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EXPLORING THE PEDAGOGICAL POTENTIAL OF VIRTUAL REALITY SIMULATIONS FOR PRE-SERVICE TEACHERS FROM A VYGOTSKYAN PERSPECTIVE

Ann-Cathrin Faldet, Thor-André Skrefsrud, and Hege Merete Somyby

Abstract: *This paper discusses the pedagogical potential of a flipped classroom practice in which advanced virtual reality simulations are used to place pre-service teachers in work-related situations, such as a home-school collaboration. The paper applies a Vygotskian perspective and discusses the simulation's potential for contributing to pre-service teachers' professional development. The article argues that, as understood through the lens of Vygotsky's sociocultural approach to learning, virtual reality simulations may enhance pre-service teachers' ability to learn through imitation, while also encouraging collaborative interaction and reflection. The aim in using virtual reality simulations in the flipped classroom is to counteract the reduction of pre-service teachers to passive interpreters and teachers to the providers of prescribed curriculums. We end the article by drawing attention to the potential limitations of the simulation when used as a flipped classroom practice.*

Keywords: virtual reality simulations, Vygotsky's sociocultural theory of learning, student-active learning, home-school collaboration, pre-service teachers training program

Introduction

In this article, we report on a project called “Active professional development in a virtual world”, funded by the Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education, which aims to enhance digital learning methods and active student learning.¹ Using virtual-reality (VR) technology, the project develops flipped classroom practices designed to build pre-service teachers' capacity for their future professional roles in schools.

As part of the project, we designed an advanced virtual reality (VR) simulation that places pre-service teachers in work-related situations.² At the time of writing this paper, pre-service teachers had not yet tried the simulation. It will be implemented at INN University in Norway as part of a pre-service teacher course on home-school collaboration. When the course starts later in 2021, the pre-service teachers will use VR headsets to engage with the simulation and to try out various scenarios and situations that in-service teachers might encounter with parents. By using VR, the pre-service teachers will be given the opportunity to experience situations repeatedly and to develop relevant professional concepts and conceptual understandings. They will be given the opportunity to explore various approaches to dealing with situations that arise and then to reflect on them together with their peers and professors (Skrefsrud, 2020). Working with both advanced technology and group discussion, the project aims to develop and explore working practices where pre-service teachers can interact to discover appropriate solutions to situations they may encounter as in-service teachers. During the first stage, the pre-service teachers will work individually and then in teams with tasks assigned by their professor. The second stage will be done in class, and they will now take part in simulations, together with their peers and professor. During the third stage, they will engage in discussion and reflection.

¹ The funding is strictly confined to the development of the digital simulation and the Agency has no economic interest in the production other than enhancing pre-service teachers' activity in teacher education in Norway.

² The VR simulation was developed in collaboration with EON Reality Norway, in-service teachers from the partner schools of INN University, and the local project group.

With the increasing use of digital technology in education, an important task for educational research is to introduce theories of learning that can help educators reflect critically and constructively on the use of digital simulations in their classrooms. Pellas *et al.* (2019) stress the need for learning theories that can guide learning methods for using digital tools effectively in education. Fowler (2014, p. 412) also emphasizes the need for a “pedagogical underpinning” for the design and use of VR systems. The importance of discussing appropriate theoretical approach is exemplified in the following with an argumentation for the using a sociocultural approach. Applying a behavioral theory of learning in our context, the digital simulation will be understood mainly as a tool by which to control, stimulate and change pre-service teachers’ behavior in a desirable direction. Behavioral theories, such as Skinner’s operant learning theory (1953), propose that we, as humans, “will repeat acts that lead to favorable outcomes” (Edinyang, 2016, p. 42). By manipulating a stimulus, the response will be manipulated, and thus behavior will be changed. Some research investigating learning outcomes resulting from the use of VR simulations has aimed to investigate changes in behavior (e.g., Fertleman *et al.*, 2018; Ramachandiran *et al.*, 2015). Behavioral change is successful when the aim is to master specific skills. However, the cognitivist approach to learning focuses its attention on how pre-service teachers may benefit cognitively from a simulation and how the design of the simulation may serve to underline the way in which the intellect grows and expands through a series of progressive stages (e.g., Piaget, 1936). Other papers that study game-based learning argue that a constructivist approach to learning is appropriate (e.g., Chen, 2016; Huang and Liaw, 2018; Lee, Wong, and Fung, 2010; Pellas *et al.*, 2019). According to a review by Papanastasiou *et al.* (2019), the combination of student-centered activities and an interactive environment is in line with the constructivist approach and its philosophy of learning. The process of actively acquiring experience and then creating knowledge based on prior experience is central to constructivist theory (e.g., Huang, Rauch, and Liaw, 2010; Lee, Wong, and Fung, 2010; Pellas *et al.* 2019; Videnovik *et al.*, 2020) and points back to the learning theories of Dewey and Piaget (Huang, Rauch, and Liaw, 2010).

However, if the educational goal is to promote learning activities in school and in teacher education that build on dialogue, interaction, and the collaborative construction of new knowledge, the sociocultural theory of learning is of particular interest. As Burnett and Merchant (2020) have emphasized, the sociocultural perspective provides an important counterbalance to cognitivist accounts that tend to have overlooked the relationship between the digital and the social. Within a cognitive-behavioral frame of reference, the digital is often “depicted as unitary, or free-standing, and in some way detached from the social, cultural and material conditions of use” (Burnett and Merchant, 2020, p. 11). In contrast, they argue that people’s use of digital tools – such as a VR simulation – is embedded in the social production of meaning helping to shape the kind of knowledge that is produced. Hence, according to Burnett and Merchant (2020, p. 105), the sociocultural perspective is helpful as it reminds us that digital devices and technologies themselves make very little difference with regard to progress and development in education, rather, it is what teachers and learners do with the technologies that matters.

In this article, we discuss the pedagogical potential of the VR simulation used with pre-service teachers from a sociocultural perspective applying the Vygotskian perspective on learning (1962, 1978, 1987). In line with Vygotsky’s (as well as Burnett and Merchant’s) thinking, we acknowledge that pre-service teachers should be seen as active participants in their own process of learning and that their perspectives and reflections should be recognized as making significant contributions to the conversation. Elaborating on the design from this perspective, we are interested in how the use of the simulation allows pre-service teachers to play the role of legitimate subjects rather than of objects to be equipped with pre-determined knowledge (Burnett and Merchant, 2020; Biesta, 2013). Instead of perceiving learning as an activity by which learners internalize knowledge as information

that is discovered and transmitted by others, the learner is seen as an active participant who contributes to the construction of knowledge within a community of learners. The research question therefore is: How can a VR simulation, used as a flipped classroom practice, contribute to enhancing pre-service teachers' imitation and collaborative interaction and reflection?

Flipped Classroom Practices

In the last decade, researchers and educators have increasingly recognized the value of the flipped classroom as an innovative and effective instructional approach. As a pedagogical practice, the flipped classroom challenges the traditional instruction situation where the teacher talks and the pupils listen. In contrast, the flipped classroom replaces in-class instruction time with at-home practice time (Bergmann and Sams, 2012; Hwang, Lai, and Wang, 2015). According to Lage, Platt, and Treglia (2000, p. 32), “inverting the classroom means that events that have traditionally taken place inside the classroom now take place outside the classroom and vice versa.” Hence, the flipped classroom moves the content previously taught by teachers in class to the time before and after the class, often dividing the process of learning into three stages. In the first stage, the pupils may work with basic knowledge and concepts, for example, by watching a video and writing down any questions they may have. The second stage is the in-class activity, which involves the teacher and pupils in face-to-face interaction, for example, discussing concepts and elaborating on questions. The third stage involves a reflection on the learning activity; for example, the teacher may use group discussion to comment on the questions in a learning-oriented dialogue with the pupils. The implementation of flipped classroom learning is not static, and the stages can be managed in different ways (Hwang, Lai, and Wang, 2015). Common to the practice, however, is the idea that the time used for in-class activities, such as discussion, problem-solving, and group projects, will enhance student-active learning. The teacher-directed time is now used in more effective ways, as direct instruction is replaced by additional class-time that is used for collaborative and active learning.

As a relatively new trend, there seems, as yet, to be little rigorous research regarding the overall effectiveness of the flipped-classroom approach (Gilboy, Heinerichs, and Pazzaglia, 2015; Mok, 2014; Turan and Akdag-Cimen, 2020). Nevertheless, a growing number of scholars have looked at different aspects of the flipped-classroom process, demonstrating both the opportunities and challenges of the method. Turan and Akdag-Cimen (2020) found that the flipped classroom increased the efficiency of class time in English language teaching, while Chen et al. (2018) documented the learning opportunities the method gave pupils. Building on data from a three-year study on student performance, Atteberry (2013) presented a contradictory finding, suggesting that flipping the classroom may not cause any significant difference in student outcomes, while Goedhart *et al.* (2019) arrived at a similar conclusion. Despite these divergent findings, there is wide agreement in the field of education on the significance of activity, reflection, and collaboration in learning (Biesta, 2013). For pioneers such as Vygotsky, Piaget, and Dewey, a crucial insight is that children learn when engaging actively with content in collaborative learning situations. From this perspective, the use of flipped classroom practices has the potential to be an effective and beneficial approach to pupils' learning, enhancing pedagogical ideals such as collaboration, interaction, and participation, in contrast to the more traditional passive approach to teaching and learning. As emphasized by Arnold-Garza (2014, p. 9), the flipped practice “encourages instructors to view incorporation of active learning as a core component of teaching, rather than as supplemental to a lecture.”

A common misconception about the flipped classroom is that students are left on their own in both the first and the third stages, working without structure or guidance from the teacher (Bergmann and Sams, 2012). If this were true, the flipped classroom practice could be said to

reduce the role of the teacher to that of a distant actor who leaves the students to discover and develop knowledge and skills on their own. According to Tucker (2012), however, the potential effectiveness of the method depends very much on the teachers' ability to lead the process of learning and to introduce clearly structured and defined tasks for the students to work on during the different stages (see also, Gillette et al., 2018). While flexibility for both teachers and students increases, it is essential that support and clear expectations are communicated by the teacher.

In summation, when used in a structured and planned way, the flipped classroom practice may initiate a transformation in the roles of teacher and pupils (Burnett and Merchant, 2020; Gillette *et al.*, 2018; Goedhart *et al.*, 2019; Turan and Akdag-Cimen, 2020). While the traditional approach to teaching has often positioned the pupils as passive interpreters of knowledge that the active teacher presents to them, the flipped classroom practice increases the pupils' responsibility without reducing the significance of the teacher. Within the flipped classroom model, both pupils and teachers are given active roles through which they construct and develop knowledge in a collaborative process of learning.

The Project as Flipped Classroom Practice

The project 'Active professional development in a virtual world' aims to activate pre-service teachers' engagement in their own learning process by using a flipped classroom method. Since the simulation has not yet been utilized with pre-service teachers, this paper is limited to exploring the project as a potential flipped classroom practice. In accord with our research question, we will discuss whether pre-service teachers will benefit more from conversations and discussions when they have first prepared for and then experienced a situation that is close to the real-life experience of an in-service teacher. Further, the pre-work and the simulation experience will be discussed in a collective learning space, using a Vygotsky perspective on learning. Our expectation is that this learning session will help pre-service teachers to develop more effective higher mental functions than they would in the traditional, teacher-centered environment (e.g., Vygotsky, 1978).

Although the different stages of the learning session are described as distinct and different parts of flipped-classroom-practice, they are closely developed from Vygotsky's perspective on learning, which sees learning as an intertwined process. For Vygotsky, imitation is crucial in learning, as it moves from a social to individual level (Vygotsky, 1987, pp. 209–210), which he describes as the zone of proximal development (Vygotsky, 1978). Hence, the three stages are carefully designed from the perspective where both social interaction and imitation play central roles in the learning process. The introductory stage is followed by a period when the early and spontaneous concepts and understandings are tested, followed by verbalization, interaction, and reflection on the experience. The prepared simulation will be at the center of the pre-service teachers' activities during this learning session; however, the learning process will start prior to the simulation and continue after it. The design of the learning session is therefore described as including more than the simulation alone.

The flipping of the classroom will largely follow the structure described above: the first stage will be introduced by the professor, but during this stage, the pre-service teachers will work at home with basic knowledge and concepts in preparation for the simulation. In the second stage, the simulation will be an in-class activity. The interactions here will be between the characters in the simulation and individual pre-service teachers, using a VR-headset. Following the simulation, the third stage will involve face-to-face interactions between the professor and the pre-service teacher involved, and among the other pre-service teachers. These interactions will make

active use of concepts introduced in the first stage, and an important aspect will involve reflecting on the experience and considering how to integrate it into their professional development.



Figure 1

The Virtual Reality Simulation

The developmental talk is an activity that in-service teachers in a Norwegian school are obligated to perform (Ministry of Education, 2021). It is a planned and structured conversation with parents and pupils that happens at least two times a year throughout compulsory schooling. This right of parents and pupils is anchored in the Education Act (§20-3), and Teacher Education is obligated to train pre-service teachers in this matter (Regulations on the framework plan for primary school teacher education for steps 5-10, § 2). Today, teaching and training regarding school-home cooperation is mainly conducted at a theoretical level: the pre-service teachers read relevant literature and attend lectures on campus where laws, regulations, theory, and discussions take place. Pre-service teachers also participate in several weeks of practicum in local schools where they receive supervision from trainee teachers. Some pre-service teachers are invited by the trainee teacher to attend a developmental or parental talk during their practicum. This is, however, a *choice* that the trainee teacher can make, and it is a task some trainee teachers do not have the opportunity to prioritize. If a pre-service teacher *is* invited to a developmental talk, it is only to observe. This implies that most pre-service teachers do not have any experience of leading conversations such as these before they are in service (Hanssen and Østrem, 2007).

Seeing that cooperation between school and home should be based on a pro-active rather than a re-active strategy, it is important that the teacher is able to establish positive communication with the parents or guardians of the child. In our VR project, we plan to give the pre-service teachers experience of conversations and situations that might arise and then, to discuss appropriate response strategies. The intention of the simulation is to give the in-service teacher the experience of being part of a professional learning community, and to establish expectations for the pre-service

teachers regarding the developmental talk, and to give them a place and a space to test out their future roles as professional teachers.

A simulation is an imitation of a real situation, and it is established and constructed to look like the reality. By participating in a simulation, pre-service teachers have the opportunity to train for challenging situations that they may meet as professional teachers but without the risks the real situation would entail. Health- and aviation-studies have used simulations for several years, preparing participants for situations where the stakes are high, and the consequences can mean the difference between life and death (e.g., Fanning and Gaba, 2009; Hyland and Hawkins, 2009; Nehring and Lashley, 2010). In the educational field, the need to make the right decision is not equally acute; however, professional teachers can make decisions that affect lives in the long-term, and one such situation is the home-school collaboration. Where there is constructive and successful cooperation between home and school, the possibility of a child succeeding in their educational purpose is more likely to be realized (Jensen and Minke, 2017).

In the preliminary work done for the simulation, in-service teachers and researchers together constructed a pupil-character that teachers often meet. The result is the pupil character Emilie, a girl in lower secondary school, aged 14–15, together with one of her parents. Emilie is described in a case description developed in preparation for the simulation and intended as a preliminary text that the pre-service teachers must be familiar with before attending the simulation. In the description, Emilie is portrayed as a girl who is hard-working but who seldom talks in class. She seems to have friends at school, her academic performance is average, and several of the teachers in the case-description characterize her as a “good girl”. Emilie is portrayed as a pupil the teacher is familiar with but does not know very well. The case description also outlines the contacts the teacher has had both with the pupil and with other subject teachers prior to the developmental talk. Another part of the preparation to which the pre-service teachers must attend is the preparation of questions and a strategy for the conversation as a proactive initiative for a successful meeting with the parent and pupil.



Figure 2



Figure 3

In the project, the advanced virtual reality simulation is designed as a conversation between a teacher (the player), the pupil (the girl, Emilie) and a parent (the father). Emilie and her father are designed as digital characters sitting behind a table, much like a real-life situation, and they move and talk as characters would in an advanced game. The characters' conversation is limited to phrases written in a manuscript and it is designed to respond to different statements from the player (the pre-service teacher). For instance, the player may initiate a topic regarding Emilie's declining grade in social sciences (described for the pre-service teacher in the case description) and then offer a statement. The player can pose this statement as a question, for instance:

"Emilie is performing pretty well on her tests, but the social science teacher says she can perform better on tests in that subject. What are your thoughts on that, Emilie?"

or the player could make a statement that just stated the facts or even gave some strict advice about performing better. Based on which strategy the player chooses, a facilitator (the attending professor) will choose the type of response that Emilie will give. Emilie may either give an answer or just sit quietly, looking uncomfortable. The manuscript offers between one and six different responses to a question, a statement, or advice, which are what we anticipated the player will use. During the development of the manuscript for the simulation, teachers in lower secondary school, faculty members and pre-service-teachers all tested the simulation as a role play, using the case description while one person played Emilie. Later in the process, there was digital animation of Emilie using text-to-speech. This served as a prototyping tool so the simulation could be experienced during the development of the manuscript. At certain stages in the simulation, the father will interject with questions or statements directed either to the player (i.e., the pre-service teacher) or to the child. The simulation conversation will continue for a few minutes, depending on how much time the player uses to talk to the characters in the simulation, and eventually, it will end with either an accepted solution to the issue or with an open-ended discussion where the parent is dissatisfied.

During the simulation, the player (the pre-service teacher) will use the VR-headset and headphones and be “alone” with the characters in the game. A group of other pre-service teachers will participate in the discussion after the simulation, having watched the interactions on a screen in the same room as the player. Later, they will rotate positions. The facilitator will pay attention to the player’s statements and control the direction of the conversation. The professor has limited control over the direction of the developmental talk and can only facilitate the most appropriate response. Thus, the simulation is random and cannot be repeated on demand. When the simulation is finished, the player will assess what worked and what did not go as well as intended. The flipping of the classroom will follow validated procedural steps for a flipped classroom design. However, as far as we know, VR simulations have not previously been constructed in a similar manner for use with pre-service teachers and so, in this regard, it is a pilot project.

Discussion

In the first stage, it is planned that the pre-service teachers will work in teams and then individually with tasks as assigned by the professor. When working in teams, the size of the team should be small enough to allow space for dialogue and active participation by all members. Thus, the tasks given must be open-ended questions for the pre-service teachers to discuss. In this stage, the pre-service teachers are introduced to new subject concepts relating to the developmental talk and home-school cooperation. The purpose now is to introduce communication skills and guidance, while also giving the pre-service teachers an understanding of the background and meaning of the developmental talk. By presenting the subject content, the intention is to introduce the pre-service teachers to new concepts, which can later be internalized through training. This is a part of the imitation process. For the imitation to be successful, it is crucial that the learning material, as presented by the professor, corresponds to the pre-service teacher’s previous experience and knowledge, for instance, by questioning students about their prior experience of the topic, such as home-school collaboration, and the laws and regulations they need to know as professionals. As Vygotsky indicates, the process of imitation happens at the social level, and is later modelled at the individual level. This process constructs and changes consciousness. One can even claim that imitation is at the heart of education’s influence on development (Vygotsky, 1987, pp. 209–210). According to Vygotsky, children cannot imitate what lies beyond their developmental zone, and this applies to learning in general and not only to children. In collaboration, people are able to solve more difficult tasks than they can manage on their own, but they cannot go beyond their own intellectual potential. Thus, the professor’s sensitivity to interactions between the pre-service teachers, the professor herself, and the subject content is central to a Vygotskian perspective. In this phase, the professor is dependent on collaboration to build up the necessary sensitivity for the pre-service teachers' motivation and learning readiness. Only on this basis can she assess the extent to which the pre-service teachers can utilize the collaboration, and thus, potentially, reduce her own role so she can observe the pre-service teachers try out and test their knowledge independently. Determining the potential level, however, requires a high level of professional competence and, not least, the ability to analyze and have psychological and socio-cultural insight and empathy. First, it is essential that collaboration actually takes place and that the pre-service teachers are not left on their own. This must be in the mind and practice of the professor at all times in the flipped classroom situation.

According to Vygotsky (1978), the establishment of the zone of proximal development presupposes that, in this context, the professor will introduce professional concepts that will form the basis for the collaboration. Mobilization of the zone presupposes a preparedness that is related to previous experience, understandings, and concepts about the developmental talk that the pre-service teachers will have. These can be understood in terms of what Vygotsky referred to as a

network of spontaneously developed everyday concepts (Vygotsky, 1987). When, during the first stage, the pre-service teacher becomes aware of his or her everyday concepts, and through the training gains access to the subject concepts, there will be two mutually complementary movements. As Vygotsky explained it, on the one hand, the academic concepts will help to expand and reorganize the meaning of the spontaneous concepts and elevate them to a more abstract level. On the other hand, through their experiential personal meaning, the spontaneous concepts will contribute to giving the academic concepts a core of meaning (e.g., Baker and Wright, 2017). Together, these cognitive activities develop the higher mental processes.

In the flipped classroom-session, in order to stimulate and mobilize the pre-service teachers' potential, the professor involved should constantly focus on tomorrow's level. In other words, the professor must first establish a collaboration with the learner over the assignment related to the developmental talk and the simulation in order to stir to life the higher mental functions that the pre-service teachers are mature enough to develop. At all times, the professor must assess the extent to which the pre-service teachers are able to make use of explanations, demonstrations, and collaboration. This should be done in a continuous interaction with the pre-service teachers and will involve the subject content and the at-home preparations that they must do on their own before the second stage.

Stage two will involve the VR-simulation, which allows the pre-service teachers to activate and test out their newly acquired concepts and skills. The conditions for mobilizing the pre-service teachers' imitation through the simulation do not depend only on the conversation in the simulation being recognizable from the first stage. They also depend on whether the digital characters' behavior evokes associations and connotations for the pre-service teachers so that a horizon of meaning and interpretation is awakened in their minds. During the simulation, the pre-service teachers should be able to test out concepts, the type of question to ask, and appropriate ways of responding. According to Vygotsky, the learner imitates what is perceived at the inter-psychological level, and in this case, what has already been presented and worked on during the first stage to be then, subsequently, tested in the simulation.

In the third stage of the VR simulation, the pre-service teachers—who will all have had a turn to participate in the simulation—come together to examine and analyze their roles in the virtual encounters with the pupil Emilie and her father. Now, they will be encouraged to reflect upon the choices they made during the conversation, how these choices may have affected the conversation, what they could have done differently, and how they believe the encounter was perceived by the pupil and her father. The pre-service teachers are now given the opportunity to build on their newly acquired practical experiences of home-school collaboration and to engage in a reflexive process together with their fellow peers and the professors involved in the simulation. Here, the professors will act as “the more capable peers” (Vygotsky, 1978, p. 86), drawing connections between the pre-service teachers' prior knowledge and their interpretation and articulation of the situation.

The Simulation's Potential for Pre-service Teachers' Imitation and Collaborative Interaction

Used in this way, as a flipped-classroom practice, the simulation underlines the social aspect of learning as emphasized by Vygotsky. According to Vygotsky, learning cannot be separated from its social context; rather, “all the higher functions originate as actual relationships between individuals” (Vygotsky, 1978, p. 57). Hence, according to Vygotsky, students learn through their interaction and communication with their peers, teachers, and other experts. Later, these young teachers will be able to create learning environments that maximize their learners' ability to interact with others through discussion, collaboration, and feedback. This process is supported by use of the simulation,

which aims to activate pre-service teachers' collaborative engagement in their own learning process under the guidance and in close partnership with their professor.

In the simulation, the reflexive process of the pre-service teachers is not limited to the third stage of the simulation, but it is a continuous activity that follows the learners through all the stages of the simulation. In this sense, the simulation supports Vygotsky's (1978) idea that the educational process should be seen as a source, not as a consequence, of the development of cognitive and learning skills (see also, Kozulin, 2004). While teacher education regularly facilitates conventional learning activities, such as reading literature and attending lectures on different issues (Cochran-Smith, 2013; Darling-Hammond, 2017), the simulation opens up a way of experiencing learning that differs from the individual's reception of factual knowledge or information. By facilitating participation and allowing the pre-service teachers to play out the role of in-service teachers, they become active participants, contributing to the construction of knowledge through their participation in a community of learners. In the light of Vygotsky's (1978) zone of proximal development, new perspectives and insights may thus arise from the differences in perspective held among the co-participants. By encountering the same situations repeatedly and getting to know their own responses to various situations, the pre-service teachers are given the opportunity to explore different approaches to situations that arise and to listen to how other pre-service teachers and the professors interpret them. In this way, their own experiences are mirrored in the experiences of others, introducing potentially new perspectives, which may broaden, advance, or even alter their own understanding of the concepts, and ultimately, their understanding of their professional role as teachers.

Hence, the simulation offers the potential for collaborative engagement. Using a digital simulation to work with the questions that arise may help pre-service teachers foster their ability to enter into relationships with others and to communicate and interact with them. At the same time, it will enhance their professional skills and expertise in home-school collaboration and make them more aware of their professional role as future in-service teachers.

Towards a New Model for Flipped Classrooms

The aim of this article has been to describe and explore the pedagogical potential of a VR simulation for pre-service teachers, drawing attention to the simulation's potential for enhancing a culture of collaborative learning among pre-service teachers. Applying a Vygotsky perspective on learning (1962, 1978, 1987), we have argued that the simulation can be seen as a sociocultural approach to professional development for pre-service teachers. Moreover, we have emphasized the crucial role of the professor in the simulation as he or she takes the role of "a more competent peer" (Vygotsky, 1978, p. 86). This includes modeling behavior for the pre-service teachers and providing a space in which they can imitate the role of a professional teacher in a home-school collaboration. This also includes the professors' responsibility to enhance the pre-service teachers' reflections, skills, and understanding by asking questions and providing critical guidance, instruction, and scaffolding during the simulation exercise.

In Vygotsky's view, imitation is a potentially transformative activity that is applied consciously and is goal-directed. Hence, imitation is not a thoughtless, mechanical copying, but refers to activities that a child performs in collaboration with an adult or with another child rather than on its own (Veraksa and Veraksa, 2018). This means that, as learners are guided by a more skilled person and discuss their experiences with their peers, their experiences may be developed into more sophisticated and effective mental processes, which Vygotsky (1978) referred to as the higher mental functions. As Vygotsky might have expressed it: "What the pre-service teachers are able to

do in collaboration today, they will hopefully be able to do independently tomorrow” (Vygotsky, 1978). Interpreting the VR simulation in the light of Vygotsky’s sociocultural approach to learning may help us to have a more profound understanding of the potential of the simulation in relation to pre-service teachers’ professional development.

Limitations and implications for practice

While acknowledging the potential of the VR simulation to create a space for pre-service teachers to negotiate their professional role in the home-school collaboration, we will end the article by drawing attention to some limitations of the simulation as a flipped classroom practice. These limitations do not indicate the failure of the method to achieve its objectives, but rather, they can be seen as challenges at the organizational and structural levels of which teacher educators and other practitioners need to be aware when applying flipped classroom practices. Moreover, such challenges may not have received sufficient attention, which makes it even more important that they should be addressed (Kerno, 2008).

The first limitation is continuity. For simulation activities to be effective and to have a significant impact on the professional development of pre-service teachers, they cannot be seen as a one-off project or an isolated happening, separate from the ordinary activities of teacher education. Rather, simulations, such as the one described in this article, should be a continuation of learning activities that embrace the student-centered approach. For example, when working with issues relating to the students’ learning, pre-service teachers should be able to reflect, in collaboration with a more competent peer, on both the barriers and possibilities for providing a creative learning environment in a school. This includes the development of a self-reflective understanding of their own positions and biases, which is only achieved through a process of engagement and active participation. In order to create a zone of proximal development, the pre-service teachers have to be willing to share their experiences and reflections. This requires a learning space where their experiences and perspectives are seen as valuable contributions and where their active participation is regarded as fundamental to the pedagogical conversation. Making the pre-service teachers familiar with different student-active learning activities is therefore imperative. Hence, to activate the potential of the VR simulation, similar practices need to permeate the curriculum and the instructional strategies used in teacher education.

A second limitation has to do with the hierarchies that exist within institutions. As Kerno (2008, p. 74) emphasizes, communities of practice are often situated within established organizations, which implies that they “co-exist with a preexisting organizational hierarchy.” This means that more powerful internal discourses, or even conflicting discourses, may threaten learning, collaboration, and participation in such communities. As noted earlier in the article, teaching practices in teacher education are often characterized by the situation where the professor talks and the learners listen. Nieto (1996, p. 102) describes such pedagogy as a one-way street, by which teachers “deposit” knowledge into students, who are seen as empty receptacles. Changing established teaching practices may be hard, and this is reflected in the reluctance or open resistance of many educators to the use of new technologies and new forms of teaching (Sime and Priestley, 2005). During the implementation, professors may also call into question the shift in roles and relationships that a VR simulation requires, where established practices and approaches must be changed. Implementing methods, such as the one described in this article, therefore requires a careful approach where institutional participation in both the design and implementation phases of the change approach are invited.

For teacher educators, becoming aware of these limitations may help them to realize the pedagogical potential of digital simulation practices, both with regard to issues of implementation

and also through a more profound understanding of how such practices relate to the competing perspectives. Moreover, such an awareness can also be seen as an important aspect of pre-service teachers' professional development. As we have aimed to show in this article, applying the theoretical lens of Vygotsky's sociocultural approach to learning when working with VR simulations in the context of home-school collaboration may enhance pre-service teachers' metacognition as part of their professional development. Potentially, it can also help pre-service teachers to see the benefits of imitation and collaboration in learning in general and encourage them to adopt these approaches in their future work as teachers. This would include their taking a critical stance against attempts to reduce pre-service teachers to passive interpreters and teachers to the providers of a prescribed curriculum.

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