

An experiment to assess the usefulness of a virtual environment as a method of public speaking anxiety exposure

Sree Poorvika Ramalakshmi Dasari, Seth Hajian
La Salle Academy, Providence, Rhode Island

SUMMARY

This abstract describes an experiment conducted to assess the effectiveness of a virtual environment to act as a method of exposure in the treatment of public speaking anxiety among high school students. In one of the experimental conditions, the participants had to make a presentation to a virtual audience using a Samsung Gear VR headset, which displayed a prerecorded 360-degree video of a classroom full of students. In another experimental condition, the participants had to make a presentation, without the VR headset and an audience. In both conditions, participant's heartbeat rate (response variable) was measured. The results show that the heartbeat during the experimental condition with a VR headset was significantly higher with respect to the heartbeat rate measured to the condition without the headset. This study should be followed up with a treatment study, where a virtual reality device would track a user's vitals during prolonged use and report the user's progress.

INTRODUCTION

In some high school classes, especially those that follow the Socratic style of teaching, students have to speak in front of their peers. Often, participation is mandatory and will count towards the grade for a class. Most high school students find this a challenging task because public speaking anxiety is prevalent among the student population. This apprehension of oral communication, while performing in front of an audience, often leads to poor performance in class, failed learning outcomes, low grades and general demoralization (1).

Currently, public speaking anxiety is treated using three main types of intervention training techniques. First, the cognitive modification technique, which requires support from teachers, family or peers; and involves practice sessions in the company of people a student might feel comfortable making mistakes. Second, the systematic desensitization technique, which involves repeated and frequent practice until a sense of routine replaces a sense of apprehension. Finally, the skills development technique, which focuses on improving specific public speaking skills, such as presentation skills, voice modulation and generating presentation content and order (2).

According to Pribyl et al., a combination of these

intervention techniques could be the most effective way to combat public speaking anxiety (2). A possible route to unification of these techniques is to employ a virtual environment (VE). A virtual environment could be used to create a sense of place illusion. That is, a VE could faithfully reproduce a public speaking environment, such as a podium, audience, auditory input, audience feedback etc., such that a user will feel a sense of being actually there (3). For instance, a virtual environment with a virtual audience (VA) could create a sense of being in a public speaking environment. Based on the effectiveness of modeling a VE, its VA, and the responsiveness of the VA to the user, the VE may seem realistic or plausible to its user (3). It can be used to practice repeatedly without the fear of making mistakes and could be used to focus on specific skills. Therefore, we believe, a VE could unify the benefits of all three interventions techniques.

Currently, there is no empirical evidence to prove that a VE can generate a sense of public speaking anxiety in high school students. This paper discusses an experiment conducted to assess the ability of a VE to expose students to public speaking anxiety, in terms of an increase in heart rate (4). Therefore, the main contribution of this paper is the result of a validation study, which lays the foundation for establishing a VE as a method of exposure to public speaking anxiety with respect to high school students.

The null hypothesis was as follows: there is no significant difference in heart rate of high school students when practicing public speaking alone versus in a virtual environment with a virtual audience. On the other hand, the alternate hypothesis is that there is a significant difference in the heart rate between the two treatment conditions.

Based on a review and synthesis of related literature, we will discuss the principles involved in creating a tangible and immersive virtual public speaking experience (VPSE). We believe that there are three main design principles that govern the development of VPSE, which will evoke public speaking anxiety in its user.

First, a VPSE must be designed to enable private space for an extended practice session. According to Smokowski et al., an effective VE can help a high school student learn by repeated and prolonged practice (5). An effective VE should not only replicate a public speaking environment and audience but also evaluate the user's performance and analyze the results to provide insights about potential areas

to improve (6).

Second, a VPSE must be designed to aid high fidelity interaction and create a sense of being there in an anxiety-inducing environment. For instance, the virtual audience could react to the user of the virtual environment, based on performance. According to Pertaub et al., even a virtual audience can create a sense of public speaking anxiety in a user, and thereby increase the user's sense of being there (7).

Finally, a VPSE must be designed to measure performance and provide feedback. The measure and the instrument used for the measurement has to be reliable and valid. For instance, according to Meehan et al., physiological measures such as heart rate and skin conductance is an objective measure for ascertaining and quantifying anxiety (4, 8).

RESULTS

The percentage change in heart rate of participants in both of the experimental conditions, with respect to their resting heart rate, were analyzed using a paired sample t-test. The results show that participants had a larger change in the heart rate while using a VR headset (mean = 7.115, $SD = 21.792$) when compared the condition where participants did not use the VR headset (mean = 0.304, $SD = 20.725$). The difference found using the t test was significant, $t(14) = 2.662$, $p < 0.05$. The results support the alternate hypothesis by suggesting that speaking to a VA in a VE can significantly increase the heart rate.

DISCUSSION

By conducting this experiment, we learned to use a VPSE as a technique, to expose high school students to public speaking anxiety. As the results of our experiment suggest, there is a significant increase in heart rate of the participant when speaking to a virtual audience. The results provides us evidence against the null hypothesis, and therefore the null hypothesis that there is no significant increase in heart rate has to be rejected. The results do not prove that the increase in heart rate, and therefore the sense of anxiety, is caused by the VPSE. However, it does suggest that there is a strong correlation between the two.

Based on our review of the literature, we have identified three experiments, which support our results, and they are as follows. First, Meehan et al. have proved that heart rate is a reliable and valid measure of presence or sense of being there in a stressful VE (4). Second, according to Jurnet et al., the sense of being there in a stressful VE and the level of anxiety are correlated (9). Finally, a VA can evoke a sense of anxiety in a VE user (10).

From the above evidence and results of our experiment, we contend that a VE has a high likelihood of being an effective method of exposure to public speaking anxiety. However, we believe that this experimental study has two main drawbacks. First, the study was limited to a single factor with two levels. It is likely that other factors that may have confounded the

results. For instance, a participant who is new to VR could be overwhelmed by the technology. Second, the effectiveness of VE has to be established by a longitudinal study, to prove its usefulness in the long term.

We believe that a VE could, in the future, offer a private and immersive environment for prolonged and repeated practice. A VE, which allows repeated practice, and tracks a user's progress while catering to the user's learning pace, will be able to unify all three public speaking intervention techniques (2). To this end, as a first step, we would like to conduct an experiment to establish that a VE can help significantly decrease public speaking anxiety in high school students by conducting a longitudinal study.

MATERIALS AND METHODS

The number of participants who volunteered for the experiment is fifteen. The participants' ages ranged from 16 to 17 years, and the median value was 16.333 years. All fifteen participants were high school students. Nine of the participants were female, and the rest of the participants were male. A Samsung Gear VR was used to display a 360-degree video. An alivecor device (kardia) was used to monitor the heart rate. The alivecor device simply connects with an app on your phone where the user places their fingers on the plates and then the app produces electrocardiograms. The experiment used a single factor repeated measures design. The independent variable had two levels. First, in the without VR level, the participant had to give a short speech without an audience. Second, in the VR level, the participant had to use a VR headset and give a short speech to a virtual audience. The dependent variable was chosen to be the heart rate of the participant.

Upon arrival, the participating students read and signed an informed consent form. Then the participants were given a brief about the tasks they would perform, and about the equipment they would use, without delving too much into the objective of the research to avoid participant bias. After participants acknowledged that they understood the tasks, a Samsung phone displaying the stereoscopic view of a classroom of students was put in the Samsung Gear VR headset. The participants were asked to present a one-minute speech about their favorite animal while wearing the headset that displayed a virtual classroom. During the duration of the speech, the participant held a Kardia Heart Rate Monitor that was connected to an iPhone and recorded their heart rate. The participant was then asked to present the one-minute speech without the headset to just one person in an empty classroom. Heart rate was recorded with the Kardia Heart Rate Monitor during the duration of the speech. Post experiment, participants were interviewed in an unstructured format. The experiment was counterbalanced to avoid order bias.

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