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Preservice Teachers' Professional Learning Community Re-Imagined: Virtual Reality Teaching Circle

Abstract • This practical report (Praxisbericht) introduces the Virtual Reality Teaching Circle (VR-TC), an innovative professional learning community (PLC) model for preservice teacher education. Integrating VR simulations, peer feedback, and structured reflection, VR-TC enables authentic, iterative, and collaborative learning. Through two examples of guided and self-organized implementations, the report proposes using this model to reimagine practice-based teacher education as a collective, technology-enhanced, and scalable approach to developing reflective and adaptive teaching competence.

Schlagworte/Keywords • Simulation-Based Teacher Education, Collaborative Learning, Professional Learning Communities, Reciprocal Feedback, Virtual Reality Teaching Simulation

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Professional Learning Community

Research on effective professional development (PD) stresses that teacher-driven learning communities could foster professional learning and drive instructional improvement (Borko, 2004). The concept of a *professional learning community* (PLC; Hord, 1997) stems from the *community of practice* model (Lave & Wenger, 1991) which emphasizes the relational and situated nature of professional learning, highlighting that learning occurs through collective knowledge building and social participation, thus is deeply interwoven with the shared practice of a community.

In particular, PLC of teachers are characterized by autonomous organization among peer teachers, mutual observation and case analysis, as well as collective inquiry and reflection in a continuous cycle (Stoll et al., 2006). PLC has been acclaimed to help foster a collaborative culture and establish communities of practice where teachers work together to build a shared understanding of excellent teaching (Corcelles-Seuba et al., 2025).

Many notable PLC models have emerged from different subject traditions and geolocations. For instance, Es and Sherin (2008) designed the *video club* approach for American math teachers, in which a group of in-service teachers regularly meet to watch and discuss their own excerpts of videotaped instruction in relation to noticing students' mathematical ideas. Similarly, drawing from Japanese elementary education, *lesson study* (*jyugyo kenkyu*) formalized a peer-learning approach in which teachers observe each other's lessons live, gather data on teaching and learning, and collaboratively analyze their findings (Lewis et al., 2006). In Australia, backed by the Quality Teaching pedagogical framework, Gore and colleagues (2015; 2017) formalized the PLC model of *Quality Teaching Rounds* as a structured process involving four or more teachers participating in three sequential sessions within a single day: a reading discussion to establish a shared theoretical foundation and sense of community, a classroom observation of one member's full lesson, and a coding and discussion phase where all participants, including the observed teacher, analyze and reflect on the lesson together.

Previous research shows PLC enhance both teaching quality and student achievement by fostering collaboration, shared leadership, and continuous professional growth (Stoll et al., 2006). Effective PLCs create supportive environments where teachers collectively reflect, con-

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struct, and sustain shared practice. While their impact depends on leadership, context, and support structures, PLCs' adaptability and focus on collective learning make them a powerful mechanism for driving lasting educational improvement.

Missing Link in Preservice Teacher Education

Although PLC are well established for in-service teacher development, the aforementioned models rarely appear in preservice teacher programs – even though research on collaborative video case analysis has shown similarly positive results for preservice teachers across many subjects (Johnson & Cotterman, 2015; Levin, 2025). Microteaching typically represents the only opportunity for preservice teachers to plan and rehearse a lesson, receive feedback, and reflect on their instructional practice (Lampert et al., 2013). However, it is most often conducted in instructor-centered seminar settings rather than in inclusive, collaborative environments that engage peers as co-learners. Furthermore, the experience is rarely repeated, as it is highly resource-intensive to implement.

The primary obstacle to establish PLCs among preservice teachers lies in the central components that afford collective observation and reflection that define PLC: the opportunity of actual classroom instruction by each participating teacher. Globally—and particularly in Germany—preservice teachers have limited, if any, opportunities to engage with real classrooms and students. When such opportunities do occur, they typically arise late in the teacher education program, at a stage when collaborative knowledge building and reflective practice would have been most beneficial during the early phases of professional formation. Consequently, preservice teachers are rarely able to implement their planned lessons in authentic classroom settings, nor to observe and analyze one another's instructional practices in iterative cycles of improvement—processes that are fundamental to the functioning of effective PLCs.

Re-Imagine PLC: VR Teaching Circle

Advancements in virtual reality (VR) technologies, which allow for the simulation of authentic classroom situations, present new oppor-

tunities for designing innovative models of case-based PLCs among preservice teachers. VR simulation can present realistic scenarios that enable teachers to experiment with different decisions and actions without the risk of negatively impacting real students (Huang et al., 2023b; Kaufman & Ireland, 2016). Additionally, it facilitates unobtrusive recording of instructional cases for later peer analysis and feedback. Most critically, VR enables the cyclical process of feedback, meaning that teachers can repeatedly modify their actions after experiencing results or receiving feedback (Dieker et al., 2014).

This practical report (Praxisbericht) will document our initial efforts to design and implement an innovative approach for organizing PLCs for preservice teachers with facilitation of VR teaching simulations, which we have termed the *VR Teaching Circle* (VR-TC). The VR-TC draws inspiration from video clubs, lesson study, and Lampert and colleagues' (2013) cycle of enactment and investigation.

During VR-TC sessions (see Figure 1), preservice teachers work in small groups of two or three, taking turns to teach a simulated lesson in a VR classroom which they have prepared in advance (for more information and research conducted in this VR environment, see Huang et al., 2023a; 2025; Richter et al., 2022).

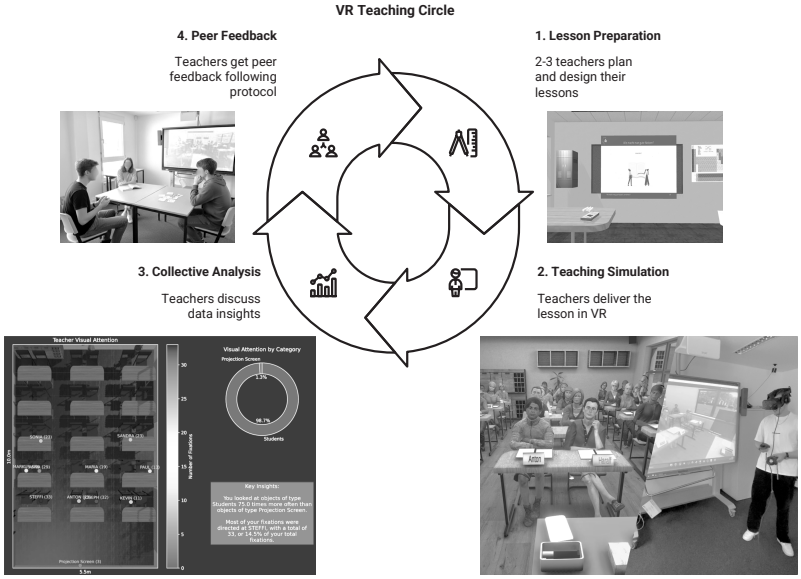

Fig. 1 Procedure of VR Teaching Circle

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Each simulation lasts around 10 minutes and is followed by a session of collective analysis using data-analytical insights from the simulation, such as a heatmap of their visual attention distribution. This is followed by peer feedback guided by a structured protocol. The VR-TC aspires to provide rapid and repeated cycles of peer enactment, observation, analysis, and feedback with actual instructional episodes, addressing the gap in practice-based teacher education. In the following section, we outline two concrete implementations of VR-TC in the Bachelor program in teacher education at the University of Potsdam.

Implementation Examples of VR-TC

Guided VR-TC

The first example of VR-TC is situated within a block seminar on the theme of improving dialogic teaching, based on extensive research that positions classroom dialogue as the core mechanism of learning (e. g., Michaels et al., 2010; Nystrand, 1997). Inspired by the cycle-of-enactment-and-investigation model (Lampert et al., 2013), the seminar alternated between investigating and enacting dialogic teaching. During investigation phases (days 1 and 3), participants analyzed selected examples of classroom interaction, focusing on discourse structures, integration of student ideas, and dialogic strategies to deepen students' reasoning. During enactment phases (days 2 and 4; VR-TC), participants practiced dialogic teaching in a VR classroom with AI-driven student agents.

During the 1.5-hour VR-TC sessions, preservice teachers worked in self-organized triads, taking turns to teach or observe in a VR classroom. The simulation is realized with a self-developed VR software (VRAISE – Virtual Reality and AI-powered Simulation for Educators) in which student agents controlled by a local large language model (LLM; Google Gemma3) can converse with the teacher naturalistically. Each teacher prepared a different lesson aimed at developing students' argumentative reasoning through a debate (e. g., Should social media use be restricted for teenagers? Should homework be abolished in schools?). Since the student avatars are driven by LLM, each teacher will encounter distinct yet comparable classroom dialogues based on their instructional decisions. The VR environment automatically record-

ed and transcribed teacher talk, supporting evidence-based reflection and feedback. After each simulated lesson, peers used an observational protocol adapted from Ambitious Science Teaching (Windschitl et al., 2018) to provide feedback, with the facilitation of the seminar instruction. Like Quality Teaching Rounds, using a structured feedback protocol gives teachers a shared language and clear standards for engaging in focused, evidence-based professional discussions with peers.

This seminar with VR-TC moves beyond theoretical input to establish a shared professional space where teachers jointly examine, discuss, and refine discourse strategies. This PLC structure encourages preservice teachers to move from individual reflection toward collective inquiry into how classroom talk supports student reasoning and understanding.

Self-Organized VR-TC

The second example took a different approach to highlight the possibility of self-organized VR-TC sessions without intervention from university instructors or teacher educators. The workshop, My Virtual Reality Teaching Partner, adopts a train-the-trainer (TTT) approach using a cascade model, in which experts prepare a small group of teachers as trainers who then deliver the same or adapted professional learning opportunities to their colleagues (Kennedy, 2005). Specifically, the workshop first prepares preservice teachers to become effective peer feedback givers who could observe classroom teaching and give structured feedback in a VR-TC session. In the first phase, feedback givers receive targeted training in protocol-supported classroom observation, the design of constructive and supportive feedback, as well as how to setup the VR technology, and orchestrate a VR-TC session. In the second phase, the trained feedback givers independently organize and conduct VR-TC sessions for other preservice teachers. They observe their peers' simulated lessons, offer structured feedback, and engage in collaborative reflection about teaching quality.

This TTT-inspired VR-TC deliberately strengthens the three effectiveness dimensions of TTT that are critical for preventing dilution as training cascades: substantive, structural, and relational dimension (Harper et al., 2024). By equipping preservice teachers with explicit protocols, shared tools, and opportunities for supported practice before they train peers, the workshop preserves the integrity of feedback practices while building local capacity and ownership. The peer-

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led VR-TC sessions further reinforce learning through authentic observation, structured dialogue, and collaborative reflection.

This particular implementation of VR-TC also underscores the distinct needs of inexperienced preservice teachers, who require explicit guidance in classroom observation and feedback strategies. Limited teaching experience often restricts their ability to identify instructional patterns and evaluate teaching effectiveness. We addressed this by providing systematic training in observation criteria, feedback formulation, and reflective dialogue. Through guided practice and peer collaboration, preservice teachers develop the analytical and communicative skills necessary for evidence-based feedback and professional growth. This explicit and scaffolded approach enables novices to transition from surface-level observation to informed, reflective analysis of teaching practices.

Implications of VR-TC for Teacher Education

Through two examples, we introduced a new PLC model situated in preservice teacher education—the VR Teaching Circle. By integrating VR simulation, structured peer collaboration, and evidence-based reflection, the VR-TC model addresses persistent challenges in teacher preparation, particularly the scarcity of authentic, iterative, and collaborative practice-based peer learning opportunities.

VR-TC operationalizes collaborative professional learning at the preservice level, extending the established benefits of PLCs to teacher preparation. The model foregrounds peer observation, feedback, and collective inquiry as central mechanisms of professional growth, thereby democratizing teacher learning. Working in small peer triads fosters a community of practice in which preservice teachers jointly construct professional knowledge, analyze teaching episodes, and develop a shared language for discussing instructional quality. This collaborative structure mirrors the social dimensions of in-service professional development, cultivating habits of collegiality, mutual accountability, and reflective dialogue that preservice teachers can carry into their future professional contexts.

VR-TC also demonstrates how technology-enhanced reflection strengthens evidence-based learning. Automatic recording and transcription of teaching episodes, combined with structured feedback

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protocols, provide robust data for analytical reflection. This enables preservice teachers to ground their evaluations in observable evidence rather than intuition, promoting reflective competence and self-regulated learning. The inclusion of AI-driven student avatars further enhances pedagogical authenticity and complexity, allowing preservice teachers to engage with diverse, unpredictable classroom interactions and to practice responsive teaching within safe, controlled conditions. Furthermore, VR-TC contributes to the scalability and equity of practice-based teacher education. Conventional microteaching and school-based practicums are often constrained by limited resources, uneven access to classrooms, and variability in mentoring quality. In contrast, VR simulations can be standardized, replicated, and accessed remotely, providing consistent, equitable learning conditions across institutions. The self-organized VR-TC model, exemplified by My Virtual Reality Teaching Partner, decentralizes professional learning by empowering preservice teachers to initiate and sustain peer-led practice and feedback cycles independently. This autonomy aligns with current emphases on self-directed learning, professional agency, and sustainable teacher development.

At the same time, the implementation of VR-TC is subject to several limitations that warrant consideration. From a technical perspective, the use of VR simulations requires reliable equipment and institutional support for setup, maintenance, and troubleshooting, which may not be uniformly available across teacher education programs. Effective participation also presupposes a baseline level of digital literacy among preservice teachers and teacher educators. Moreover, while the VR-TC model is designed to be scalable, working with large cohorts can pose organizational challenges, including scheduling, coordination of peer triads, and ensuring consistency in facilitation and feedback quality. Finally, although VR simulations offer rich approximations of classroom practice, they cannot replace the relational, contextual, and emotional complexities of real school environments, underscoring the need to position VR-TC as a complement rather than a replacement for in-school practicum experiences.

Ultimately, the VR-TC framework signals a paradigm shift from teaching about practice toward learning in and through shared practice in a community. It reimagines practice-based learning as a collective, iterative, and technologically mediated process. Integrating VR-TC into teacher education curricula may enable early and repeated engage-

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ment with authentic teaching scenarios, foster collaborative inquiry, and normalize feedback-driven professional growth.

In sum, the implications of VR-TC for teacher education are both conceptual and practical. Conceptually, VR-TC bridges theoretical understanding and embodied teaching practice within a social learning framework. Practically, it offers a scalable, accessible, and pedagogically rigorous model for cultivating reflective, adaptive, and collaborative teacher professionalism. As teacher education evolves to meet the demands of increasingly complex educational environments, the VR-TC provides a compelling blueprint for preparing future teachers who can navigate classroom challenges with confidence, evidence-based reasoning, and a commitment to collective learning.

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