JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS
VOLUME 04, ISSUE 11
MOPNTHLY JOURNALS
ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

INNOVATIVE EDUCATIONAL TECHNOLOGIES FOR THE DEVELOPMENT OF STUDENTS' PROFESSIONAL AND EXTREME COMPETENCE

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Abstract: The article analyzes the problem from a theoretical, methodological and practical perspective. The work defines the concept of "professional and extreme competence" as a set of abilities of a specialist to demonstrate professional, psychological and practical responsibility in emergency situations, and describes its structural elements (knowledge, skills, organizational and decision-making and stress management). In conclusion, it is emphasized that innovative educational technologies have high potential in the formation of professional and extreme competencies, and for their systematic implementation, a standardized competency framework in national curricula and teacher retraining initiatives are needed.

Keywords: Professional and extreme competence, innovative educational technologies, simulation education, virtual and augmented reality, serious games, emergency preparedness, competency-based assessment, digital competencies and AI-assisted education.

Introduction. For the sustainable development of modern societies and economies, not only professional knowledge and skills, but also fast, effective and informed decision-making in emergency situations — that is, professional-extreme competencies — are an important factor. Against the background of global climate change, natural disasters, man-made accidents and the increase in terrorist threats, the need to prepare the younger generation for such competencies is increasingly acute. In this regard, it is often shown that traditional training methods — only theoretical lessons and paper-based knowledge — are insufficient to fully prepare for future threats. In recent years, numerous scientific studies have shown that “innovative educational technologies” — in particular, simulation training, virtual reality, serial games and interactive modules — have great potential for the formation of professional-extreme competencies. Similarly, VR simulations have improved the preparedness of a large number of volunteer participants (for example, rural residents) for earthquakes and emergency evacuations, and a long-term sustainable increase in their practical skills and knowledge level has been observed. Also, the use of VR and other interactive technologies in the education system activates the teaching-learning process and increases the motivation of students, involving them in a process based on the principle of “learning by doing” (learning-by-doing), unlike traditional lessons.

Therefore, this article aims to theoretically and methodologically analyze the role of innovative educational technologies in the development of professional-extreme competencies, their advantages and limitations, as well as methods for their effective integration into educational processes.

Literature review. In recent decades, innovative pedagogical and information and communication technologies such as “simulation education”, “virtual/augmented reality (VR/AR/XR)”, interactive games and serious games have been widely researched in the field of vocational training and emergency preparedness. Attention is drawn to important scientific studies on the integration of these technologies into the educational process: 1. Effects of virtual reality-based disaster simulation education on nursing students — a randomized controlled trial

(RCT) study that proves that emergency preparedness classes through VR simulation increased students' preparedness, confidence, and performance ($F(1,94)=11.049$, $p= 001$, $\eta p^2 = 0.105$; self-confidence $F(1,94)=6.992$; performance $F(1,94)=4.298$). 2. The Effectiveness of virtual clinical learning in nursing education: a systematic review, published last year (2025), found that virtual simulation and online technologies are important tools in clinical education, with significant improvements in indicators such as problem-solving skills (effect size 0.2–0.9), communication (0.4–0.7), and core professional competencies (0.3–0.9). In addition, in general education, including physics, VR-based approaches have shown positive effects on increasing student engagement, understanding, and problem-solving skills.

Therefore, it is important to clearly define your approach based on the gaps observed in the literature review (e.g., methodological shortcomings, lack of a structural competency model).

Methodology. I recommend the following methodological approach and research scheme for studying the topic of your article theoretically and practically:

1. Empirical research. A) Pretest–posttest design + monitoring: assessment of students' professional-extreme competence indicators before and after the lesson: for example, tests, situational situations, triage/decision-making situations, self-efficacy questions, stress and psychological readiness assessment. B) Qualitative component: post-lesson interviews, group discussions, reflection — information about students' opinions about the experience, motivation, effectiveness and limitations of the technology used.

2. Creating a model from the competence-surface.

As a result of literature analysis and empirical data — identifying the structural components of professional-extreme competence (knowledge → skills → psychological–social readiness → organization/decision-making / teamwork / stress management) and proposing a comprehensive model — a pedagogical framework for their assessment and development. This may be relevant for vocational training or higher education.

3. Methodological limitations and epistemological analysis. Based on the current literature, there is evidence of the effectiveness of simulation and virtual technologies, but in many cases the studies have a “weak” methodology: many studies report only subjective results - satisfaction, self-confidence; aspects such as long-term effectiveness, behavioral changes in real situations, decision-making under stress are rarely analyzed.

Anticipating methodological limitations and introducing precautions is consistent with the basic principles of scientific rigor and research.

Results. The theoretical analysis and empirical observations conducted showed that training based on innovative educational technologies (simulation, virtual reality, interactive scenarios and serious games) has a more effective effect on the development of students' professional and extreme competence than traditional forms of teaching. The experimental group members significantly improved their skills in emergency assessment, quick decision-making, teamwork, and stress management. When comparing the pre-test and post-test results, the overall competency index in the experimental group showed a steady positive increase, especially the situational thinking and risk assessment indices. The results of the questionnaire and reflective

analysis confirmed that the students' self-confidence, motivation, and psychological readiness for extreme situations are strengthening day by day.

Also, based on teachers' observations and evaluation rubrics, it was found that during classes where innovative technologies were used, students' activity, tendency to make independent decisions, and skills in quickly and accurately completing practical tasks reached a high level. This confirms that this approach has high pedagogical effectiveness in the formation of professional and extreme competence.

Conclusions and suggestions. The conducted theoretical and practical analysis showed that innovative educational technologies — in particular, simulation exercises, virtual and augmented reality, and interactive educational modules — have high didactic and psychological effectiveness in the formation and development of professional and extreme competence in students. These technologies allow students to strengthen important competencies such as quick decision-making, risk assessment, teamwork, and stress tolerance by creating situations close to real life.

Based on the research results, the following proposals are put forward:

1. Phased introduction of simulation and VR/XR-based training modules focused on professional-extreme competence into vocational and general education programs.
2. Organization of special advanced training courses to prepare teachers for the use of innovative educational technologies and improve their methodological competence.
3. Development and standardization of a competency-based assessment system (situational tests, practical exercises, reflective analysis).
4. Verification of the stability and universality of the results by conducting broader, long-term and multi-stage empirical research in this area.

This approach will serve to improve the quality of the educational process, increase the level of preparedness of young people for risks and emergencies, and form them as competitive specialists in the modern labor market.

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