

**A New Avenue for Teacher Education: Virtual Reality Intervention as a Path Towards  
Reducing Public Speaking Anxiety and Supporting Growth Mindsets**

By

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### Abstract

The National Institute of Mental Health reports that public speaking anxiety affects approximately 73% of the population (2016). Individuals with a fear of public speaking worry about being judged in social situations by other people (American Psychiatric Association, 2013). This is a problem if we consider public speaking to be a fundamental skill in today's society, even more so when it comes to professions related to fields of education. Everyday teachers speak in front of students. However, some pre-service teachers lack confidence in their public speaking skills - a fear that could compromise their teaching effectiveness. Our research examined pre-service teachers' experiences with public speaking anxiety and the potential of a three-session virtual reality intervention. When asked about what made them most anxious speaking in front of students, pre-service teachers described concerns related to their professional roles and the expectations of others. Our results showed that pre-service teachers' public speaking anxiety was reduced following the three-session VR intervention. Furthermore, when asked about the brief VR intervention, pre-service teachers described it as being both realistic and useful. Our results are discussed within the context of potential support that could be provided to pre-service teachers.

Keywords: *public speaking anxiety, pre-service teacher, brief virtual reality intervention, pre-service teacher education*

### Preface

This thesis is an original work by Bryce Dueck. The research project, of which this thesis is a part, received ethics approval from the University of Alberta Research Ethics Board, Project Name “Virtual Reality to reduce Performance Anxiety”, No. Pro00086675, February 1, 2019.

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## A New Avenue for Teacher Education: Virtual Reality Intervention as a Path Towards Reducing Public Speaking Anxiety and Supporting Growth Mindsets

Being able to speak confidently to other people is a necessary skill in today's society. In fact, much of today's work requires individuals to be able to communicate effectively. However, a large majority of the population fears speaking in public. In particular, the fear of public speaking is the most common phobia ahead of death, spiders, and heights (National Social Anxiety Center, 2016). Having a fear of public speaking in a profession like teaching that regularly requires speaking to an audience is highly problematic. Obviously, teaching requires educators to be able to communicate effectively with their students. Previous research demonstrates that individuals with a fear of public speaking routinely experience actual communication difficulties (e.g., having difficulties expressing oneself, forgetting; see Byrne et al., 2012 for comprehension apprehension) in addition to decreased confidence in their ability to communicate and the belief that it will never improve (Dweck, 2006). Despite this importance, public speaking is not part of formal teacher education programs meaning that pre-service teachers likely have to seek out their own ways to mitigate this anxiety. Unfortunately, even if pre-service teachers want to deal with their anxiety, they have few opportunities to practice public speaking in realistic environments outside of teaching practicums. Teacher education programs that want to support pre-service teachers in dealing with public speaking anxiety need to seek out creative and cost-effective options. One such timely option is to integrate virtual reality (VR) for the purposes of practicing public speaking as a part of pre-service teacher training. In other words, VR could present teacher educators with an affordable and unique opportunity to support pre-service teachers who experience public speaking anxiety.

## **Teacher Education**

There are many perspectives on what contributes to a high-quality teacher education program. A leading expert in this area, Darling-Hammond (2006) describes three components: coherence between courses and clinical work, linking theory and practice in supervised clinical work, and proactive relationships with schools that serve diverse learners. This framework deals directly with competencies pre-service teachers need to develop, but it does not provide space for addressing personal anxieties or struggles that are relevant to the profession. For example, teachers are required to communicate effectively to students, parents and staff members alike even though public speaking is not directly considered in teacher education programs. While most teachers appear to be able to speak with ease, it has been observed that some pre-service teachers experience public speaking anxiety during their professional training and into their teaching activities (Daud et al., 2019). Teachers who are anxious speaking in front of students have even been found to forget to include pertinent material when speaking to their students (Byrne et al., 2012). As such, a more fulsome understanding of why pre-service teachers' experience public speaking anxiety and ways to treat it may be beneficial for teacher educators to consider.

## **Public Speaking Anxiety**

Most teachers do not suffer from a clinical level of fear of public speaking; however, this perspective is relevant to understand the possible manifestations of this concern. Public speaking anxiety is characterized in the Diagnostic Statistical Manual for Mental Disorders - 5th Edition (DSM-5) as a social anxiety disorder, or social phobia (American Psychiatric Association, 2013). Social anxiety disorder is one of the most common anxiety disorders around the world (National Collaborating Centre for Mental Health UK, 2013). Social anxiety disorder is characterized by

fear or anxiety about one or more social situations, for example taking part in social interactions in which an individual worries that they will be judged by other people (APA, 2013). In particular, the individual worries that their actions will lead to their humiliation, embarrassment or to their rejection by others (APA, 2013). The DSM-5 (APA, 2013) includes a *performance only* specifier for individuals whose fears center around performing in front of others. Individuals with the *performance only* type of social anxiety disorder have performance fears that are typically most impairing in their professional lives (e.g., musicians, dancers, performers, athletes) or in roles that require regular public speaking (APA, 2013). These performance fears can also appear in work, school or academic settings in which regular public presentations are required (APA, 2013) as would be the case for the work of teachers.

Social situations like public speaking are often unavoidable in today's society thus leading individuals with social anxiety disorder to routinely experience intense fear or anxiety during these situations (APA, 2013). Although the fear experienced is out of proportion to the actual threat posed by speaking in public, it can lead to clinically significant distress and/or impairment in social and occupational functioning among other important areas (APA, 2013). For example, social anxiety is associated with elevated rates of school drop-out in addition to decreased wellbeing, employment, workplace productivity, socioeconomic status, and quality of life (APA, 2013). Despite the extent of the distress and/or impairment associated with social anxiety disorder, only about half of individuals with the disorder in Western societies seek treatment and usually after having experienced symptoms for a number of years (APA, 2013). Detection of social anxiety disorder is usually performed with standardized self-report measures where respondents are asked to assess their level of anxiety in social situations (Myers et al., 2016).

**Anxiety and Mindsets.** As mentioned, public speaking anxiety is not only a clinical issue. It is important to note that individuals who do not meet diagnostic criteria for social anxiety disorder also experience significant difficulties. In particular, recent research indicates that subclinical social anxiety is associated with dysfunctions at multiple psychological and biological levels, in a manner that seems reminiscent of social anxiety disorder (Crişan et al., 2016). Additionally, researchers have found that oftentimes anxiety correlates positively with what is known as a fixed mindset in student populations (see Bostock et al., 2018 for example). People with a fixed mindset believe that a certain ability, such as public speaking, is fixed and uncontrollable whereas people with a growth mindset believe that ability is malleable and can be changed through hard work and effort (Dweck, 2006). Stewart et al. (2017) found only growth mindsets were associated with lower apprehension and higher self-perceived public speaking competence. Indeed, a variety of mental health concerns such as depression, social anxiety and drinking tendency have been shown to be more easily treated when the individual holds a growth mindset compared to when the individual holds a fixed mindset (Schroder et al., 2016). It may be the case that public speaking anxiety is more easily treated in individuals who hold growth mindsets regarding their public speaking ability. Thus, further research is needed in regards to treating public speaking anxiety for individuals whose symptoms both do and do not meet diagnostic criteria.

### **Treatments for Public Speaking Anxiety**

Common treatments for clinical levels of public speaking anxiety include Cognitive therapy (CT; Anderson et al., 2016) and Cognitive Behavioural therapy (CBT; Safir et al., 2011) where the client is gradually exposed to feared social situations. Typically, exposure therapies include in-vivo and imaginal exposure. In-vivo exposure, that is, directly facing a feared object

or situation or activity in real life, has been used to treat public speaking anxiety. In-vivo exposure allows individuals to experience public speaking in a controlled environment. However, in-vivo exposure requires coordination in terms of suitable venues and audiences which can in turn pose challenges to treatment time and cost. Likewise, if suitable audiences and venues are found, situational elements including the reactions of others which cannot be controlled may pose additional challenges to in-vivo treatment (Bouchard et al., 2014). Approaches to treatment for public speaking anxiety also includes imaginal exposure, or imagining the feared situation. Imaginary exposure can be facilitated through picture or video aids.

For subclinical public speaking anxiety, the most common recommendation is to practice. Indeed, groups such as Toastmasters International<sup>®</sup> were exclusively designed to help people overcome their fear of public speaking after recognizing the need for training in the art of public speaking (see Yee & Abidin, 2014). As a sub-clinical population, there are two ways in which pre-service teachers might have opportunities to practice public-speaking: during their coursework and during their practicum. Pre-service teachers may have opportunities to practice public speaking during in-class presentations, however this type of speaking may differ from classroom teaching. During the COVID-19 pandemic, this has proven even more relevant given the restrictions to indoor gatherings and the on-and-off transition from in-person to online learning. While there are opportunities to practice public speaking in-class, they may be insufficient for individuals with excessive public speaking anxiety. For example, in teacher education classes, students may be more concerned about their academic performance and less so about their professional teaching ability. In fact, grading assignments like oral presentations, motivates high-achieving students to continue to achieve high grades regardless of whether that

goal also happens to overlap with their learning (Schinske & Tanner, 2014). For students who are struggling, grading lowers interest in learning and enhances anxiety (Schinske & Tanner, 2014). As such, increasing the frequency of in-class presentations may not be an effective way of addressing pre-service teachers' public speaking anxiety as it pertains to the profession.

Pre-service teachers' main audience would be the students they teach during practicum placements. With the support of mentor teachers, pre-service teachers gain experience in planning instruction, teaching lessons, managing the classroom, assessing student progress and tailoring instruction to meet the needs of diverse learners. In advanced practicum placements, pre-service teachers are required to approach field experiences as full-time teaching positions. As it stands currently, practicums are integral to all pre-service teacher education programs in Canada. Nonetheless, previous research suggests that practicums may not effectively prepare pre-service teachers for their professional role (Gregory et al., 2011). Due to increasing enrolments and limited availability of placements, pre-service teachers are often restricted in terms of accessing quality practicum experiences (Muir et al., 2013). Moreover, even within placements, there is no guarantee that pre-service teachers will have the opportunity to work through their fears regarding public speaking because this is not a named outcome. In particular, there is limited support available to pre-service teachers during practicums due to the increased workloads of their academic supervisors and additional cost factors (Canadian Association of University Teachers, 1998; 1999; Campbell & Uusimaki, 2006). Moreover, pre-service teachers may feel reluctant to access general support regarding their public speaking anxiety due to feelings of embarrassment (Rickinson, 1998).

With limited chances to practice public speaking and the few instances that exist being fairly high-stakes in nature, new approaches should be considered in addition to practicum and

in-class presentations to help alleviate pre-service teachers' public speaking anxiety. Virtual reality (VR) may be one such possibility.

### **Virtual Reality Interventions**

Virtual reality is a type of virtual environment which allows users to experience situations similar to the real world, for example, by delivering an oral presentation in a virtual classroom. These environments of which VR is a part of are interactive, multisensory, three-dimensional and computer-generated (Schroeder, 1970). VR interventions in particular typically involve a head-mounted display worn by users which allows them to experience the 3D environment. Users experience the virtual environment by moving through space, examining objects from multiple viewpoints, and by interacting with pre-programmed avatars.

Previous research has shown that user experience and/or presence is related to treatment intervention outcomes (Wiederhold & Wiederhold, 2005). In particular, realistic virtual environments influence user presence, or the sensation of being in the environment which has been shown to heighten emotional responses while using VR, including feelings of anxiety (Riva et al., 2007). Although VR has historically been resource intensive (e.g., difficult to set up) and unaffordable, recent advances in technology have led to it becoming a more affordable treatment option (Maples-Keller et al., 2017). Indeed, VR has shown promise in treating public speaking anxiety.

**Evidence Supporting VR Interventions.** Previous research supports VR efficacy for the fear of public speaking compared to traditional exposure techniques. For example, Anderson and colleagues (2013) conducted a randomized control trial comparing virtual exposure therapy to in-vivo exposure for social anxiety disorder. Participants with social anxiety disorder who identified public speaking as their primary fear were recruited from a community sample. Participants were

randomly assigned to a VR exposure therapy, exposure group therapy, or wait list condition. Participants completed 8 sessions of manualized treatment and were asked to complete standardized self-report measures at pre-treatment, posttreatment and at 12-month follow-up. The study found that VR exposure therapy was equally as effective for treating the fear of public speaking as exposure group therapy. Moreover, at the 12-month follow up, participants in both active conditions showed significant improvement from pre-treatment on all measures. There were no significant differences between the VR exposure and in-vivo exposure groups at any time during the study, nor were there any differences in achieving partial or full remission. These results have since been supported by more recent studies (see Bouchard et al., 2017; Ryan & Griffin, 2016).

Empirical evidence also supports the efficacy of VR for the fear of public speaking in student populations. For example, Hinojo-Lucena and colleagues (2020) conducted a systematic review on published work from 1997 to 2019 examining VR as a treatment for public speaking anxiety in high-school and university students. Thirteen articles with a combined sample size of 481 students were indexed from two databases. Eleven studies had university students as a sample compared to 2 studies where the population was high school students. The students ranged in age from 16 to 31.36 years old ( $M = 22.67$ ;  $SD = 4.82$ ). In three of the studies students were diagnosed with social anxiety disorder, where the rest showed symptoms but had not been formally diagnosed. The duration of treatment ranged from one day to three months ( $M = 20.25$  days) while the number of treatment sessions ranged from 1 to 12 sessions. Session length ranged from 5 minutes to 90 minutes ( $M = 19.76$ ;  $SD = 23.26$ ). The intervention environments included: virtual classroom (46.15%), auditorium (38.46%), everyday situations (7.69%), meeting room (7.69%), wedding reception (7.69%), and party and presentation environment



(7.69%). Regarding their effectiveness, 10 interventions showed a positive effect (76.92%), while three studies showed a zero effect (23.07%) for VR as a treatment of public speaking anxiety. Of these three studies, each measured pre-post changes over a 1-day period with limited treatment times of 5 or 10 minutes which may explain the null results.

**VR in Teacher Education.** Although the body of literature concerning VR in teacher education is limited, some research studies show that teacher educators have begun experimenting with the use of VR to supplement pre-service teachers' learning and as part of their professional training (see Billingsley et al. 2019 for review). For example, Judge et al. (2013) investigated pre-service teachers' use of a set of behaviour management strategies in a simulated classroom. Pre-service teachers interacted with virtual avatars whose attributes were controlled by an external research assistant. Their results indicated that the majority of participants evidenced an increase in the use of differential reinforcement strategies to enhance student engagement in the classroom. Pre-service teachers also commented on the benefits of the simulator at making them "more aware of the options [teachers] have when dealing with student disruptions." Moreover, Gregory and colleagues (2011) researched the experiences of pre-service teachers who undertook a teaching role-play activity in a virtual world. In the study participants were tasked with teaching a seven-minute lesson in VR. When not teaching, pre-service teachers were asked to role-play "good" students (e.g., teacher pleasers) or "bad" students (e.g., back talkers) while other pre-service teachers delivered their lesson. The study found that 40% of the pre-service teachers found the activity to be useful. Unfortunately, some pre-service teachers were unable to role-play the part of the teacher due to technical difficulties. Of these teachers, the vast majority indicated that they did not find the activity to be useful which suggests that playing the role of teacher was the most important part of the activity from the pre-

service teachers' perspective. While these studies lend support for VR as a training supplement, they did not examine whether VR is an effective method of reducing pre-service teachers' public speaking anxiety – perhaps because this problem is not a priority in teacher education. Moreover, these studies are over a decade old. It is likely that the VR technology used in these studies has since been updated. Likewise, it is probable that users may have an easier time adjusting to VR interventions today as people have become increasingly comfortable with interactive technology. As such, this study will provide updated findings for the use of VR interventions for public speaking anxiety in pre-service teachers.

### **The Current Study**

To the best of our knowledge, virtual reality interventions for public speaking anxiety have yet to be studied among pre-service teacher populations. VR has several advantages to other treatment modalities making it an attractive option for teacher educators. VR eliminates the need to secure training environments and suitable audiences. Furthermore, VR may remove pre-service teachers' concerns or poor performance in front of familiar people (Clemmensen et al., 2020) and reduce chances of embarrassment (North et al., 1997). Thus, the purpose of the current study was to examine pre-service teachers' perspectives on public speaking anxiety and the utility of a three-session virtual reality intervention. We posed the following research questions (1) “Why is public speaking anxiety provoking for some pre-service teachers?”, (2) “Is a three-session VR intervention capable of reducing pre-service teachers' public speaking anxiety”, and (3) “What are pre-service teachers' experiences of the VR intervention?”

### **Methods**

Data were collected from a sample of pre-service teachers at the University of Alberta. This study was a multi-method single-group intervention study and was approved by the University of Alberta's Research Ethics Board (see Appendix A).

### **Participants**

Pre-service teachers who self-identified as having public speaking anxiety were eligible to participate in the study. Thirteen pre-service teachers completed the pre-test questionnaires.<sup>1</sup> Seven pre-service teachers completed the full intervention consisting of three sessions (5 women, 2 men, age 19-24,  $M = 20.86$ ). Three participants identified as Caucasian, two identified as Latin American, one identified as East Indian/Caucasian, and one identified as Southeast Asian. Five participants were enrolled in the secondary education program and 2 were enrolled in the elementary education program. Two participants were enrolled in their second year, three in their third year, one in their fourth year, and one student was enrolled in their fifth year of studies. None of the pre-service teachers who completed the intervention had any teaching practicum experience at the time of the intervention.

### **Procedure**

We recruited pre-service teachers in the Faculty of Education at the University of Alberta via posters in the Educational Building and online through the Education Student Association and the Undergraduate Student's Digest (see Appendix B). Pre-service teachers clicked the posted link and completed a pre-test questionnaire before deciding whether or not to pursue the VR intervention. The researchers contacted interested participants via email and provided information regarding the procedure for the VR intervention portion of the study which

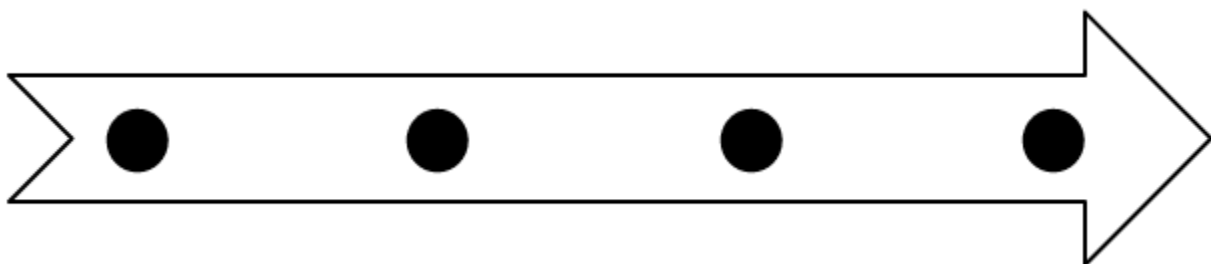
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<sup>1</sup> Baseline public speaking anxiety for the 6 pre-service teachers who did not complete the full intervention ( $M = 3.19$ ).

consisted of three sessions. Once they decided to participate, in advance of each session, the researchers sent the participant a preselected video on which to design a lecture that they would deliver to a VR classroom. In addition to delivering their prepared lesson in VR, participants completed a combination of questionnaires and/or an exit interview for each session. Session 1 began with a pre-VR interview followed by participants delivering a lesson on severe weather in VR and an exit interview. In Session 2 participants delivered their lesson about climate change in VR followed by an exit interview. In Session 3 participants delivered their lesson on zodiac constellations in VR followed by an exit interview and the post-test questionnaire. Each VR session lasted approximately 15-20 minutes. VR sessions were scheduled based on participant availability and took place over a period of 5 months from October 2019 to February, 2020. On average, participants finished the in-person sessions over a 5-week period. The full procedure is summarized in Figure 1.

**Figure 1**

*Brief Virtual Reality Intervention Procedure*



Pre-VR	Session 1	Session 2	Session 3
Pre-test Questionnaire - Background Questions - Public Speaking Anxiety Scale - Mindset Scale	Pre-VR interview Lesson in VR Exit Interview	Lesson in VR Exit Interview	Lesson in VR Exit Interview Post-test Questionnaire - Public Speaking Anxiety Scale - Mindset Scale - VR Presence Scale

## Measures

We collected demographic data from participants as well as a combination of open-ended and likert-scale questions at each VR session to answer each of our three research questions from.

**Background questions.** Prior to the VR intervention (Pre-VR Figure 1), participants identified their age, gender, ethnic background, program, year of studies, and if they had completed any practicum placements. This information was used to describe the sample (see above). To get a sense of how anxious participants were, we asked them to rate their anxiety about their practicum (1 = not at all 5 = very) and to indicate if they would value opportunities to practice public speaking prior to their practicum (yes, no). In the Session 1 pre-VR interview, we orally asked participants “What makes you most anxious about speaking in front of students?” and recorded their responses.

**Pre-post questionnaires.** To measure the impact of the VR intervention on mindsets and public speaking anxiety, participants completed self-report scales before the first VR session and after the third VR session. Specifically, participants completed an adapted Theories of Intelligence Scale (Dweck, 1999). We used this scale because it has evidence of high reliability ( $\alpha = .93$ ). Students responded to three questions on a 5-point likert scale (1=strongly disagree,

5=strongly agree). The items included “You have a certain amount of performance anxiety, and you can’t really do much to change it”, “Your performance anxiety is something about you that you can’t change very much”, and “You can learn new things, but you can’t really change your levels of performance anxiety.”

Participants also completed the Public Speaking Anxiety Scale (PSAS; Bartholomay & Houlihan, 2016). We used this scale because it has evidence of high reliability ( $\alpha = .93$ ). Participants responded to 17 items on a 5-point likert scale 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Items addressed participants’ thoughts on public speaking, for example, “Giving a speech is terrifying”, and participants’ experiences giving a speech, for example, “My heart pounds when I give a speech.”

**Intervention.** Participants delivered three lessons to a VR classroom. This study used the Virtual Orator© program to simulate a school classroom. Virtual Orator© enables researchers to adjust audience size and avatar behaviour to fit training needs and purposes. For the purpose of this study, we adjusted audience behaviour to mimic the behaviour of older students in a classroom as we did not have access to elementary student avatars. For each session, there were 22 male and female students in attendance representing various ethnicities. The student avatars were informal in their actions and were friendly towards the pre-service teachers. The audience was generally unconcentrated due to frequent distractions including students talking to one another and noise outside of the classroom. However, some of the student avatars showed interest and engagement by nodding and maintaining eye contact. The student avatars were unable to raise their hands, ask or answer questions when asked.

## Figure 2

*Example of the Virtual Reality Classroom*



**VR experience questions.** To understand participants' experiences with VR, they completed an adapted VR Presence scale (Witmer & Singer, 1998) after the third VR session. The VR Presence scale was chosen given its widespread use in VR research in addition to its evidence of reliability ( $\alpha = .81$ ; Witmer & Singer, 1998). Participants responded to seven items on a 7-point likert scale. Of these, we examined individual scores on four items that addressed the participants' perceptions of the VR environment (see Table 3): "How natural did your interactions with the environment seem?", and participants' interactions with the environment, for example, "How much did the visual aspects of the environment involve you?" Participants also responded orally to four questions designed to capture their experience of VR: (1) "Did you feel more nervous having us [the researchers] in the room?" (2) "Did you like the VR intervention," (3) "Will it benefit you in real life?" and (4) "What did you hope to get out of it?". We examined scores and responses for each participant individually to capture their overall experience of VR.

### **Plan for Analyses**

We conducted our data analysis in three stages. To answer our first research question, we examined pre-service teachers' responses to the various background questions and conducted a thematic analysis on responses to the question "What makes you most anxious about speaking in front of students?". To answer our second research question, we conducted paired samples *t*-tests to examine whether there were any significant changes on the Mindset questionnaire (Dweck, 1999) and the Public Speaking Anxiety Scale (PSAS; Bartholomay & Houlihan, 2016) following the VR intervention. Finally, to answer our third research question about the VR experience, we examined participants' individual responses on the Adapted VR Presence scale (Witmer & Singer, 1998) and to the four open-ended questions.

### **Results**

This study had three objectives. The first was to explore pre-service teachers' perspectives on public speaking anxiety (see RQ 1) while the second was to examine the potential utility of a three-session VR intervention at increasing pre-service teachers' growth mindset about public speaking (i.e., that they could improve) and reducing their self-reported public speaking anxiety (see RQ 2). Our third objective was to examine pre-service teachers' experiences of the brief VR intervention (see RQ 3). Results are reported by the three objectives as follows.

#### **Pre-service Teachers' Perspectives on Public Speaking Anxiety**

All seven participants indicated that if given the chance they would practice public speaking before their practicum placement and their anxiety about the practicum ranged from 3 to 5 (median = 4, 5-point scale). In terms of their oral responses to the question, "What makes you most anxious about speaking in front of students?," two research assistants independently



coded the responses and then compared and discussed any discrepancies in their themes until consensus was achieved. Three themes were identified across the two coders as summarized in Table 1.

**Table 1**

*Description of Emerging Themes with Sample Statements*

Theme	Description	Sample Statement
Communication difficulties	Experiencing communication difficulties when speaking in front of students.	“Um, normally forgetting what I am trying to say, and just like looking like I don't know the material very well.”
Expectations of others	Fear of not meeting the expectations of other people when speaking in front of students.	“I guess that it's the pressure that they expected you to do everything well...”
Judgment of others	Fear of judgment from other people when speaking in front of students.	“Um, just like I guess if you were to make a mistake, especially at the grades I want to teach like junior high they tend to be quite judgmental and so making a mistake in front of them gives them plenty of opportunity to judge you and make you know their judgment.”

Pre-service teachers commented on *communication difficulties* as being one of their main sources of anxiety when speaking in front of students. As an example, one pre-service teacher commented “you know the idea like going blank and forgetting what you are going to say because of the pressure.” Aside from forgetting what they had planned to say, several pre-service teachers expressed the fear of not being able to explain the subject matter clearly. For example, one pre-service teacher expressed concerns over “...being able to deliver it without like stuttering

and stuff” while another worried about their “thoughts not coming out coherently” and “not going to be able to explain um what you need to explain properly, that it will be all jumbled up.”

Pre-service teachers also commented on the *expectations of others* as being a source of anxiety when speaking in front of students. For example, one pre-service teacher commented, “...they expect you to know what you are doing” while others mentioned, “that they expect you to do everything well” and “...to know everything.” Moreover, several pre-service teachers expressed concerns that they worried about being *judged by others* when speaking in front of students. As an example, one pre-service teacher commented, “Um just like I guess if you were to make a mistake, especially at the grades I want to teach like junior high they tend to be quite judgmental and so making a mistake in front of them gives them plenty of opportunity to judge you.” Similarly, another pre-service teacher commented, “I’m scared that they are going to judge me.”

Aside from *communication difficulties*, *expectations of others* and being *judged by others*, pre-service teachers expressed concerns about not being prepared for their lesson, not being familiar with the subject matter, having difficulties with classroom management and being at the center of the students’ attention when speaking in front of students.

### **Utility of a Brief VR Intervention**

Our results indicated that there were significant changes in participants’ mindsets and public speaking anxiety after the three-session VR intervention (see Table 2). In particular, participants endorsed more of a growth mindset after completing the three VR intervention sessions. Indeed, participant’s scores on the mindset measure changed by almost one full-point after their VR sessions. Additionally, pre-service teachers experienced lower public speaking anxiety after the three sessions of the VR intervention compared to before the intervention. The

magnitude of change on the PSAS (.47) was considerably lower comparable to previous VR research (see Kahlon et al., 2019).

**Table 2**

*Mean differences of mindsets and public speaking anxiety at pre-test and post-test*

Variable	Pre-test		Post-test		<i>t(df)</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Mindset (higher score more fixed)	2.71	1.18	1.81	.72	2.45(6)	.05
Public Speaking Anxiety	3.60	.31	3.13	.27	3.01(6)	.024*

*Note.* \*Significant at the  $p < .05$  level.

### **Pre-service Teachers' Experiences of the Brief VR Intervention**

Finally, we examined pre-service teachers' responses to several likert-scale and open-ended questions to understand their experience of the brief VR Intervention. From a quantitative perspective, participants had relatively high scores on the Adapted VR Presence Scale (Witmer & Singer, 1998). Participants scored above the midpoint on all items with the highest agreement with the item "How quickly did you adjust to the virtual environment experience". Individual scores and means for the seven participants are displayed in Table 3.

Based on their oral responses, we determined overall agreement/disagreement with the question as well as individual explanations. In terms of agreement, pre-service teachers were split on the effect of having the researchers in the room with them. Three out of the seven pre-

service teachers commented that they did not feel more anxious having the researchers in the room. Four pre-service teachers commented that they did feel more anxious having researchers in the room. Some reasons for heightened anxiety included “I think if it was just me in this room alone it would have been a little easier,” while another pre-service teacher commented, “It is still a little bit nerve wracking cause like you know there is someone else in the room still with you.”

All seven of the pre-service teachers explained ways that they liked the intervention. Four pre-service teachers commented on the *realism of the VR classroom* as compared to a conventional teaching classroom as a reason as to why they liked the VR intervention. One pre-service teacher commented, “Yah it kind of gets you first person perspective, from like what it would actually be like with like students like looking at you.” Similarly, another pre-service teacher mentioned, “I feel like it creates like an atmosphere where like it feels pretty real like there is students right in front of you.” Moreover, several pre-service teachers commented on the realism of the student avatars. For instance, one pre-service teacher commented, “...It looked like actual students doing their own thing, it looked like some of them weren't paying attention, some of them looked bored, some of them looked like they were paying attention.” Even though they overall liked the program, some pre-service teachers described ways to improve the Virtual Orator© program. For example, two pre-service teachers commented, “...it doesn't replicate the real scenario perfectly” while another commented “...It's not as convenient because you can't really move around and do like activities where the students are like discussing with you.”

All seven pre-service teachers described ways they believed that the intervention would benefit them in practice. Four pre-service teachers commented on the benefit of having more opportunities to practice public speaking. One pre-service teacher commented, “I think it was a good practice just to come in and talk in front of people, or like even if they aren't real people

just having something there to you know help yourself prepare to feel what it's like to have to teach a lesson.” Similarly, another pre-service teacher expressed, “...any time you are practicing lecturing or speaking it's going to help...” Additionally, pre-service teachers commented on the benefit of VR in helping them to develop their teaching abilities. In particular, one pre-service teacher commented, “...with actually teaching in a classroom timing is pretty unpredictable right so I think this is a good way to um practice actually sticking to your lesson plan as you plan it ” while another commented on the benefit of being able to use VR to prepare them to, “[deal] with uncertainty of what's going to happen, whether you have answers or not, interruptions, and distractions.”

**Table 3**

*Participants’ Individual Experiences of the Brief VR Intervention*

Participant	A	B	C	D	E	F	G	M	SD
Adapted VR Presence Scale – Likert Questions									
How quickly did you adjust to the virtual environment experience? Anchors 1 = Not At All 7 = Less Than One Minute	7	7	6	4	5	7	6	6	1.16
How proficient in moving and interacting with the virtual environment did you feel at the end of the experience? Anchors 1 = Not Proficient 7 = Very Proficient	7	6	6	5	7	5	5	5.86	.90
How involved were you in the virtual environment experience? Anchors 1 = Not Involved	7	5	6	7	6	5	4	5.71	1.11

7 = Completely Engrossed									
How much did your experiences in the virtual environment seem consistent with your real world experience? Anchors 1 = Not Consistent 7 = Very Consistent	7	6	5	4	4	3	6	5.00	1.41
Open-ended oral questions									
Did you feel more nervous having us [the researchers] in the room?"	No	No	Yes	Yes	Yes	Yes	No	--	--
Did you like the VR intervention?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--
Will it benefit you in real life?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	--	--

Finally, the majority of pre-service teachers indicated that their main hope was that the VR intervention would lessen their public speaking anxiety and allow them to feel more comfortable when public speaking. For example, one pre-service teacher commented, "I'm just hoping that I'll be able to speak clearly without having any negative thoughts" while another mentioned the goal of becoming "...more comfortable speaking in front of groups." Moreover, several pre-service teachers expressed an interest in having the opportunity to practice public speaking. For example, one pre-service teacher commented, "I'm hoping that through practicing with the virtual reality that I might be able to build some confidence in my abilities to speak in front of an audience." Similarly, another pre-service teacher expressed that having the ability to practice public speaking would help them to "...become more confident up in front of like a bunch of people."

## Discussion

Our research examined pre-service teachers' perspectives of public speaking anxiety and the utility of a three-session virtual reality intervention. In this discussion, we discuss (a) how our findings elaborate on pre-service teachers' sources of public speaking anxiety and (b) how a VR intervention can help pre-service teachers deal with public speaking anxiety and facilitate a growth mindset and (c) offer suggestions as to how teacher educators might incorporate our findings when developing training materials for pre-service teachers. In closing we also discuss limitations of our research and some recommendations for future research.

### Pre-Service Teacher Anxiety

Pre-service teachers' experiences with public speaking anxiety centered around *communication difficulties* as being their main source of anxiety. In particular, pre-service teachers worried that they would experience communication issues (e.g., dysfluency, mind going blank, not being coherent) when speaking. There is the possibility that pre-service teachers ruminated on the negative aspects of the public speaking situation. In fact, most pre-service teachers spoke to previous public speaking engagements that were unsuccessful. It may be the case that rumination, or dwelling on negative thoughts made pre-service teachers hyper aware of mistakes they could make when public speaking. There is also a strong possibility that pre-service teachers' anxiety about public speaking resulted in them experiencing difficulties with communication. This finding is consistent with research by Hasibuan and Irzawati (2019) who found that English as a Foreign Language (EFL) university students' speaking anxiety was negatively correlated with their speaking performance which measured pronunciation, grammar, vocabulary, and comprehension. One potential avenue that can be used in practice to help pre-service teachers with communication issues is to improve their self-confidence in their public

speaking abilities. In particular, previous research has shown that self-confidence is positively correlated with speaking achievement (Tridinanti, 2018). As such, it may be beneficial to place more emphasis on helping pre-service teachers to build self-confidence in their public speaking skills during their professional training.

The second and third themes we identified with regards to why public speaking was anxiety provoking for pre-service teachers were *expectations of others* and being *judged by others*. Several pre-service teachers commented on being expected to “know everything” and “to do everything well.” These comments are problematic as they insinuate that pre-service teachers are expected to be naturally good at teaching and to not make mistakes while learning how to teach. It may be the case that these unrealistic expectations resulted in pre-service teachers fearing judgement from other people, for example their students or mentor teachers. In fact, several pre-service teachers expressed a concern over being judged by others when public speaking. This finding is consistent with work by Kim and Kim (2004) who examined anxiety provoking situations for foreign language pre-service teachers in Korea. Their study identified several sources of foreign language teaching anxiety including being compared to native English-speaking teachers (i.e., expectations) and fear of negative evaluation by students. Helping pre-service teachers to feel comfortable with public speaking in the future may help alleviate these fears.

Lastly, some pre-service teachers mentioned additional sources of anxiety as contributing to their public speaking anxiety including being ill-prepared for their lesson, not being familiar with the subject matter, having difficulties with classroom management, and being at the center of students’ attention. As such, it seems that pre-service teachers conflated their sources of anxiety regarding public speaking precisely with their generalized anxiety about teaching



responsibilities. This finding is consistent with previous work by Merç (2011), Agustiana (2014) and Aydin (2016). It is important to note that none of the pre-service teachers had any practicum experience at the time of the intervention. It may be the case that practicums could have helped alleviate some of their general teaching anxiety and to the extent that is conflated with public speaking anxiety also helped to resolve that concern. Given this, it would be timely that these teachers receive support for teaching anxiety prior to practicum as well as during.

### **VR Intervention: Effectiveness and Experience**

Our results indicated that there were significant changes in pre-service teachers' mindsets after the three VR sessions. In particular, pre-service teachers endorsed more of a growth mindset after completing the VR intervention. Specifically, pre-service teachers believed that they could change their level of public speaking anxiety to a greater extent at the end of the intervention compared to before. It may be the case that allowing pre-service teachers to reflect on their public speaking anxiety and performance in real time resulted in changes in their mindsets. This notion is consistent with Korstange (2016) who argues that training students to think reflectively helps them to develop a growth mindset. In particular, the intentional, structured or systematic analysis of process and outcomes has the potential to lead to gains in student retention and persistence, which in turn could help students to develop a growth mindset (Korstange, 2016). As such, future public speaking anxiety interventions may benefit from the addition of reflection exercises.

In line with previous research (Stupar-Rutenfrans et al., 2017), our study found that a VR intervention was successful at reducing pre-service teachers' public speaking anxiety. The magnitude of change on the PSAS (.47) was considerably lower comparable to previous VR research (see Kahlon et al., 2019). Further research is warranted to see whether significant

comparable changes on the PSAS are replicated in a larger sample size. The success of the virtual reality intervention may in part to the pre-service teachers' experiences with the Virtual Orator© program. Pre-service teachers expressed that they enjoyed the *realism* of the virtual reality classroom compared to a conventional teaching classroom. Moreover, pre-service teachers shared the belief that the VR intervention was consistent with their real-world experience. Our findings support previous research by Witmer and Singer (1998) who found that the effectiveness of virtual reality is linked to the presence or sensation of its users. Similarly, previous research found that users of a digital mental health intervention for depression liked interventions with interactive relatable content and a game-like feel (Garrido et al., 2019). Overall, all seven pre-service teachers had positive perceptions of the Virtual Orator© program even though they had ideas for how to improve it in the future.

Moreover, all seven pre-service teachers indicated that they believed that the three-session VR intervention would benefit them in practice. Together, these findings lend support for Expectancy-Value theory (Eccles et al., 1983) which postulates that achievement-related choices are motivated by a combination of expectations for success and subjective task value. For example, people are more likely to pursue an activity if they value it and expect to do well (Eccles et al., 1983). Expectancy-Value theory differentiates task value into four components: *attainment value* (i.e., importance of doing well), *intrinsic value* (i.e., personal fulfillment), *utility value* (i.e., perceived usefulness for future goals), and *cost* (i.e., competition with other goals). Pre-service teachers found the Virtual Orator© program to have *utility value*, or to be useful at preparing them for their professional roles as teachers. Building usefulness and more realistic features into future VR interventions may make pre-service teachers more likely to access support with their public speaking anxiety in the future.

### **Implications for Research and Practice**

Previous research suggests that teacher training programs could integrate VR into their training programs to support learning and aid in preparation for practicum (e.g., Judge et al., 2013; Gregory et al. 2011). Our results highlight an additional benefit of VR to help build growth mindsets and reduce public speaking anxiety. For students who suffer from public speaking anxiety, it might be beneficial for students to practice lessons in VR before delivering their lesson to a group of students. VR allows pre-service teachers to engage with the student avatars in a similar manner to which a teacher would engage with their students (e.g., posing questions, discussion facilitation, behaviour management etc.). Aside from students, teachers are required to speak with staff and parents. VR might provide pre-service teachers with the opportunity to practice public speaking in other anxiety provoking situations, for example, discussing differences of opinion with colleagues and/or parents. Likewise, it may make these situations when faced in real life feel less daunting. Moreover, the brief nature of the VR intervention, in terms of the number of sessions and time pre-service teachers spend in VR makes this an economical choice for pre-service teachers and educators alike. In conclusion, VR can be considered not only for the treatment of public speaking anxiety, but also as a tool to help pre-service teachers develop skills that will help prepare them for their professional careers.

### **Limitations and Future Directions**

While our findings provide important insights that can support pre-service teacher training, four limitations should be mentioned. First, our sample was limited to pre-service teachers at one Canadian institution who chose to participate out of concerns with public speaking. Future research should consider reflections from other pre-service teachers in other institutions, provinces and even countries. Although it is not uncommon to focus on a single

training site in educational research, the availability of the VR programs could allow researchers to gather reflections of pre-service teachers from around the world. We encourage teacher educators to consider using VR as part of their teacher training materials. It appears as though pre-service teachers found the Virtual Orator© program to be a helpful learning tool. As such, a three-session VR intervention could become a pedagogical tool as much as it served a purpose in the current study.

Second, in terms of design our study had a relatively small sample size ( $n = 7$ ) compared to recent VR studies (see Takac et al., 2019) and did not include a control group. Nonetheless, the sample offers promising preliminary data. Additionally, there was not an active comparison group which limits our ability to claim the benefits were the sole product of the three-session VR intervention. For example, it would be interesting to compare the brief VR intervention compared to a control group of university students using a non-VR platform with a larger sample size.

Thirdly, although participants liked the Virtual Orator© program and it was effective in bringing about our hypothesized results, it lacked the ability for participants to interact with the student avatars. Although the current study was designed to imitate a classroom environment, future research using VR to address public speaking anxiety may benefit from interactive features. This would allow the user to engage with the student avatars in a similar manner to which a teacher would engage with their students (e.g., discussion facilitation). An investigation by Pertaub and colleagues (2001) showed the effectiveness of real time social interactions (e.g., animated group comments) between VR avatars and participants. It may be the case that pre-service teachers would feel more prepared to enter the classroom having had the opportunity to teach and manage classroom behaviours simultaneously. Relatedly, the Virtual Orator© program

lacked access to young (i.e., elementary) student avatars. As realism is related to VR intervention effectiveness, other interventions would benefit from access to young student avatars, particularly for pre-service teachers training to teach elementary education.

Lastly, several pre-service teachers expressed that they did not know what to expect regarding the VR program itself. Although preparation materials were given, it would be beneficial for future researchers to give a more detailed description of the VR programs they will be using to reduce participant anxiety as uncertainty regarding the VR program could influence baseline measures. Likewise, some pre-service teachers experienced anxiety when asked to teach content that they were unfamiliar with. Adapting content in future studies to match pre-service teachers' content area (e.g., math, English, social studies etc.) could reduce pre-service teachers' anxiety prior to delivering their lesson in VR.

## **Conclusion**

In closing, the results from our study provide researchers and teacher educators with valuable information to support pre-service teachers who struggle with public speaking anxiety. Although it may not be a top priority in preparing pre-service teachers for their role, public speaking anxiety may represent an additional stressor for some who choose the profession. Given that VR seems to be a viable treatment for public speaking as well as a space to develop additional skills (Cheong, 2010; Gregory et al. 2011), we encourage teacher educators to consider its potential for significant impact in the field of pre-service teacher education.

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## Appendix A

## Ethics Approval

**Notification of Approval**

Date: February 1, 2019  
Study ID: Pro00086675  
Principal Investigator: [Torrey Loucks](#)  
Study Title: Virtuoso in VR: Virtual Reality can reduce Performance Anxiety  
Approval Expiry Date: January 31, 2020  
Sponsor/Funding Agency: Sound Studies Institute, University of Alberta

Thank you for submitting the above study to the Research Ethics Board 2. Your application has been reviewed and approved on behalf of the committee.

A renewal report must be submitted next year prior to the expiry of this approval if your study still requires ethics approval. If you do not renew on or before the renewal expiry date, you will have to re-submit an ethics application.

Approval by the Research Ethics Board does not encompass authorization to access the staff, students, facilities or resources of local institutions for the purposes of the research.

Sincerely,

Ubaka Ogbogu, LLB, BL, LLM, SJD  
Chair, Research Ethics Board 2

*Note: This correspondence includes an electronic signature (validation and approval via an online system).*

## Appendix B

## Recruitment Letter

# Are you a pre-service teacher in the Faculty of Education? Are you nervous about public speaking?



<https://greatperformersacademy.com/interesting/education-3-0-how-virtual-reality-will-change-the-way-we-learn>

The ACME lab is looking for pre-service teachers to take part in an academic study. Interested students will be asked to complete an online questionnaire and then may be invited to up to 3 Virtual Reality sessions designed to reduce performance anxiety. If you are interested in taking part, or if you have any questions contact us at

[bhoy@ualberta.ca](mailto:bhoy@ualberta.ca).