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USING VIRTUAL REALITY SIMULATION TRAININGS FOR SAFETY PROMOTION IN HAZARDOUS WORK ENVIRONMENT

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Introduction

There are many safety-training programs and legal requirements in Kazakhstan, yet around 1500 people yearly are injured, while 200 people die on hazardous workplace [1]. Although efficiency of safety programs can be questioned, it is clear that safety trainings have to be in place in any applicable ways. Recorded video instructions and printed hard copy documents are long-established ways of delivering safety trainings, yet latest inventions of digital era extend the possibilities suggesting immense potential to upgrade the training delivery process. According to Tichon J. different industries with acceleration are resorting to virtual reality (VR) usage in reproducing dangerous work conditions to allow trainees to practice essential cognitive qualities such as problem solving and decision-making. He further states that due to high cost and risks associated with using heavy machinery in trainings reproducing hazardous settings, the use of virtual reality technologies gaining more popularity across many industries, including mining, transpiration, construction and so on[2].

Group of researchers, in their work dedicated to learners and teachers in forensic sciences on using eExtended reality (XR) virtual practical and educational eGaming to implement effective learning environments characterized by deep absorption in process, highlight several advantages. Virtual environments not only make it possible for trainees to learn asynchronously by having day-and-night access to educating programs, but also make it effective learning experience letting them keep the intensity of attaining knowledge in their own pace. Moreover, wider utilization of above-mentioned technologies may lead to accessibility of high quality learning programs for significantly larger circle of people, ensuring inclusivity of offered educational programs [3].

Discussion

According to a publication concerned about the effectiveness of training and education for the safety of workers published on National Institute for Occupational Safety and Health journal, through highly participatory training methods, the trainee plays a much more active part in the learning process.During highly engaging training sessions, trainee can be intensively involved in considerable intellectual and behavioral activities, with easy access to immediate assistance from instructors.It is common to reach the highest engagement through in person learning sessions, yet virtual simulations adding more options for safety training providers in attaining high levels of uptake.Self-assessments,target setting and new behavioral strategies aimed to solve problems and make decisions are some of the widely used, so called, “behavioral modeling techniques”. In order to consolidate the learned training material, participants offered range of activities including, but not limited to “tabletop exercises in a board game format in a classroom, to mine rescue training of emergency personnel within a simulated mine”.High engagement level of computer-based trainings can be reached via respective simulations, which could inducethe analysis of the material, yielding to potential for decision-making and feedback on performance[4].

Educators from many different industries are convinced that VR is powerful training instrument, which demonstrated its effectiveness in a wide range of disciplines. VR technology allows trainees not only acquire knowledge in a more relevant and practical way than the information given by more conventional teaching methods, but also makes it possible to encounter the consequences of mistakes made without actually risking their wellbeing. Technical features supported by VR technologies allow trainees observing and hearing options in simulated conditions that would be challenging or even impossible to revive in real world. A good virtual reality simulation can consistently provide a wide range of possible learning scenarios with no high cost and no risk to staff, equipment and vehicles [5].

The improvement of skills and performance does not just depend on well-designed simulation training.However,the number of training prototypes constantly increasing, with less attention paid to the proper assessment of training delivered by this technology. Tichon J. argues that performance indicators are equally important because they can ultimately provide feedback on learning success or failure and identify any shortcomings to guide ongoing improvements. In order for the cognitive skills acquired in a virtual learning environment (VTE) to be transferable to the real world, the learning goals must be directly related to a realistic scenario of events that, in turn, are directly related to indicators of specific required attitude [2].

The experience of simulator sickness is one of the major disadvantages discussed, while touching upon the VR technologies usage. This terminology started appearing in research works when some users reported certain symptoms upon the exposure to VE and the use of VR. Most of the symptoms are related to vestibular sensory and motor sensory systems, such as “feeling disorientated, headache, eye strain, paleness, nausea, dizziness, vomiting, and thinking that surroundings are swirling, sweating, dry mouth and a lack of coordination”. Simulator sickness is a broader inclusive term, which combines three different notions“visually induced motion sickness (VIMS), virtual simulation sickness, virtual reality-induced symptoms and effects”[6].Rebenitsch and Owen states that,unpleasant experience is not the only matter, potential safety danger must be a disquietude caused by simulation sickness effect on a worker who serves in a safety critical industry. The latter is crucial because influence of simulator sickness can last for hours or even days.In spite of available knowledge of the side effects associated with the use of IVT, “there is no official standard regarding the safety of such systems”[7].

Many interested parties, including researchers have been trying to understand the nature of the simulation sickness. In spite of the existence of highly acknowledged theory on the simulation sickness, explained by the conflict of visual and vestibular systems (‘sensory conflict theory’), there is no proved theories, which can completely clarify it, forecast it or explicate individualities in experiencing the symptoms[6].There are two major determinant groups, where all the factors causing simulation sickness can be allocated. These are technology- related and individual related factor groups.If the first is more or less has clarity, latter factors, combined in individual related bucket, have no certainty. On one hand, a number of studies have examined the relationship between individual factors such as gender, age, personality, experience with virtual reality and experience of simulator sickness. The results of these studies were mixed, leading to conclusion that individual factors are not well understood.On the other hand,technology-related factors demonstrated results that are more explicit. Namely, there are certain efforts on increasing FOV (Field of View) in VR. Widening the FOV allows enhanced spatial perception, offering elevated sense of presence through enhanced immersion. Which in turn, may lead to improving memory by making a trainee feel the presence of one, rather than observing something in a given condition. Technology-related factors consists of the quality of visual displays, the quality of positioning tools, the frequency of refreshing frames and the latency of system time with real-time interaction and glimmer perception, which may increase as the field of view (FOV) expands. Even though many initiatives are taken by developers to improve all the above-mentioned

technological features of VR, there are still number of factors, which keep the high possibility of experiencing simulator sickness [8].

Conclusion

It can be concluded that VR technologies have significant potential to be applied in Kazakhstan for safety trainings. There are many advantages of using VR such as, high engagement of trainees through practicing problem solving and decision-making skills within high quality simulation of hazardous work environments; economic viability by replacing heavy machinery used in replicating dangerous conditions with virtual reality; and flexibility to learn asynchronously using dedicated online platforms.

Despite of the explicit dominance of positive effect of VR in delivering safety trainings, further analysis need to be performed in order to appropriately evaluate the efficiency of the trainings provided via this technology and eliminate the risks associated with side effects of using comparatively under researched field.

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