Effectiveness of High Fidelity Human Patient Simulators in Neuroscience and Neuropharmacology Teaching - A Pilot Study

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Background

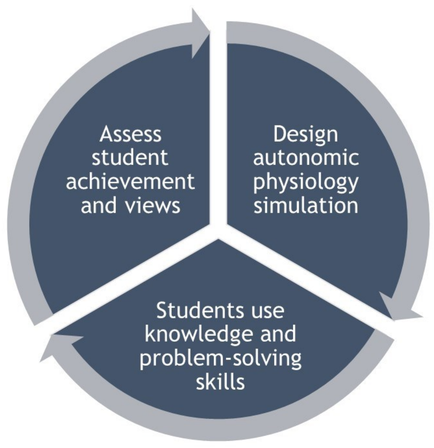
- Human patient simulators (HPS) are life-sized, computer controlled mannequins that can be used model a number of physiological measurements.
- These simulators were initially designed to train doctors, nurses, paramedics and other healthcare professionals how to treat patients in certain conditions without putting real patients in danger.
- In some institutions (e.g. Bristol University) they have also been applied to medical science teaching to help students understand the dynamic nature of concepts.
- Use of such simulators might also reduce the need for animal or human experiments in practical classes and thus, reduce the costs and logistical requirements of such exercises.

Figure 1. Example of a simulated exercise using a high-fidelity human patient simulator mannequin.

This is one type of immersive or experiential learning that is used for many clinical courses but is not so common in science classes.

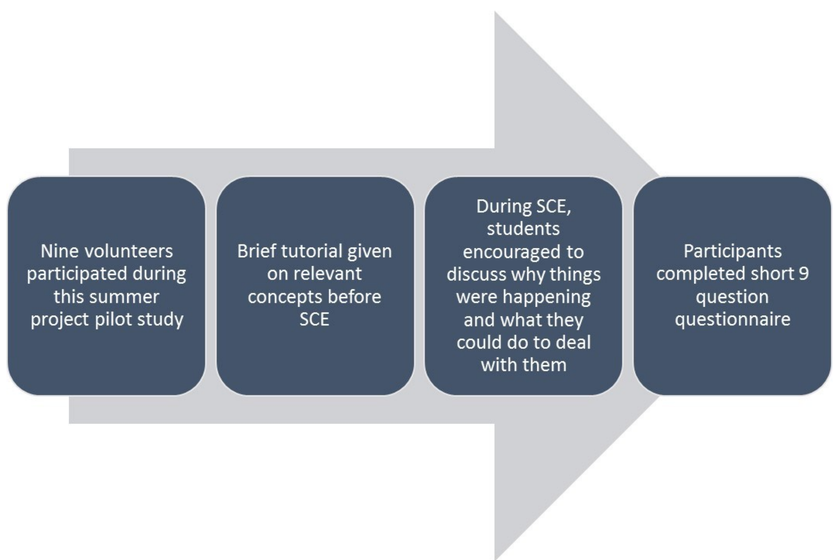
Aims

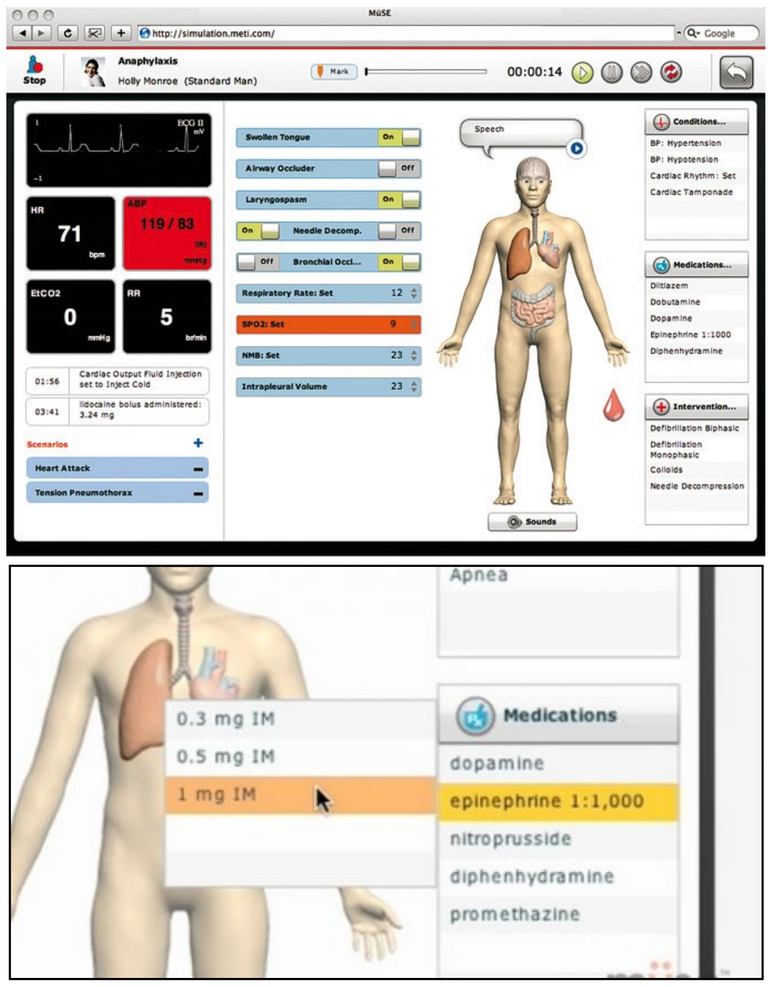
The aim was to design an interactive problem solving tutorial focussing on the physiology of the autonomic nervous system and the pharmacological agents that can affect it. During the class students would use their knowledge of the topic and their problem solving skills to work through a simulated clinical event (SCE).



Methods

- This study used the iStan Human Patient Simulator (HPS), operated by Muse software.
- iStan is able to mimic cardiovascular, respiratory and neurological symptoms.
- The parameters are modelled on one another; if iStan's heart rate changes, his blood pressure, cardiac output, respiratory rate and more will all change accordingly.
- This software allows the user to design a scenario and to perform interventions on the HPS during the practical class. It also gives a visual indication of physiological measurements from the HPS and an ECG trace. When an intervention was performed on the computer, a mock version of the intervention was physically performed on the HPS (e.g. when non-rebreather oxygen mask was selected on the computer, the HPS mannequin was simultaneously given a non-rebreather oxygen mask.)
- The scenario simulated during this exercise was organophosphate poisoning since that would involve students using a range of knowledge about autonomic physiology and pharmacology.
- An outline of the study is provide below.





Figures 2 & 3. Computer interface for the high-fidelity human patient simulator mannequin.

The interface allows the instructor to alter the content and pace of the exercise to suit the abilities and knowledge of the learners.

It also allows the instructor to alter the scenario depending upon how the students are progressing, thus allowing more advanced students to be challenged, or for struggling students to consolidate their understanding.

Scenarios can be linked to other classroom tasks such as data analysis, calculations, ethical discussions, literature searching etc.

Results

Question	Group Mean Score	Student Mean Score	Staff Mean Score
Was it interesting?	9.56	9.60	9.50
Did it enhance presentation of scientific concepts?	8.78	9.00	8.50
Did it help your understanding?	8.00	8.20	7.75
Would it be useful for your neuroscience/ neuropharmacology course?	8.22	9.20	9.25
Overall rating for this class?	8.89	9.20	8.50

Figure 4 Mean scores from questionnaire after simulation.

Participants scores each question on the questionnaire using a Likert scale from 1-10. Higher scores indicate a more favourable response.

Participants include 4 academic staff and 5 Level 4 students.

Other questions were free text and asked about potential applications

of simulator classes and any suggested feedback or improvements.

Discussion & Conclusions

- Positive feedback highlighted that this style of class was an interesting and novel approach to problem solving tutorials and that it could be applied to a number of different areas of teaching within the school.
- Staff and students immediately came up with alternative scenarios or applications that could improve teaching and learning in multiple parts of the curriculum.
- All students were engaged throughout the whole learning event.
- One point of criticism was that, at the beginning of the SCE, participants were unsure how to interact with the HPS and to what degree they were involved with the decision making aspect of the tutorial. To overcome this hesitance future versions of the class will feature an 'ice breaker' activity where students are invited to have a look at the HPS and measure its pulse.
- A second suggestion from participants was that it would be useful for students to gradually be given supplemental information about the stages of the SCE as it progressed. In future versions, students will have a timed presentation with information running alongside the SCE display or will be supplied with an edited version of the demonstrator's script.
- The tutorial will be run again, with these changes as part of a level three course this academic year and students will fill in a similar questionnaire. This provides the potential for further projects to develop a range of classes covering different subjects.
- Similar test projects with larger groups of participants to provide more detailed feedback are underway. These will assess whether use of high-fidelity simulators are useful in helping students understand topics that have historically been perceived as difficult such as renal physiology or complex pharmacological problems.
- Use of high fidelity human patient simulators may be a useful adjunct to other teaching activities within medical sciences disciplines.

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