Class Room vs. In-Situ Simulation

Measuring the effects of two different simulation settings on participants in emergency medicine scenarios

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No conflicts of interest.
Hypothesis

The authors' hypothesis was that 1) learners will perceive a different level of realism when comparing in-situ to class-room scenarios; 2) the learners statements on relevance of the scenario will not have a positive relationship to the simulation setting; but 3) the immersion into the scenario will be higher in the study group.

Results

Simulation setting fidelity does influence the physical dimension of perceived realism but has no statistically significant effect on semantical and phenomenal realism or perceived relevance. However, independent from the setting, higher total realism leads to higher levels of perceived relevance.

- Physical realism correlates well with semantical ($P < 0.05$) and phenomenal realism ($P < 0.01$).
- Perceived relevance correlates well with perceived level of realism ($P = 0.008$).

Table 1: Pearson Correlations between realism indices and perceived relevance.

<table>
<thead>
<tr>
<th></th>
<th>Physical realism</th>
<th>Semantical realism</th>
<th>Phenomenal realism</th>
<th>Perceived relevance</th>
<th>Realism</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical realism</td>
<td>1</td>
<td>0.724*</td>
<td>0.460</td>
<td>0.351</td>
<td>0.655**</td>
</tr>
<tr>
<td>Semantical realism</td>
<td>0.724*</td>
<td>1</td>
<td>0.395</td>
<td>0.363</td>
<td>0.643**</td>
</tr>
<tr>
<td>Phenomenal realism</td>
<td>0.460</td>
<td>0.395</td>
<td>1</td>
<td>0.529**</td>
<td>0.780**</td>
</tr>
<tr>
<td>Perceived relevance</td>
<td>0.351</td>
<td>0.383</td>
<td>0.529**</td>
<td>1</td>
<td>0.521**</td>
</tr>
<tr>
<td>Realism</td>
<td>0.655**</td>
<td>0.463**</td>
<td>0.780**</td>
<td>0.521**</td>
<td>1</td>
</tr>
</tbody>
</table>

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Conclusion

Hypotheses 1) and 2 could be confirmed by this study. However, the In-Situ Setting did not affect the level of immersion measured in the study group. The findings of this work are consistent with earlier findings (Hays & Singer 1989), stating that high fidelity does not necessarily lead to superior learning experiences. The results advocate high performance in scenario design, as semantical and phenomenal realism will be effected by well designed scenarios and correlate with both immersion into the simulation and perceived relevance. This in return may improve learning of the adult learner (Knowles 1968).

References


Figure 1: Frequencies of calculated realism and immersion indices by group: Only the physical realism index is statistically significantly different between the study groups (unpaired t-test with $P < 0.05$).
Class Room vs. In-Situ Simulation

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Abstract

Background: Simulation training is now widely used in medical education. Traditionally, simulation courses take place in simulation centers where considerable effort is done to mimic a real working environment. In-Situ simulation provides simulation in a real working environment, where highly realistic training conditions can be provided. This study looks especially into the question whether or not the simulation environment in in-situ simulations changes the student’s perception of realism of the scenario and evaluates if perceived realism correlates to the students statement on how relevant the scenario was for achieving the learning objectives.

Methods: This observational study compares two groups of healthcare professionals (n = 25) who participated at an one-day course on emergency medicine. For both groups, a medium-fidelity simulator and authentic medical equipment was used to simulate complex emergency medicine scenarios. For the study group, an In-Situ setting was chosen in a mobile intensive care unit (MICU), whereas the control group did the scenarios in a conference room. A participant response tool was used to measure student’s perception of realism based on three dimensions of realism. 5-point Likert-scales (5=fully agree, 1= fully disagree) where used to measure immersion and relevance from students perspective.

Results: There were significant differences in the level of perceived physical realism between the two groups, efforts done to increase the level of realism in In-Situ simulation were perceived by the students (4.48 vs 4.11, P<0.05). Simulation settings, however, did not influence the perception of both semantic and phenomenal realism significantly (4.33 vs. 4.44, 4.22 vs. 4.43 respectively). In general, those students with higher levels of perceived realism rated the scenarios as more relevant for their professional life, realism indices correlate well with relevance indices using the Pearson correlation (r=0.008).

Conclusions: In-Situ Simulation alters the level of perceived physical realism, but not the level of perceived relevance in general. However, results of this study suggest that factors including scenario design help to reach high levels of perceived realism, especially in its phenomenal and semantic dimension. Perceived realism in general increases the relevance of the simulation scenario for the learner.

Keywords: Realism, In-Situ simulation, relevance perception.

Background

Traditionally, simulation courses take place in simulation centres where considerable effort is done to mimic a real working environment (Rall et al 2010) such as hospital wards. The relatively new concept of In-Situ simulation temporarily converts real workplaces into a safe learning environment and often achieves significantly higher levels of realism when compared to a typical simulation suit (Patterson et al 2008). The concept of simulation fidelity (Hays & Singer 1989) describes the level of realism provided by the patient simulator (the manikin) itself, in terms of its physical and functional characteristics (Feinstein & Cannon, 2001). Various studies have evaluated the influence of simulation fidelity on learning outcomes (i.e. Issenberg et al, 2005; Hays & Singer, 1989) and found that high fidelity does not necessarily translate to high educative outcome. To perceive realism however, students use not only physical, but also semantic and phenomenal thinking modes (Laucken, 2003). Whereas the physical dimension of realism includes haptic perceptions of the simulator, used equipment and environment, the semantic dimension focuses on the concepts of the scenario. The phenomenal dimension is marked by the emotions and beliefs of students in a simulation scenario (Dieckmann, Gaba & Rall 2007). This study measures perceived physical, semantic and phenomenal realism of students undergoing complex emergency medicine simulation.

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scenarios and looks especially into the question whether or not the simulation environment in In-Situ simulations changes the student’s perception of realism of the scenario and evaluates if perceived realism correlates with the student’s statement on how relevant the scenario was for achieving the learning objectives.

Methods

Study Design

This prospective, quantitative study measured perceived realism in two different simulation settings from December 2011 to March 2012. The study group (high realism HR) received In-Situ simulation training in the real working environment of a mobile intensive care unit, whereas the control group (low realism LR) did simulation scenarios in a typical class room. The study group consisted of critical care paramedics from a medium-sized ambulance service in Switzerland (n=10), whereas the control group consisted of nurses and physicians of a state hospital in Switzerland (n=15). In both groups, used medical equipment was real equipment of each organisation and the medium fidelity simulator was identical in both groups (ALS simulator, Laerdal, Norway). In both groups, medical monitoring was simulated using specific software (SimMan Vers. 3.4, Laerdal, Norway) and a 21-inch touch screen. Both groups were isolated from both instructors and observers during the scenario, an audio-video system was used to observe the scenario. After the scenario, all participants were invited to rate 5 categories of the scenario on a 5-point likert scale (5=fully agree, 4=rather agree, 3=neutral, 2=rather disagree, 1=fully disagree).

Survey content and administration

The participant response tool was specifically developed for this study and was pre-tested in a similar simulation training. The survey is a 3-page hard copy including 33 items in total. The items are categorised in 5 main groups: Reception of physical, semantic and phenomenal realism, level of immersion and perceived relevance. Cronhbach’s α was used to measure reliability of the three main categories for realism (α=0.86). The survey was distributed after the scenario, the author introduced the study and was available for questions. Participation at the study was voluntary and data collection anonymous. Completed surveys were coded using a customized database (MS Access, Vers. 2010) and exported to an SPSS data file.

Statistical analysis

For each category, results were summarized by using mean and standard deviation. All tests were two-sided and considered significant if P<0.05. Statistical analyses were conducted using IBM SPSS Vers. 20, 2011.

Results

All 25 participants completed the survey. In the study group all participants were critical care paramedics (n=10; 100%), the control group consisted of nurses, physicians and medical students as presented in Table 1.

<table>
<thead>
<tr>
<th>Setting</th>
<th>Profession</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-Situ Simulation</td>
<td>Paramedic</td>
<td>10</td>
<td>100,0</td>
</tr>
<tr>
<td>Class-Room Simulation</td>
<td>Registered nurse</td>
<td>6</td>
<td>40,0</td>
</tr>
<tr>
<td></td>
<td>Physician</td>
<td>4</td>
<td>26,7</td>
</tr>
<tr>
<td></td>
<td>Medical student</td>
<td>5</td>
<td>33,3</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>15</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 1: Professions in the study groups
Professional experience varies in the groups, due to the medical students in the LR group, years of experience is lower than in the HR group (> 3 years: 46.7 % vs. 90 %) as shown in Table 2.

As expected, the perceived level of physical realism was significantly higher in the HR group (4.48; 95 % CI 4.23 – 4.72) compared to the LR group (4.11; 95 % CI 3.89 – 4.32) using an unpaired t-test ($P=0.024$). Indices for semantic and phenomenal realism as well as for immersion and relevance did not show any significant difference ($P>0.3$) between the groups, however non-significant trends towards higher values in the study group can be identified. Results are summarized in Table 3.

<table>
<thead>
<tr>
<th>Item</th>
<th>Class-Room Simulation</th>
<th>In-Situ Simulation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Physical realism</td>
<td>4.11</td>
<td>.39</td>
</tr>
<tr>
<td>Semantical realism</td>
<td>4.33</td>
<td>.46</td>
</tr>
<tr>
<td>Phenomenal realism</td>
<td>4.22</td>
<td>.59</td>
</tr>
<tr>
<td>Perceived immersion</td>
<td>3.89</td>
<td>.50</td>
</tr>
<tr>
<td>Perceived relevance</td>
<td>4.31</td>
<td>.39</td>
</tr>
</tbody>
</table>

Table 3: Learners perception of realism, immersion and relevance

For a sub analysis, perceived realism was summarized from all three dimensions of realism using mean and standard deviation. As for the single dimensions, there was no significant correlation between simulator setting and perceived realism in total. However, when comparing perceived realism in general (independent from the simulator setting), to perceived relevance of the scenario, a significant correlation ($P=0.008$) is found.

**Discussion**

The results of this study suggest that learners in simulation training do perceive differences in simulator settings during a simulation scenario. Furthermore the data show that realism should be considered as a multidimensional construct which can be altered by various means and physical imitation is only one potential option. Based on literature findings published elsewhere (Hwang, 2008; Hays & Singer, 1989; Dieckmann et al. 2007) it is not surprising that a difference in physical realism (or physical fidelity) does not automatically lead to increased perception of relevance. However, findings in the subanalysis support the concept of creating realism in simulation scenarios to improve the relevance of the scenario for the student. Based on Knowles (1968) findings on adult learners, a reduction of learning barriers (such as low relevance perception) leads to improved learning. In the context of Lauckens (2003) thinking modes, the authors findings suggest that not only physical imitation, but (perhaps even more important) appropriate scenario design (Harteveld 2011; Cooper et al. 2011) is fundamentally important to involve the student fully into the learning experience. The scenario must therefore be designed in a way that the learners concepts, believes and emotions are matched, since even when only low physical realism is present, the learner may still find the scenario relevant to his/her learning process if perceived semantic and phenomenal realism is sufficient.

**Limitations**

The survey was not specifically powered to measure immersion in details, as there were no questions in the survey to identify the role of the participant in the scenario. Therefore, results of immersion are difficult to analyse, as the items in the category immersion were especially phrased to meet the
requirements of team leaders. Other team members will probably show different signs of immersion (e.g. stress levels in team leaders might be higher when compared to operative team members).

Conclusion

In-Situ Simulation alters the level of perceived physical realism, but not the level of perceived relevance in general. However, results of this study suggest that factors including scenario design help to reach high levels of perceived realism, especially in its phenomenal and semantic dimension. Perceived realism in general increases the relevance of the simulation scenario for the learner.

References


Rall, Marcus; Gaba, David M.; Dieckmann, Peter; Eich, Christoph (op. 2010). In: Ronald D. Miller (Editor.): Miller's anesthesia. 7th Ed. Philadelphia: Churchill Livingstone-Elsevier.