**Article Title:**

Initial Evaluation of a Virtual Reality Bomb Defusing Simulator for Development of Undergraduate Healthcare Student Communication and Teamwork Skills

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**Abstract**

Introduction

Communication and team-working skills are essential healthcare professional skills yet undergraduates exhibit reluctance to engage with group-work, especially in inter-professional groups. The aim of the study was to investigate whether a virtual reality bomb-defusing simulator would enable students to gain these skills through an enjoyable and challenging scenario without profession-specific knowledge.

Methods

Students took it in turns to play the role of the “Defuser” immersed in a headset while the rest of the group were “Experts” with a printed manual, but no sight of the bomb. The task challenged students to relay obscure symbols and instructions to each other rapidly and effectively. A subsequent focus group explored the impact of the simulation on the students’ perceived learning, engagement and communication skills.

Results

The focus group of five multi-professional healthcare students reported high levels of engagement and satisfaction while highlighting value in developing communication and teamwork. The simulator nurtured initial group dynamics and team bonding.

Conclusions.

Evaluation data indicated that the intervention facilitated cooperation, team bonding and the development of good communication skills. This method of encouraging communication would fit well into an inter-professional learning session as a useful tool ahead of more technical and clinically based group work.

**What this paper adds**

**What is already known on this subject.**

Group work is an essential aspect of undergraduate healthcare training, yet students frequently find this to be challenging and this can affect future learning. Although Escape Room scenarios offer an enjoyable and effective means of nurturing groupwork skills they are challenging to implement in the modern curriculum. Recent advances in headset technology mean that virtual environment alternatives to escape rooms can be implemented on campus.

**What this study adds**

Our study suggests that a virtual environment escape room simulation can facilitated cooperation, team bonding and the development of good communication skills. This method of encouraging communication would fit well into an IPL session as a useful tool ahead of more technical group and clinically relevant group work.

**Initial Evaluation of a Virtual Reality Bomb Defusing Simulator for Development of Undergraduate Healthcare Student Communication and Teamwork Skills**

**Introduction**

Communication and teamwork are essential health professional skills and are typically gained during training through “inter-professional learning” (IPL). For new undergraduate students, group work with unfamiliar peers can be challenging,[1] especially within the first few weeks of studies. It is essential that students gain communication and teamwork skills rapidly, so that subsequent learning can be provided. Interactive Escape Rooms require players to solve puzzles, complete tasks and work together efficiently, drawing on ‘soft skills’ such as leadership, teamwork and communication[2]. There is growing evidence supporting the use of “serious games” for student learning[3] and their role as useful constructivist learning opportunities.[4-5] Used in the correct context, with sound pedagogical underpinning, these games have proven to be valuable for increasing soft skills.[6] Clinical curricula, however, often provide group work training using resource-intensive technical simulation equipment or events [7] or clinical department practice to provide this training. There is little evidence addressing the role of VR training for clinical “soft” skills, yet problem-based learning in a safe virtual environment (VE) not only encourages interaction, role play,[8] creativity and independent thinking abilities, but can nurture communication and teamwork skills.[9] The aim of this study was to explore initial student perceptions of a bomb-defusing simulation in the development of soft skills.

**Methods**

Purposive sampling was used in to recruit a range of undergraduate health professional students who were unfamiliar with each other. Students were invited to participate verbally at a lecture session or via email. The intervention was the game “Keep Talking and Nobody Explodes”[10] using the HTC Vive headset and controllers. The student wearing the VIVE headset is the “Defuser” and is trapped in a virtual room with a ticking, timed bomb they must defuse. The other students outside the room are the "Experts" who must provide clear instructions by deciphering the printed Bomb Defusal Manual without seeing the bomb. The game uses visual symbols that are unfamiliar and hard to describe, forcing students to be creative with their communication skills. This simulation shares many characteristics with escape room games, but is designed to take place over 5 minutes. Uniquely, the game enables small group working despite using only one headset. After completion, a focus group, facilitated by an experienced independent moderator, harvested student feelings and attitudes concerning collaboration and learning. The resulting audio transcription was coded independently by two researchers to identify emerging patterns and themes. These themes were agreed and used to formulate a final analytic narrative.

Results

Three orthoptics students, one occupational therapy student and one physiotherapy student provided feedback relating to the subthemes seen in Table 1.

**Table 1: Thematic Analysis Results**

|  |  |  |
| --- | --- | --- |
| **Theme** | **Classification** | **References** |
| VR Experience | Fun | 28 |
|  | Lack of control | 3 |
|  | Difficulty | 3 |
| Interpersonal | Communication | 16 |
|  | Teamwork | 6 |
|  | Trust | 5 |
|  | Leadership | 1 |
| Pedagogy | Comparison with IPL | 12 |
|  | Active learning | 5 |
|  | Suggestions | 5 |

**Discussion**

**VR Experience**

The student perception of the experience was predominately favourable:

*“It was really fun…exciting” (P1)*

*“enjoyable having the headset on” (P4)*

*“want to have another go (P2)*

*“enjoyed the pressure” (P3)*

*“pressure added to the fun of it”(P2)*

The use of a countdown timer and tense music appeared to generate a stressful & challenging scenario, yet this engendered engagement and realism.

**Communication Skills Development**

Several comments related to adaption, experiential learning, familiarity and reflection on communication. Despite the non-clinical setting, comments demonstrated that learners recognised the value of adapting communication to ensure understanding. Most students did not know each other before engaging with the simulation, yet all reported that they trusted each other to help irrespective of the role they were undertaking within the simulation. Additional pressures arising from the countdown timer and the fictional threat helped users to develop effective long-term communication strategies:

*“Okay I really need to communicate well now” because I am describing to other people.” (P1)*

This participant continued by reflecting on how the activity may be relevant:

*“I think that that is something that is going to carry over to clinical settings because…you have to alter your communication when you are talking to family members.” (P1)*

The communication and teamwork skills required by the simulation were constructed by the students themselves as an activating event[11] that forces the students to identify and solve problems together. This type of event has been previously recognised as an excellent example of problem-based learning.[12,13]:

*“Rather than talking about communication and talking about how we all communicate with each other. (P1) Like actually doing it.” (P3)*

The students developed their own skills to deal with the situation, corroborating findings in a video game study[2] which identified increases in communication, adaptability and resourcefulness.

**Teamworking Skills Development**

The topic of trust carries over to the teamwork theme. All students appeared to trust the “Expert” members of the team even though their virtual lives were at risk in the increasingly tense situation.

*“It was the people that you kind of had to rely on. You just had to listen to what they were saying and try to describe what you were seeing and then act.” (P4)*

*“I trusted these guys though” (P2)*

The use of humour evident in the data demonstrated that there was little defensiveness in the group, which is a potential barrier to group working.[14] Instead there was clear inclusivity, and the dynamics and level of engagement and response demonstrated good interaction amongst the group of initial strangers. If this group were now set a technical task, it would be hoped that their engagement and learning would be superior to a group who had not the opportunity to develop soft skills together. We plan to explore this in future research.

**Pedagogical Implications**

The students made several comparisons between the activity and their learning in IPL sessions:

*“IPL session is just like you put three of four professions in one room and you just talk about each other right? It’s basically to encourage you and to teach you how to work in a multidisciplinary team. But this thing is like quite good as well to teach you how to work in a team. So I would rather do this than to sit in an IPL session.” (P3)*

The reported feedback here concerning IPL may arise from enforced grouping which can cause resentment and loss of control.[14] A serious discussion of experiential learning in direct comparison to IPL activities was driven by the students in this focus group. It is of particular interest to note that the students agreed that the bomb defusing simulation could fit into clinical practice, despite the non-clinical scenario.

**Limitations**

Timetabling restrictions limited focus group engagement and thus sample size. This initial pilot study did, however, provide an opportunity to explore student perceptions which will underpin a future longitudinal study using the Durans Communicative Adaptability Scale.[15]

**Conclusion**

The time pressurised, fun and not overtly clinical simulation was well received by the students. Qualitative exploration indicated that a non-technical intervention facilitated cooperation, team bonding and the development of good communication skills. This method of encouraging communication would fit well into an IPL session as a useful tool ahead of more technical group and clinically relevant group work.

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**Competing Interests**

There are no competing interests for any author.

**Contributorship**

All authors contributed to the design and execution of the study, data analysis and writing of the submitted paper

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