

Virtual Reality learning retention in education and trainings

Retencja uczenia się z zastosowaniem wirtualnej rzeczywistości w edukacji i szkoleniach

Słowa kluczowe: rzeczywistość wirtualna, retencja uczenia się, edukacja ustawiczna, krzywa zapomnienia.

Streszczenie: W codziennym życiu towarzyszą nam dynamiczne zmiany technologiczne i organizacyjne spotęgowane dodatkowo przez zjawisko pandemii COVID-19. Wyzwania te są udziałem całych społeczeństw. Ludzie muszą radzić sobie z tymi problemami we wszystkich przejawach życia indywidualnego i społecznego. Wiele z tych problemów obserwujemy w obszarze edukacji, gdzie nauczyciele zostali „rzuceni na głęboką wodę” bez odpowiedniego wcześniejszego przygotowania w zakresie prowadzenia zajęć on-line. Pamiętam czytankę ze szkoły podstawowej z końca lat 80., w której uczniowie nie musieli chodzić do szkoły i łączyli się z nauczycielami za pośrednictwem jakichś urządzeń. Pamiętam, że to opowiadanie bardzo mi się podobało ze względu na swój futurystyczny charakter, zazdrościłem też bohaterowi, że nie musi chodzić do szkoły. Minęło trzydzieści lat i takie rozwiązania stały się koniecznością, na którą nauczyciele i trenerzy muszą być przygotowani w jak największym stopniu. Z czasem uczniowie i słuchacze będą oczekiwać coraz lepszej jakości przygotowywanych materiałów i metod prezentowania treści. W takim kontekście pojawia się wirtualna rzeczywistość (VR) z wysokim poziomem atrakcyjności i nowoczesnymi technologicznie sposobami prezentacji informacji oraz rozwoju umiejętności. Co więcej, szkolenia VR wydają się mieć duży potencjał „retencji uczenia się” rozumianej (w ujęciu psychologicznym) jako zdolność zapamiętywania (wskazywana jako jeden z kluczowych elementów procesu uczenia się). Zastosowanie VR w edukacji i szkoleniach staje się więc jednym z aspektów procesów uczenia się, które wymagają dalszych badań i odkrywania.

Key words: virtual reality, learning retention, continuous education of adults, forgetting curve.

Abstract: We observe dynamic technological and organizational changes in societies that were enhanced by COVID-19 pandemic. People are challenged in all areas of individual and social life. Problems have been observed in education where many teachers have been thrown into the deep end without any preparation to teach students on-line. I remember a reading book from an elementary school in the late 1980s, where students did not have to go to school and connected with teachers through special devices. I liked the story very much and I envied the protagonist not having to go to school. It sounded really futuristic at that time. Thirty years have passed and such solutions have become a necessity for which teachers and trainers must be prepared. Students expect teachers to be professionals and use high quality materials and methods to

present their knowledge. That is where VR comes in – with a high level of attractiveness and new technological ways of presenting information and developing skills. Moreover VR trainings seem to have great “learning retention” possibilities meant (in psychology) as an ability to remember (indicated as one of key elements of the learning process). The use of VR in education and training needs further exploration as it is one of key aspects of the learning process.

Learning retention

COVID-19 pandemia situation and need of distant (or blended) learning methods dissemination has shown growing importance of such competences as critical thinking and use of new ICT tools in education. New technologies, professions and specialities arises and that cause increase of the meaning of education also in the non-formal contexts, such as courses and trainings. Rapid up-skilling or flexible courses are more and more often replacing traditional forms of education with growing importance of „*deuteroeducation*” meant as „learning of efficient learning” (Bauman, 2008, p. 160). That’s why more and more people without formal education/qualification in pedagogy are dealing with teaching and trainings (Kutschenereiter-Praszkiewicz, Luck, Nowaczyk, Prussak, Smolarek, Tytz-Lemieszek, 2010). *The Integrated Skills Strategy 2030* confirms that fact. In this document non-formal education and educators were in the focus for further competence strenghtening. That concerns ia.: trainers, coaches and people supporting learning process informally like: leaders and members of NGO’s, social animators, employees etc. With the increasing meaning of non-formal and informal education there is a need for wider range of methods and tools supporting skills development.

Knowledge on diverse methods of learning and teaching becomes a key issue for the improvement of the didactical work of teachers and trainers (ZSU 2030). That refers also to the use of methods with Virtual Reality (VR) and Augumented Reality (AR) tools.

Training is about forming of skills and attitudes requiring basic theoretical preparation. It is interlinked with the psychological term of a „transfer” described by W. Okoń as an influence of learning effects on other knowledge, skills and abilities acquired by the participant. In the „positive transfer” aspect we experience enhancement of acquiring new information thanks to previously obtained ones. Going more into deep, from cognitive psychology aspects, learning (as the main goal of the training) is about the creation of proper conditions to learn. It is a line of biochemical changes, evolving in the brains of participants while learning processess. The goal of training than is to „*convey information that will be stored in long-term memory and maximally insulated from forgetting*” and that is called „learning retention” (Maddox, 2017).

Training methods effectiveness differ and it should be taken into account when we design the training programme with materials and tools. It is useful here to look on *the Cone of Learning Retention* elaborated on the *Edgar Dale’s Cone of Experience*

(developed between 1946–1969 in few various versions connected with use of TV for educational purposes).

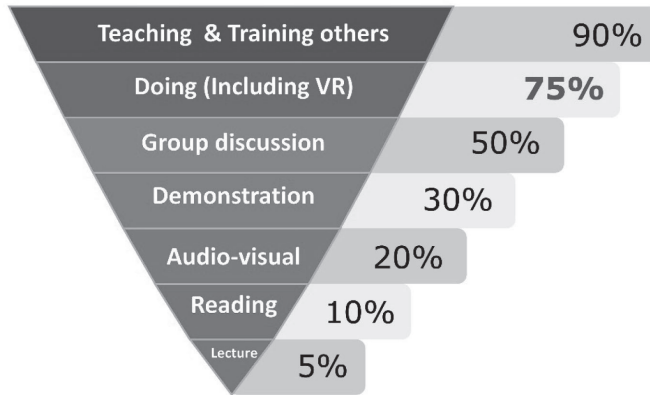


Fig. 1. Learning Retention Cone with VR distinction

Source: <https://frontcore.com>

They show that the less effective methods are passive ones like „lecture” (5%), reading (10%), demonstrations (30%) while working in small groups give about 50% of efficiency, experimental works and learning by doing about 75–90%, case studies, projects prepared with others, learning with colleagues and teaching/training others may brought 90% of efficacy. VR trainings are also highly assessed 75% of efficacy measured with learning retention. The most useful methodies are those that give us an opportunity for retention of acured knowledge, skills and competencies. They are teaching others, learning by doing and VR trainings fallowed by working in small groups (50%). Training is about achieving „learning retention” which is possibility to convey information that will be stored in long-term memory and maximally protect from forgetting. That means that VR trainings are efficient and should be disseminated (as at least supplementary to other methods).

We can't afford to be „forever yesterday”

Manfred Spitzer in his „Die Smartphone-Epidemie” reflects on the role of new technologies in modern societies indictating that „forever yesterday” people become victims of the progress (referring also to the industry revolution’s repercussions that have caused many suffering and lead to weavers uprising in Silesia in the 1844). What is astonishing is that only one of twenty five students claims that schools teaches how to make use of the digital media (Spitzer M. 2021, pp. 106, 216). That confirms that more and more knowledge and skills we acquire outside of the schools walls and there is a greater need also for employees to upgrade competences

more frequently and with the use of ICT. COVID-19 pandemia however showed that many teachers aren't ready to conduct distant teaching efficiently. If we will think of using VR in teaching/trainings those results can be far more worse (due to the VR headsets prices to some extent).

In COVID-19 time, VR classrooms are becoming more and more popular as there is around ten new platforms developed within only the 2021 year. One of them called „Horizon Workrooms” was created by Facebook and is integrating avatar customisation, handwriting whiteboard, share PC screen and different rooms (<https://www.oculus.com/workrooms/>). Other VR applications are for example: GLUE (with Doodle in 3D and 3D objects import, taking notes, team files <http://glue.work/>), Spatial with our own image of avatars (<https://spatial.io/>) or MeetinVR – performing high five and handshakes (<https://meetinvr.net/>). Those are still quite expensive tools as we should have VR headsets and the second problem is the lack of teachers/trainers who would have communication skills related to this technology. Such communication skills are being developed in the ERASMUS+ project called Collaborative Virtual Reality platform for e-learning: Teaching Communication Skills „COViR” (covir.eu) and will become open-source ready to use materials. That project is being realised in collaboration with other educational organisations like: EDITC, MMC learning solutions, Fundación Equipo Humano, Hellenic Confederation of Commerce and Entrepreneurship (ESSE) Cyprus Certification Company and IT solutions creator „Senseworks” (developer of VRESS platform for people with autism spectrum). Such strong consortium will be able to develop training courses with certification schemes, test it on the VR platform and then deliver the training of trainers module. Łukasiewicz-Institute for Sustainable Technologies is a leader of that partnership.

Bearing in mind highly estimated learning retention for VR solutions (75%) our institute's Center for VET Research and Innovation Management together with optomechatronics and constructors centers have undertaken also another project from European Institute for Innovation and Technology (EIT-Manufacturing) called PLC-Centered VR-Training for Industry 4.0 (VR-PLC). That project foresees use of VR tools for development of „digital twins” for six techno-educational stands that exist already in physical form. Such virtualization of VET allows to increase security and efficacy of the training (thanks to modularisation and flexible approach) and enables to lower training costs. Together with Institut for Product and Service Engineering of Ruhr University of Bochum and Lithuanian employers organisation (LINPRA) we will make those stands virtual and test their functionalities with Polish and Lithuanian enterprises.

Two important elements of that VR-PLC project will be about gamification elements and open badges given by the consortium (lead by German Ruhr University). Gamification can be even more effective learning method if we use elements of fantasy and competition. Other interesting elements of gamification for learners

are: (feeling of) control, feedback, curiosity, achieving goals (progress) and collecting badges.

As for collecting badges (or „micro-credentials”) it is relatively new approach in education and trainings. It enables confirmation of acquiring small learning outcomes such as those that can be achieved after few days of course (or even 20–30 hours of training), so it is approach oriented towards adult learners. In other way „open badges” can be an expression of „mile stones” in graphic and digital form that we can collect in our „digital backpacks” in educational journey.

The brain is hardwired to forget

„The brain is hardwired to forget” is the statement of Todd Maddox PhD from University of California (Santa Barbara) strengthened with the arguments that human memory has limited capacity for storing information. Information that is to be given by teacher or trainer in order to be stored in long-term memory should be focused on reduction of forgetting. Three most critical elements (that prevent from forgetting) are required: high-quality training, engaging content and optimized training procedures. Process should also refer to „spaced testing” and „targeted retraining” (Maddox, 2017).

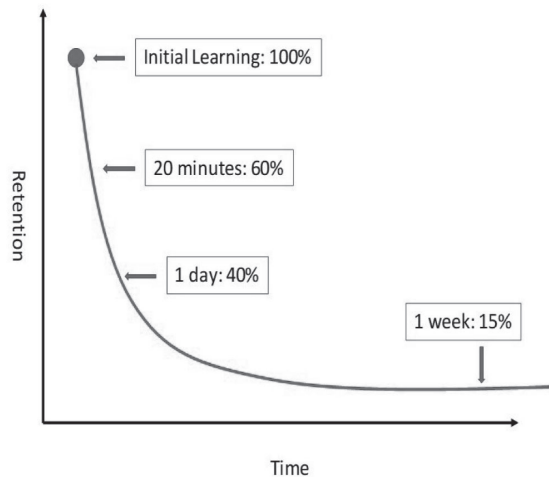


Fig. 2. Hermann Ebbinghaus's forgetting curve

Source: Maddox, 2017.

Tests and targeted retraining sessions stimulates however long-term memory storage enabling to keep acquired information and even recall them back (with some techniques as activation of pra-knowledge for example). Tests and retraining should however be repeated for few (even three or four) times so that „less and less information must be retrained, and forgetting is nearly absynt” (Maddox, 2017).

ICT and VR tools enable us to re-use again once finished course (or to return to game, training materials etc.). It is reflected on Figure 3. *Learning retention with the reference to teaching/training others.*

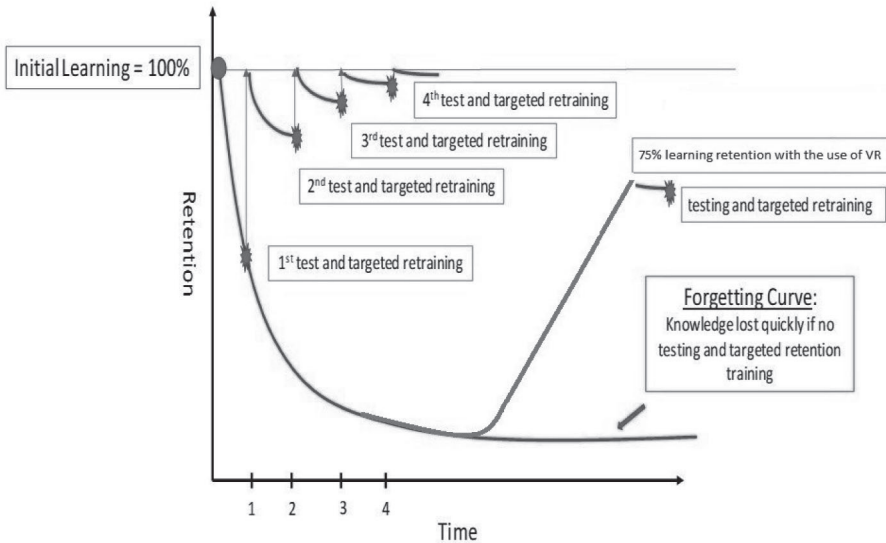


Fig. 3. Learning retention with the reference to use of VR

Source: own elaboration from Maddox, 2017.

Conclusions

Education and trainings with the use of Virtual Reality seems to have many requested qualities that are rare in school-based type learning. It is attractive, has elements of gamification and help us memorizing training content due to intensity of VR experiences. It is enabling us to „break away from the reality” however it can brought up also some inconveniences like headaches, inner-ear disorder or skin rashes (<https://www.bbc.com/news/av/technology-45661979>). It strictly depends on our personal features and well-being so VR should be used in proper, common sense way. Bearing that in mind we can say however that there are new models of VR headsets and equipment being delivered to the market and producers are trying to listen carefully to consumers voices.

VR trainings are getting more attention (especially in the pandemia time) and seem to develop rapidly with ideas, solutions and technologies that can be adpoted for learning retention. Nevertheless still one rule is in chargé of education and that is using various methods and techniques. Using only activating methods for longer time in training can be counterproductive as learner experiences too much stimulation. Right balance of methods selection (and well-being of a learner) is

secured by didactic competencies of the trainer that determine use of selected methods, forms and techniques for delivering information to participants with inclusion of ICT (communicational) skills and „understanding of performed social and professional role” (Sałata, 2013, pp. 81–90). That is why to deliver VR trainings (and experiences) not only to learners but also to teachers, trainers and VET instructors. If they have to introduce VR into their pedagogical practice they have to master it first. That is similar and compatible with M. Grzegorzewska statement from 1947 where she wrote *You have to know a lot and know it well to be able to teach someone* and that is also the case of VR.

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