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Difficulty of Control and Manipulation Using XR Technologies as a User Interface in Educational Process

Branislav Sobota[a], Štefan Korečko[a], Csaba Szabó[a], Timotej Sobota[a], Gábor Kusper[b], Ede Troll[b]

[a]Technical University of Košice
{branislav.sobota,stefan.korecko,csaba.szabo,timotej.sobota}@tuke.sk

[b]Eszterházy Károly Catholic University
{kusper.gabor,troll.ede}@uni-eszterhazy.hu

Abstract

An important component in the communication of students with the system is the creation of a suitable interface. The traditional form is the use of a terminal or a text-based dialog line. One of the innovative procedures can be an interface based on XR technologies. This assumes the possibility of multimodal student-system communication. This applies both to the simulation environment and to a possible advanced assistant. The paper provides a pilot analysis of the impact and use of advanced procedures and technologies of augmented reality (XR – eXtended Reality), which represent highly progressive tools in the context of their application in the educational process. In accordance with [6], augmented reality is understood as any combination of real and virtual (computer-generated) environments and corresponding systems and technologies. XR can therefore be considered an umbrella term that covers virtual (VR), mixed (MR) and augmented (AR) reality. The paper is focused not only on identifying the impact of the complexity of digital content for learning environments and the costs associated with its creation, but also on assessing the impact of the use of the aforementioned technologies by the target group, i.e. students and teachers, in the teaching process. These technologies can contribute to making teaching processes more efficient and simpler, including mastering complex concepts while communicating more naturally with AI. On the other hand, they can represent a mental and physical burden associated

with working with such an interface. This suggests one of the possible directions for increasing the ability to effectively use AI systems in practice and better integrating the target group into the modern information society.

As the competencies and skills of this target group (current students) grow, the demand for ever more interactive and intelligent (smart) solutions in this area also grows. One of the most dynamically growing technological areas that could significantly increase the level of interactivity is the aforementioned XR. The penetration of XR technologies into the field of education has recently been noticeable in several applications, such as the use of XR simulators for training young surgeons [7] or firefighters [9]. The need for their deployment, e.g. in the field of construction, is also confirmed in [5]. A significant trend in education is also the provision of virtual learning environments with game elements (gamification) or in the form of serious games, where students perform activities aimed at mastering the corresponding content. According to [1], from the point of view of deploying XR technologies in education, in the case of some subjects, the possibility of displaying a virtual scene on a realistic scale relative to the user is important. As a result, the three-dimensional model is realistic in terms of size and the student can imagine real proportions in the virtual environment and at the same time gets a better idea of the difficulty of solving some problems.

The benefit of virtual learning environments, scenarios and relevant XR technologies can be further increased by including cooperation between a group of users (students with each other or students and teachers) in real time [4]. Shared virtual environments in particular are open to the possibilities of various simulations, training or education and other types of activities. From the point of view of Flavián [2], collaborative/shared systems represent a specific architecture and technological equipment for the possibility of creating collaborative and educational activities. The authors [3] emphasize the need for the physical presence of users or their virtual appearance in the form of avatars in collaborative environments. The most common collaborative environments at this level are virtual cave-based systems and VR headset-based systems as forms of collaborative environments accessible to a wide group of users. In the case of virtual environments, it is important to mediate natural interaction in real time. According to [8], the method of natural interaction can be highly effective and realistic, but it can also bring a certain form of fatigue if the interface is not adaptive enough, both for interaction between users and interaction with virtual objects. This can expand the application area not only to the creation of an application base but also to the creation of 3D digital interactive content and effective testing of its usability and difficulty. Support for such technologies increases the flexibility of the teaching process in the event of, for example, possible future pandemic situations and the need to deploy online teaching on a wider scale.

XR technologies can therefore facilitate, simplify, accelerate and clarify the communication of students and, last but not least, teachers with computing technology, also when teaching software development methods in the context of software engineering, as well as with their environment in the future with the easy deployment

of artificial intelligence elements, e.g. in the form of pedagogical or development assistants at a higher level than AI will use in this area today. This concept is also interesting in general from the point of view of possible long-term goals in the context of educational development.

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