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Chapter

Presenting in Front of a Virtual Audience: A Synthesis of Research in Higher Education

Stan Van Ginkel

Abstract

While previous studies in educational sciences emphasized the essence of feedback on developing students' oral presentation competence, it remains questionable how innovative technologies can successfully deliver high-quality feedback on such a competence. Recent experimental studies in this field revealed the effectiveness of virtual reality (VR) for increasing oral presentation competence and diminishing presentation anxiety. Due to both technological and educational developments, VR systems facilitate the translation of quantitative data into qualitative feedback messages, relating to presentation delivery aspects. This challenges current presentation curricula if the learner is able to individually interpret automatized and personalized feedback messages after rehearsing in front of virtual audiences. As a consequence, it questions to what extent teachers' roles might change over time. This chapter synthesizes recent studies into a set of educational design principles for effective use of VR, discusses practical implications, and provides a future research agenda on this topic for the higher education context.

Keywords: educational design principles, feedback, higher education, oral presentation competence, virtual reality

1. Introduction

Presenting can be considered as a core competence of the higher educated professional [1–3]. It is perceived as relevant for working in various working environments, for career success, and for effective participation in democratic societies [4]. However, young professionals entering working practice often failed to acquire public speaking skills according to the scientific literature as well as evaluations from the corporate sector. Therefore, it is crucial to critically discuss the effective and efficient integration of learning trajectories on oral presentation competence in higher education curricula [3].

A recently conducted review study revealed a comprehensive set of educational design principles for developing oral presentation competence in higher education [3, 5]. Three out of the seven principles directly refer to formative assessment strategies, of which the type of feedback, involving peers in feedback processes, and self-assessment are named as crucial learning environment characteristics. Although several empirical studies, aiming to further refine these principles, mentioned the teacher as a crucial feedback source, it might be questioned to what

extent innovative technologies, such as VR, could play an essential role in both (1) facilitating presentation rehearsals and (2) providing feedback to the individual learner.

Follow-up research showed that students' oral presentation competence can be developed by the use of VR [6]. However, still the role of the teacher remained crucial, since the produced data reports, delivered by the VR system, needed to be interpreted by the teacher into feedback messages for the student. Recent developments in technology and education managed to translate the quantitative data into qualitative feedback messages on presentation delivery aspects. As a consequence, current designers of presentation curricula are challenged if the learner is able to individually interpret automatized and personalized feedback messages after rehearsing in front of virtual audiences. In line with this, it questions to what extent teachers' roles might change over time.

The goal of this chapter is to synthesize recent studies into a set of educational design principles for effective use of VR, to discuss practical implications and to construct a future research agenda on this topic for the higher education context.

2. VR and developing oral presentation competence

Previous studies in this field emphasized the benefits of using VR to reduce presentation anxiety in the higher education context [7, 8]. These studies revealed that if students present in a virtual environment, they report lower self-reported levels of anxiety. Further, researchers showed that the degree of anxiety experienced by the presenter depended on the type of virtual audience. In line with this, a hostile, negative audience demonstrated a strong effect on students' perceived presentation anxiety [8]. Other researchers focused on the relationship between VR and students' development of oral presentation skills. It was found that immediate feedback could positively impact students' evaluation if sparse feedback strategies were provided instead of continuous or no feedback at all [9]. In that study, feedback was delivered by a color-coded gauge above the audience. Further, another study proved that interactive audiences in VR encouraged students' development of presentation skills [10].

Although several studies focused on the relationship between VR for delivering feedback and reducing presentation anxiety and developing oral presentation skills, cognition and attitude towards presenting were not included within the research foci. Following the construct of competence, it is stated that if students acquire more knowledge about presenting, their presentation behavior might positively develop and as a result also change their attitudes towards presenting [3]. Further, previous researchers studied immediate feedback on presentation delivery aspects within VR, while delayed feedback verbally provided by a presentation expert can be considered as an essential type of feedback in realistic presentation skills curricula. Another bias of the described studies is that the feedback is solely provided within the system. However, it remains questionable to what extent VR is as effective as presentation experts providing their feedback based on observation and interpretation of students' actual behavior. Finally, students' perceptions with regard to the use of VR and the provision of feedback based on these systems have scarcely been researched. Therefore, it is crucial to include this crucial intermediate variable for encouraging learning processes and outcomes in follow-up studies.

Taking the mentioned gaps in presentation literature on VR into consideration, a recent experiment studied the effectiveness of a VR-based presentation task, in which students received feedback after the presentation rehearsal in VR—on eye contact, use of voice, posture and gestures—that was traced by the VR system

Figure 1.
Presenting in front of a virtual audience in the television studio of "Presenting with Impact." ©Kees Rutten.

and interpreted by a presentation expert [6]. The results showed that the three components—cognition, behavior, and attitude towards presentation—increased significantly without a difference in impact between the experimental and control conditions consisting of a face-to-face presentation with only an expert feedback. In addition, a self-evaluation test showed that students from the experimental group highly appreciated the analytical and detailed characteristics of the VR feedback and at the same time shared suggestions regarding the integration of VR in higher education. With regard to the scientific relevance of that study, integrating both forms of feedback (VR and face-to-face feedback) could further increase the quality of feedback messages and as a result impact students' learning outcomes focusing on presenting. In line with this, educational design principles relating to the type of feedback could be further optimized.

Recent developments in innovative technologies as well as in pedagogical and educational sciences revealed that feedback messages can be constructed by the VR computer system and delivered to the individual learner [6]. At the same time, recent trends in educational practice underscore the need to encourage personalized learning in which learning environments directly match learners' needs and individual preferences, to adjust learning environments just-in-time and to facilitate opportunities to practice and to deliver feedback irrespective of time and place [6]. Taking the earlier published comprehensive set of seven educational design principles for developing oral presentation competence in higher education into account, how can virtual learning environments further optimize existing principles, such as instructions, learning activities, and formative assessment strategies, in order to create more effective, efficient, and challenging learning trajectories fostering students' presentation competence in higher education curricula? (**Figure 1**).

3. Towards a set of principles for VR on presenting

This section focuses on constructing seven educational design principles for optimizing students' development of oral presentation competence by making use of VR. The first sentence of each paragraph formulates the particular design principle followed by conceptual and empirical argumentations.

First, learning trajectories fostering students' presentation competence in VR should directly relate to personal learning objectives of the individual learner. As emphasized by studies in presentation literature, learners vary with respect to their learning needs and preferences [2, 3]. For instance, some students need to develop their use of voice, and others should use more supportive gestures during their presentation. In regular presentation skills courses, it is considered as a challenge for teachers to differentiate between students with varying objectives partly due to time constraints. However, VR environments can facilitate opportunities to practice and to rehearse irrespective of time and space, at students' own preferred pace and potentially without the intervention of a presentation expert. These developments foster personalized learning and could create more effective as well as efficient learning environments.

Second, presentation learning paths should be positioned just-in-time prior to an authentic presentation task. Normally, face-to-face presentation courses are being provided at a fixed moment in time without a specific connection to a final, authentic presentation task [3]. If mobile, personalized learning environments in VR are facilitated prior to a presentation task for a real client, it could impact the motivation of the individual learner and as a consequence foster the development of students' oral presentation competence [3]. Positioning presentation activities in VR prior to a performance for a real audience, for example, in the context of an internship, might also increase the perceived relevance resulting in more effective student learning.

Third, presentation learning environments should incorporate varying types of non-expert and expert models. In current face-to-face presentation courses, students acquire knowledge on presenting by observing non-expert models such as peers. However, the presentation literature revealed that both non-expert and expert models can foster students' self-efficacy towards presenting [3]. Further, expert models show different types of performances with regard to eye contact, use of voice, and posture and gestures. In line with this, within VR environments, learning activities can be integrated, focusing on developing presentation behavior based on preferred expert models. Finally, learners in VR can compare their own performances on presentation delivery aspects to the averages of world leaders, CEOs, or television personalities.

Fourth, learning trajectories towards presenting should facilitate opportunities to practice in varying environments. In face-to-face presentation curricula, one of the challenges for teachers is to provide rehearsals for students, especially in times when opportunities for teacher-student interactions are diminishing. Virtual reality facilitates practicing presentations in front of interactive audiences in varying contexts, such as classroom settings, theater environments, and television studios. Although previous researchers claim that a two-presentation sequence is required, other presentation experts suggest that students need at least four or five rehearsals in order to significantly develop their behaviors [11, 12]. Practicing in front of virtual audiences in different contexts is considered as one of the crucial principles for virtual learning environments fostering students' presentation competencies.

Fifth, students should receive immediate and delayed feedback messages on their actual presentation performances. A recently conducted experimental study revealed that feedback from VR systems can be characterized as detailed and analytic, while face-to-face feedback from teachers concerns positive and constructive messages [6]. Combining these insights and relating these to the main quality criteria of feedback could facilitate the construction of personalized high-quality feedback messages fostering students' presentation skills [13]. Further, another study revealed that immediate feedback is as effective as delayed feedback; however, this type of feedback is especially effective for enhancing aspects such as eye contact, use of voice, and posture and gestures [14]. During presentations in front

of virtual audiences, icons can be projected above these avatars informing the presenter on the extent to which they make eye contact with all audience members and their speech rate.

Sixth, students should have the opportunity to receive feedback from external feedback sources such as peers. Previous research revealed that triangulating feedback mechanisms allow for greater reflective learning [3]. Further, students that are actively involved in their learning processes and work collaboratively could feel a higher sense of responsibility and an increased attention to the performance criteria and as a result foster their presentation skills. However, the provision of peer feedback in regular educational face-to-face systems is limited. By making use of VR, students can deliver and receive feedback irrespective of time and space. Further, it could also increase the authenticity of the situation. For example, if students are required to present in English and their peers are from another country, it could increase their motivation and as a consequence also their performances.

Seventh, reflection activities facilitate the development of students' oral presentation skills. Students' reflection on their own behavior can be considered as essential for student learning [15]. However, quasi-experimental studies revealed that self-assessment tasks revealed a limited impact on students' attitude towards presentation and the actual presentation skill [3, 16]. Essential argumentations refer to the lack of an external feedback source, the complexity of reflection cycles, and a lack of active reflection of the individual student [3]. VR could optimize the principle of self-assessment tasks for presentation skills development, since feedback can be delivered by the system and learning trajectories are adapted based on the input of the individual learner. Further, students can practice in front of virtual audiences without the need to be actually in environments such as classrooms, theater environments, and television studios.

4. Practical implications for effective use of VR

Research on VR fostering presentation competence combined with recent developments in technology and education facilitated the design of a mobile, personalized, and comprehensive learning environment in VR. The following advantages for student learning can be formulated: (1) the environment relates to the personal learning objectives of the individual learner, (2) the student is able to use this VR tool for developing presentation skills just-in-time, and (3) presenters can individually rehearse their presentation performances as many times as they need and receive feedback by the VR system during or after every single presentation.

While teachers and teacher educators in varying countries, such as the Netherlands, Italy, Thailand, and the United States, are experimenting and integrating this VR tool in educational practice, several challenges appear so far.

First, teachers are challenged to critically rethink their presentation curriculum if certain parts can be facilitated by the VR system. Examples refer to (1) working with individual learning objectives, (2) learning from instructions, (3) observing presentation models, (4) rehearsing in front of different environments, and (5) receiving immediate and delayed feedback on performances.

Second, teachers are challenged to design more effective self-assessment tasks with the support of VR. In line with this, more information of the individual learner can be traced, such as big data, by monitoring their learning processes in VR. This challenges the teacher not only to act as an instructor within presentation curricula but also to further support their role as coaches by making use of both observations and interpretations and analyzing detailed information about presentation delivery aspects facilitated by the VR system.

Third, teachers are also challenged to co-design such virtual learning environments because their educational expertise and experience are key for making effective use of VR. Since expertise from several domains, such as ICT, communication, and education, is needed in order to effectively develop these environments, teachers and teacher educators should collaborate with professionals from varying domains and sectors.

Nevertheless, several implications for educational practice remain with regard to implementing VR in presentation education. Integrating VR in education means that teachers, teacher educators, curriculum designers, and coaches need to be trained before entering formative assessment processes supported by VR. Finally, working with VR means, initially, investments in terms of effort, time, and financial resources that should directly relate to strategic policies of higher education institutions [6, 17].

5. Constructing a research agenda on VR and presenting

The following section describes five directions for future research and sets a research agenda for developing oral presentation competence supported by VR in higher education. These directions are built on the gaps concerning the foci of previous VR studies, inconsistencies in empirical and conceptual findings, and the quality of empirical evidence, taking into consideration the related study designs of the reviewed publications.

First, recent technological developments managed to convert quantitative information from the VR system into qualitative feedback messages that directly relate to the standards for high-quality feedback in presentation research [13, 18, 19]. In line with this development, the question is to what extent the presentation expert (the teacher)—as a crucial feedback source—can be replaced in certain parts of the feedback process [20]. Therefore, an empirical study should be conducted within a realistic educational setting in higher education and focuses on the impact of qualitative feedback messages in a VR system on the development of students' ability to speak in public. Such an experimental pretest posttest study examines to what extent the development of students' cognition, behavior, and attitude towards presentation depends on an experimental condition in which students present in front of a virtual audience and receive automated feedback that can be interpreted individually. The effects are suggested to be compared with a control condition in which students present in VR and receive feedback based on the VR system that is interpreted by the teacher. Mixed methods, such as knowledge tests, validated rubrics, and self-evaluation tests, should be used for data collection [16]. Such a study contributes both to presentation research and educational practice, since insights from this study could lead to a further refinement of educational design principle 5, with regard to the type of feedback, as previously emphasized by researchers in this field [3, 21]. Moreover, the results of the study provide insights about how teachers' roles might change in formative assessment strategies in the higher education context with regard to ensuring personalized and automated feedback.

Second, previous studies revealed that self-assessment tasks have limited impacts on students' development of oral presentation competence in the higher education context [3, 15, 22]. The question is whether the development of personalized learning environments in VR can enhance the quality of self-assessment tasks in higher education, since students can now (1) adjust their learning trajectory to their personal learning objectives, (2) use these VR environments just-in-time, and (3) practice their presentation skills and receive unlimited feedback. A longitudinal study should focus on students' data obtained by the VR system. Mixed methods,

consisting of quantitative analyses of VR data and qualitative research (including observations and in-depth interviews), are suggested to be used to (1) describe the learning processes of students in VR, (2) monitor the reflection processes of the individual students with the aim of strengthening self-assessment tasks in presentation education, and (3) test the relationship between (a) reflection processes of students and (b) learning outcomes focused on presenting in VR [3].

Third, previous studies emphasized that at least a two-presentation sequence is required for students to effectively develop their oral presentation competence [2, 6, 11]. However, it remains questionable how the development of students' performances behaves after their second presentation. In the context of a business curriculum, researchers studied the optimal number of presentations and concluded that a significant increase in performance can be traced between the first and second presentation, though a three-presentation sequence revealed no significant benefits. This might be caused by the fact that students past the apex of the classical S-shaped learning curve [11]. Other researchers, however, claimed the integration of four or five performances in presentation curricula [12, 23]. These findings should be interpreted in the light of domain-specific face-to-face presentations assessing solely presentation skills instead of taking other core components of the construct of competence, such as cognition and attitude towards presenting, into account. Further, facilitating students' presentations in curricula can be considered as a time-consuming activity. Therefore, future research should test the hypothesis of the two-presentation sequence, scarcely supported by empirical studies in presentation literature, by integrating VR in realistic educational settings. Future experimental studies could distinguish between several conditions, such as a one-presentation, two-presentation, and three-presentation sequence, and verify potential differential impacts on students' oral presentation competence in higher education.

Fourth, a previous study on VR and the development of students' oral presentation competence emphasized the limitation with regard to students' unfamiliarity with adopting VR for learning purposes [6]. This could have influenced the results of that study, both in terms of impacts on developing presentation competence and perceptions towards using the innovative technology [24]. For example, certain students might have perceived the use of VR as motivating, while other students might have experienced the use of VR as evoking their presentation anxiety. Therefore, longitudinal studies could reveal if oral presentation competence can be influenced if participants first become more familiar with the technology and whether students' perceptions change over a longer period of time while using VR.

Fifth, future studies should focus on testing the generalizability of the constructed and formulated set of principles in this chapter with regard to different student characteristics. Since researchers in this field reported that students could differ in their perceptions of VR depending on their preferred learning activities, it is suggested to incorporate the following characteristics in future experimental study designs: (1) students' traits (such as gender, age, and educational level), (2) experienced versus non-experienced students regarding presenting in VR, (3) students from different sociocultural traditions (e.g., teacher-centered versus student-centered higher education curricula), and (4) students with varying personal goals or learning patterns that influence their perceptions of the value of feedback types for developing presentation competencies [25].

6. Conclusion

This chapter aimed to synthesize previous studies into a set of educational design principles in VR, fostering students' presentation competence, to discuss

practical implications and to construct a future research agenda on this topic. Optimizing earlier formulated principles could develop a theoretical framework situated in the context of VR for presenting to direct intervention and empirical and theoretical studies. Besides studying the optimization of the formulated principles, future studies should test the generalizability of the set by taking student characteristics, their perceptions, and sociocultural backgrounds into consideration. In line with this, it remains questionable to what extent this set of principles can also be adopted to foster other academic and communication competencies in VR, since comparable learning environment characteristics are visible for developing argumentation, negotiation, and scientific writing skills. Future scientific and practical research should also take the recent developments of technological and educational trends into account in order to create both effective and efficient virtual learning environments in higher education in which high levels of ecological validity are guaranteed.

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Conflict of interest

None of the authors or partners in the project report any conflict of interest.

Informed consent

Informed consent was obtained from all individual participants in the reported studies.

Notes

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Author details

Stan Van Ginkel
Archimedes Institute, University of Applied Sciences Utrecht, The Netherlands

*Address all correspondence to: stan.vanginkel@hu.nl

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