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When technology meets educational sciences: Combining virtual reality and microteaching to train pre-service teachers' kindergarten classroom management strategies.

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Abstract

In our study, we asked 19 pre-service teachers (PSTs) about their experiences with and perceptions of a microteaching-supported virtual reality (VR) kindergarten classroom where they practiced and experimented with different classroom management strategies (CMS). We analyzed quantitative and qualitative responses to gain insight into the perceived usefulness of this learning environment for CMS development and transfer to internship practices. The quantitative results show that practicing in the VR classroom supported mastery of CMS and helped PSTs to manage behaviors at their internships. The qualitative data suggest that the microteaching approach can support transfer of CMS practiced in the VR-kindergarten classroom to in-situ classroom management situations, possibly because of the opportunity to collaboratively engage in reflexive practices. Moreover, PSTs raised valuable suggestions to further improve the microteaching structure to strengthen the effect of peer feedback. The results of this study underline the importance of purposefully grounding VR applications in proven instructional theories.

Keywords: *Pre-service teacher education; classroom management strategies; development; transfer; virtual reality; microteaching.*

1. Introduction

On a daily basis, teachers must think about ways to manage their classrooms to create a positive learning environment that stimulates students' social and academic learning. Effective classroom management entails restoring order by timely recognition of disruptive behaviors and selecting and applying suitable classroom management strategies (CMS) to prevent, stop, or discipline behaviors (Borich, 2011; Korpershoek et al., 2016). However, deciding which CMS is most effective to address specific behaviors is one of the foremost concerns to many teachers. Especially beginning and pre-service teachers (PSTs) have difficulties deciding when behaviors need to be managed, determining which anticipative (i.e., preventive), deflective, or reactive strategy will be most effective, and recognizing when it is time to switch to another strategy (e.g., Emmer & Stough, 2001; Putman, 2009).

Ideally, PSTs develop effective CMS during their internship. However, many PSTs feel that the kindergarten-classroom internship, in particular, does not offer enough possibilities to practice or try out different types of CMS. PSTs find it challenging to apply CMS theories to dynamic kindergarten practices and sometimes feel pressured to adopt their mentor's strategies, even if they feel uncomfortable doing so (Zeichner et al., 1981). Moreover, internships in Dutch teacher-training programs are often confined to specific days or parsed in a relatively short period in which only a limited number of disruptive behaviors can be observed and managed. Hence, kindergarten internships leave little room for PSTs to purposefully experiment with different CMS to find their teacher voice.

Simulation-based learning environments such as virtual reality (VR) have potential for learning complex professional skills (Chernikova et al., 2020). A Head-Mounted Display simulates an immersive experience and creates a realistic and authentic learning environment that encourages active exploration and interaction (Renganayagalu et al., 2021). We implemented an interactive VR-kindergarten learning environment in which PSTs of our Academic Teacher Training Program can interact with kindergarteners and respond to a variety of pre-programmed disruptive behaviors ranging in complexity levels, enabling PSTs to experience more disruptive behaviors as compared to an internship. Moreover, it is possible to rerun complex situations, allowing PSTs to experiment with different CMS and helping them understand the reciprocity between behaviors and CMS. This technological affordance seems to perfectly lend itself to a proven instructional technique in teacher education called *microteaching*. In its original form, microteaching involves designing and delivering a small part of a lesson to peers, observing each other teaching, and giving and receiving feedback to improve specific teaching skills (Mergler & Tangen, 2010). Applying a validated didactical structure such as microteaching to VR is relatively new: Most studies evaluating the educational potential of VR have primarily focused on technological aspects of educational designs or VR affordances (e.g., Pantelidis, 2009). Using a mixed-methods design we examined: *How do PSTs perceive the usefulness of a microteaching-supported*

VR-learning environment for developing kindergarten-specific CMS and transfer of CMS to the in-situ kindergarten internship?

2. Methods

2.1. Participants, Design, and Procedure

From September to December 2021, 19 PSTs (17 women, M_{age} = 20.17 years) participated in a microteaching-supported VR curriculum. Parallel to the curriculum, PSTs were based at a kindergarten internship. The goal of the VR curriculum was to offer PSTs a safe learning environment in which they could practice and experiment with different CMS in response to a variety of kindergarten-specific behaviors. PSTs started with a theoretical lecture on classroom management and filled out an online pre-measurement questionnaire (September). Groups of four PSTs visited our university's VR-lab three times for a VR microteaching session. During these sessions, PSTs took turns and individually guided a whole-group activity while managing 20 virtual kindergartners engaging in various (potentially) disturbing behaviors. As is common during microteaching sessions, the other three PSTs live observed the session and noted down feedback. After each session, PSTs discussed their performance and received feedback. The feedback was then put into practice during a second 'run'. The VR sessions gradually build up in terms of the level of complexity of disruptive behaviors, duration, and microteaching focus (see Figure 1). During the first VR session (September), PSTs prepared and practiced with CMS relevant for starting up a lesson, such as meaningfully getting the attention of all kindergartners, a plenary opening, and switching to the busy-picture activity. The second VR session (October) centered on practicing CMS such as scanning and observing, timely recognition of and reacting to potentially disturbing behaviors. During the third VR session (November), PSTs were challenged to actively experiment with different CMS to discover which CMS works for them and to gain insight into the reciprocity between different behaviors and specific CMS. PSTs twice filled out a self-report questionnaire distributed through Qualtrics: once before the VR sessions (September) and once at the end of their kindergarten internship (in December).

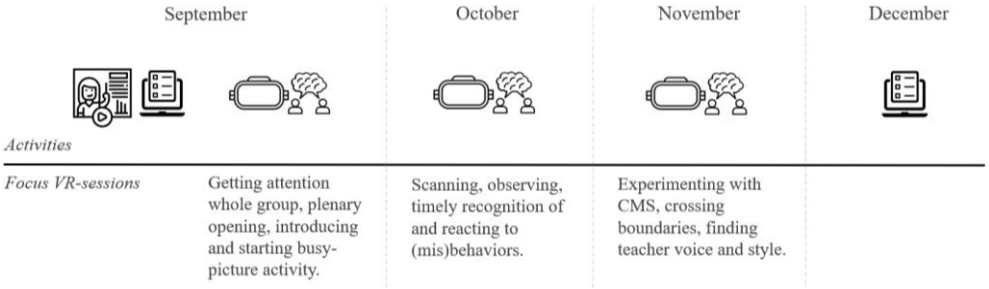

Figure 1. Timeline and focus didactical activities and questionnaires.

2.2. Measurement Instruments

In the pre-questionnaire, PSTs were asked to set a learning goal and noted their expectations of the curriculum. The post-questionnaire comprised slider- and open-ended questions. On the 100-point slider-scales, PSTs indicated the extent to which they thought five elements of the microteaching-supported VR curriculum contributed to CMS development and transfer. They then described to what degree their learning goals and expectations were met and were asked to reflect on the strengths (*'tops'*) and points for improvement (*'tips'*) for both the VR-kindergarten classroom learning environment and the microteaching didactical approach.

2.3. Analytical Approach

PSTs' responses to the slide-scale questions are visualized in boxplots (Figure 2) and interpreted based on the descriptive statistics. For analyzing PSTs' qualitative responses to the open-ended questions, we followed a Grounded Theory approach. Responses were categorized in an open-coding process (i.e., codes emerged from the data; Braun & Clarke, 2006), followed by a further in-depth thematic cluster-based exploration of the responses.

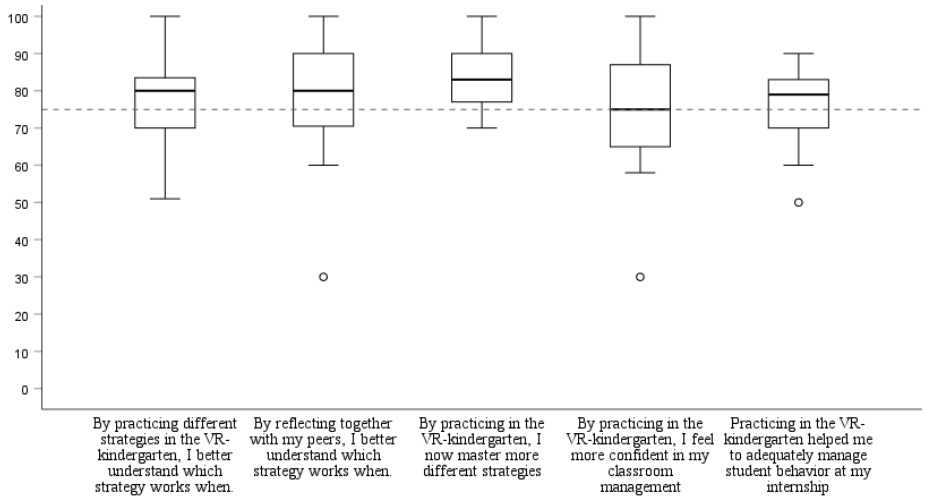

Figure 2. PSTs' quantitative perceptions of usefulness VR and microteaching for CMS development and transfer.

3. Results and Discussion

3.1. Quantitative Perceptions of the VR Environment and Microteaching Approach

Overall, the quantitative data indicate that PSTs were rather positive about the value of the VR-kindergarten classroom and microteaching approach for CMS development and transfer; the five items were all (on average) rated with 75 or higher on a 100-point (see Figure 2). The possibility of practicing in the VR classroom to master more different CMS was rated

highest (*M* = 84.11, *SD* = 9.33), followed by PSTs' perceptions towards the added value of reflecting with peers for better understanding which strategy works when (*M* = 78.58, *SD* = 17.12). The usefulness of practicing in the VR kindergarten for self-efficacy beliefs was rated relatively 'lowest' (*M* = 75.53, *SD* = 17.25). However, please note that the *absolute* differences between the mean ratings of the five items are minimal. These quantitative perceptions are further explored and interpreted through the qualitative data.

3.2. Qualitative Perceptions of Aspects Related to the VR Environment

PSTs' perceptions of the usefulness of VR for CMS development and transfer were captured in 172 codes. These codes could be categorized into six overarching themes: outcomes (27.32%), VR affordances (20.93%), training CMS (20.93%), VR technology (19.19%), reflection on teaching practices (9.88%), and other didactical aspects (1.74%). Hence, most remarks concerned the added value of VR in terms of learning outcomes. Here, PSTs most often mentioned that the VR environment is useful (12 times) and that it supports transfer to practice (10 times), CMS development (9 times), and self-efficacy beliefs (5 times). As one PST described: "*During my internship, I sometimes thought back to the VR-sessions and thought about how I approached a situation in the VR classroom and whether this would also be appropriate in an internship situation."* Regarding the VR affordances, PSTs noted that the kindergarten classroom provides them with a safe space (7 times) that facilitates experimenting with different strategies (7 times): *"What really surprised me is that I just tried everything I wanted, without any shame really. I felt at ease."* The benefits for CMS development mostly pertained to applying (8 times) or practicing (8 times) different CMS or trying new CMS (7 times). The VR environment also helped PSTs to reflect on their teaching practices, especially in terms of finding their teacher voice (10 times): *"Because I applied these strategies in the VR-session, I now know which CMS suit me, which ones I like and which ones I don't. I now know which strategies I feel comfortable with."*

PSTs' points for improving the VR kindergarten classroom concerned VR technology-related aspects (87.50%), other didactical aspects (9.38%), and learning outcomes (3.12%). In previous studies, improvement in terms of the VR technology primarily pertained to the software-related aspects and system performance (i.e., bugs and glitches, unrealistic behaviors, inadequate auditory input; Mouw et al., 2020), whereas in the current study PSTs' reflections on the VR technology were more related to strengthening the *didactical* potential of the environment. For example, PSTs most often expressed the wish for creating engagement through in-depth verbal interaction with the virtual kindergartners: "*The most difficult thing for me was that the interaction was limited, while in a real kindergarten, this is the most important thing."* PSTs also expressed a desire to vary the busy picture to improve authenticity and variation of practice: "*At the internship, you would not offer the same activity every week, and this (varying the busy picture) would make it more realistic."*

In sum, PSTs generally found the VR kindergarten classroom useful for CMS development and self-efficacy beliefs, and that the environment supports transfer to practice, possibly because it provides them a safe space that facilitates active experimenting with different CMS. Hence, even though PSTs also experienced some limitations (i.e., verbal interaction and the busy picture), it seems that these to-be-improved aspects *did not* lead to a training situation that was too disconnected from everyday classroom practice (Putman, 2009).

3.3. Qualitative Perceptions of Microteaching-Related Aspects

PSTs' perceptions of the usefulness of microteaching for CMS development and transfer were captured in 155 codes reflecting six overarching themes: Microteaching affordances (58.06%), outcomes (21.94%), reflection on teaching practices (7.74%), VR affordances (5.16%), training CMS (3.87%), and other didactical aspects (3.23%). PSTs generally held positive perceptions towards microteaching's didactical affordances and mentioned the added value of (peer)feedback provision and discussion (16 times), the possibility to observe peers (14 times), collaborative reflection (9 times), the opportunity to apply received feedback (9 times), and getting inspired by others (8 times). In terms of outcomes, PSTs most often mentioned that the microteaching structure is very useful (18 times) and pleasant (6). PSTs reflections on the affordances of microteaching often included a reflection on outcomes. For example: "*Exchanging feedback provided a lot of guidance and it made my self-confidence grow."* In the category reflection on teaching practices, PSTs most often (10 times) mentioned reflexive practices (i.e., reflecting on, becoming aware of, and/or changing specific teaching behaviors) as an added value: *"Because you receive in-depth feedback about what you could do differently, you will pay attention to that in the future. You also think more carefully about the choices you make in your classroom management."* In terms of other didactical aspects, PSTs found the didactical build-up and focus of the VR sessions worth mentioning (4 times).

PSTs also raised points for improving the microteaching approach. Most of the 28 codes pertained to other didactical aspects (75%), followed by microteaching affordances (17.86%), and outcomes (7.14%). Feedback on the didactical aspects mostly concerned ways to strengthen the effect of peer feedback (5 times) or to improve the feedback-provision structure (4 times): "*One tip would be to ensure that everyone takes the feedback they received home. Not everyone took a picture of the (joint) feedback form, and this way valuable feedback was sometimes forgotten."* For the affordances of microteaching, the importance of a safe social climate was twice mentioned: "*Sometimes I felt uncomfortable with having my peers observing me. (…) it gives me the idea that I did something wrong."*

In sum, it seems that peer-related aspects of the microteaching approach that stimulated reflexive practices were particularly valued as *didactical* affordances; PSTs highly appreciated the opportunity to observe their peers' teaching practices and to practice specific

CMS, receive feedback and reflect on these practices, and subsequently try out the feedback received. At the same time, PSTs felt that the didactical approach should be further improved to strengthen the effect of peer feedback, for example by fine-tuning the feedback forms.

4. Conclusion and Future Directions

In this paper, we aimed to gain insight into PSTs' experiences with and perceptions of a microteaching-supported virtual reality kindergarten classroom in terms of usefulness for CMS development and transfer to their internship practices. All in all, our findings seem to suggest that combining the best of both worlds, that is, applying a *didactical* approach to a *VR* environment, has much potential to support the development of complex teaching skills such as classroom management. The quantitative data showed that practicing in the VR classroom supported mastery of CMS and helped PSTs to think about how to manage behaviors at their internship. Moreover, collaboratively reflecting with peers supported their understanding of which strategy works when. PSTs' qualitative reflections suggest that a microteaching approach can support the transfer of CMS practiced in an in-vitro VR-training situation to in situ classroom management situations, possibly because of the opportunity to engage in in-depth collaborative reflexive practices. PSTs also reflected on possibilities to further improve the microteaching structure to strengthen the effect of peer feedback.

Following Radianti et al. (2020)—who argue that one of the issues impeding integration of VR in higher education is that most applications lack grounding in learning and instructional theories—we stipulate that a purposeful implementation of VR in teacher education should start by carefully examining how existing instructional theories are best adapted when designing a *VR*-learning environment. To this end, we recommend more thoroughly evaluating the didactical affordances of microteaching, for example, by systematically variating different components of the microteaching structure (i.e., providing peer feedback only versus a combination of teacher and peer feedback, using feedback structures, et cetera) and to empirically assess the independent effects of microteaching and the VR environment on CMS development. Another direction worth further exploring is the integration of eye-tracking in VR-learning environments. Research shows that being able to identify classroom behaviors accurately and rapidly is important for developing effective CMS (Van den Bogert et al., 2014). As such, gazing patterns can be an extremely important source of information. We postulate that visualizing gazing patterns *in real-time* could steer more targeted (peer) feedback provision as peers can then see what is (not) observed or dealt with in the virtual classroom, which could deepen the discussion and stimulate reflexive practices.

Our study indicates that combining the best of both worlds, that is, technology and educational sciences, can be very fruitful. By providing PSTs with a VR-learning environment in which they can freely practice real teaching skills in an authentic, yet safe

setting, we can help them in finding their own teacher identity and their teacher voice. In the future, we hope to provide our students with more opportunities where they can finetune their CMS in a VR kindergarten to optimally prepare them for their professional teaching careers.

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