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THEORETICAL AND METHODOLOGICAL FOUNDATIONS OF TEACHING PEDAGOGICAL DISCIPLINES BASED ON VIRTUAL REALITY TECHNOLOGIES

Otayeva Madina Ravshonbek qizi
Asia international university

Abstract. This article examines the theoretical premises and methodological conditions under which virtual reality (VR) can be integrated into the teaching of pedagogical disciplines in higher education. The study clarifies the concepts of immersion, interactivity and presence, relates them to experiential and constructivist learning theories, and identifies the areas of teacher education in which immersive environments add genuine didactic value. Particular attention is paid to classroom management simulators, which allow pre-service teachers to rehearse professional decisions in a psychologically safe setting. On the basis of a theoretical analysis of international research, the author proposes a four-stage model of a VR-supported lesson (orientation, immersion, guided reflection and transfer) and formulates organisational, technical and ethical recommendations for universities with limited resources.

Keywords: virtual reality, immersive learning, presence, teacher education, pedagogical disciplines, classroom simulation, experiential learning, digital competence.

INTRODUCTION

The digital transformation of education has moved beyond the stage at which a computer was regarded merely as a tool for presenting information. Modern technologies increasingly create environments in which the learner acts, makes decisions and observes their consequences. In the Republic of Uzbekistan, the development of a digital educational space and the improvement of teacher training are identified as priorities in the Development Strategy of New Uzbekistan for 2022–2026 [1]. Against this background, the question of how emerging technologies can change the preparation of future teachers is becoming especially relevant.

Virtual reality occupies a special place among these technologies. Unlike conventional multimedia, it places the user inside a computer-generated three-dimensional world and allows them to interact with it in real time. For pedagogical disciplines, whose central goal is to form professional skills of communication, organisation and reflection, this property is particularly valuable: knowledge about teaching can be supplemented by an experience of teaching, even before the student enters a real school. At the same time, the use of VR in teacher education remains fragmented, and its methodological basis is still insufficiently developed. The purpose of this article is therefore to substantiate the theoretical foundations of VR-based instruction in pedagogical disciplines and to propose a practical model for its implementation.

LITERATURE REVIEW

Researchers usually describe virtual reality through three interrelated characteristics. Immersion refers to the technical capacity of a system to surround

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the user with sensory information; interactivity denotes the ability to change the virtual environment through one's own actions; and presence is the subjective sense of "being there" that arises when the first two conditions are met. M. Slater and M. V. Sanchez-Vives emphasise that it is precisely the illusion of presence that makes people respond to virtual situations in ways that resemble their behaviour in real life [2]. This finding is of direct importance for teacher training, where the aim is to evoke authentic professional reactions.

A systematic review by J. Radianti and colleagues showed that immersive VR in higher education is most often used for procedural and practical knowledge, simulations of complex situations and the development of soft skills, while the pedagogical rationale behind many applications remains weak [3]. Earlier reviews by L. Freina and M. Ott, as well as by L. Jensen and F. Konradsen, reached similar conclusions: head-mounted displays are effective for spatial, behavioural and affective learning objectives, but do not automatically improve the acquisition of abstract theoretical knowledge [7; 8].

The theoretical justification for VR in pedagogy can be found in D. Kolb's experiential learning cycle, which describes learning as a movement from concrete experience through reflective observation and abstract conceptualisation to active experimentation [4]. A virtual environment provides the concrete experience that is often missing from university courses in pedagogy. The best-known example of its use in teacher education is the mixed-reality classroom simulator described by L. A. Dieker and co-authors, in which pre-service teachers interact with virtual pupils and practise behaviour management strategies [5].

At the same time, research warns against uncritical enthusiasm. G. Makransky, T. S. Terkildsen and R. E. Mayer found that a highly immersive version of a laboratory simulation produced a stronger sense of presence but lower learning outcomes than a desktop version, which the authors attributed to increased cognitive load [6]. Consequently, the didactic effectiveness of VR depends not on the degree of technological sophistication, but on how the virtual experience is embedded in a well-designed instructional sequence.

METHODOLOGY

The study is theoretical and analytical in nature. It relies on a comparative analysis of international publications on immersive learning, a content analysis of the curricula of pedagogical disciplines taught in teacher-training universities, and the modelling method, which was used to construct a didactic sequence for VR-supported lessons. The selection of sources focused on systematic reviews and widely cited experimental studies, which made it possible to separate well-established findings from isolated or contradictory results.

RESULTS AND DISCUSSION

The analysis made it possible to determine which sections of pedagogical disciplines benefit most from virtual reality. These are primarily the areas where the learning objective is the formation of practical skills and professional attitudes rather than the memorisation of definitions. The correspondence between disciplines and possible VR applications is summarised in Table 1.

Table 1. Possible applications of virtual reality in pedagogical disciplines

Discipline / section	VR application	Expected learning outcome

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Didactics	Virtual lesson in which the student selects teaching methods and observes pupils' reactions	Ability to justify the choice of methods and forms of instruction
Theory of upbringing	Simulated conflict situations between pupils or with parents	Skills of pedagogical communication and conflict resolution
Pedagogical skill	Classroom management simulator with feedback on speech, gaze and timing	Self-regulation, confident behaviour in front of a class
Inclusive education	Scenarios reproducing the perception of a child with visual or hearing impairment	Empathy and readiness to adapt the learning environment
History of pedagogy	Virtual excursions to historical schools and educational institutions	Contextual understanding of the development of pedagogical thought

Based on Kolb's cycle and the findings on cognitive load, the author proposes a four-stage model of a VR-supported lesson. At the orientation stage, the teacher formulates the learning objective, explains the scenario and agrees on the criteria by which the student's actions will be analysed. The immersion stage is the virtual experience itself; it should be short, typically no longer than 10–15 minutes, in order to avoid fatigue and simulator sickness. The guided reflection stage is the core of the model: the student, together with peers and the instructor, analyses their decisions, compares them with theoretical principles and identifies alternative strategies. Finally, at the transfer stage, the student plans how the acquired experience will be applied in real teaching practice, for example during the school placement.

The proposed model shifts the emphasis from the technology to the pedagogical process. The virtual episode becomes a source of material for discussion rather than an end in itself, which addresses the risk identified by Makransky and colleagues that a highly immersive experience may distract from the content [6]. Moreover, rotating small groups through the immersion stage while the rest of the class works on observation sheets or case analysis makes the model feasible even when a university has only a few headsets.

The implementation of VR in teacher education also faces several barriers. These include the high cost of equipment, the shortage of educational VR content in the Uzbek language, physiological discomfort experienced by some users, and the insufficient digital competence of university teachers. To overcome them, it is advisable to start with low-cost solutions such as 360-degree video and mobile VR, to develop national content in cooperation with IT specialists, and to include modules on immersive technologies in professional development programmes for

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lecturers. Ethical aspects deserve special attention: participation in simulations should be voluntary, the emotional intensity of scenarios should be appropriate, and data collected by the systems should be handled confidentially.

CONCLUSION

Virtual reality opens up new opportunities for teaching pedagogical disciplines because it allows future teachers to acquire professional experience in a safe, repeatable and controllable environment. Its theoretical foundation lies in experiential and constructivist learning theories, while its effectiveness depends on a clear didactic goal, a limited duration of immersion and, above all, a structured reflection stage. The four-stage model proposed in this article (orientation, immersion, guided reflection and transfer) can serve as a methodological basis for designing VR-supported lessons in teacher-training universities. Further research should focus on the empirical verification of the model and on the development of VR content adapted to the national education system.

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