ORAL PRESENTATION COMPETENCE IN VIRTUAL REALITY

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Abstract

Chenyu Hou: Oral Presentation Competence in Virtural Reality
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Oral presentation is increasingly important in higher education and workplaces, while many students reported that their presentation skills were inadequate for work or academic presentations. Traditional instructional methods to improve presentation skills are time-consuming, so many researchers have attempted to use automated feedback systems to provide students with timely feedback and virtual simulations to offer a practice environment. Presentation competence is a multidimensional construct with cognitive, behavioral and emotional components. However, studies on the affective components during oral presentation have concentrated on pathological public speaking anxiety, while limited studies have addressed the variety of emotions in virtual simulations that predict the virtual reality efficacy. The current study focused on students' emotional experiences of practicing oral presentation in a virtual simulation. The quantitative analysis shows that participants did not improve their presentation skills with the virtual simulations. The study utilized code mapping analysis to analyze qualitative data from focus groups and survey answers. Four kinds of emotions emerged: 1) Increased level of comfort; 2) Frustration with the feedback; 3) Awkwardness with irrealistic simulations; 4) Anxiety over negative avatar interactions. Limitations and future research directions are also identified.

To my mentors, family and friends.
To my little cat, Hulu.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1: INTRODUCTION

Oral presentation is a critical component of higher education. It is defined as *a combination of knowledge, skills, and attitudes needed to speak in public to inform, self-express, relate, or persuade* (De Grez et al., 2009). Its merits include fostering deep learning, eliciting students' reflective thinking on learning material and promoting effective communications among classmates (De Grez et al., 2009). Higher education is also the place where students build professional skills in oral presentations for their future careers (Chan, 2011). With the rise of digital learning, many university students learn with digital tools such as pre-class videos, visualizations, and automated feedback. A portion of the courses becomes self-directed, and professors reported difficulties finding space in the curriculum to address presentation competence (Chan, 2011). Graduates from universities reported that their oral presentation skills are inadequate for workplaces (Andrews & Higson, 2010). A systematic review of oral presentation pointed out that an oral presentation includes cognitive, behavioral and affective components (van Ginkel et al., 2015). Researchers need to consider all three aspects in designing an effective learning environment to promote oral presentation competence (van Ginkel et al., 2015). However, studies on the affective components during oral presentation have concentrated on pathological public speaking anxiety, while limited studies have addressed the variety of emotions in virtual simulations that predict the virtual reality efficacy. Recent research has been working on studying innovative tools that could provide informative practice spaces for oral presentations and address possible negative emotions associated with public speaking.

The Current Study

It remains an ongoing investigation about the effectiveness of digital learning tools. For oral presentations, many researchers have utilized various techniques to improve students' presentation skills. For example, video-taping the presentation for self-assessment might help track improvement (Simpson et al., 2019). Ginkel et al. (2019) found that analytical feedback of virtual reality facilitated their practice. The current study involves a simulation-based learning tool that allows students in an entrepreneurship course to practice delivering their presentations to avatars and receiving instantaneous evaluations. During the presentation, the avatars will respond to students' speech through gestures, such as nodding, looking away, and chatting, based on students' speech content. After the presentation, the automated evaluation would rate the performance with eight scales, including pitch variability, pace variability, volume variability, verbal distractors, total pauses, pace, long pause, and eye contact. The study was designed to demonstrate that students can improve their oral presentation through practice, and the virtual space can foster positive emotions associated with public speaking. Specifically, the research questions are:

1. Can participants' presentation competence improve using this virtual simulation?
2. What are students' emotional experiences using this virtual simulation?

I hypothesizes that participants can improve their oral presentation through practicing in a virtual environment over the semester, and students would experience less negative emotions associated with public speaking.

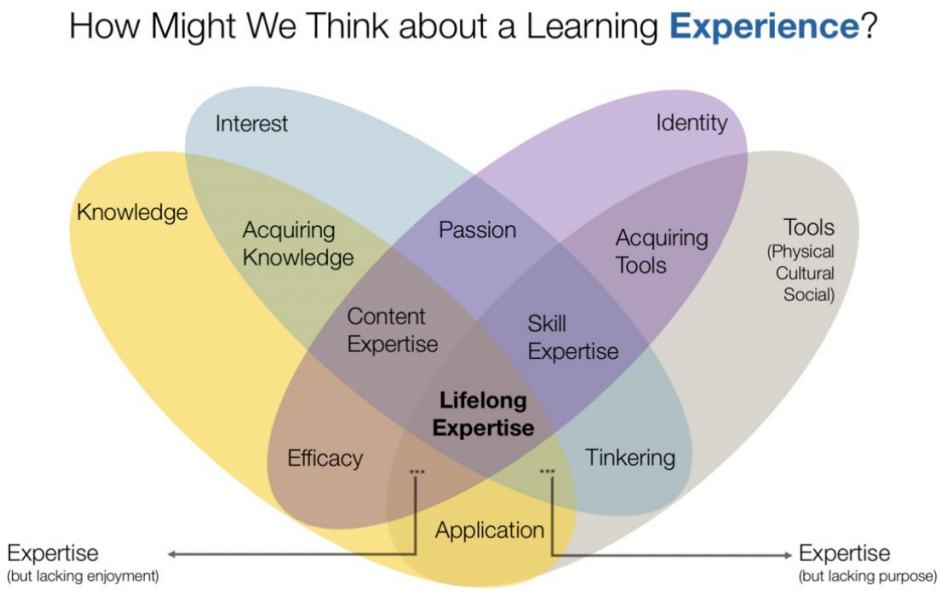
Theoretical Framework

Ahn (2018) describes a recent shift from instructional design (ID), which assumes that students learn in a fixed location, to learning experience design (LX), where students learn in formal and informal locations. Ahn (2018) proposes a framework that manifests the interrelated

influences of knowledge, interest, identity and tools on learning environment design (see Figure 1). In the context of oral presentation competence, knowledge refers to students' skills in delivering their ideas and engaging audiences. Interest refers to their learning motivation of class materials. Identity, in this study, refers to entrepreneurship students who are aware that oral presentation is a critical part of their future careers. Lastly, the tool in this study is the virtual simulation that evaluates students' oral presentations. By combining all four elements, this study intends to foster a long-term improvement in presentation competence.

Figure 1.

Learning Experience Design Framework



Note: Graph adopted form Ahn (2018).

Control-Value Theory

Fewer learning theories describe the impact of emotions on communication skills, but educational psychologists are aware that learners' emotions significantly impact learning outcomes, and positive emotions would facilitate students' self-regulated learning (De Grez et

al., 2009; Wolter, 2003). Pekrun (2006) proposes a Control-Value Theory that illustrates the cyclic feedback processes among emotions, cognitive effects, and learning outcomes. Control-Value Theory presents an integrative framework to investigate emotions in academic contexts. It illustrates that subjective control and value over a task link to the achievement emotions, which are defined as emotions directly associated with the achievement outcomes. The achievement emotions that recur multiple times would develop into trait achievement emotions such as test anxiety. Students' appraisal of their control over a specific learning task can be generally divided into situation-outcome expectancies, action-control expectancies and action-outcome expectancies (Pekun, 2006).

Situation-outcomes expectancies refer to the probability that a situation would produce positive outcomes with no actions taken. For example, in the context of oral presentation, if the audiences are passionate about the topic, the situation-outcomes expectancies would be high for positive outcomes (high situation-outcome expectancies). Action-control expectancies imply the ability to produce an action. In the presentation, students' capacity to produce a persuasive speech is denoted as high action-control expectancies. Lastly, the action-outcome expectancies refer to the prediction about the outcomes associated with the action. For example, if a student is not confident in his presentation competence, the student would predict failure (low action-outcome expectancies).

Value in the Control-Value Theory is two-folded (Pekun, 2006). Intrinsic value is directly related to the task itself. For example, if the task itself is straightforward and exciting, students would assign high intrinsic value to such a task. Extrinsic values refer to the usefulness of the task for future goals. For example, students might evaluate a given class activity based on

future career orientation. A positive value placed on a task means that the learner hopes to achieve success, while a negative value means avoiding failure (Pekun, 2006).

Control-Value Theory and Oral Presentation

Control-Value Theory can be the foundation to investigate emotions associated with oral presentation. The Control-Value Theory includes prospective emotions, retrospective emotions, and activity emotions, but prospective emotions are most closely related to oral presentation. An example of prospective emotions is anxiety before and during the presentation. Perkun (2006) theorizes that prospective outcome emotions are based on outcome expectancies and outcome value. A typical temporary order of appraisal of failure emotions has three steps. The first step is situation-outcome expectancy. Students decide the probability of failures. For example, students can evaluate the probability of failing an oral presentation based on previous experience, confidence, and potential audiences. If failure is possible, students would appraisal the value of such failure to themselves and their future. For example, a class presentation might directly link to their final scores, while a business presentation could be critical for their future career. Lastly, they evaluate their control to see if subjective actions could be taken to avoid failure. In the context of oral presentation, subjective actions include practicing, getting feedback, and preparing drafts. Students will experience anticipatory relief if they have high control and hopelessness if they have low control. Most significantly, if their control over oral presentation is uncertain (i.e., there is a probability of success and threat of failure), they might feel hope and anxiety simultaneously (Pekun, 2006).

Table 1.

Control-Value Theory: Basic Assumptions on Control, Values, and Achievement Emotions

	Appraisals		
Object focus	Value	Control	Emotion
Outcome/prospective	Positive (success)	High	Anticipatory joy
		Medium	Hope
		Low	Hopelessness
	Negative (failure)	High	Anticipatory relief
		Medium	Anxiety
		Low	Hope

Note. Table excerpted from Pekun (2006).

Control-Value Theory implies that fostering positive emotions by empowering the control of learning tasks and shaping the outcome expectancy would lead to higher achievement (Pekun, 2006). Recent empirical studies on communication competence have pointed to the same direction that the pedagogical model of oral communication should emphasize the interrelationship among cognitive, behavioral, and affective dimensions (Bower et al., 2011; De Grez et al., 2009; van Ginkel et al., 2015). Therefore, this study was designed foster students' positive emotions in learning oral presentation through two paths with virtual simulation. For starters, there is no harm to the students associated with failure in a simulation, so Control-Value Theory predicts no negative emotions (Pekun, 2006). A virtual simulation allows the student to have complete autonomy and control over delivering a presentation. Students can decide the time, location, and frequency they use the simulation, which might increase their action-control expectancies. Avatars' non-verbal gestures would positively or negatively respond to students'

speech content, which would help them evaluate their total expectancy of success. I hypothesizes that students can improve their oral presentation competence with virtual simulation and not experience negative emotions associated with oral presentations.

CHAPTER 2: LITERATURE REVIEW

Previous research has cast light on the efficacy of virtual reality in educational settings (Vallade et al., 2021). Virtual simulations provide a safe environment for students to practice their oral presentations. The current study investigates students' emotions of practicing oral presentation in a virtual simulation. In this section, I will first review previous research on fostering oral presentation competence and then move to the importance of emotions in learning. Similar to emotions in traditional learning contexts, emotional experiences in virtual realities may also impact the learning outcomes. However, studies on emotions during oral presentation have concentrated on pathological public speaking anxiety. Limited studies have addressed the variety of emotions in virtual simulations that predict the virtual reality efficacy. Therefore, I want to fill the gap by studying students' emotional experiences during oral presentation in virtual simulations.

Oral Presentation Competence

Summarizing past research on oral presentation, a systematic review points to a comprehensive model to build a learning environment (van Ginkel et al., 2015). It indicates that research on oral presentations has three categories. The first line of research that considered here investigates the effect of feedback on presentation competence. The most common feedback sources for oral presentation are peers, teachers, and tutors. In general, students prefer feedback from authoritative sources such as teachers and tutors, which strengthens the result that students benefit most from teachers' feedback (van Ginkel et al., 2017a, 2017b). Simpson et al. (2019) revealed a slightly contradictory pattern that the participants do not perceive assessors' feedback

as more useful than peers. The authors noted that students found it easier to connect assessors' feedback with their presentation with the aid of peer feedback and examplar videos (Simpson et al., 2019). In addition, students learned more from immediate feedback than delayed ones (van Ginkel et al., 2015). Another prominent source of feedback in recent decades is students themselves. By watching their recorded presentation, the student can critically reflect on their own performance and challenge their self-assumptions about their competence. A study utilizing reflective journals found that students can reflect on their own performance from multiple levels after watching their videotaped presentation (Li & Peng, 2014). In addition, students were more likely to reflect on their non-verbal characteristics using recorded videos (Simpson et al., 2019).

The second line of research to be considered on oral presentation is instructional design. De Grez et al. (2009) argued that presentation activities tailored to course content and students' interests improve students' engagement in countent learning. This result also aligns with the Control-Value Theory that students would evaluate the values of learning activities. When the activities are interesting and rewarding, their engagement is high. Moreover, teachers need to explicitly state the expectations to help students formulate their goals. Deliberate practices aiming at specific goals would most effectively foster competence (van Ginkel et al., 2015). Studies also showed that scaffolding is effective for presentation competence. Econopouly et al. (2010) revealed that an easy presentation followed by more challenging topics significantly impacts competence. Thus, instructional designs that offer scaffolding and articulate expectations are more likely to foster self-efficacy and decrease communication anxiety (van Ginkel et al., 2015).

The third line of research focuses on practice conditions that promote competence. Oral presentation is time-consuming, so teachers normally expect students to practice on their own time. As a result, self-learning is the dominant approach with which students acquire presentation skills (Bankowski, 2010). Students can improve presentation skills through observations. Building on social learning theory, in which modeling is important for skill-learning, one study provide students with experts or peer models of presentation to improve their self-efficacy beliefs (van Ginkel et al., 2015). While it is intuitive that more rehearsal result in better performance, studies show that practice and presentation might be curvilinearly related (Smith & Frymier, 2006). There are scare studies that examine the optimal number of practices for oral presentation improvement. A recent study showed no improvement in performance after the third time of practice (Boetje & Ginkel, 2021). In addition, how students perform these practices would also impact their presentation improvement. Smith and Frymier (2006) demonstrated that students practicing in front of large audiences outperform students with small or no audiences. Studies indicate that practices produce high efficacy in authentic settings with interactions (Chan, 2011; Vallade et al., 2021). While presentation rehearsals are practical ways to improve competence, their drawbacks are also obvious. The lack of realism limits students' ability to interact with the audience, such as through pitch variety or eye contact. To facilitate students' practices, researchers have built different models with automated assessment and feedback .

Oral Presentations with Automated Feedback

Traditional practice conditions and feedback qualities have many limitations. The lack of attentive audiences to practice and the uneven quality of formative feedback hamper the development of presentation skills in higher education (Ochoa & Dominguez, 2020; Van Ginkel

et al., 2020). Additionally, limited attention is paid to audience interaction, while paralinguistic features (e.g., visual aids ad and body language) are critical components for a presentation (Uştuk & Aydın, 2018). Therefore, many researchers are exploring innovative tools that might compensate for the limitations of traditional methods.

Quite a few recent studies are investigating the effect of automated feedback presented in a virtual environment (Ochoa & Dominguez, 2020; Ochoa et al., 2018; Schneider et al., 2019; Damian et al., 2015). One study applied the RAP system (Spanish acronym for Automated Presentation Feedbacks), which provided offline auto-generated feedback coupled with good and bad examples for entry-level presenters (Ochoa et al., 2018). The participants walked in a closed room with pre-recorded audience video and received analysis on body gestures, gaze, pauses, and visual aids. The automated feedback agreed with expert-generated feedback, and participants reported that the system helped them improve presentation skills (Ochoa et al., 2018). In this study by Ochoa et al. (2018), the equipment is low-cost, but the participants reported that the pre-recorded audiences offered zero interactions during the presentation, which led to a lack of authenticity of the presentation environment (Ochoa et al., 2018). A few studies utilized Presentation Trainer that provides instantaneous feedback on gestures, facial expression, pause and volume on the screen during the presentation. The result showed that participants' overall performances improved over three practice sessions, with the biggest improvement on gestures and pauses (Schneider et al., 2019). Notably, the user experience questionnaire of this study revealed that the participants did not enjoy the interruptions of instantaneous feedback (Schneider et al., 2019). Many studies have emphasized the timing of feedback because of the temporal transience of presentations (Simpson et al., 2019). With instantaneous feedback, students can discern unconscious behaviors and connect them to the feedback provided. Another

group of researchers have tried to provide unobtrusive real-time feedback of behaviors with Google Glass and an intelligent system called Logue. They selected a range of icons that would not distract people from presentation but signify appropriateness of behaviors. Result showed that the system could positively change behaviors (Damian et al., 2015). These lab studies provided some evidence that automated feedback systems are effective in improving presentation skills. A recent study involved a randomized controlled experiment with RAP in a real classroom. The result showed that the system improves some techniques such as looking at the audience, with no improvement on other dimensions (Ochoa & Dominguez, 2020). Van Ginkel et al. (2020) compared immediate computer feedback and delayed expert feedback, and found no difference between the two conditions. The computer feedback assessed students' eye contact and paces, and students perceived that this feedback had supported their immediate behavior adjustment (Van Ginkel et al., 2020).

To summarize, many models can evaluate oral presentations from various levels, allowing students to practice their oral presentations with timely feedback. As pointed out by Van Ginkel et al. (2015), the timing of feedback is especially important to integrate the feedback with their own performance. The effectiveness of automated feedback in virtual reality remains obscure with the scarcity of research that implements automated feedback systems in real learning environments. Moreover, these studies primarily focus on the learning outcomes, while not enough studies have investigated people's experience using simulations and their impact on presentation.

Emotions in Learning

Emotions in learning are essential for learning outcomes. Emotional learning describes how emotions are acquired through cognitive-based learning (Ben-Eliyahu, 2019). Emotions

used to be considered as a by-product of the learning process, but Ben-Eliyahu argues that academic emotions should be explicit targets of learning to achieve better learning outcomes (Ben-Eliyahu, 2019). In previous studies on oral presentation competencies, researchers concentrated on competence improvement, but Bower et al. (2011) explained that competence differs from skill because competence includes cognitive and affective components. The affective components are the communicator's feelings, attitude, and motivation. Inquiry about students' emotional experiences in virtual simulation is grounded in the role of emotions in learning.

Overall, past research used to center on the detrimental effects of negative emotions on learning outcomes, but the results are divergent (Pekrun & Linnenbrink-Garcia, 2014; D'Mello et al., 2014; Baumeister et al., 2015). Jarrel et al. (2017) studying retrospective emotions (pride, joy, anger, and shame) found that students who express positive emotion clusters have higher performance, while negative clusters have lower. The intensity of emotions also has an impact. A heightened emotional state leads to higher focus and information retainment by stimulating cognitive processes, but it might also lead to an illusion of learning (Baumeister et al., 2015). One group of research centered around epistemic emotions that include joy, anger, surprise, boredom, confusion, and frustration. The study showed that confusion facilitates effortful deliberation, leading to deep learning (D'Mello et al., 2014). A study that examined emotions during cognitive and metacognitive learning uncovered that surprise can predict metacognitive accuracy but negatively predicts the feeling of knowing (Taub et al., 2021).

The mixed results might suggest that the variable-centered approach could not explain the variance in learning gain. Instead, researchers adopted a person-centered approach that assumes students can feel concurrent emotions during learning. This trend aligns with Pekrun's

Control-Value Theory that mixed affective experiences can reflect different learning behaviors (Pekrun et al., 2017). For example, if negative emotions were followed by positive affective states, students might have solved a difficult task. Such emotional change is associated with higher academic achievement (Arguel et al., 2019; Barker et al., 2016). Using a person-centered approach, Robinson et al. (2017) demonstrated that positive and deactivated (tired or relaxed) profiles have higher engagement and higher scores than negative and moderate profiles. Wortha et al. (2019) examined emotion profiles with MetaTutor, revealing that negative profiles learn less if they use fewer emotion regulation strategies. The study also points out that feedback prompted by the system would influence students' emotions, while negative emotions are the most stable across all emotion profiles (Wortha et al., 2019). These studies point at the same direction that students' emotional experience is dynamic and could be influenced by multiple triggers. Digital learning environments need to be sensitive to students' negative emotions and address them timely to optimize learning outcomes.

Emotions in Virtual Reality

Virtual reality as an "affective medium" can have a higher affective impact than other digital tools such as videos (Pallavicini et al., 2020). Whether virtual reality can induce similar emotions that people experience in real settings is a crucial question before introducing virtual reality into educational settings. Study design have widely utilized visual, acoustic, and vestibular (e.g., soundtracks that mimic natural environments) stimuli to trigger emotional responses (Diemer et al., 2015; Felnhofer et al., 2015). However, these stimuli are not enough for people to have a holistic emotional experience. *Presence,* a mental representation of the environment, is an irreplaceable mediator that allows people to have emotional experiences in virtual simulations (Price et al., 2011) (See Table 2 for illustration). Presence is a

multidimensional phenomenon intricately linked to the intensity of emotions (Chirico et al., 2017). Feeling of physical space, the perception of continuousness of physical environment, and engagement, people's interest in the virtual environment, correlate with emotional intensity (Baños et al., 2008). *Immersion* is another dimension of Presence associated with higher intensity of emotions in a virtual environment (Baños et al., 2004; Diemer et al., 2015). For example, one study attempted to use different park scenarios to elicit the five discreet emotions. By manipulating background music, weather, and characters' facial expression, the researchers can elicit specific emotions (i.e., joy, sadness, boredom, anger, and anxiety) (Felnhofer et al., 2015). Juan and Perez (2009) found that sophisticated virtual simulations can elicit fear and anxiety. Lipp et al. (2021) found that objects that remind people of their significant others (e.g., wedding dresses; a child's seat) in virtual simulations will evoke strong negative emotions. In terms of positive emotions, one study showed that chronic patients reported higher positive emotions after virtual sumulated sessions (Baños et al., 2012). Chirico et al. (2017) demonstrated that virtual reality is more effective in eliciting intense positive emotion and awe compared to two-dimension videos. People can also experience complex emotions in virtual realities. One group of researchers compared the levels of empathy people experience when watching a refugee girl in a virtual reality condition with a two-dimensional format and concluded that virtual reality can promote higher empathy (Schutte & Stilinović, 2017).

Table 2.

Dimensions of Prsence in Virtual Environment

	Dimension	Meaning
Presence is a Mental Representation of virtual environment	Feeling of physical space	The perception of continuousness of physical environment
	Engagement	People's interest in the virtual environment
	Immersion	People’s experience in virtual environment

In summary, the authenticity of virtual environments provides a sense of Presence for people to have a similar emotional experience as the real world. Therefore, the virtual environment offers a safe simulation for students to practice their presentations and allows them to anticipate their emotional responses during the real presentation. These studies lay down the foundation that people can experience similar emotional responses in virtual simulation as real presentations.

Virtual Reality Therapy for Public Speaking Anxiety

Some research has studied the emotions of oral presentations in a virtual environment, but such studies largely focused on pathological anxiety. A rationale behind such research concentration is the curvilinear relationship between anxiety and performance. A moderate level of anxiety is beneficial, but pathological anxiety would hamper performance (Robinson et al., 2017). Public Speaking Anxiety (PSA) can severely impact education, occupation, and social relationships (Aderka et al., 2012). Psychological intervention of Public Speaking Anxiety (PSA) tend to be exposure therapy, through which patients systematically overcome a hierarchy of fear in public speaking (Ebrahimi et al., 2019). Virtual reality is especially suitable for exposure therapy because it can activate physiological anxiety (Owens & Beidel, 2015). At the same time,

exposure therapy through virtual reality can have lower costs, conduct through long-distance, and stay confidential (Reeves et al., 2021). Meta-analysis demonstrates that Virtual Reality Exposure Therapy (VRET) has similar efficacy as *in vivo* therapy, where patients directly face their fear (Carl et al., 2019). The most up-to-date meta-analysis includes 22 studies that examine the efficacy of VRET for anxiety revealed that the efficacy does not differ from *in vivo* therapy, but *in vivo* therapy has a long-lasting effect (Horigome et al., 2020).

Such a result implies that there might be individual differences in treatment efficacy, so that virtual reality treatment should be tailored to fit each patient's situation. For example, the number of audiences in the virtual environment would impact the level of anxiety (Stupar-Rutenfrans et al., 2017). Moreover, compared to static scenarios, an interactive environment can elicit more diverse emotional responses. Interactions can increase people's sense of Presence (Carl et al., 2019). Qu et al. (2014) found that synthetic positive emotions displayed by virtual humans can elicit positive emotions. These findings have led to the design of more emotionally responsive avatars for enriched emotional experiences in a virtual environment.

Emotional-Responsive Avatars in Virtual Reality

Emotions expressed by virtual humans can affect individuals. Burleson and Picard (2007) found that avatars' non-verbal effective support can impact students' self-awareness during problem-solving activities. For oral presentations, researchers found that people react to virtual audiences in a similar way to real audiences. For example,in one study, groups of participants presented to three kinds of audiences, positive audiences that demonstrate friendly behavior, negative audiences that demonstrate bored behaviors, and emotionally neutral audiences that do not provide any response. This between-group study showed that the pre-presented confidence level did not predict post-presented confidence level only in negative

audiences group, which implies that avatars' negative responses will evoke participants' anxiety (Pertaub et al., 2002). El-Yamri et al. (2019) designed a virtual audience that is responsive to voice tone. By comparing virtual audiences to a real audience, they confirmed that virtual audiences can affect the audience's reactions (El-Yamri et al., 2019). Chollet et al. (2015) compared interactive virtual audiences with direct visual feedback (i.e., objective performance measure). The result shows that people have higher engagement and lower speaking anxiety with an interactive virtual audience (Chollet et al., 2015). However, Felnhofer et al. (2015) point out that the realism of the audience in a virtual environment serves as a precondition of Presence that elicits people's emotions, rather than a factor correlated with emotions. Therefore, interactive avatars in oral presentation simulation have the potential to impact people's emotional experience, which might ultimately impact their improvement in presentation competence.

Indeed, research in technology acceptance has illustrated that emotions is a significant predictor of technology adoption. A qualitative study assessing students' experience using virtual reality to rehearse oral presentation reveals that positive emotions, such as enjoyment and interest, are the most frequent factors contributing to students' perceived usefulness (Vallade et al., 2021). Thus, considering studies that showed people have more frequent and intense positive emotions in virtual reality, a thorough investigation of students' emotions in virtual simulation could reveal more information about virtual environment design.

Summary

The literature review section summarizes previous research that investigated the instructional design, feedback methods and practice conditions to improve presentation competence. Based on the results, researchers have studied the possibility of using automated feedback systems to practice presentations and receive timely feedback. These studies led to our

hypothesis that students can improve their oral presentation through practicing in a virtual environment.

Moreover, previous studies have demonstrated that virtual simulations that provide a safe environment for students to practice oral presentation can evoke a wide range of emotional responses that are similar to responses in real situations. Specifically, emotional-responsive agents that use non-verbal gestures and facial expressions to interact with presenters can impact the users' emotions. However, limited research specifically addresses the wide variety of emotions people experience when using virtual realities to practice oral presentation. Based on the theoretical framework, the Control-Value Theory, which implies that improving subjective control over learning tasks would decrease negative emotions and promote positive experiences, I hypothesize that students will report positive emotions in a simulated oral presentation where they have full control.

CHAPTER 3: METHODOLOGY

Participants

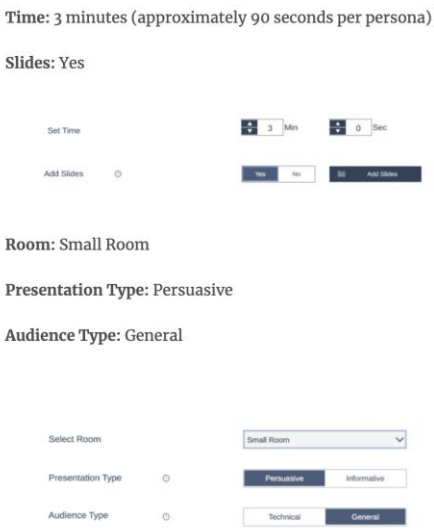
23 participants (n = 23) from a Master-level entrepreneurship class in a large public university participated into the study. 22 of them completed ~~the~~ more than 5 practice trials in the simulation and therefore were included in the study.

Procedure

The data collection was during the fall semester of 2021. As part of the course design, the students were required to complete multiple presentations using PVtool, a presentation simulation where virtual audiences would provide simultaneous non-verbal feedback based on speech content. The students also received an evaluation of their speech after each practice. Their speech evaluations were accessible for researchers to track their progress along eight scales. The presentation topics varied, ranging from pre-rating their comfort level of public speaking, proposing educational innovations, and explaining class contents. There was specification for each assignment such as the length of the presentation, and the virtual environment (see Figure 2). The researchers would not intervene with the ways that participants use this presentation tool. Students could choose the number of attempts for each assignment or the locations to do the presentation. They were required to submit their speech recordings as part of course assignments. At the end of the semester, parcicipants completed online surveys and focus groups investigating their experience with the tool.

Figure 2.

Example of a Presentation Setting (different for each assignment)



Measures

Survey of Overall Experiences

The survey consists of four questions about using PVtool. Participants respond to first three questions on Likert scale (from 1= "lowest degree", 5 = "highest degree"). The first three questions inspect their subjective feelings of using PVtool as a component of course design (e.g., "On a 1-5 scale, with 1 being lowest and 5 being highest, how closely linked do you use PVtool with the course content towards the end of the modules?"). The last question is an open-ended question that asks if they would recommend PVtool for others and the rationale for this decision ("Would you recommend PVtool as an effective tool for instruction? Please state if you would or would not recommend PVtool and your rationale regarding you recommendation").

PVtool Scales

PVtool offers an evaluation of speech performance on eight scales. The system evaluates pitch variability, pace variability, volume variability, verbal distractors, total pauses,

pace, long pauses, eye contact. There are four levels for each scale: Need improvement, average, good and excellent (see Figure 3 for illustration). The system also displays an overall score for objective assessment of improvement.

Figure 3

Example of the System Evaluation Result

Focus group

To allow a more in-depth understanding of participants' experiences of PVtool, the study conducted a semi-structured focus group about students ‘emotional experiences, opinions, challenges and interactions. We conducted 3 focus groups that include 1-2 students for each focus group. The focus group lasts about 1 hour. The participants were notified that the meetings were recorded. Below is a list of pre-determined questions for the focus groups about PVtool:

1. What did you like about engaging with PVtool as part of these modules?
2. What challenges did you have when engaging with PVtool videos as part of these modules?
3. Reflecting back on your learning experience, were there times you felt happy, sad, anxious, frustrated, excited, or another way while engaging with PVtool?
4. Is there anything else you would like to share about your experience with these modules?

There were also follow-up questions based on the participants’ responses.

Data Analysis

The study design involves mixed methods approach. The quantitative data collected based on PVtool's evaluation was anlyzed using Repeated Measure ANOVA to observe performances improve over time. Survey answers and focus groups transcription was analyzed using code mapping (Anfara et al., 2002). According to Anfara et al. (2020), code mapping involves three iterations to uncover meaning and structure of collected data (See Appendix 1). The first iteration brings codes into meaningful chunks, and then the second iteration identifies themes through the chunks. The third iteration anlyzed the themes to reach a conclusion (Anfara et al., 2002).

CHAPTER 4: RESULTS

Quantitative Result

I examined students' emotions while using virtual realities to practice oral presentations. For that examination, quantitative data was used to answer the first research question of whether participants' presentational skills improve by practicing in the virtual simulation. To uncover their emotions using the virtual simulation, partcipants completed surveys and participated in focus groups.

Overall, the study had 23 participants. Participants had an unequal number of practices trials, ranging from 3 to 10. For consistency, the study excluded participants who practiced less than five times using the platform. For those with more, the study only analyzed the first five scores for data analysis. Hence, 20 participants were included. 16 participants are native English speakers, and 4 participants have English as the second language. Table 4 illustrates the demographic data of all participants.

Table 4.

Demographic Data

Age			**Ethnicity**		
21-25	6	30%	Black	4	20%
26-30	6	30%	White	11	55%
31-35	5	25%	Asian	4	20%
>35	3	15%	Hispanic	1	5%

Based on descriptive statistics, there are no obvious increase in scores from the first trial (M = 68.40, SE = 13.17) to last trial (M = 68. 85, SE = 13.41) (see Table 4 for descriptive statistics). The subscale scores are not listed because PVtool used a proprietary algorithm for calculating these scores. To document them, a categorical system was put in place to rank the scores as Need Improvement, Good, Excellent.

Table 5.

Descriptive Statistics

Trials	Mean	Standard Deviation
First	68.40	13.17
Second	72.10	15.64
Third	70.35	18.37
Fourth	67.60	19.07
Fifth	68.85	13.42

To measure participants' improvement over the semester, this study used Repeated ANOVA. There was no outlier and a Shapiro-Wilk test showed no significant departure from normality ($W(20) = .979$, $p = 0.925$; $W(20) = .912$, $p = .070$; $W(20) = .956$, $p = .476$; $W(20)=.929$, $p =.151$; $W(20) =.942$, $p = .258$). Mauchly's Test of Sphericity indicated that the assumption of sphericity had not been violated (X^2 (9) = 3. 006, $p = .410$). Repeated ANOVA determined that the scores did not differ significantly between the five time points ($F(4, 76) = .491$, $p =.743$, $\eta^2 = 0.025$).

Qualitative Result

The survey question briefly prompted students to express their level of excitement using the of PVtool. Over the semester, their excitement for practicing in PVtool has dramatically

decreased (see Table 6). At the end of the semester, most students think that using PVtool is not exciting (*n* =12).

Table 6.

Level of Excitement using PVsim

Excitement Level using PVsim	At the start of the modules	At the end of the modules
1-not excited	5	12
2-somewhat excited	4	4
3-excited	7	2
4-very excited	1	0
5-extremely excited	1	0

The survey responses show that participants found the PV tool interesting to use at first but gradually lost their interest in the tool. The themes generated from the focus groups reflect a similar change from positive experiences to negative experiences. Participants found that practicing in the simulation helped increase their comfort level for real presentation at first, but graduated felt frustrated when they could not improve their scores.

The code mapping identified four themes: 1) increased level of comfort; 2) frustration with feedback; 3) awkwardness over unrealistic simulation; 4) anxiety over negative avatars' feedback (see Appendix for detail).

Increased Levels of Comfort

Across the survey answers and focus group responses, most participants started with positive experiences using the virtual simulation. The most significant benefit of using the simulation to practice is that they have an additional channel for feedback. One participant said that using the platform “saves much time because the alternative is practicing a lot on your own and getting individual feedback from people that might not always be possible." In addition, the platform is helpful to raise awareness of their speech patterns. One participant commented that

the platform “built awareness about the number of fillers” used in her speech and helped her notice her pitch variability. Similarly, toggling between slides view and audience view is another helpful feature that promotes students to have eye contact with audiences. A participant said that "consciously kind of hitting it made me kind of reflect on how often I was hitting it to glance back the deck."

Students reported that the simulation provides a unique experience that helps them prepare for the authentic presentation. One student said that "the variety of different types of environments that you could practice in. the boardroom, the conference room, the virtual piece … is a completely different kind of way of coming about it." He felt that the experience was different when he talked in a simulation versus in Zoom. Such simulation helped students switch their mindset to a formal presentation situation where they must articulate their ideas and logic without the script. For example, one student mentioned that the platform pushed her to articulate their ideas, while another student said, "I think it [platform] is nice to work on stating things clearly." At the same time, the simulation does not bring too much pressure as one student commented that "I don't think it puts you in that pressure-packed situation as much." As a result, one student stated that "it helped me feel more comfortable in front of a real audience." Therefore, it is evident that students can have some positive experiences using the platform to practice their presentations, and such preparation will raise their comfort level for authentic presentations.

Frustration with Feedback

However, students also mentioned that the initial excitement quickly faded away when they discovered that the platform was "just looking for movement and voice modulation." It is true that the platform only measures the quantitative elements of the speech, such as pace

variability, pauses, eye contact, and volume variability. The platform does not consider the qualitative side of the speech, such as logic coherence and speech structures. All three focus groups mentioned that they started to “cheat” the platform when they realized that the system only cares about how they talk instead of what they talk about. For example, one participant said that "I am going to speak like a … cartoon character with crazy pauses and voices inflation, and I got the highest score." Similarly, another participant said that he once stared at the ceiling and “Just speak gibberish.” When they realized that the platform could only account for the quantitative side of the speech, they felt frustrated practicing their pitches repeatedly.

Another common frustration with the feedback is that participants' self-rated scores do not match system-generated scores. For example, one participant said that "one time I thought I did the best I've ever done, and I got the lowest score." While many students mentioned that the platform raises their awareness of speech patterns, it does not provide detailed feedback for improvement. One participant said that "I was not sure how to improve the pitch variability reasonably." Many participants mentioned that they had tried various ways to improve their scores, but the platform did not recognize their efforts. "I tried multiple times but always got really low on eye contact … so I tried looking at the people on the screen to get a higher eye contact, didn't work." Only providing assessment but no explicit feedback on improvement is a significant reason students experienced frustration with the platform. Short lessons or exemplar modules that explicitly explain how the platform assesses the performance and how to improve the scores will be helpful. The platform needs to ensure that students can learn presentation skills rather than just knowing their deficiencies.

Awkwardness with the Unrealistic Simulation

Some students reported that the simulation settings were not realistic, which significantly affected their emotions using the simulation. Avatars' animations distracted participants from their presentation. For instance, one participant commented that "I find it almost awkward in the unrealistic sense to watch this weird animation like try to act like human and it feels less realistic than pitching to no one in your room." Instead of creating a more immersive experience with interactions with the audiences, avatars compromised the experience. A participant said that "the audience members in the video were not as lifelike as I would have hoped, so it felt like talking to a brick wall with very little body movement or facial expressions." Connection with audiences is an important part of the presentation. Presenters might vary their presentation strategies based on the audience types. For example, one student mentioned, "If I am trying to convince someone emotionally, I will be more excited than presenting to my grandmother." While some participants enjoyed the various environment simulations, the avatars' unrealistic animations were not appreciated. One participant directly stated that "I want to have real feedback from real people." It becomes clear that participants do not trust the unrealistic simulation component. This lack of connection raised discomfort among participants. This discomfort is further reinforced when technical issues intervene in the experiences. One student said he had an emotional withdrawal when he could not upload the slides. "I uploaded failed multiple times at that point, so then there was a little bit passive aggression kicking in." Another group of participants also mentioned that "it bothered every time because I hate to go through a set of slides to get to the next slide."

Anxiety over Avatar's Reactions

Many participants have noticed the negative reactions avatars had during the presentation, such as looking at their watches, scratching heads, and looking away. They reported a feeling of anxiety about completing the videos with negative visual feedback. For

example, one student mentioned that "sometimes [I was] scared and nervous because the people in the video, when they responded, were quite rude in their reactions." These reactions were designed to remind students to vary their pitch or have eye contact to engage the audience, but instead, these reactions induce anxiety over presentation. One participant said that “at times it [the platform] made me feel more self-conscious and nervous about public speaking than I naturally am.” The negative reactions from avatars can decrease students’ confidence.

Nearly all students did not get positive reactions from the avatars. It might be because negative reactions such as looking at their watches and looking around are more obvious than positive reactions such as nodding. Responding to these negative reactions, some participants avoided looking at the audience. "I just started to stare at my webcam and not at them, so avoid seeing how they were reacting." On the other hand, some students hoped to have affirmations by varying their tones. However, similar to improving system-generated scores, students found it hard to change avatars' reactions in a five-minute presentation. One student responded that "Most of the time I knew I was being successful if they [avatars] weren't doing anything because that was when I had success with that up a little bit. So, I got used to nothing being a good sign of success."

CHAPTER 5: DISCUSSION

This study was designed to study students' experience using a virtual simulation. The simulation provided a virtual environment for students to practice their presentations. During the simulation, the avatar audience responded to students' speech through gestures such as nodding, looking away, and chatting. At the end of the presentation, the platform provided an automated evaluation with eight scales, including pitch variability, pace variability, volume variability, verbal distractors, total pauses, pace, long pause, and eye contact. Previous studies have demonstrated that students can improve their public speaking skills through automated feedback and experience various emotions in virtual simulations (Boetje & Ginkel, 2021; El-Yamri et al., 2019). Based on the theoretical framework, Control-Value theory, I hypothesize that the virtual space can foster positive experiences associated with public speaking by providing full control (Pekrun, 2006).

The first research question was hether students can improve their presentation competence using this virtual simulation. The study used Repeated ANOVA of students' improvement through five practices and revealed no significant improvement in their final scores. The result diverges from previous studies on automated feedback (Chollet et al., 2015; van Ginkel et al., 2020). It might relate to the fact that the current study tried to implement the automated feedback system in a real classroom rather than applying it in a controlled lab setting. For example, van Ginkel et al. (2020) designed a study combining in-person and VR practices. Both conditions followed a seminar-like format in which participants discussed the rubric before doing the presentation. The lab setting gave participants opportunities to develop a rubric,

observe peer presentations and receive assistance from researchers. These external resources were limited in the current study. In addition, a previous study had participants practice their presentations on the same topic repeatedly using the simulation, but the current study allowed participants to practice on various topics (Schneider et al., 2019). Such difference might also explain why there was no significant increase, as scores for the first practice on each topic tend to be low.

A survey and focus groups were conducted to investigate the second research question about students' emotional experiences using this virtual simulation. Through code mapping, four themes that represent the emotional responses of the students to the VR pitches were identified. First, students reported some positive experiences using the virtual simulation, including increased awareness of speech patterns and practice in a low-pressure situation. This theme aligns with previous research results that participants consider the virtual simulation for public speaking as engaging and non-threatening (Van Ginkel et al., 2020). Previous research has demonstrated that virtual simulation can offer a safe environment to treat public speaking anxiety (Stupar-Rutenfrans et al., 2017). These positive experiences have led them to have increased comfort levels towards the authentic presentation. However, their experiences with virtual simulations gradually shifted to negative ones. Specifically, they experienced three kinds of negative emotions. The first one is frustration with feedback. Students reported that their self-rated scores do not match the system-rated scores. It is probably because students themselves rate their speech based on the speech content, while the platform can only assess the quantitative aspect of the speech. One participant said that "…one time I thought I did the best I've ever done, and I got the lowest score. So I think that I don't really agree with how they run their analytics…". Previous research on automated speech feedback shows that students can improve

some quantitative aspects of speech, such as pauses, body gestures, and looking at audiences (Ochoa et al., 2018; Schneider et al., 2019; Ochoa & Dominguez., 2020). However, no studies validate whether students can improve the speech content through automated feedback in a virtual simulation. The platform provides students with assessment scores, but the platform does not provide materials such as model examples. Hence, students found it hard to improve their performance. Previous studies supplemented automated feedback with other resources, such as good examples for entry-level presenters (Ochoa et a., 2018). Including these resources on the platform might help students interpret the scores.

The second negative emotion was awkwardness with the unrealistic simulation. In this context, awkwardness means an emotional distance when participants found the avatars' movement and the environment settings strange and unrealistic. Based on the description, they did not feel a sense of presence in the simulation. One study notes that congruency in levels of realism between elements is a critical dimension in creating an immersive experience (van Gisbergen et al., 2019). It might explain why participants in the current study found the avatars' movements awkward to watch. While avatars' emotional reactions are highly realistic elements, the avatars' appearance and the boardroom setups are not congruent with that realism level.

The last negative emotion is anxiety over avatars' reactions. Participants used strong words, such as rude, disconcerting, and scary, in describing their emotional experiences in response to avatars' interactions. Research shows that emotional characteristics of the environment design are more likely to elicit emotional reactions from participants than graphic realism (Riva et al., 2007). The current study confirms that students experience strong negative emotions in an interactive virtual simulation. Previous experiments on virtual audiences have shown conflicting results. One experiment that compares speech improvement between direct

visual feedback and interactive virtual audience found that participants considered the virtual audience easy and non-threatening (Chollet et al., 2015). Another study that compares direct feedback with interactive feedback demonstrates that students have higher technology acceptance for direct feedback (Palmas et al., 2021). The current study shows that students dislike virtual audience interactions, but it is noteworthy that most participants only reported negative responses from the avatars. Students might appreciate the interactions if avatars display more positive reactions.

The current study contributes to the extensive research on oral presentation competence through integrating a simulation-based tool to a college-level course. While most previous studies only assess presentation tools in a lab setting, this study focuses on students' experience using the simulation in a real classroom (Ochoa & Dominguez, 2020). Contrary to the previous research, this study illustrates that students' presentation performance did not improve through virtual simulation, and participants reported more negative emotions than positive ones using the simulation. The effect size for this study was calculated, but it was found to be insignificant. There are many limitations of the study. First, the study did not use surveys to explicitly measure their achievement emotions after each practice, and relied on their retrospective reports on their experiences using the tool. The emotions being reported might be inaccurate, and some mild emotions might be overlooked if participants forgot to mentioned them. Future research could use facial recognition software to identify participants' emotions during the practice as all the practices in virtual simulation have been video-recorded. Second, this study did not use an experimental design to measure participants' improvement. Participants have different proficiency levels in presentation before the study. Many factors intervened in participants' performance during the study, such as the number of practice attempts, the locations, and speech

topic. Participants' improvement may be marginalized after a certain number of practices. Lastly, the study only includes graduate students from an educational entrepreneurship program. These students are passionate about educational technologies and public speaking, which makes the sample more specific than representative.

For future research, it is worthy of studying how different resources together contribute to students' presentation improvement. Virtual simulation provides a safe practice space but not detailed feedback. It might produce the highest efficacy when the virtual simulation tool is complemented with other resources such as exemplar videos or teachers' comments. Moreover, one previous study has shown that three might be the optimal number of practices in virtual simulation (Boetje & Ginkel, 2021). Since participants in this study uncovered the assessment criteria of automated feedback after repeated practices, the tool's efficacy likely decreased after the first few practices. Future research could continue to study the optimal number of practices in a virtual simulation that improve presentation competence or reduce presentation anxiety. Lastly, future studies could include a more diverse sample: high-school students, minority students, or English learners. Students from diverse backgrounds could provide more insights on this virtual simulation tool.

In conclusion, virtual simulation for oral presentation has some merits, but how the tool can be integrated with course instruction needs further research. Virtual simulations offer a safe place for students to start practicing their pitch and help them notice unconscious speech patterns. A properly implemented virtual simulation is also promising in reducing students' speech anxiety and promoting positive experiences with presentations. Virtual simulation tools with automated feedback can also serve as an additional channel for feedback that complements the shortage of formative feedback on students' presentations in current higher education.

However, the design of the virtual environments and the interactive avatars needs further improvement. Students can experience negative emotions if the platform's visual cues and formative assessment keep discouraging students, which lead to low technology acceptance.

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Appendix

The Code Mapping

Research Question

What kind of emotions do people experience during practices in virtual realities?

Third Iteration: Major Theme

The platform can prepare people to feel more confident over presentation, but formative feedback, unrealistic simulation, and avatars' negative reactions will lead to negative emotional experiences.

Second Iteration: Categories

A. Increased comfort Level
B. Frustration with feedback
C. Awkwardness with the unrealistic simulation
D. Anxiety over avatars' reactions

First Iteration: Initial Codes

A1. not a pressure-packed situation
A2. re-watching the videos was helpful
A3. force to articulate ideas
A4. help to notice speech patterns
A5. Nice addition to get feedback

B1. Frustrated to use repeatedly
B2. do not know how to improve
B3. frustrated that it does not offer good pitch example
B4. Feedbacks are not explicit enough
B5. The platform does not assess the content

C1. get real feedback from real people
C2. no connection with the audiences
C3. cannot upload the slides
C4. awkward with unrealistic avatars
C5. The platform is not configurable

D1. more self-conscious and nervous about public speaking
D2. Feel awkward completing the videos.
D3. disconcerting with A.I. people stare at you
D4. Avatars do not give any affirmations
D5. No interaction is good sign