RESEARCH ARTICLE

REVISED The use of Simulated Observations in Medical Simulation and its effect on perceived realism: A pilot project

[version 2; peer review: 1 approved, 2 approved with reservations, 1 not approved]

James Ainsworth, Sounder Perumal, Suresh Pillai

Morriston Hospital, Swansea, SA6 6NL, UK

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Abstract

Introduction

Simulation is an effective teaching method with increasing growth and recognition and refers to the artificial representation of a real-life scenario. The aim of this study was to compare simulation with and without the use of a simulated observations monitor and to investigate differences in students' impression of realism, engagement, learning, and enjoyment.

Methods

Simulation sessions were delivered to second and third-year Swansea University Medical Students, and a total of 15 students were included. Students carried out 2–3 scenarios each with and without the use of a simulated observations monitor. Data collection was conducted via student surveys and a joint interview.

Results

All students had an increased sense of realism with the use of the simulated observations monitor, feeling a closer resemblance to what would be experienced in clinical practice. They felt this improved their learning, making them more prepared for the real-life scenario. The monitor was more dynamic, responding to their interventions, helping them maintain focus and engagement throughout. A key theme was the reduction of interruptions or deviations from the scenario to communicate with the examiner or ask for observations. The visual and audible affects provided additional stimuli, adding to the realistic nature of the simulation.

Open Peer Review

Approval Status ✓ ? ? ✗

	1	2	3	4
version 2 (revision) 30 May 2024	✓ view			
version 1 01 Sep 2023	? view	? view	? view	✗ view

1. **Anne D Souza**, Manipal Academy of Higher Education, Manipal, India
2. **Sherri Rudinsky**, Uniformed Services University, Bethesda, USA
3. **Therese Gunn**, Queensland University of Technology, Brisbane, Australia
4. **Stephanie Mansell**, University College London, London, UK

Any reports and responses or comments on the article can be found at the end of the article.

Discussion

Simulation has been shown to be a useful education tool, but there is less evidence to support the use of higher fidelity over lower fidelity simulation. The terms are often used inconsistently, and many factors affect the students' perceived sense of realism. This study shows that the addition of a simple device such as the simulated observations monitor can produce a higher level of fidelity, particularly in terms of the stimuli provided and student perceptions of realism, which may be effective in improving engagement with the simulation, learning, and aid recall when presented with similar scenarios in a real-life situation.

Keywords
Simulation, medical simulation, medical education, simulation fidelity, perceived realism

This article is included in the Simulation-Based Medical Education collection.

Corresponding author: James Ainsworth (james-ainsworth@hotmail.co.uk)

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REVISED **Amendments from Version 1**

There are no significant changes to this re-submission. Some additional background regarding simulation is included in the introduction, as well as further explanation of the simulated observations monitor (SOM). Some additional information is included regarding the methods and the information provided to the facilitator. An additional note in made in the limitations of the study, regarding the methods used in this pilot study - we will aim to mitigate these in the extended study.

Any further responses from the reviewers can be found at the end of the article

Introduction

Simulation teaching is an educational tool used within medical school and specialty training, with increasing growth and recognition of the potential benefits in medical education. It is a method that is not unique to medicine, and is a technique used in other professions for many years, such as the aviation and aerospace industry, and in the military (Al-Elq, 2010). According to Al-Elq 2010, "Simulation is a generic term that refers to an artificial representation of a real world process to achieve educational goals through experiential learning". In medical education, simulation is a method of teaching where a clinical scenario is replicated in a safe and controlled environment, with the aim of promoting the acquisition of skills and knowledge through stimulating the expected behaviours. It provides opportunities for students to practice skills without the fear of making mistakes or causing harm to a real patient. Any mistakes made during a simulation session provide opportunities for feedback and development (Al-Elq, 2010). It is used in both undergraduate and postgraduate medical training, and is an important tool in specialty training such as anaesthetics, where it is useful in the development of clinical and communication skills, particularly during emergency situations. Simulation also allows the facilitator to create scenarios rarely encountered in practice e.g. malignant hyperthermia (Maran & Glavin, 2003; So *et al.*, 2019), and is an effective tool for inter-professional education and collaboration (So *et al.*, 2019). There are many different simulation modalities available, which may have different benefits depending on the specific learning aims required, such as the use of task trainers for developing specific skills or practical procedures, standardised patients to develop communication skills, and simulation using a manikin, allowing individuals to practice and develop various clinical skills (Elon University, 2024). This study will focus on simulation with a manikin, and making a comparison of simulation with and without the use of real-time patient observations using a simulated observations monitor (SOM).

There is increasing emphasis in modern medical curricula not only on the acquisition of knowledge, but on its application in practice, with competence in clinical skills being essential in a newly qualified doctor. This includes physical examination, history taking and diagnostic skills, resuscitation, and procedural skills, but also core skills such as communication skills, problem solving, clinical reasoning, teamwork and leadership. Organisational skills, time management, and prioritisation of tasks are also important. How best to help develop all of these skills, in addition to the vast amount of knowledge required to qualify as a doctor, is the challenge faced by medical school curricula (Al-Elq, 2010). Incorporating simulation teaching is shown to be associated with improved outcomes in terms of knowledge, skills and behaviours (Issenberg *et al.*, 2005; Norman *et al.,* 2012; So *et al.*, 2019; Tun *et al.*, 2015). Students are more frequently thought of as adult learners, and simulation provides the learners with more control over their learning experience (Norman *et al.*, 2012; So *et al.*, 2019), as well as incorporating the concept of "situated cognition" (Norman *et al.,* 2012) which suggests that better learning is achieved the closer the learning context to the context where it will be applied.

There is a growing interest in high fidelity simulation, but there is less evidence that higher fidelity simulation is more beneficial in terms of performance outcomes when compared with lower fidelity simulation (Kardong-Edgren *et al.*, 2007; Massoth *et al.*, 2019; Norman *et al.,* 2012). Simulation may differ in how 'realistic' it is, also called the 'fidelity' of simulation (Al-Elq, 2010). The term may however cause confusion on what exactly defines 'high' or 'low' fidelity and is inconsistently used, but is generally thought to describe the extent to which the simulation resembles the real life scenario and tasks that are being simulated (Maran & Glavin, 2003; Tun *et al.*, 2015). Both low and high fidelity simulation may have a role in medical education. Low fidelity simulators provide the basis of many medical examinations, such as OSCEs (Maran & Glavin, 2003). Lower fidelity simulation, lacking situational context may be useful for focussed learning of simple tasks, for example procedural skills (e.g. cannulation) (Al-Elq, 2010). Higher fidelity simulation has the aim of being as realistic as possible, and may be more complex in nature. This may be highly variable, but generally is seen as having a real life scenario or context, and a whole body manikin, with some simulation centres having a huge amount of technology allowing manikins to closer resemble living patients, with the ability to communicate and interact with the mannequin, display physiological signs, and withstand interventions (Al-Elq, 2010; Massoth *et al.*, 2019). However, does this additional technology actually increase the learner's sense of realism when carrying out the simulation? And how does this affect learning and outcomes? A greater understanding of this is important, given the additional demands of running such high fidelity simulation (cost, equipment, space, time, staff training and numbers, etc.), and is this additional cost and requirements necessary to produce effective results? Further research is needed in this area, given the current controversial nature of the benefits of high fidelity simulators (Al-Elq, 2010; Massoth *et al.*, 2019; So *et al.*, 2019).

It is important to note that the 'fidelity' of the simulation and the students' sense of realism is not only influenced by how 'realistic' the environment is and its resemblance to the real world, but also how realistic the scenario is felt to be, the expected actions of the learner, and how the scenario unfolds during the course of the simulation. Flexibility from the

facilitator can play an important role here. These factors must all be taken into account when planning and delivering a simulation teaching session. Pre-briefing the artificial nature of the simulation session or "fiction contract" (So *et al.*, 2019) and the expectation to commit to the simulation as if it were a real clinical scenario may actually contribute to their perceived level of realism then during the activity. The concept of 'engineering fidelity', the extent to which the environment and task replicates the real life scenario, and 'psychological fidelity', i.e. is the simulation able to promote the learner to carry out specific behaviours required, which may not essentially be dependent on how 'realistic' the simulation appears (Maran & Glavin, 2003; Norman *et al.,* 2012). Simple simulation or lower fidelity may still provide a high level of psychological fidelity (Norman *et al.,* 2012). One interpretation of fidelity is that a simulation may therefore be seen as being high fidelity if the right cues and stimuli are provided, prompting the desired behaviour (Tun *et al.*, 2015).

This study provides a comparison between simulation teaching with and without the use of a simulated observations monitor (SOM), and a simple comparison of a lower and higher fidelity simulation. The SOM (using an Apple iPad) was used to simulate a patients bedside observation monitor, displaying the various observations (such as heart rate and blood pressure etc.). This would provide an audible and visual aid for learners, which could be manually altered by the facilitator. The aim of the SOM here is to negate the need for continuous interruptions by the examiner or facilitator to deliver the observations, but the visual and audible effects may add significantly to the student's sense of realism. This idea of perceived realism and the student's level of it with the addition of small changes is discussed in this study.

Methods

This was a prospective pilot study that enrolled 15 second and third year Swansea University Medical School post graduate entry medical students. Only students in their second or third year of study from Swansea University Medical School graduate entry medicine programme were included in the study. There were no other specific inclusion/exclusion criteria beyond this. Students were included on a first come first served basis, with those that responded first to participant recruitment emails being included in the study. The Medical Research Council (MRC) tool was used in order to determine if NHS REC review was required for this pilot study, which indicated that REC review was not required for sites in Wales. Simulation scenarios were written with an acutely unwell patient, at an appropriate level for second and third year graduate entry medical students. Scenarios included medical emergencies, such as: acute myocardial infarction (MI); seizure; anaphylaxis; acute asthma or chronic obstructive pulmonary disease (COPD) exacerbation; diabetic ketoacidosis (DKA); sepsis; etc., and surgical emergencies, such as: bowel perforation; trauma; wound infection. Information for the facilitator included information to help maintain flow during the simulation, such as changes in the observations with progression of the scenario or learner interventions, sequence of information or tasks, and possible branch points. All simulation carried out during this pilot study (both with and without the SOM) was facilitated by the same facilitator. The student was given written information with a brief patient background and instructions, then asked to enter the room and start the scenario immediately. Each scenario ran for 10 – 15 minutes. Information for the facilitator included observations at the start of the scenario, and changes as the scenario developed, which could vary depending on interventions carried out by the student.

Additional equipment and props consisted of: a sim mannequin (head and torso but with no electronic features); basic ward equipment such as cannulas, syringes, blood bottles, a choice of fluids; and drug charts which the students could prescribe any medication given.

Basic learning aims were created: the main one being to carry out an ABCDE assessment of an acutely unwell patient, and to practice their structured approach to the assessment and management; problem solving and working under pressure were additional aims. Group discussion or debrief was done at the end of the session, allowing for feedback and for the students to analyse their own performance.

Multiple sessions were organised and facilitated by the author. Sessions were delivered in small groups with 2 – 4 students attending per session.

The aim of the study was to compare simulation with and without the use of a simulated observations monitor, and to investigate differences in the student's impression of realism, engagement with the simulation, learning, and enjoyment or preference.

Students carried out 2 – 3 scenarios each without the use of the simulated observations monitor, with all observations at the start and any changes during the scenario being delivered verbally by the facilitator. They would then carry out similar simulation scenarios with the use of the simulated observations monitor, which could be seen clearly on a screen, this also had the benefit of providing visual and audible cues, as with a real patient bedside observations monitor.

The SimMon app (Castle, 2018) was used to display the 'patients' observations during the scenario. An Apple iPad was used as the display monitor, which was able to display: respiratory rate (RR); oxygen saturations (SpO2); heart rate (HR) including an electrocardiogram (ECG) trace; blood pressure (BP); and end tidal carbon dioxide (ETCO2). Different waveforms for the vital signs were also possible to display, such as a damp SpO2 trace, and different ECG rhythms, such as an ST elevation MI (STEMI), atrial fibrillation (AF), or a cardiac arrest rhythm such as ventricular tachycardia (VT) or ventricular fibrillation (VF). The Apple iPad was linked to another device allowing the facilitator to alter the readings effortlessly during the course of the scenario, and respond to interventions carried out by the students or make changes as the scenario progressed, without the need for further communication with the student.

Data was gathered by two methods:

- Joint interview with 2 students
- A 9 question online survey with 10 respondents

A link to the online survey was sent to the students following completion of both simulations. This was done using an anonymous online Survey Monkey. Once all students had responded to the survey the results were reviewed. The joint interview was facilitated by the researcher (Dr James Ainsworth) immediately following completion of the simulation, with two students. The interview was semi-structured, using a pre-formed set of questions, which were similar to those used in the online survey, to allow collection of additional qualitative data and a more in depth analysis. The aim was to explore and compare students perceptions or feelings in both simulations (with and without the simulated observations). Audio from the interview was recorded, and was manually transcribed by the author, ensuring all identifiable data was removed.

All simulation and the interview were carried out in the medical education centre within Morriston Hospital. Only the researcher (Dr James Ainsworth) and the students attending the simulation were present at the time.

The survey and interview questions attempted to gather information on the following themes, around which the data were also organised: Sense of realism; Engagement with the simulation; Learning; Enjoyment/Feelings, which allow easier interpretation of the results.

All students attending teaching sessions agreed for any data collected to be used for educational research, with signed informed consent. Any data collected from the surveys or focussed group was anonymised, with no names or other details included. The survey responses were also all anonymised, and included a question confirming that the respondent was happy for the answers given to be used for research. The results from this study will be used to design a larger study.

Results

Sense of realism

All respondents to the survey felt that the use of the simulated observation increased their sense of realism whilst in the simulation scenario. Figure 1 demonstrated the results clearly, and that 70% of students felt that their sense of realism was increased a great deal. All students felt that their sense of realism was either 'A lot' or 'A great deal' more with the simulated observations monitor.

Written responses by the students in the survey demonstrated an increased sense of realism. "Much more realistic in real time, to see the results after action" [Respondent 3]. "Real time updates, allows you to react instantly and see changes from your interventions" [Respondent 6]. "It was much more realistic as you could look at the observations in live time and react to them as they changed rather than asking for an update from the person running the sim" [Respondent 8]. There was clearly a feeling that this was more realistic, with a closer resemblance to what would be experienced in clinical practice. "Getting used to looking at the observations and interpreting them, provides better clinical picture than just hearing the values which can go in one ear and out the other" [Respondent 7]. There was a feeling of things happening in real time, and allowing them to respond to changes more quickly, and to more easily assess the response to their interventions.

The feedback in the interview was similar, with both students stating their sense of realism was increased. Interviewee 1 commented on the audible sounds of the observations making the scenario feel more realistic. Interviewee 1 again commented on the monitor making it easier to adapt to changes in real time.

Engagement with the simulation

All students felt their engagement with the simulation was increased with the simulated observations monitor (see Figure 2). 60% of students in the survey stated that their engagement improved a great deal, "With monitor it was much easier to stay engaged" [Respondent 9].

This is clearly partly due to the increased sense of realism felt by the students during the simulation scenario, "Made it feel more real, and that it wasn't just a dummy lying in bed" [Respondent 5], "Felt more 'clinical' and in control of the situation" [Respondent 7]. Students also stated that they felt they were better able to assess the results of their interventions, and to more easily monitor the changes (improvement or deterioration) in the patient's status as the scenario progressed or following interventions.

Figure 1. Sense of realism: Pie chart showing the extent to which the simulated observations monitor increased students perceived realism. All students felt their sense of realism was increased, with 70% stating their sense of realism was increased a great deal.

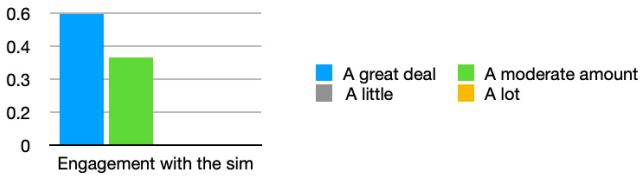

Figure 2. Engagement with the simulation: Bar graph showing the effect of the simulated observations monitor on students engagement with the simulation monitor. All students either stated that their engagement was increased a moderate amount, or a great deal.

Another key factor appears to be the flow through the scenario, and the reduced interruptions from the scenario to gain information from the facilitator regarding the status of the patient, "It didn't break up the flow of the simulation by asking for observations, made it more like a real life situation" [Respondent 8]. Not having to ask the facilitator for information repeatedly throughout and whether any changes had occurred, particularly following the administration of a treatment or an intervention allowed the students to remain focussed and engaged throughout.

The feedback from the interview was positive, with similar information gathered as from the survey, "...we also disconnected less to talk to the examiner..." [Interviewee 2]. The interviewees commented on reacting to changes in the observations quicker, and being able to see or hear changes as they went along. "... was much easier to adapt in real time vs continually asking the person in charge of the sim has the heart rate changed, has the resp rate changed or what not" [Interviewee 1].

Learning

The majority of students felt like their learning was improved by the use of the simulated observations monitor. Figure 3 displays the percentages as a chart. 0 students marked none at all or a moderate amount.

Students felt that the more realistic nature of the simulation session with the use of the simulated observation monitor improved their learning, by making them more prepared for a real life scenario, "Feels more realistic so builds confidence in clinical skill and looking at monitors on the wards - knowing how it fits together" [Respondent 7], "prepare for real life scenario" [Respondent 6]. "It gave me a more realistic example of how situations unfold and puts you under pressure to apply your knowledge. It also highlights areas you are less confident in very evidently" [Respondent 2].

One student commented that it helped solidify their ABCDE approach to the acutely unwell patient. Some commented on an improvement in focus through the scenario. "I felt they were conducive to my learning, I felt that the simulations really emphasised the importance of ABCDE assessments" [Respondent 5].

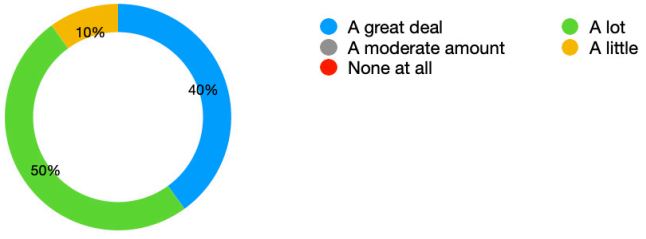

Figure 3. Learning: Pie chart displaying the extent to which students felt their learning improved as a result of having the simulated observations monitor. 0 students marked none at all or a moderate amount. 50% stated a lot and 40% stated a great deal.

One student however felt that it made little difference to the outcome or their learning, but that it did make the scenario feel more realistic, and "...made the abcde progression smoother and made the sim less disjointed" [Respondent 8].

Similar data was gathered from the focus group, with Interviewee 1 stating that the more realistic the simulation training the more prepared you feel when faced with similar scenarios in real life. Interviewee 1 stated that they "... felt more focussed with it. Rather than just thinking this is a simulation session, because it was more realistic you were more focussed on the actual scenario presented in front of you rather just this is a teaching session or an examination session".

Enjoyment/feelings

All students in the survey (100%) stated that they preferred the simulation scenarios with the simulated observations monitor, again this was often due to the increased sense of realism during the simulation (see Figure 4). Being able to see the observations during the scenario continuously also meant that the students did not need to remember all the information delivered verbally by the facilitator, with one commenting that can actually add to the confusion during the scenario. "I quite enjoyed having it there just so I could keep looking at it and referring to it myself" [Interviewee 2]. Some did comment however on an increased feeling of pressure or anxiety, particularly when starting the simulation. Figure 2 shows that all students preferred the simulation with the use of the simulated observations monitor.

Discussion

We can see from the literature that simulation is proven to be a useful educational technique in medical education, and is shown to be beneficial in developing clinical competence. Despite the growing popularity and ingenuity of simulation within medical education, the benefits and differences in outcomes of higher fidelity simulation in terms of training and development and patient safety is less clear. What exactly defines the fidelity of a simulation session or scenario is also variable between sources, with many factors requiring consideration that may contribute to the student's sense of realism and commitment or engagement with the simulation.

This study shows that a simple measure such as the addition of a simulated observations monitor may significantly

Figure 4. Enjoyment/Feelings: Pie chart showing that all students preferred the simulation with the use of the simulated observations monitor. All students (100%) stated that they preferred the simulation with the use of the simulated observations monitor.

increase the learner's perceived sense of realism. This may be a relatively simple intervention, but is sufficient to create a noticeable change in the fidelity of the simulation scenario. The presence of the monitor gave the students a feeling of closer resemblance to attending to a patient on the ward. All participants in this study (both the survey and the interview) stated that the addition of the simulated observation monitor increased their sense of realism. 'Made it feel more real, and that it wasn't just a dummy lying in bed' [Respondent 5]. The following quote by Respondent 9 is effective in conveying the increased feelings of realism: 'More immersive, real time monitoring, not having to "check out of the scenario" for information from examiner'.

This may be largely due to the benefit of reduced interruptions during the scenario. The simulated observations monitor reduces the need for deviations from the scenario by negating the need for repeated communication with the facilitator, therefore helping maintain the student's sense of realism throughout the session, "I think we also disconnected less to talk to the examiner. So it's not 'in out' it's just in there, there are the obs, and you don't have to turn to the examiner and say what's happening now what's happening now" [Interviewee 2].

In addition, the visual effect of actually seeing the patients vital signs displayed on the monitor in real time, combined with auditory stimulation kin to that heard on the wards therefore being more similar to a clinical situation in which they might encounter in practice. Some students did comment on the benefits of being able to see the observations on the monitor continuously, and also in being able to hear the sounds. Students often appeared very receptive to audible changes in the monitor, created by changes in the vitals, such as an increase in heart rate or a change in tone with a decline in oxygen saturations. "Even having the background noise makes it a bit more realistic" [Interviewee 1]. "I like the fact that I could see the changes live during the simulation, felt more realistic - albeit the sounds it made was more heart-racing!" [Respondent 5].

Engagement with the simulation was higher during the sessions with the simulated observations monitor. "With monitor it was much easier to stay engaged" [Respondent 9]. The information given via the monitor is dynamic, allowing the facilitator to make changes to the patients' vitals throughout the scenario, and respond to any interventions. This was appreciated by the students. "Much more realistic in real time, to see the results after action" [Respondent 3]. This allowed the students to maintain focus on the task at hand.

The students felt that the use of the simulated observations monitor also improved their learning. Removing the need to remember all the observations delivered at the start of the scenario and the mental effort required for non-essential tasks or learning, therefore decreasing the extrinsic cognitive load. It also allowed the students to refer back to the information during the scenario, and to monitor carefully for any changes. One student felt that having the monitor did not change what they learned, but made the simulation more realistic and the scenario ran more smoothly, less disjointed.

So which did the students prefer? Simulation is a useful learning tool, and creates a safe space to do practice emergency or rarely encountered scenarios. Simulation can however be a nerve-racking or stressful process for students, particularly when used as for examinations, or when being watched by colleagues. All students in this study stated that they preferred the simulation sessions using the SOM as opposed to similar sessions without it. It may also however add to the pressure felt whilst approaching or performing the sim, although one would hope this was due to that sense of realism and the feeling of a closer resemblance to being in a real life scenario or assessing an unwell patient. Students did comment on the additional pressure felt, but some felt that this added to their performance.

This study shows that the addition of a simple device such as the SOM can produce a higher level of fidelity, particularly in terms of the stimuli provided and student perceptions of realism, which may be effective in improving engagement or commitment with the simulation, learning, and aid medical student (and then junior doctor) recall then when presented with similar scenarios in a real life situation, or situated cognition (Norman *et al.*, 2012). "with a simulation session, it's an artificial environment, by having something that's a bit more realistic it takes that artificialness away from it, so if you were presented with a scenario in real life you're far more ready to deal with it as it was rather than trying to remember what you did in a sim session". [Interviewee 1]. This feeling of helping the students 'prepare for real life scenario' [Respondent 6], may also increase motivation or intrinsic drive, with an increased feeling of relevance.

Limitations

This was a pilot study with a small number of participants, and included medical students on the post-graduate entry course only from the second and third year, from one medical school. There was no follow up beyond this to assess for ongoing learning or proven changes in performance, with subjective data collected by student self-assessment and perceptions or feelings following the session. Consideration for the order of the scenarios was not taken into account in this pilot study - the extended study will include randomisation of participants to participate in simulation with or without the SOM first.

Data availability

Underlying data

This project contains the following underlying data:

- Anonymised survey results.docx

Figshare: Anonymised survey results.docx. https://doi.org/10.6084/m9.figshare.23599995.v1 (Ainsworth, 2023a).

- Anonymised survey results (non-aggregated data)

Figshare: Simulation Pilot Study anonymous survey data (non-aggregated). http://doi.org/10.6084/m9.figshare.23913021 (Ainsworth, 2023b).

- Interview Transcript.docx

Figshare: Interview Transcript.docx. https://doi.org/10.6084/m9.figshare.23599992.v1 (Ainsworth, 2023c).

Acknowledgements

The previous version of this article was presented at Ottawa Lyon Conference (26–28 August 2022).

References

Ainsworth J: **Anonymised survey results.docx.** figshare. [Dataset]. 2023a.
http://www.doi.org/10.6084/m9.figshare.23599995.v1

Ainsworth J: **Interview Transcript.docx.** figshare. [Dataset]. 2023c.
http://www.doi.org/10.6084/m9.figshare.23599992.v1

Ainsworth J: **Simulation Pilot Study anonymous survey data (non-aggregated).** figshare. [Dataset]. 2023b.
http://www.doi.org/10.6084/m9.figshare.23913021.v1

Al-Elq AH: **Simulation-based medical teaching and learning.** *J Family Community Med.* 2010; **17**(1): 35–40.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

Castle N: **SimMon**. 2018; [Accessed 01/06/2021].
Reference Source

Consideration for the order of the scenarios was not taken into account in this pilot study - the extended study will include randomisation of participants to participate in simulation with or without the SOM first.

Issenberg SB, McGaghie WC, Petrusa ER, *et al.*: **Features and uses of high-fidelity medical simulations that lead to effective learning: a BEME systematic review.** *Med Teach.* 2005; **27**(1): 10–28.
PubMed Abstract | **Publisher Full Text**

Kardong-Edgren S, Anderson M, Michaels J: **Does simulation fidelity improve student test scores**. 2007; **3**(1): e21–e24.
Publisher Full Text

Maran NJ, Glavin RJ: **Low- to high-fidelity simulation - a continuum of medical education?** *Med Educ.* 2003; **37 Suppl 1**: 22–28.
PubMed Abstract | **Publisher Full Text**

Massoth C, Röder H, Ohlenburg H, *et al.*: **High-fidelity is not superior to low-fidelity simulation but leads to overconfidence in medical students.** *BMC Med Educ.* 2019; **19**(1): 29.
PubMed Abstract | **Publisher Full Text** | **Free Full Text**

Norman G, Dore K, Grierson L: **The minimal relationship between simulation fidelity and transfer of learning.** *Med Educ.* 2012; **46**(7): 636–647.
PubMed Abstract | **Publisher Full Text**

So HY, Chen PP, Wong GKC, *et al.*: **Simulation in medical education.** *J R Coll Physicians Edinb.* 2019; **49**(1): 52–57.
PubMed Abstract | **Publisher Full Text**

Tun J, Alinier G, Tang J, *et al.*: **Redefining simulation fidelity for healthcare education.** *Simulat Gaming.* 2015; **46**(2): 159–174.
Publisher Full Text

Open Peer Review

Current Peer Review Status: ✔ ? ? ✘

Version 2

Reviewer Report 05 June 2024

https://doi.org/10.21956/mep.21841.r37307

✔ **Anne D Souza**
Department of Anatomy, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India

I have no further comments to make.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Planning and designeing learning, Medical Ethics, 3D Printing in Anatomy Education, Simulation in medical education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 06 May 2024

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✘ **Stephanie Mansell**
[1] University College London, London, England, UK
[2] University College London, London, England, UK

Thank you for the opportunity to review this manuscript. The authors should be congratulated on

taking the time to share their work. This article describes how simulated monitoring devices impacts on the realism of simulation based education.

I would encourage the authors to increase the clarity of their title, it should be made clear in the title the research is investigating the use of a simulated observation monitor.

The authors should take the time to ensure their references are relevant and up to date. I would encourage them to read the work of Gaba. There are inconsistencies in the language used. The role of debrief is an essential aspect of simulation and should be included in the definition. Given the focus of the article on the difference between fidelity and realism the authors should be clear to define these terms. The definitions used currently are unclear.

Of most concern is the lack of trial registration, I would have expected to see at least institutional registration of some description. Secondly it is concerning that there was no ethics sought. This is justified, however the authors refer to recruiting participants, consent and refers to the work as research.

The aims are repeated and are inconsistent, I would suggest the authors review the aims at the end of the introduction and those stated in the methods.

Research has shown that the "sim effect" starts to be reduced and students are more able to suspend disbelief, with resulting increased fidelity after 3 scenarios. The authors state that participants completed 2-3 scenarios. The difference between 2 and 3 scenarios could impact on the results and I would encourage the authors to include this in their discussion.

The methods would have improved by randomizing the order in which participants were exposed to the simulated monitor. The impact of the order should be included in the discussion and this should be recognized as a limitation.

There is a lack of detail on how the survey questions were designed. The survey questions are leading in nature and could have created confirmation bias, this should be recognized in the limitations and discussion. More detail should be provided in the methods. There should also be some justification on why validated surveys and outcome measures were not deployed. The response rate should be considered in the discussion.

Additionally there is a lack of detail on the methods used for developing the interview questions or the methodologies used for data collection and analysis. I would encourage the authors to consider qualitative methodology. The provided transcript demonstrated that the interviews were very brief (3.5mins), which demonstrates a missed opportunity for data collection. The questions were leading in nature and more methodological rigor would have greatly improved this aspect of the research.

The results of this study provide evidence at Kirkpatrick level 1, the authors should recognize this as a limitation and include this in the discussion.

Figure 4 is redundant and should be removed. Why is there different formatting between the figures, please ensure consistency in the formatting.

New results are presented in the discussion, please ensure no new data is presented in the discussion. Please also ensure the quotes are relevant to the aims of the study.

The discussion should cite the results of this study in the context of other literature. I would encourage the authors to source additional relevant references to increase the context of their results. The authors should avoid conjecture e.g. "students often appeared very receptive".

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Partly

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Have any limitations of the research been acknowledged?
Partly

Are all the source data underlying the results available to ensure full reproducibility?
Partly

Are the conclusions drawn adequately supported by the results?
No

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Simulation-based education, respiratory physiotherapy, sleep and ventilation, airway clearance

I confirm that I have read this submission and believe that I have an appropriate level of expertise to state that I do not consider it to be of an acceptable scientific standard, for reasons outlined above.

Reviewer Report 25 January 2024

https://doi.org/10.21956/mep.21125.r35567

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Therese Gunn

[1] Queensland University of Technology, Brisbane, Queensland, Australia
[2] Queensland University of Technology, Brisbane, Queensland, Australia

Well done and I look forward to the extended version of this study beyond this pilot.

You have indicated the importance of using authentic feedback devices (SOM) to enhance the learning of the medical students rather than a verbal list of observations.

I feel there is a lack of background/definition of the SOM. At first I thought it referred to a method of educator observation of the student, but then realised it was the patient observation. I think this needs to be clearly defined/discussed in the introduction - perhaps use some of the description from the methods (7th paragraph) in the intro.

The first paragraph in the introduction could benefit from providing some examples of the different simulation strategies (manikins, VR, role playing etc). Then when it comes to your study, define the simulation you are evaluating - manikin with real-time patient observation vs without.

I would like to see some current literature in the introduction and evidencing your theories and aligning with your own conclusions. Especially your 2nd last paragraph in the discussion around the pressure of the task due to the realism.

I have done a quick look at current literature (and I admit it was not thorough) but I include a few below that might offer some insights for your study.

References

1. Wilson C, Furness E, Proctor L, Sweetman G, et al.: A randomised trial of the effectiveness of instructor versus automated manikin feedback for training junior doctors in life support skills. *Perspect Med Educ*. 2021; **10** (2): 95-100 PubMed Abstract | Publisher Full Text
2. Drost-de Klerck AM, Olgers TJ, van de Meeberg EK, Schonrock-Adema J, et al.: Use of simulation training to teach the ABCDE primary assessment: an observational study in a Dutch University Hospital with a 3-4 months follow-up.*BMJ Open*. 2020; **10** (7): e032023 PubMed Abstract | Publisher Full Text
3. Yu JH, Chang HJ, Kim SS, Park JE, et al.: Effects of high-fidelity simulation education on medical students' anxiety and confidence.*PLoS One*. 2021; **16** (5): e0251078 PubMed Abstract | Publisher Full Text
4. Keskitalo T, Ruokamo H: Exploring learners' emotions and emotional profiles in simulation-based medical education. *Australasian Journal of Educational Technology*. 2020. 15-26 Publisher Full Text

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Simulation in education; healthcare education; learning design/pedagogy

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 27 Apr 2024

James Ainsworth

Thank you for your review and for your feedback. We are still in the process of completing the HRA application for the extended study but hope that we will be starting soon, and that we may have the extended version out within the next year! I have included some additional explanation regarding the SOM in the introduction, which is then expanded on later on in the methods as previously noted. I have added some additional information with examples of different simulation strategies as suggested. Thank you for your suggested references to support the article, this is extremely useful. We will aim to discuss the stress response in more detail in the extended version of the article with additional literature review. In addition, as part of our extended study in addition to qualitative data we will also collect data on physiological parameters during the simulation to provide some quantitative data to support claims regarding stress or pressure.

Competing Interests: No competing interests were disclosed.

Reviewer Report 24 January 2024

https://doi.org/10.21956/mep.21125.r35565

Sherri Rudinsky
[1] Uniformed Services University, Bethesda, USA
[2] Uniformed Services University, Bethesda, USA

This article describes how a simulated monitoring device (vitals display) effects students perceptions on realism and effectiveness of learning during a series of simulation scenarios. The authors accurately state in the introduction that higher fidelity, or more technology, does not always equate to a more effective learning experience and comes at a, sometimes prohibitive, cost. This pilot study provided some insight into one example where more fidelity (use of the simulated vitals monitor) appeared to positively add to the experience for a small group of students. With the positive experience being defined by student perception of realism, engagement and subjective learning. The key theme cited in the abstract - requiring less direct communication with the examiner - certainly allows for more active engagement and immersion into the scenario and makes sense logically that this is what the students came away with.

A few areas where I would have liked to see more discussion regarding the methods include:
1 - how were the facilitators trained to ensure flow of the scenario (both with and without use of the monitor). Facilitator ability to "run" the scenario contributes greatly (more than the technology itself) of the learning experience.
2 - was there consideration to the order of the scenarios. Everyone appeared to complete scenarios without the monitors first, which may have provided a bias toward the use of monitors simply as the students felt more comfortable with simulated experiences in general by that time.
3 - why did the authors chose different methods of data collection (survey vs interviews)? They state interviewed two (of 15) students to obtain more depth, however, they did not mention why they did not chose to interview all of them nor why those particular 2, etc.

The authors correctly mentioned in the limitations section that this study did not answer questions of improved performance which is in line with the overall stated learning objectives for the educational session. Ultimately, this is the "gap" in the literature - is higher fidelity more effective in achieving the educational objectives of the learning experience (improved performance outcomes), not how the students feel about the experience. Agree, this is the next required step.

Is the work clearly and accurately presented and does it cite the current literature?
Yes

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Medical Education, Simulation Education, Emergency Medicine

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 27 Apr 2024

James Ainsworth

Thank you for your review and for your feedback. With regards to your points:

1. A single facilitator carried out all simulation scenarios (both with and without the SOM), I have noted this on the methods. I have also added a note regarding facilitator information to help maintain flow during the scenario.
2. There was no particular consideration with regards to the order in this pilot. For the following larger scale study that we are planning this will include randomisation to carry out simulation with or without the SOM. I have added this to the limitations for this study.
3. Interviews were used to provide additional data to supplement that collected from the surveys. The 2 included were the initial 2 to respond and agree to participate.

I appreciate evidence in achieving education outcomes is lacking (both here and in the literature), and is challenging to achieve.

Competing Interests: No competing interests were disclosed.

Reviewer Report 09 November 2023

https://doi.org/10.21956/mep.21125.r35151

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Anne D Souza
[1] Department of Anatomy, Kasturba Medical College, Manipal, Manipal Academy of Higher Education, Manipal, Karnataka, India
[2] Department of Anatomy, Kasturba Medical College, Manipal, Manipal Academy of Higher

Education, Manipal, Karnataka, India

The manuscript addresses the comparative effect of using high-fidelity simulation with the help of a simulation observations monitor (SOM). This pilot work was carried out using a prospective study design. The manuscript is written elaborating methodology and results clearly emphasizing the key concepts.

There are a few areas which would require attention. Firstly, what is the rationale for using a prospective study design? The students who participated in simple simulations were made to participate again with SOM. This could lead to confounding as the same group is exposed to two interventions. A study with a two-group comparison would work well in such situations.

It was nice to read the student feedback on different aspects of the educational intervention. Additionally, was any test done to assess the effectiveness of the intervention? If not, what measures can be considered to evaluate learning in this situation?

The study can be strengthened by citing more published literature on simulation-based research in undergraduate education.

Is the work clearly and accurately presented and does it cite the current literature?
Partly

Is the study design appropriate and is the work technically sound?
Partly

Are sufficient details of methods and analysis provided to allow replication by others?
Yes

If applicable, is the statistical analysis and its interpretation appropriate?
Yes

Have any limitations of the research been acknowledged?
Yes

Are all the source data underlying the results available to ensure full reproducibility?
Yes

Are the conclusions drawn adequately supported by the results?
Partly

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Planning and designeing learning, Medical Ethics, 3D Printing in Anatomy Education, Simulation in medical education

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard, however I have

significant reservations, as outlined above.

Author Response 27 Apr 2024

James Ainsworth

Thank you for your review and for your feedback. We decided to use this design and for students to participate in both arms of the study so that we could make a direct comparison of their perceived realism between each type of simulation. I appreciate there are flaws in some aspects of the design. We Weill try to mitigate some of these in the extended study, for example we will include randomisation to participate in simulation with or without the SOM first. As mentioned in the limitations, there was no assessment of outcomes beyond this activity. I appreciate evidence in achieving education outcomes is lacking (both here and in the literature), and is challenging to achieve, but that this is a limitation of this study. Perhaps measures such as a follow up survey or interview at a later date to assess confidence in assessing patients in clinical practice, or assessments of performance in repeated simulations could be used.

Competing Interests: No competing interests were disclosed.

Comments on this article

Version 1

Author Response 27 Apr 2024

James Ainsworth

Thank you for reading and for your feedback! And for your suggestions. We are preparing to carry out an extended study, which will include a combination of qualitative and quantitative data, and I hope will also be an interesting read. I will certainly consider your suggestions and read the linked artilces before developing the background and literature review for the next study.

Competing Interests: No competing interests were disclosed.

Reader Comment 07 Sep 2023

Jessica Stokes-Parish, Bond University, Robina, Australia

Dear Colleagues, interesting work and thank you for sharing. It is a brave person indeed who wades into the discussion of realism and fidelity. It would be wonderiful to see some more theory on realism in this work, as fidelity can not be conflated with realism. I wonder if you have consider Laucken and Dieckmann's theories of realism? There are some previous models for measuring realism that may be of interest for you when considering further research (such as this one by Wilson et al https://advancesinsimulation.biomedcentral.com/articles/10.1186/s41077-018-0080-7) .

Fidelity is highly criticised in more recent literature - highly recommend reading Hamstra et al (Reconsidering fidelity in simulation-based training - PubMed (nih.gov)) for a more considered approach.

Happy researching :)

Competing Interests: No competing interests were disclosed.