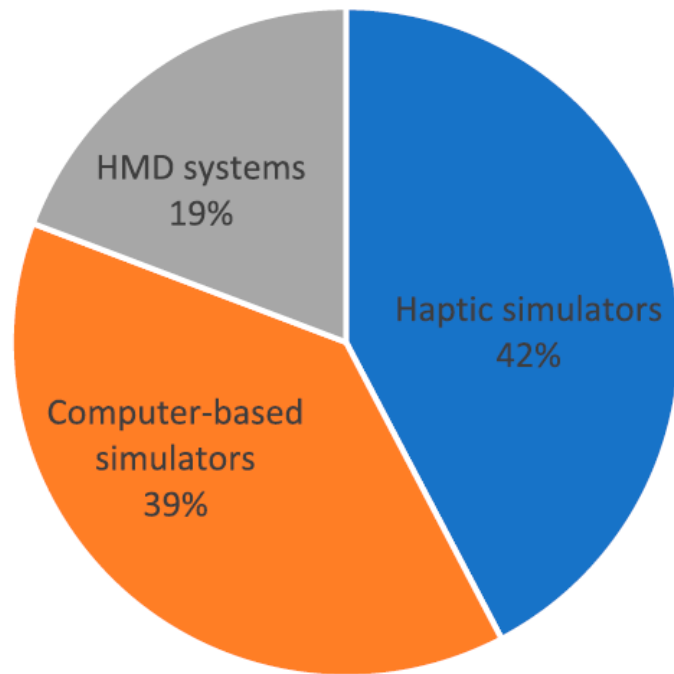


Figure 3. VR technologies used for learning in healthcare in the reviewed studies.

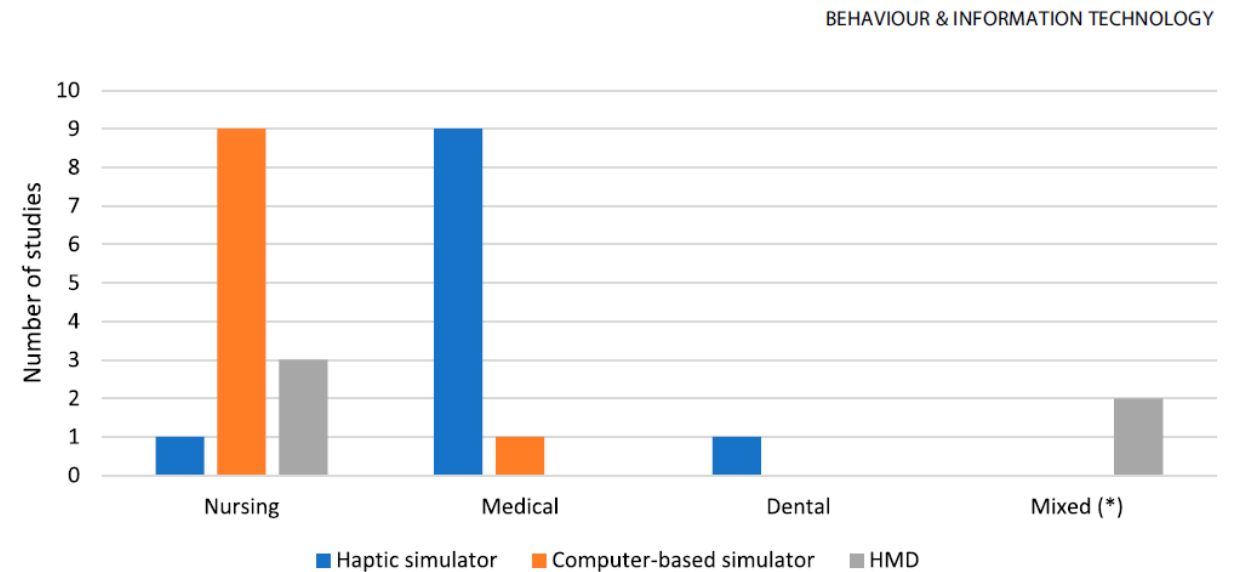


Figure 4. VR technologies in healthcare in the reviewed studies, by learning context.

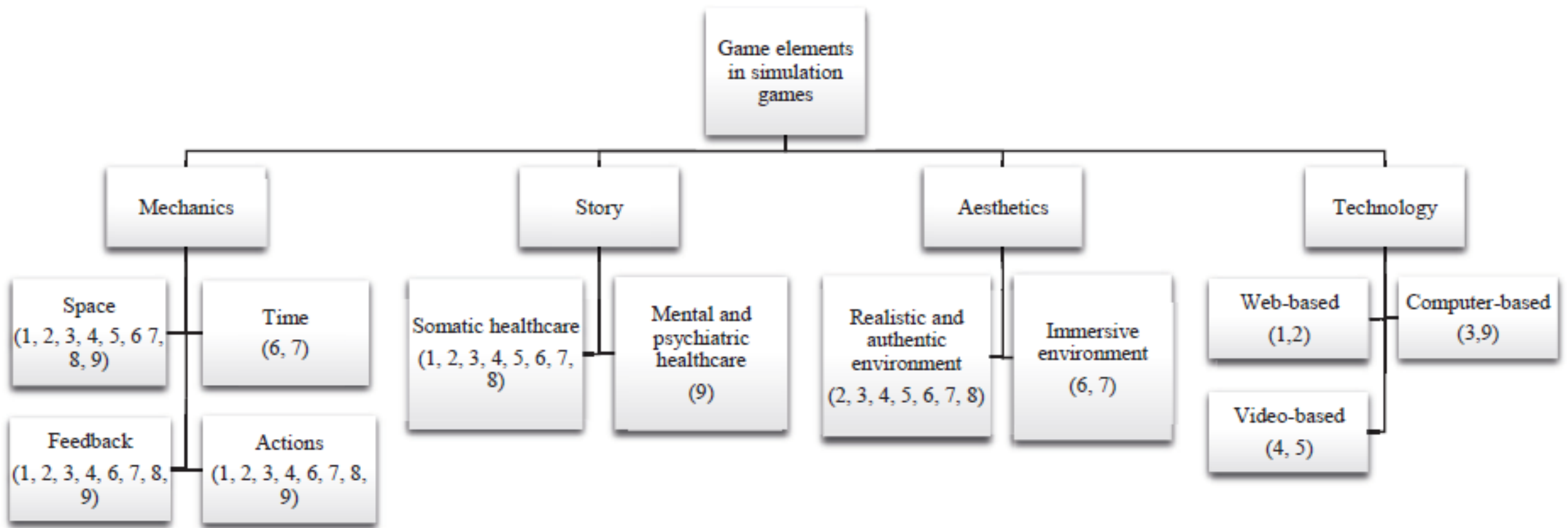


Figure 2 Game elements in simulation games used for learning clinical reasoning. (1) (Forsberg et al., 2011); (2) (Georg and Zary, 2014); (3) (Heinrich et al., 2012); (4) (Johnsen et al., 2016); (5) (Johnsen et al., 2018); (6) Koivisto et al., 2016b; (7) (Koivisto, Multisilta, Niemi, Kataisto, & Eriksson, 2016b); (8) (Pittiglio et al., 2011); (9) (Sunnqvist et al., 2016).

Game elements

Havola, S., Koivisto, J.-M., Mäkinen, H., & Haavisto, E. (2020). Game elements and instruments for assessing nursing students' experiences in learning clinical reasoning by using simulation games: An integrative review. *Clinical Simulation in Nursing*, 46(C), 1-14. <https://doi.org/10.1016/j.ecns.2020.04.003>.

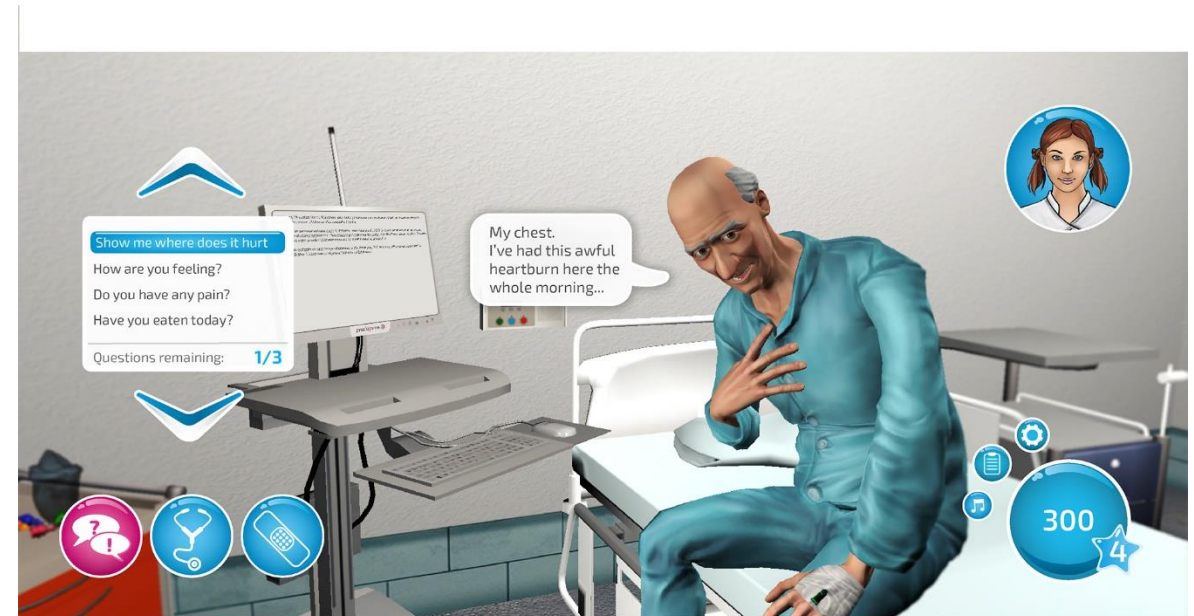
- Good learning outcomes in CR can be achieved by gamifying simulations (Georg & Zary 2014; Pittiglio ym. 2011; Koivisto ym. 2016a,b).
- Nursing students CR skills have improved in collecting information about the clinical condition of the patient and taking action in patient care (Koivisto ym. 2016a).
- Research on the effectiveness of learning CR skills through simulation games is still very limited.

Purpose and research questions

- The purpose of this study is to evaluate the effectiveness of a simulation game on nursing students' clinical reasoning skills.
- 1. How were nursing students' clinical reasoning skills before and after playing the simulation game?
- 2. What is the difference between nursing students' clinical reasoning skills before and after playing the simulation game?
- 3. What is the relationship between students' characteristics and self-evaluated clinical reasoning skills?

Description of the simulation game

- The simulation game was developed as part of Koivisto's (2017) doctoral dissertation
- The game mechanics were built around the CR process (Levett-Jones et al. 2010).
- Gameplay is non-linear, which allows the player to proceed with patient care based on the patient's clinical condition.
- Five surgical patient scenarios were used.



Materials and Methods

- A quasi-experimental, one group, pre-post-test design were used.
- All of the participants participated in a one-week intervention.
- The participants (n=376) were enrolled in one of the following bachelor's degrees: nursing, nurse-deaconess, paramedic, midwifery or public health.
- The data were collected at three universities of applied sciences in Finland (1.3.2018–31.5.2019) using self-report electronic questionnaire in two phases: before (pre-test) and after (post-test) intervention.
- The research was conducted according to the guidelines for responsible conduct of research and procedures.
- Participation in the study was voluntary and based on informed consent.

Instrument

- The Clinical Reasoning Skills scale (CRSs) used in this study consists of seven demographic items: age, gender, educational background, study phase, work experience in social and health services, degree programme and gaming activity.
- The CRSs consist of six subscales and 25 items (Cronbach Alpha 0,85–0,92).
 - Collecting information, processing information, identifying problems/issues, establishing goals, taking action, evaluating outcomes.
- The items are rated using a five-point Likert scale.
- Descriptive and multivariable analyses were used.

Demographics

Age		
15-20	50	13.37
21-25	167	44.65
26-30	60	16.06
31-35	41	10.96
36-	56	14.97
Missing: 2		
Gender		
Male	53	14.40
Female	315	85.60
Missing: 8		
Educational background		
Vocational upper secondary education, practical nurse	96	34.78
Matriculation examination*	180	65.22
Missing: 100		
Degree programme		
Nurse	251	67.47
Nurse-deaconess	19	5.11
Paramedic	17	4.57
Midwife	31	8.33
Public health nurse	54	14.52
Missing: 4		
Study phase		
First year	274	73.26
Second year	79	21.12
Third year	21	5.61
Missing: 2		
Work experience in social and health services		
<1 year	219	58.56
1-5 years	114	30.48
6-10 years	23	6.15
>10 years	18	4.81

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Previous gaming activity

- The male respondents played more non-digital ($p=0,042$) and digital ($p<0,0001$) games than the female respondents.
- Nursing students played more non-digital ($p=0,033$) and digital games ($p=0,005$) as well as educational games ($p=0,011$), than the midwifery students.

		Non-digital games	Digital games	Educational games
Age				
26-30 vs 15-20	p	0.0385 -0.35 (-0.68, -0.01)	NS	NS
Gender				
Male vs female	p	0.0353 0.22 (0.01, 0.42)	<.0001 1.10 (0.73, 1.46)	NS
Work experience in social and health services				
1-5 years vs >10 years	p	0.0003 -0.71 (-1.14, -0.26)	NS	NS
> <u>1 year</u> vs >10 years	p	0.0007 -0.78 (-1.27, -0.25)	NS	NS
Educational background				
Matriculation examination** vs vocational upper secondary education, practical nurse	p	NS	NS	0.0004 0.48 (0.21, 0.74)
Degree programme				
Midwife vs nurse	p	0.0331 -0.36 (-0.70, -0.02)	0.0053 -0.77 (-1.38, -0.16)	0.0112 -0.43 (-0.79, -0.07)

Nursing students self-evaluated clinical reasoning skills before and after playing the simulation game

- Before playing the simulation game, the participants rated their CR skills strongest in evaluating outcomes and weakest in establishing goals.
- After playing the simulation game, the participants rated their CR skills best in collecting information and weakest still in establishing goals.
- The largest difference between the means was in items 'I can utilise the ABCDE approach in the assessment of a patient's clinical condition'.

The difference between clinical reasoning skills before and after playing the simulation game

- The participants rated their CR skills higher after playing the simulation game than before playing the simulation game. The difference was statistically significant for almost all of the items.
- The largest difference between the means was observed for 'I can utilise the ABCDE approach in the assessment of a patient's clinical condition' (0.34 (0.23, 0.46), $p < .0001$).

		POSTTEST VS PRETEST*	
Item		Difference between means	p
I can			
Collecting information Cronbach Alpha 0.85			
1	Collect information about a patient by interviewing	0.19 (0.09, 0.30)	0.0003
2	Collect information about a patient by observing	0.26 (0.16, 0.36)	<.0001
3	Collect information about a patient with different measuring methods	0.14 (0.03, 0.24)	0.0147
4	Utilise the ABCDE approach in the assessment of a patient's clinical condition	0.34 (0.23, 0.46)	<.0001
Processing information Cronbach Alpha 0.90			
5	Analyse the information I have collected	0.15 (0.06, 0.26)	0.0053
6	Assess the importance of the information collected about a patient		NS
7	Distinguish essential information from non-essential	0.16 (0.05, 0.27)	0.0058
8	Predict the effects of my decisions on a patient's clinical condition	0.18 (0.06, 0.29)	0.0026
9	Assess the cause and effect relationships related to a patient's clinical condition	0.24 (0.13, 0.36)	<.0001
Identifying problems/issues Cronbach Alpha 0.86			
10	Recognise a patient's need for care	0.16 (0.06, 0.27)	0.0022
11	Make a nursing diagnosis	0.27 (0.15, 0.39)	<.0001
12	Recognise changes in a patient's clinical condition	0.16 (0.05, 0.27)	0.0041
13	Prioritise a patient's nursing needs	0.14 (0.02, 0.25)	0.0242
Establishing goals Cronbach Alpha 0.90			
14	Establish nursing goals	0.13 (0.02, 0.24)	0.0285
15	Plan nursing activities		NS
16	Make decisions regarding a patient's care independently	0.21 (0.08, 0.33)	0.0012
17	Make decisions regarding a patient's care quickly	0.28 (0.16, 0.41)	<.0001
Taking action Cronbach Alpha 0.92			
18	Provide symptomatic care to a patient	0.15 (0.03, 0.26)	0.0106
19	Make choices between different care alternatives	0.19 (0.07, 0.30)	0.0021
20	Choose the nursing interventions required by a patient's clinical condition	0.20 (0.08, 0.31)	0.0010
21	Care for patient whose clinical condition has deteriorated	0.20 (0.08, 0.30)	0.0014
22	Prevent the deterioration of a patient's clinical condition	0.14 (0.03, 0.26)	0.0159
Evaluating outcomes Cronbach Alpha 0.90			
23	Evaluate implemented nursing care	0.14 (0.04, 0.25)	0.0053
24	Evaluate the care outcomes in relation to care needs	0.15 (0.04, 0.27)	0.0084
25	Evaluate whether a patient's clinical condition has improved, deteriorated or is unchanged	0.12 (0.02, 0.22)	0.0192

The relationship between students' characteristics and self-evaluated clinical reasoning skills

- Statistically significant differences were found between the background variable categories for the participants' self-evaluated CR skills.
- Participants with practical nursing background rated their CR skills better for almost all items compared to participants with upper secondary school backgrounds.
- Students enrolled in nursing degree programme rated their CR skills to be better than students enrolled in paramedic degree programme.

Conclusion

- Limitations: students' self-reported questionnaires, no control group.
- The main result of this study is that students' self-evaluated CR skills improved after playing a simulation game.
- The evidence from this study suggests that simulation games are effective for gaining CR skills in nursing education.



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