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An immersive learning model using evolutionary learning☆

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ABSTRACT

In this article, we have proposed an educational model using virtual reality on a mobile platform by personalizing the simulated environments as per user actions. We have also proposed an evolutionary learning algorithm based on which the user learning path is designed and the corresponding simulated learning environment is modified. The main objective of this study is to create a personalized learning path for each student as per their calibre and make the learning immersive and retainable using virtual reality. Our proposed model emulates the innate natural learning process in humans and uses that to customize the virtual simulations of the lessons by applying the evolutionary learning technique. A quasi-experimental study is conducted by taking different case studies to establish the effectiveness of our learning model. The results show that our learning model is immersive and gives long term retention while enhancing creativity through reinforced customization of the simulations.

1. Introduction

With the prevalent model of learning, students were found to be bored, disengaged and sometimes not even sure why they were learning about a topic in the first place. Thus, the paradigm of education shifted to incorporate new innovative teaching methods, such that classic textbooks turned into e-books, blackboards turned into YouTube videos, new course management and dashboards came into existence to somewhat personalise the user learning process, and lecture hall monologues turned into MOOCs (Massive Open Online Courses) while becoming more mobile and accessible as on the go classrooms. But if we take a closer look at it, the teaching method in schools remained almost the same with no real innovation. Therefore, for an information age appropriate system, an open, customizable, interoperable (through learning objects) and immersive educational resources should be used in a personalized learning environment. This brings the decentralization of learning technologies with simulated learning methods and accessibility on mobile devices, thereby supporting better customization and use of a plethora of open resources. According to this decentralized learning system, the student can create the contents themselves and engage with education in a way that is meaningful for them. The content creation aspect by the students is inter-twined with the proposed evolutionary learning algorithm that has been realized with virtual environment simulations on mobile platforms. This is done to effectively use the conjunction of different techniques in facilitating self-directed, interest based learning, where problem solving, innovation and creativity drive education (as per Education 3.0™ model).

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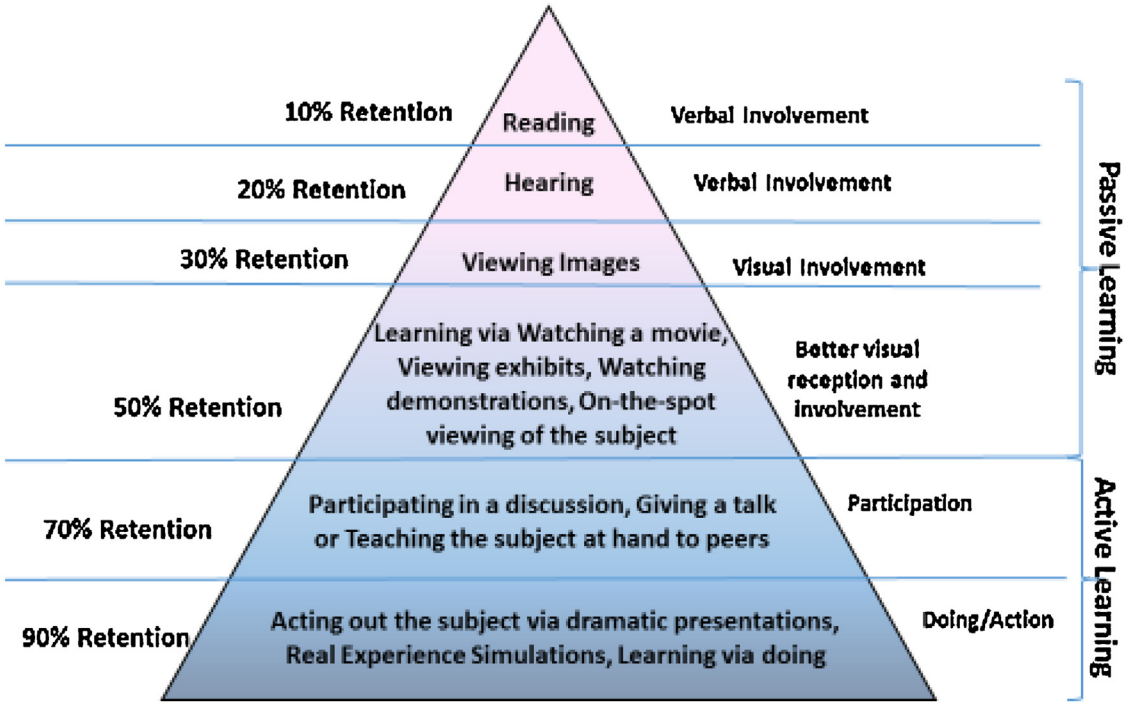

Fig. 1. A learning and retention triangle describing various forms of learning.

According to our natural learning methods, the moment we read or hear a word, we visualize it [1], such as reading about the sound waves formation, planetary motions or cellular functions. We instinctively learn via visualization. Therefore, simulations of such real-world occurrences offer this visualization to aid learning in a much more real way than our mindful imaginations. However, the learning method can be improved by living those events in a virtual world which supersedes just viewing videos and graphics on a screen, thereby redefining interactive learning. This can be understood by Fig. 1 showing the learning and retention triangle in humans.

There has been a myriad of takes on m-learning methods which are run on not only cell phones but also on any device that has mobility. The methods in literature till date incorporate story-telling, game playing, and virtual reality simulations to education. The common factor among the above methods is simulation. In this paper, we have proposed and implemented an immersive simulated learning model that personalizes the learning path for every user by applying the designed evolutionary learning technique.

The remaining paper comprises the related work in Section 2, the proposed method in Section 3, the implementation and result analysis in Section 4 followed by the conclusion in Section 5.

2. Related work

Sherman and Craig [2] first gave a definition of the computer simulated stage of virtual reality, describing the four critical elements in experiencing it as, (1) a virtual world or space; (2) level of immersion; (3) sensory feedbacks; and (4) interaction between the real and virtual worlds. Shanken [3] defined simulation as a representation of the reality with shared attributes to provide participants with not only virtual environments but also a social system with the corresponding shared attributes. Lave and Wenger [4] had expressed the belief that simulations give students a chance to learn within a simulation of real-world practices. This in turn would provide enough experiences to the students while dealing with the simulations and interacting with them effectively, eventually facilitating meaningful learning from those experiences. In the succeeding years, many researchers have applied simulations in varied ways to develop educational theories and methodologies, such as story-telling, role-playing and simulations of virtual laboratories to aid in learning. In literature, various views of simulated environments have been outlined where it was shown how computer-generated simulations can be used as a learning guide for students to interact and tackle ill-structured and unpredictable problems. Further, in literature, [1], it was stated that virtually simulated environments can provide uniquely immersed experiences to students as well as helping them to explore a variety of objects, places, environments and processes in the virtual world. In [7], possible advantages of applying immersive virtual reality technology to simulate educational learning was outlined such as, the exact replications of research in the behavioural sciences and social psychology, and the provision of a research and experimentation platform for some problem that was previously extremely challenging to control and arrange. Also, Reilly [8] suggested that some simulated

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