The potential and limitations of simulations - examples from the healthcare sector

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Contents

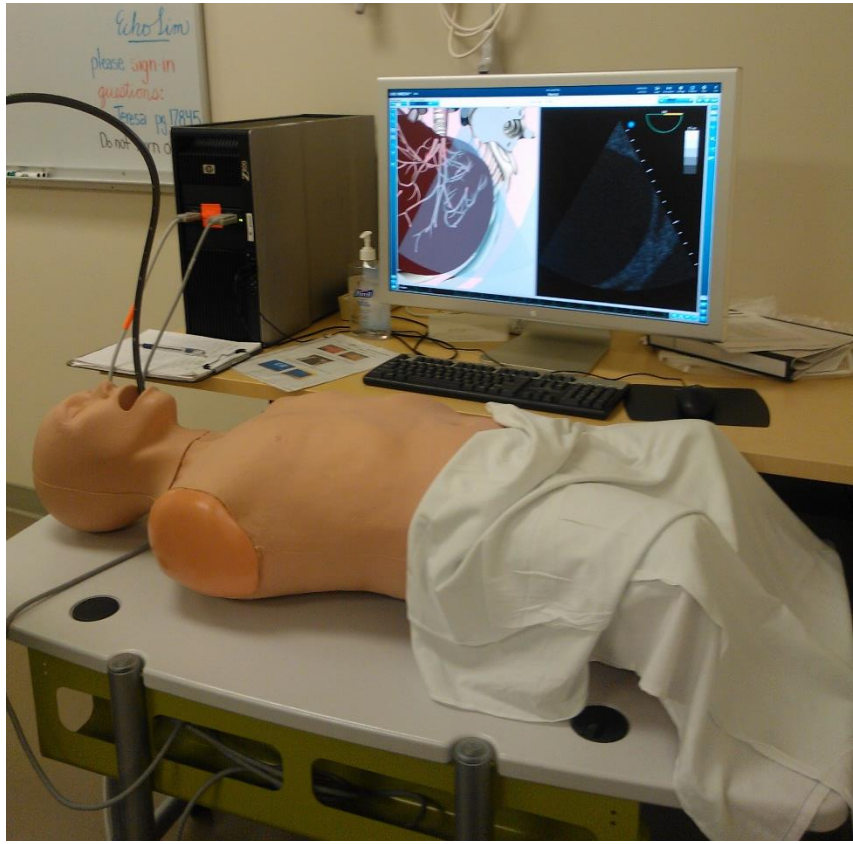
- What kind of simulations are used in healthcare

- **Research** on simulations in learning healthcare professions: three examples of potentials and limitations

- **Practices** of simulations in learning healthcare professions: pedagogical/didactical potentials and limitations

Simulations in healthcare?

Simulations are attempts “**to replicate** some or nearly all of the essential aspects of a clinical situation so that the situation may be more readily understood and managed when it occurs for **real in clinical practice.** Simulation illustrates the process of healthcare, practicing skills **to manage procedures or to support and develop know-how, teamwork**, etc. **to amplify or replace actual experience”** (Gaba, 2011, pp 198-199)



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Gaba DM (2011). Have we gone too far in translating ideas from aviation to patient safety? NO. Br. Med. J. 342: 198-199. http://dx.doi.org/10.1136/bmj.c7310

Three types of simulations

Living

Virtual

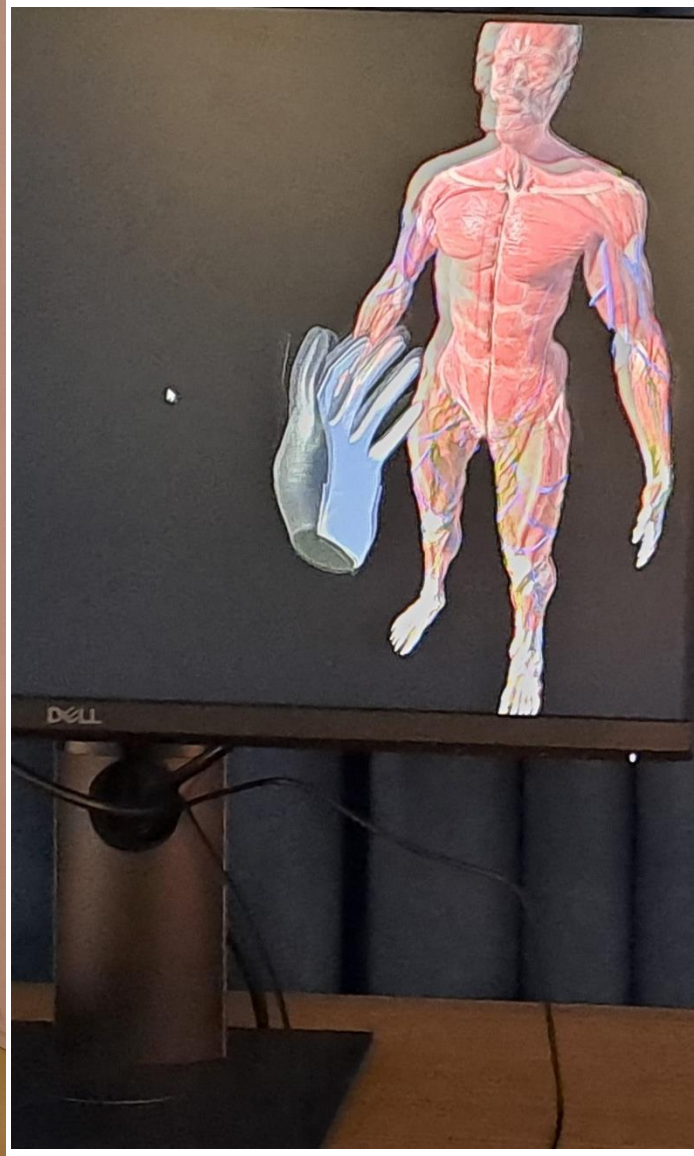
Manikin

Banks, C., & Sokolowski, J. (2011). Fundamentals of Medical and Health Sciences Modeling and Simulation. In Sokolowski, C. Banks (Eds.), Modeling and Simulation in Health Sciences. (4-32). Hoboken, NJ: John Wiley & Sons., Inc.

Models as tools

Kuva 3.
Pienoismallisimulaattori: kaupunki

Kuva 4.
Pienoismallisimulaattori: teollisuusalue



Teräs, M., & Jokela, J. (2015). Simulaatio-opetuksen haasteet ja mahdollisuudet ammatillisessa koulutuksessa [Possibilities and challenges of teaching via simulations in vocational education]. In J. Laukia, A. Isacsson, K. Mäki & M. Teräs (Eds.*), Katu-uskottava ammatillinen koulutus – uusia ratkaisuja oppimiseen* (pp.144-155). Helsinki, Finland:

Typology of technological simulation levels

Table 1. Proposed typology of simulation methodologies split in 6 levels and with there respective characteristic. Each can either be student or trainer-led.

Technological simulation levels	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
Simulation technique	Written simulations includes pen and paper simulations or ''Patient Management Problems'' and latent images	3-D models which can be a basic mannequin, low fidelity simulation models, or part-task simulators	Screen-based simulators Computer simulation, Simulation software, videos, DVDs, or Virtual Reality (VR) and surgical simulators	Standardized patients Real or simulated patients (trained actors), Role play	Intermediate fidelity patient simulators Computer controlled, programmable full body size patient simulators not fully interactive	Interactive patient simulators or Computer controlled model driven patient simulators, also known as high-fidelity simulation platforms
Mode of delivery	Usually student led	Student or trainer led	Student or trainer led	Student or trainer led	Preferably trainer led	Preferably student led

Alinier G. (2007). A typology of educationally focused medical simulation tools. Medical Teacher; 29: e243–e250

How about learning in simulations ?

Several learning theories and pedagogical models have been employed to explain learning, for example, problem-based learning, process learning, social practices, meaningful learning, expansive learning (e.g., Butler et al 2009, Liaw et al 2010, Wong et al 2008, Buykx et al 2011, Keskitalo et al 2010)

For references see: Poikela, P., & Teräs, M. (2015). A Scoping review: Conceptualizations and pedagogicalmodels of learning in nursing simulation. Educational Research and Reviews, 10(8), 1023-1033.

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Previous research tells us that simulations are beneficial in learning…

- Clinical skills (e.g., Hyland & Hawkins 2009)
- Self-efficacy and self-confidence as well as communication skills (e.g., Bambini et al. 2009)
- Increase of knowledge (e.g., Burns et al 2010)
- Decision-making (e.g., Smith-Stoner 2009)
- Team-work, interprofessional cooperation (e.g., Onda 2011)

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For references see: Poikela, P., & Teräs, M. (2015). A Scoping review: Conceptualizations and pedagogical models of learning in nursing simulation. Educational Research and Reviews, 10(8), 1023-1033.

On the other hand…

- Simulation is not an authentic work situation and patient-interaction is limited (e.g., Hravnak et al 2007)
- Economic and human resources (e.g., Burns et al 2010)
- Strong feelings (e.g., Roberts & Greene 2011)

For references see: Poikela, P., & Teräs, M. (2015). A Scoping review: Conceptualizations and pedagogical models of learning in nursing simulation. Educational Research and Reviews, 10(8), 1023-1033.

Empirical material

DATA	QUESTIONNAIRE	INTERVIEW	VIDEO	DATE	ANALYSIS METHOD
DATA A			10 SCENARIOS	30.-31.2013	
University of AS	TEACHERS 9		10 DEBRIEFINGS	2014 April-May	Qualitative thematic analysis
	STUDENTS 16				
					Video analysis
DATA B	TEACHERS 19			December-February 2014-2015	
University of AS	STUDENTS 119				
DATA C	WORK TRAINERS 10	WORK TRAINERS 6	SCENARIOS 9	February-April 2015	
Working life	STUDENTS (before) 29	STUDENTS 5	DEBRIEFINGS 14		
University	STUDENTS (after) 18				
University of AS					
TOTAL	TEACHERS/TRAINERS: 38 STUDENTS: 164 202	11 INTERVIEWS	SCENARIOS: 19 (+5 audiotaped) DEBRIEFINGS: 24		

First example: challenges and opportunities

- The objective: **to explore beneficial use of simulations, opportunities and challenges** of the method.
- The methodology involved **qualitative semi-structured** questionnaires for teachers (9) work place trainers (10) and students (45)
- Qualitative Thematic analysis was used to explore the research material
- Research questions: How do simulations **differ** from other teaching and studying methods? What kinds of **opportunities** and **challenges** do participants identify in simulations?

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Teräs, M. Learning and Developing Expertise via Simulations. Conference paper World TVET Conference 2015, Kuching, Malaysia, 25 – 27 August 2015

Analytical concepts: opportunities and challenges

- Opportunities are **favorable circumstances** and **chances** simulations can offer for learning healthcare expertise
- Challenges are **difficult** or **demanding** tasks or problems in relation to learning healthcare expertise in simulations

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Results: differences

- Hands-on practicing vs. reading, listening, writing, discussing

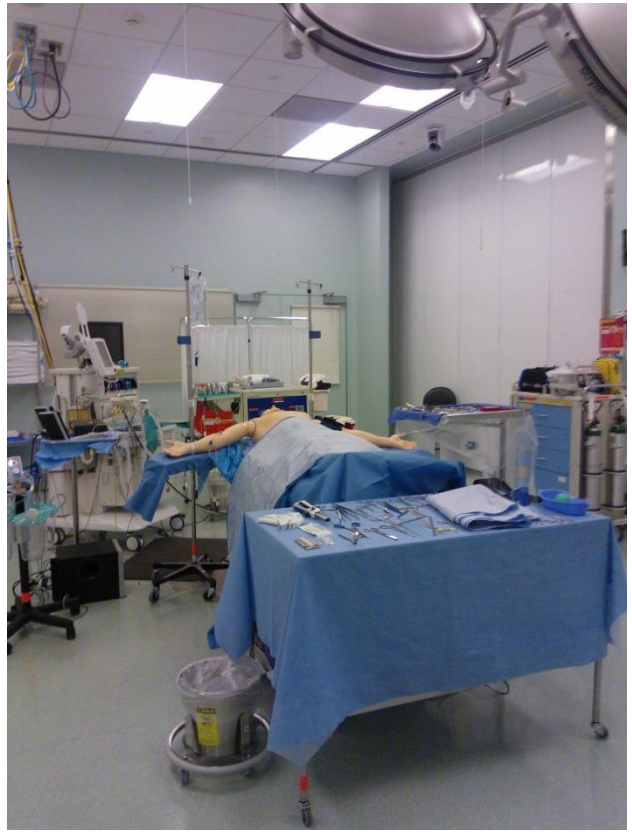
Four main themes:

- Situational
- Student related
- Teacher/trainer related
- Method related

Differences

- Both students and teachers recognized differences. They compared it with reading a book and thought that it was a **“better way to study than reading a book”** (Student 8).
- In addition teachers thought that simulation method was intensive and comprehensive and that “**one needs to throw oneself in a different way, one can really experiment and also fail”** (Teacher 7).
- ” usually students remember better ”real situations” used in simulations, also one needs **to participate in** teaching with whole person. it is not enough to sleep at the back seat or check facebook…”(Trainer 9)

Opportunities…



- Both students and teachers thought that usefulness of simulations was in ”**learning working practices**” (Teacher 1).
- Linking theory to practice, learning group work and collaboration and learning from mistakes
- “Practicing such situations, which are **rare** in **real nursing** work” (Student 5).
- “Practicing demanding procedures before internships gives **self-confidence”** (Student 6)

Challenges…

”1) **participants’ attitudes** (this is in vain/unnecessary/nonsense) are difficult. In order for teaching to be beneficial, one needs to want to do it. 2) **Attitudes of the management:** Simulation teaching needs much resources and time, the management needs to support it. 3) **problems with resources**: simulations need good spaces, instruments and time to implement, and get people removed from other duties.” (trainer 9)

Remarks on example 1

Beneficial:

- practical skills
- linking theory to practice,
- learning group work and collaboration

The students' challenges:

- unnatural situation
- anxiety and tension

The teachers' and trainers' challenges:

- lack of competence
- Lack of both human and economic resources.

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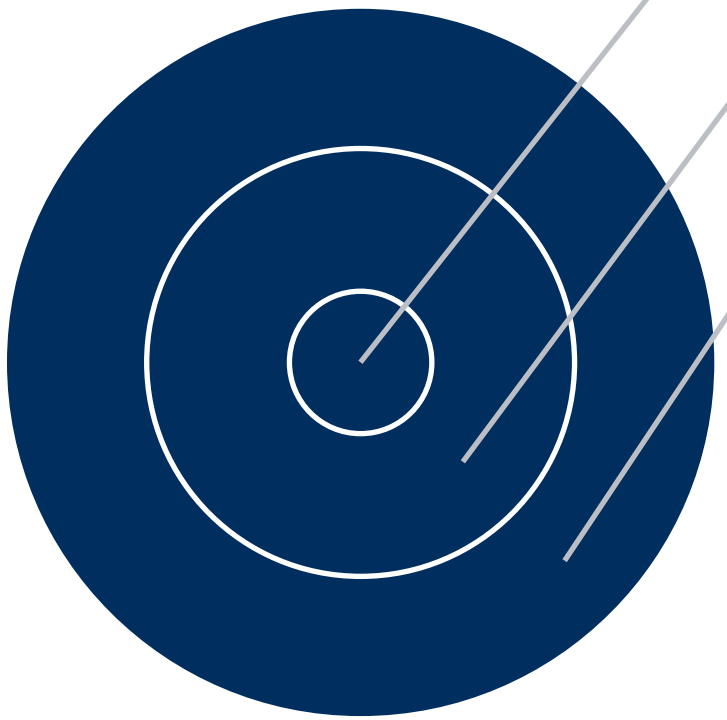
Zones of learning and development



Zone of comfortable: Professional role: skillful and competent

Zone of proximal development (Vygotsky): Learner's role: someone else is skillful and competent

Zone of opportunity: Developer's role, includes risks, failure, mistakes and no one is skillful and competent, yet.

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Second example: A learning stage

- Aim: to explore interaction and roles of participants in scenarios
- Material: 10 recorded video scenarios with five different patient cases
- 19 nursing students and 2 teachers
- Methods: a qualitative video analysis (Goldman 2009)
- Episode as a unit of analysis: topic of discussion (Engeström R., 1999, 102)
- Orgnization of episodes with ELAN-video software programme

Goldman, R., 2009. Video representations and the perspective framework: epistemology, ethnography, evaluation, and ethics. In: Goldman, R., Pea, R., Barron, B., Derry, S.J. (Eds.), Video Research in the Learning Sciences. Routledge, New York, pp. 5–32.

Engeström, R. (1999). Toiminnan moniäänisyys: Tutkimus lääkärinvastaanottojen keskusteluista [Multivoicedness of activity: The study about discussions in the doctor's surgery]. Helsinki: Helsinki University Press.

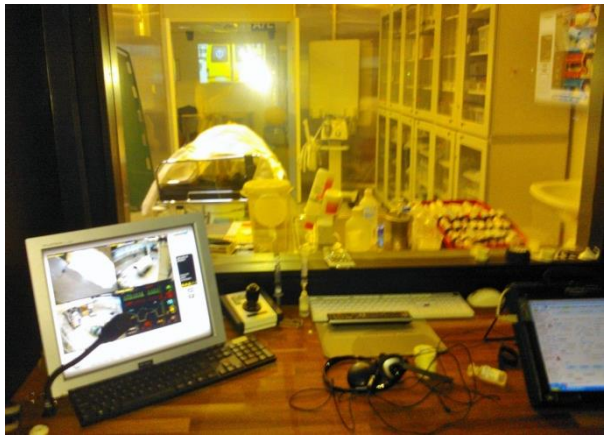
Goffman's stage theory as a framework

- **Stage:** situations in work when an individual presents her/himself
- **Performance:** activities of an individual in the time interval during which he or she is continuously under the control of certain observers
- **Performer:** tries to create an impression according to one's social role.
- **Audience:** follows the performance and the impression it creates.
- **Impression:** the perception experienced by others based on the situation and observations.
- **Front**: a standard means of communication used consciously or unconsciously by an individual in performance.
- **Front region:** place where the performance is presented
- **Back region**: a place that is linked to the performance and where the impression created by that performance is deliberately called into question

(Goffman, E. Arkielämän roolit [The presentation of self in everyday life 1959]. 1971: pp 9, 12, 32, 34, 36, 119, 124. WSOY)

Scenario as a stage for learning to care

- Performance: 5 different patient cases
- Performers: two healthcare students, teachers
- Stage: simulation space
- Front region: around manikin
- Back region: teachers space, debriefing space
- Audience: other students



Interaction episodes 1-15/ Patient waiting for surgery

1. **Greetings**
2. **Explanation**: you are going to surgery
3. **Explanation**: blood pressure is low
4. **Question**: how are you feeling now?
5. **Interruption**: voice problem, microphone is starting to echo
6. **Explanation** : let's try to get a quick one
7. **Question**: about the pain
8. **Negotiation**: painkiller
9. **Explanation** : about painkiller and cannula
10. **Search for equipment**
11. **Interruption**: teacher/patient voice now ok
12. **Question**: where is the pain?
13. **Explanation** : wait, let's get it
14 **Question**: in what situation do you have pain?
15. **Initiative: I probably have a temperature too**

Interaction patterns

- **Patient-Nurse : Explanation** (138E), Patient initiatives (126E), **Question** (110E) (total 374E)
- **Nurse- Another professional**: Calling (37E)
- **Student-Student:** **Negotiation** (89), Division of labour (51), (Explanation, guidance, preparation, searching for tools, 'thinking aloud') (total 140E)
- **Student-Teacher:** **Interruption** **(**55E)

Exampels of interaction

Nurse-Patient Explanation:

"Now it stings a bit then".

Student-Student Division of labour:

Student 1: Do you want to call the doctor?
Student 2: Yeah.

Teacher-Student Interruption (through microphone):

Teacher: the [infusion fluid] on the table is fine.
Student: this. (takes the infusion fluid from the table)

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What kind of roles?

Students/Performers

- Nurse
- Student

Teachers/Performers

- Simulation facilitator, patient, another professional
- Trouble-shooters, whisperer, giving feedback

Audience:

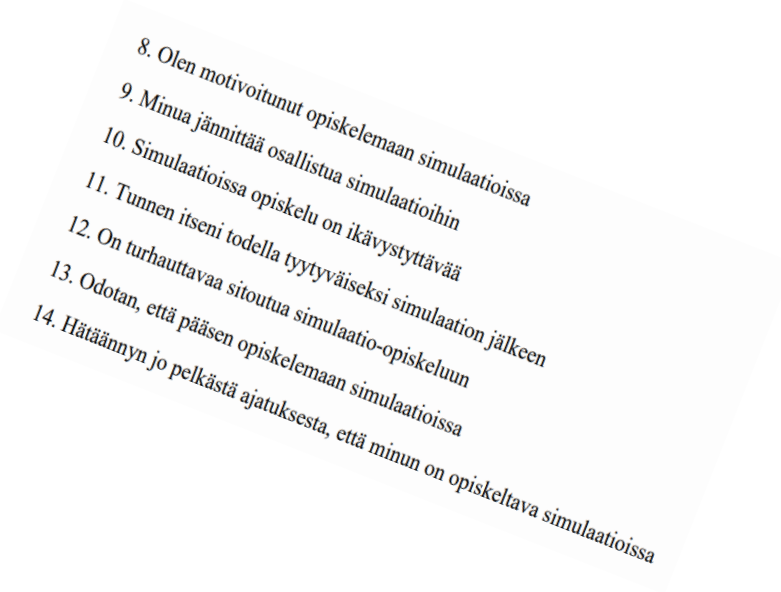
- Silent observer, giving feedback

Remarks on example 2

- The dialogue and interaction was between students and between students and other professionals
- All performers took on **different roles**, both front region and back region
- Simulation space was both **learning stage and caring stage**

Example 3: Healthcare students' emotions in simulations (Konkola, 2018)

- Aim: To investigate the emotions and sets of emotions associated with simulations by nursing students.
- 162 healthcare students responded to the survey
- Factory analysis, cluster analysis was used to form student profiles of different emotions (5-point Likert scale)
- Content analysis to open questions



Konkola, S. (2018). Terveydenhoitoalan korkeakouluopiskelijoiden emootiot simulaatioharjoituksissa [Emotions of Health Care Students in Simulations]. Pro gradu –tutkielma. Helsingin yliopisto.

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Findings…

- Emotion dimensions: a) **Enthusiasm** during simulations, b) **Confusion** during simulations, c) **Satisfaction** during simulations and d) **Worry before** simulations.
- Student profiles: 1) **hesitant** students, 2) **enthusiastic** and **satisfied** students, and 3) **positive** students.
- Enthusiastic and satisfied students did not associate much emotion of worry and confusion with the simulation exercises. Hesitant students were characterized by a lack of enthusiasm and concern throughout their studies. Positive students were enthusiastic and satisfied with the simulations, but their feelings of confusion increased as the studies progressed.

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Konkola, S. (2018). Terveydenhoitoalan korkeakouluopiskelijoiden emootiot simulaatioharjoituksissa [Emotions of Health Care Students in Simulations]. Pro gradu –tutkielma. Helsingin yliopisto.

Remarks on example 3

- Students experience **different emotions** connected to simulations ranging from enthusiastic to hesitant
- How do teachers and facilitators of simulations can take these emotions into account?

Potential and limitation of simulations studying learning for healthcare expertise

Potentials

- Simulations can offer rich and large empirical material for studies
- Researchers can use different methods for collecting empirical material and used as well as in the analyses can combine various methods

Limitations/challenges

- “Simulation as an intervention (Brown, 1992):” Bartlett Effect”, “The Hawthorne Effect”, ”The Reality Principle”
- One cannot transfer results to working situations
- Ethical questions

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Brown, A. (1992). Design Experiments: Theoretical and Methodological Challenges in Creating Complex Interventions in Classroom Settings. The Journal of the Learning Sciences, Vol. 2, No. 2 (1992), pp. 141-178.

Pedagogical dilemmas in using simulations for learning healthcare expertise

Teräs, M., & Jokela, J. (2024). Simulation pedagogy in action: Challenges and Possibilities. In L. Moreno Herrera, M. Teräs, P. Gougoulakis & J. Kontio (Eds.) Learning, teaching and policy making in VET, special issue: Emerging issues in research on vocational education & training, vol 9. (pp. 211-229). Atlas Akademi.

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Pedagogical dilemmas….

Pedagogical dilemmas as "**problems** that **do not have one definite solution**: one might describe them as problems that provoke more discussion and have several solutions." (Yaffe & Maskit 2010, p. 94)

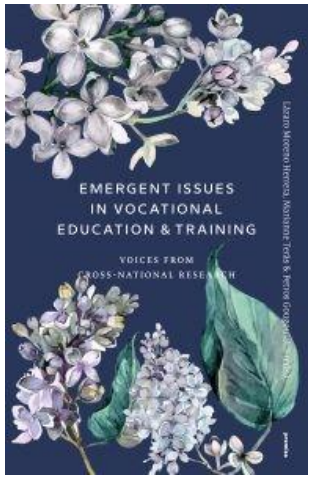
Many of the pedagogical dilemmas in simulations are connected to **'how real'** they are.

Yaffe, E., & Maskit, D. (2010) Discussing pedagogical dilemmas with teacher educators: Facilitating their professional development. *Professional Development in Education, 36(*1-2), 93-109. https://doi.org/10.1080/19415250903454890

Realism and authenticity

”The more real the better.” (Rooney & Nyström, 2018, s.55)

vs. Practice in its own right (Rystedet & Sjöblom, 2012)



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Rooney, D., & Nyström, S. (2018). Simulation: A complex pedagogical space. Australasian Journal of Educational Technology, *34*(6). https://doi.org/10.14742/ajet.4470
Rystedt, H., & Sjöblom, B. (2012). Realism, authenticity, and learning in healthcare simulations: rules of relevance and irrelevance as interactive achievements. Instr Sci (2012) 40:785-798 DOI 10.1007/sl 1 25 1-01 2-92 1 3-x

Manipulation and Fidelity

- **Manipulation of scenarios**

"The **degree of fidelity** should be **adjusted** to the **students' practical experiences in order** to optimize their learning process. **Lower** degrees of fidelity may have **a positive** impact on developing **creative thinking** and reducing the students' anxiety."

(Aarkrog, 2018, s.1)

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

Reality or perception of reality

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Willingness to participate vs. Unwillingness and suspicion

- ”Willingness to engage” (”suspension of disbelief”)
  - (Herrington et al. 2003)

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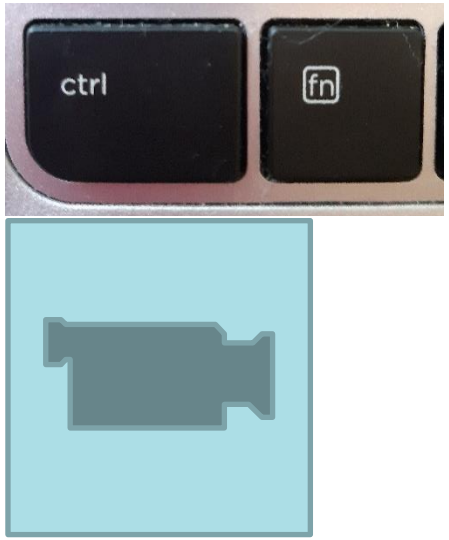
Herrington, Oliver, Reeves. (2003). Patterns of engagement in authentic online learning environments. Australian Journal of Educational Technology 2003, 19(1), 59-71.

Control vs. Indulgence



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Deception vs. Trust

”Between the real and the unreal”

Deception: “…modulations in which there is **no clear agreement or knowledge among participant**s regarding the **ground rules** of the activity. In simulation, the concern is about **the lack of agreement** or consent.” (Calhoun et al. 2015, s. 163)

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Calhoun, May, Pian-Smith, Truog, Gaba, Meyer. (2015). Deception and Simulation Education Issues, Concepts, and Commentary. 5 Society for Simulation in Healthcare, 10(3), 163-169. DOI: 10.1097/SIH.0000000000000086

Ethical considerations

- Impact on the **self-image** of participants
- **Value and power** issues related to practices
- **Stereotypical** behaviours (Langemayer, 2012)
- Can simulations replace internships?
- Is the simulation **safe?**
- Is there a need for "deception“, responding to abuse (Calhoun et al 2015)

https://www.acfe.com/uploadedImages/ACFE_Website/Content/images/topic-landing/ethics-and-compliance.jpg

Langemayer, I. (2012). Learning in a simulation-OT in heart surgery and the challenges of the scientification of work. Journal of Education and Work, 27:3, 284-305, DOI: 10.1080/13639080.2012.742182

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Concluding remarks …

- Simulations **offer potentials** both for researchers studying simulations and teachers and students using simulations for learning healthcare expertise
- However, there also **limitations and challenges** that need to be taken into consideration
- In the future: virtual reality, AI, ‘immersive technology’

THANK YOU!

Questions, comments…

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