Chapter 8

Instructional Developments and Progress for Open and Equal Access for Learning

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Additional information is available at the end of the chapter

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Abstract

Digital learning has become a very effective educational experience. Recent applications of e-learning which combines classroom learning plus e-learning are generally expensive alternatives of the real environment. So we should better focus on the virtual learning and the benefits of virtual learning. In this chapter, we emphasize some instructional developments and progress for open and equal access and specifically learning with virtual reality which is very helpful for learning. Augmented Reality (AR) and Virtual Reality (VR) are the digital mediums created to present realities in real life or realities to be displayed in a 360°and/or 3D environment beyond the perception capacity of sensory organs by virtue of virtual reality. In this study, we try to explain the differences introduced to the virtual world transition-like evaluation of the learning and evaluation of the educational methods then touch on the hype cycle of the technology to see the rise of the virtual and augmented learning. Finally, we also tried to discuss, the advantages of virtual reality (increased reality) in terms of content for open and equal access and the content construction to include AR and VR to the Learning.

Keywords: augmented reality, virtual reality, learning, instructional developments

1. Introduction

There has been a big and diverse transition in learning from letters to learning with mobile for distance education the last century. Technology has become a powerful tool for transforming learning. Technology can help affirm and advance relationships between educators and students, reinvent general/special approaches to learning and collaboration, shrink long-standing equity and accessibility gaps, and adapt learning experiences to meet the needs of all

learners. Education stakeholders; leaders; teachers, faculty, and other educators; researchers; policymakers; funders; technology developers; community members and organizations; and learners and their families are also important in this issue. The needs and preferences of these stakeholders are also changing in this roundabout situations all around the world.

In this context, it is necessary to develop different methods in order to offer better education in distance education as well as to develop new technologies to influence learners. On the other hand, the modes of learning are evolving from mass to individual by means of modern communication technology.

Distance learning has become more acceptable learning style which is nowadays adopted by the general public. In fact, most learning outcomes are shifting from classical education to hybrid education which has several intersection points with e-learning and m-learning. Flipped learning and STEM are used more and more in learning structures. These areas are at the forefront of the fields discussed in such topics as the development of different robot tutors in practice. Presenting standard information by such systems will convenience the students. Moreover, support for different individuals at appropriate speeds in terms of their learning speeds and structures leads to the acquisition of accepted standard information according to the learning speed and structure of the individual.

Educational institutions and educational life has been changing after the communication and internet technologies. Actually, the efforts to change the critiques and approaches in the world of education in post-1960 have been increased, and the necessity of finding new and different perspectives has been emphasized. However, according to Bruner [1], support of education in a manner has not changed very much over the centuries. Especially from his book written in 1966 till today, most of the universities still have the same pattern which is admittedly medieval; in the schools, this pattern is even older and tempered only by the inroads of progressive education which, in turn, have been diluted through misunderstanding, misapplication, and lack of skilled practitioners. In the same period Jacques Ellul [2] said that "Education must seek, rater, to develop a balanced way all their faculties, physical, manual, psychic, and intellectual and in this last, it must seek personal observation and reasoning instead of rote learning". Computer technology has just begun to be used in these days. During this period, this technology let create educational alternatives to occur futuristic opinions. At that time, compared to technological developments, there was not much improvement in the speed of development of teaching methods.

Thanks to Alvin Toffler about mentioning the third wave in human life which indicates the information age. These kinds of foresights affected all of us. Learning could not be out of this. The first wave in campus technologies has evolved the educational environment from one-way education to information-driven learning management systems. This means digitally literated life has started for the educational institutions. In this situation, the content development is very important and the latest educational technologies offer creative solutions for the content development.

However, people are getting more curious for the subjects and events around the world, as there is a big difference in our environment for the last two decades. These are the effects of

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information and internet technologies surrounding the humans that have changed and/or caused process of change in their lives. Digitalization has speeded up these changes. People are also faced with disruptive technologies in this change. Learning also has taken its share.

Despite the fact that since the 1960s, there have been many developments in technology around the world, there is still much to be said about continuing old-style approaches in education today. This is why it is important to consider how to handle it, to examine it, and how to use these new technologies and to see some developments and equal access to learning.

A number of new internet tools, which can be said to differ substantially from the forms and the initial concept of the World Wide Web as it emerged into mainstream technology use in the 1990s. These new digital technologies appear to be especially connective and social in nature [3] for educational technology.

One of the critical points here is that distance education, e-learning, and digital learning are now almost transforming into mainstream learning styles. Along with this transformation, it is easier to use the advantages of technology and to provide much faster and more effective communication and interaction. However, the practices and habits of the current classical style cannot be easily abandoned and some resistances are encountered. There are many innovations and many alternatives, right/wrong mixation, blurriness and a wide variety of choices in the face of learners who taught such resistance and struggle on the institutional side.

In this study, we are moving from the point of view of the fact that one of the most important things about the development of learning virtual reality (VR) which is raised to remove the above-mentioned blurriness and provide better learning. Indeed, virtual reality emerges as an open technology to rapidly develop in the near future. We think that the field of instructional development will be very seriously affected. For its use, it is necessary to discuss the development of effective learning styles as well as the use of the useful sides of the current teaching understanding.

We will also evaluate the educational movement, which is the present from the past, and some basic points of transition to learning. In this context, we will consider how we can add virtual reality to learning models. We will try to evaluate how people can use it without appealing. We will discuss topics such as how to influence our understanding of what can bring to learning.

2. Brief history of learning

Learning notion starts when people born (even they become fetus), and keeps up life-long. There is no certain date but 30,000 BC the first presumed existence of man. Since then human beings have started learning to sustain their life in the world. Ceramics production started after 5000 BC then first wheel was invented in 4000 BC. This technology offered easier and better transportation and life during that day. Early forms of writing in Ziggurats started in 3400 BC. These were pictographic writings of Sumerians. Hieroglyphics in Egypt, accounting in Inca [4] and then Chinese writing started in 1500 BC were the mainframes of the

information architecture of knowledge and learning. Then, Roman alphabet was the result of nearly 4000 years of transformation [5]. By 100 AD boys and girls in Roman Britain went to a school called a ludus to learn reading and writing. At about the age of 12, boys went on to learn rhetoric, history, literature, and geometry. Upper class Roman women were often highly educated at home by tutors [6]. In Medieval Age, we saw some handwritings in several civilizations. But these were very special knowledge and that wisdom had belonged to some special groups (clan, religious order, or so).

After the printing press was invented by Gutenberg in China, these scripts could be distributed to many people to read. So many writers and philosophers had several thoughts about human being. Many literatures were written after the start of printing press. This started the massive increase in access to books and knowledge. This also caused various works to be translated from different languages and shared. During Modern Age 1492–1789 AD, the new military technologies were developed. This period has started the urbanization that caused people to be settled. The Renaissance and Reform movements also advanced the art and the science. Individuals think more about the details of several issues of life after 1789 French Revolution. In late 1800, Magic Lantern inspired the visual instruction movement then people had access to visual media for educational purposes. In 1900, Dewey [7] has said "Humans best learn though real life activities".

During the same period, human beings faced industrial revolution that needed a mass schooling systems. Then mass media has effected life of all people with films, radio, and TV. These made the mass media an important tool for manipulation and guidance. Mass media began to show examples of modern human beings or say popular culture.

Starting from 1930, world became acquainted with TV. In 1950s, instructional programming has started. It can resemble that the TV news in the mass media arrange information age those who produce TV news can exert a powerful influence on our opinions simply by determining which events are given exposure and how much exposure they are given [8]. There were also some studies of distance learning and TV broadcasting [9, 10]. Then after 1980s, personal computer came out on stage which let the people to individually find or calculate the information easily. Word processing and other types of software has been used to create some new educational tools. In 1990s, another stepping stone to information age is internet. It was a kind of revolution after French Revolution, which has changed some of the basic concepts and rules for the human beings. World Wide Web has become a mainstream where these new digital technologies appear to be connective and social in nature after 1990s. These new technologies have brought a suite of practices that originate in open, web-based interaction for institutions, and organizations which has also been argued by Flaythornthwaite and Andrews [11]. Then after 2000s, Web 2.0 changed the rules of the game to make individuals and information become interactive.

Given the power of these technologies, it is reasonable to ask which factors determine which learning items are selected for each content. The answer is not easy. But there are several things to think about like games and some other attractive activities that motive learners. How this should be done, how the new generation should approach it, and how it should be addressed should be evaluated. For example, there should be the basis of entertainment.

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Nowadays people are consuming through the globally disseminated popular culture products, which frequently reached across a multitude of semiotic domains and "affinity spaces" like music, films, football, sports, etc. Put differently, teenagers' everyday literacy practices with learning – driven by and linked to fun and enjoyment – were grounded in their individual interests within local contexts but were nonetheless influenced by global flows of media, information, and culture. Rothoni [12] has taken this for learning English but it is the same for all subjects.

The fact that the content of learning is moving to different forms with the technology available across multiple devices. Therefore, teaching environments become more challenging and more creative. Most of the content is being generated, shared, and continuously updated by users.

According to Benson-Armer et al. [13], new and disruptive content of learning is moving to the cloud, becoming accessible across multiple devices, and teaching environments. These contents are enriched by the new technologies such as virtual reality, augmented reality (AR), simulations, etc. The introduction of broadcasting also allowed more flexibility on teaching/learning in a broader environment. Broadcasting technology shaped the idea of open education and open learning even more. Nasseh [9] also tried to explain these for distance education in the historical timeline.

There are different ways for representing abstract concepts in an interactive way. These are visualization, animation, and simulations and these techniques can be used across several disciplines [10]. But before coming into detail, we should better check the evaluation of the educational methods until today.

3. Methodology

Since our work is in its infancy, our work can be considered as a descriptive study. In this context, a literature review has taken on the subject. We also tried to evaluate the educational methods both for face-to-face and online environments. Then we wanted to conclude this from our observations and opinions which are semantically brought together.

4. Evaluation of educational methods until today

In this section, it will be useful to take a brief look at traditional education to assess the direction of "Teaching" toward "Learning". The traditional method of education is basically based on three types of learning: systematic, static, and knowledge with appropriate content. It is structural, and to understand the proper content, static so long-winded content that can be turned into a permanent knowledge base that is based on the enrichment of teaching basic may be content to other disciplines.

Educational strategies can be expressed in three different ways according to their teaching objectives in general: object-oriented, subject-oriented, and institutional-oriented strategies. These strategies should be revised and "teaching" should be linked alongside to "learning".

When we check the teaching-oriented strategies, namely in object-oriented strategies, the transfer of information is very important than the vehicle used. In the case of topic orientation, the teacher focuses on the subject and establishes the relationship between the class and the subject. The aim is to create more motivation in the classroom and to influence the students.

The targets of learning are outsourced and predefined (identification of learning objectives) and then there is an evaluation of learning. These forms the focus of teachers' behavior. Transfers related to the targets set by the institution are also transferred to the students from the institution, for example, the place of internship of a student or institutional collaborations.

Information on traditional learning is transferred directly from the teacher to the student. The structure of knowledge is either "ready" to give or "to prepare", and the students are accepted as "passive" buyers. For this reason, the traditional method can be described as one-way "vertical communication" (from provider to receiver). In other words, students learn a systematic approach that evolves "without recourse to individual sources of information that they listen to, what information they describe, and which they can use to learn more".

In most students, the extent of learning depends on the rhythm and the teaching ability of the teacher and the classroom conditions. It is expected that the teacher will prepare [14]:

- Defining teaching objectives
- Subdivision of training curriculum into subheadings (curriculum development)
- Intermediate evaluations
- Final assessment exams
- Preparation of the module possible for those who missed the course of the year.

Traditional training tools and methods allow the development of many effective outcomes and subject-oriented training. This allows students to develop their ability to keep an understanding on content and concepts and to monitor them by teachers, making them in direct contact with teachers in the classroom environment. Traditional education gives the students a basis for out-of-school behavior, but at the same time it does not provide a solution to students' curiosity when teaching a rigid topic index. Another limitation is that the inability of the learner to adapt to the conception of the learner often causes various risks due to the closed and rigid formation of the learning process.

Thus, the traditional school method is based on the perception and assimilation of the teacher and the book. In other words, the subjects are given by the teacher. Subjects and books are tried to be "received, understood, and remembered". On the other hand, the technology-based learning is interactive and open source tools to "learn by doing". As Halverson and

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Collins [15] also say, school is static and "based on time", whereas technology-based learning is dynamic and "timely learning". This is why information provider (teacher/trainer) is not in control of what his/her students earned/taught. While the old system could divided the program and progress in the learning process, technological innovations have led to oversight, more modular and comfort for the learner. There is also a need to "reduce the absolute ownership of knowledge and be considered in another dimension".

According to Duruhan [16], traditional approach and methods in schools have the following characteristics:

1. Progressive and beneficial objectives of the traditional school.
2. Load of courses and crowded classes.
3. Non-determined behavioral objectives.
4. Traditional teaching methods.
5. Conventional regulation of education-training environments.
6. Evaluation of student achievement with questions of knowledge and understanding.
7. Teacher in the center of education and training.
8. Tasking with vertical communication and authoritative ınspection.
9. Passive student conception.
10. Irregular school building and equipment.
11. Managerial management approach.
12. The bureaucratic structure of the traditional school.
13. Other objectives of the traditional school outside the official purposes.
14. Traditional school philosophy.

According to Telli Yamamoto and Karaman [17], Web 2.0 tools bring more interaction to the education system, however in current education system, the use of these applications is very limited because the ruling class was educated in the old way and still accustomed to the old technologies in the present. New technologies will shift this paradigm of the learning and will make possible for new kinds of educational methods that we face difficulty even in predicting and visualizing such as associative learning theory which has been discussing since 1969.

Although there is an on-going debate on the explanatory power of associative learning theory [18], recent studies on the social interaction [19] seem to bolster the status of associative learning. The crux of the controversy nonetheless does not question experimental evidence, of which plenty exists, but whether such evidence is supported by current models within the terms of reference of traditional associative learning theory [20]. So the constructional and behavioral learning theories still in on the agenda.

According to Zapalska and Brozik [21], individual learning styles must be taken into account in the instructional design template used in online education. Their paper argued that when students' learning styles are identified, it is possible to define an appropriate context of learning.

5. Hype Cycle of technology and applications

Hype Cycles and Priority Matrices offer a snapshot of the relative market promotion and perceived value of computing innovations [22]. Gartner, Inc. annually develops and announces branded graphical presentation report called "Hype Cycle" for representing the maturity, adoption, and social application of specific technologies (**Figure 1**). Gartner Hype Cycle methodology gives a view of how a technology or application will evolve over time, providing a sound source of insight to manage its deployment within the context of the specific business goals to its users (Gartner, n.d.). Gartner declares that the Hype Cycle "drills down into the five key phases of a technology's life cycle" [23] and "a technology (or related service and discipline innovation) passes through several stages on its path to productivity" [24] in the Hype Cycle. These paths are Innovation Trigger, Peak of Inflated Expectations, Trough of Disillusionment, Slope of Enlightenment, and Plateau of Productivity.

- Innovation Trigger (formerly called Technology Trigger): a potential technology starting here are often still in the R&D stage. Often no usable products exist and commercial viability is unproven.
- Peak of Inflated Expectations: a wave of "buzz" builds and the expectations for this new technology rise above the current reality of its capabilities. This is the point when expectations and reality are furthest apart.
- Trough of Disillusionment: problems with performance, slower than expected adoption or a failure to deliver financial returns in the time anticipated all lead to missed expectations, and disillusionment sets in.
- Slope of Enlightenment: there is certain understanding of the benefits, practical implementation and limits of the technology. Experience of the early adopters' perception grows about where and how the technology can be used to good effect and, just as importantly, where it brings little or no value.
- Plateau of Productivity: with the real world benefits of the technology demonstrated and accepted, growing numbers of organizations feel comfortable with the now greatly reduced levels of risk. Target audience will have acquired related products by this point [24].

In recent years, new technologies have been reduced to niche applications include the artificial intelligence (AI), virtual reality (VR) and augmented reality (AR). They have taken along the curve in recent years. VR first appears in it modern appearance and placed in the Hype

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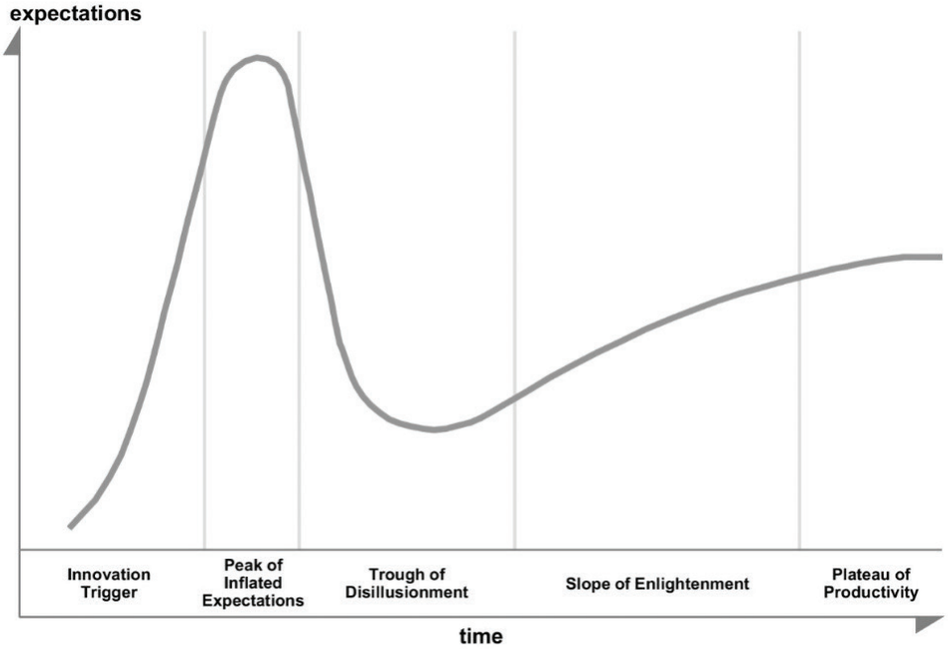

Figure 1. The Hype Cycle [27].

Cycle in 2013. Fenigson [25] states that "Over the course of the next two years, it moves on to a position right on the cusp of the Slope of Enlightenment though at all times Gartner's icon for it never wavers from a 5-10 year journey to the Plateau and mainstream adoption". **Figure 2** shows Gartner's 2016 Hype Cycle for Emerging Technologies prescience in 2016. Thus to the standard Hype Cycle, virtual reality is going to be mass market, and it will be the progress for VR because of its capability of other technologies such as streaming media, augmented reality, and film industry. That would mean VR has a potential to be more dominant by 2020s. Mike Walker, research director at Gartner, emphasized that "We can see how the transparently immersive experience technologies such as affective computing, connected home, augmented reality, virtual reality and the growing human augmentation, are pulling the other trends along the Hype Cycle" [26]. That means VR is approximately in such a stage where it is widely understood by the public.

In 2015, Gartner's Hype Cyle is expected to pass virtual world's trough of disillusionment to slope of enlightment by 2020. It is expected that this structure will be very important in the context of mobile government and Education, because the world is demanding different applications than classical style education and training. In particular, it will be necessary to make assessments in all learning areas, organizational trainings, and to be ready for the millenial generation which has very different tendencies in their life stages.

Different technologies can improve learning by augmenting and connecting learning activities. Digital technologies can also be exciting for the learners and offer a potentially more engaging alternative. It is important to be aware that some learners may be less confident in learning with digital technologies and steps need to be taken to ensure equality of access [27].

Figure 2. Conditions of the Hype Cycle for 2016, regenerated from http://www.gartner.com/newsroom/id/3412017.

Personal learning network (PLN) is an individual's loose collection of links with other people or resources. The aim of such a network is to facilitate an exchange of ideas that supports learning links can be through virtual learning environment (VLE). A VLE is an e-learning education system that is web-based, but modeled on conventional face-to-face education. It provides access to courses, course content, assessments, homework, links to external resources, etc. Moodle Blackboard easy way to collate and organize courses and information flexibility of access software can limit course structure high level of maintenance.

6. VR/AR definitions

There are several definitions about virtual reality which mean varies drastically with context. Virtual reality term first used in 1986 by Larnier [28] then Steuer, 1995 [29]; Heim, 1998 [30], and Yoh, 2001 [31]. Virtual reality is a technology that convinces the participant that he or she is actually in another place by substituting the primary sensory input with data received produced by a computer.

Virtual reality is electronic simulations of environments experienced via head-mounted eye goggles and wired clothing enabling the end user to interact in realistic three-dimensional situations [32].

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Basically, virtual reality is a technology which simulates interactive 360° digital environments replace the real world. Virtual reality is one of the digital mediums created to present realities in real life or realities to be displayed in a 360° and/or 3D environment beyond the perception capacity of sensory organs by virtue of virtual reality.

Virtual reality is also a three-dimensional, computer-generated environment which can be explored and interacted by a person in technical terms. This would be presented with a version of reality that is not really there, but from your perspective it would be felt as real.

Virtual reality can "stimulate learning and comprehension, because it provides a tight coupling between symbolic and experiential information" [33]. Experience is the most important cause and effect value for loyalty in order to be involved in VR.

Virtual reality provides a great contribution to the virtualization of learning by living in an environment without great risk. For example, the hospital surgery environment or dangerous environments in traffic could easily teach through virtual reality. According to Armstrong [34], currently available two main categories of VR are mobile (Samsung/Google) and PC (Oculus). The future expectations for VR—from a headset and content perspective—as both improve so will people's desire for VR as it moves from a "nice-to-have" to a "must-have". Curcio et al. [35] states that the technology developments were not only on the display side but, among the others, also on the capture side. A many of 360° recording cameras have been presented to the market in the last period for allowing VR content to be easily produced.

Barab et al. [36], Chittaro and Ranon [37], Dickey [38], Mennecke at al. [39] are some researchers have argued that virtual environment and simulation can be used to facilitate learning tasks that lead to increased understanding, motivation, engagement, collaboration, and knowledge transfer [40]. So for these new type of learning has an importance to use virtual reality technology for both personal and collaboratively.

From the first modern appearance in 2013 [26] and still in its improvement stage, learning VR technology will be effective in situations where it is necessary to experience physically, to do things that cannot be done in many ways easily, and to approach things differently and the technology is becoming more common to the users and producers of learning. You can see the landscape of VR (**Figure 3**) with content and headset types which has start to be used in games, gamification, designing, filming, and learning.

After several decades of experimenting VR invention in limited environments, Google Cardboard in the year 2014 became accessible to the mass market. This is a paper made do-it-yourself head-mounted display (HMD) for smartphones priced at around 5 dollars. At the same time, there are many public releases of consumer editions of VR hardwares such as Oculus Rift and HTC Vive. Many educational companies and startups have just started to develop learning, training, and educational VR contents and platforms. These let us shift to the immersive experience over just a 2D screen plus mouse/keyboard experience into something altogether more physical.

Presence is the main attribute in defining experience for VR using with head-mounted display. Mikropoulos and Strouboulis [41] investigated the sense of presence of children while

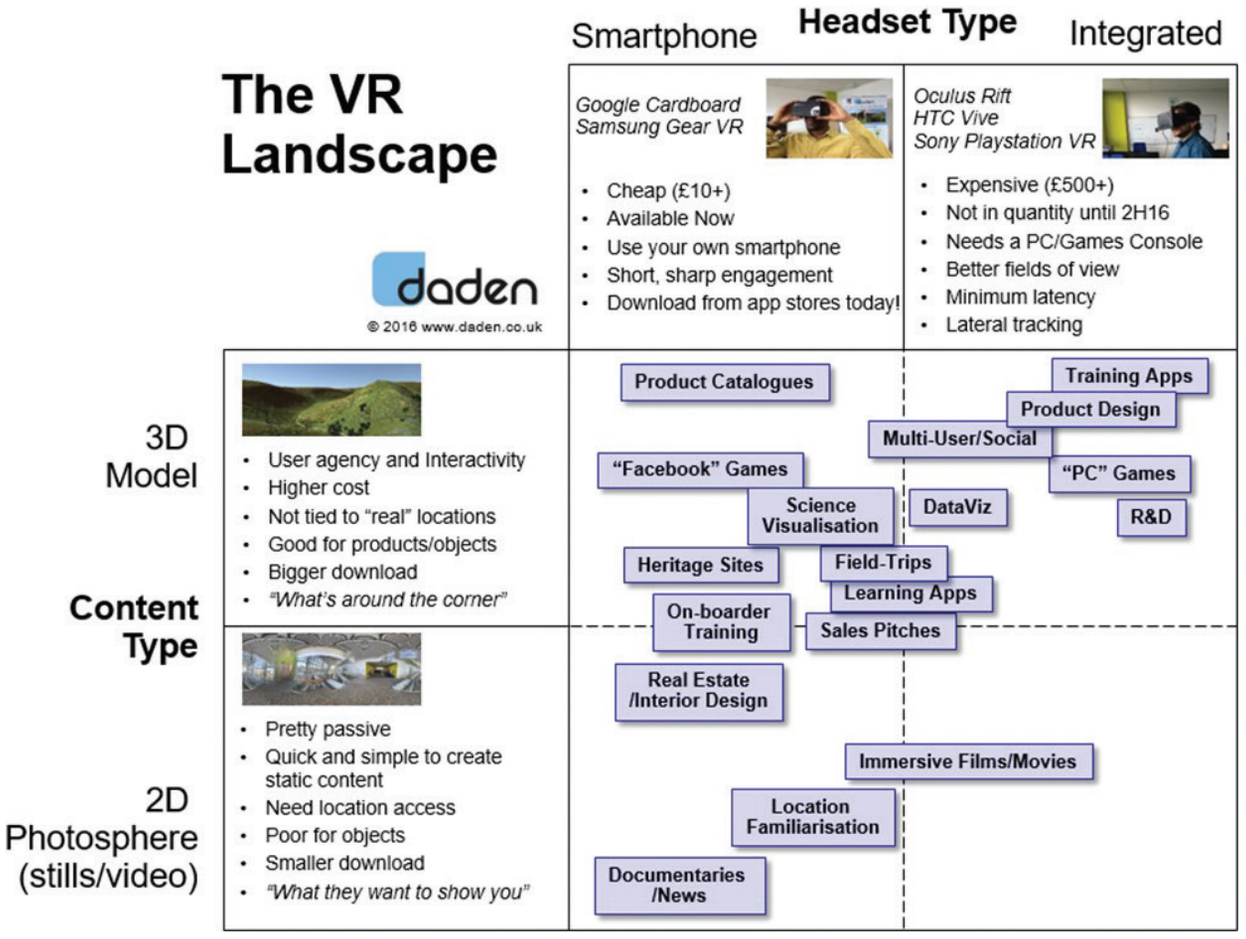

Figure 3. Landscape for VR. David Burden. Virtual reality for L&D: Part 1, https://www.learnevents.com/blog/2016/07/26/virtual-reality-for-ld-part-1/ retrieved 07/05/2017.

navigating as an incomparable avatar in an immersive VR using various input devices such as HMDs for interaction. Project was representative of an ancient house in Kassiopi, Greece and the interactive actions within educational learning goals. Due to immersive VR's ability, learners can act through representations of the characters or avatars. Results are impressive; Mikropoulos and Strouboulis explored long-term retention (2 months later) of cognitive content and sense of presence. Younger learners are very familiar with those representations of self.

7. VR learning

Due to the advancement in digital technologies virtual reality and augmented reality have received high consideration in educational domains. Interest and tendency for using these types of learning were suitable for the new generation who are commonly known as "net-generation" [42].

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Virtual reality technology proposes and provides various educational learning capabilities, and grants a positive impact to its educational application if appropriately fulfilled. Chen [43] defines some of these capabilities that are able to provide support for education, such as learners' ability to visualize, manipulate, interact, and experience in real time with the 3D virtual environments that are unavailable or unfeasible due to distance, time, cost, or safety factors. Because of that, virtual reality technology in education brings about excitement and high expectation of its capabilities.

Virtual reality provides interaction with learning content. For instance, learners can view virtual environments from multiple viewpoints or zoom and pan in/out the virtual objects. This will probably enhance the learning effect when the learners are actively constructing new knowledge [44].

According to Chen [44], the constructivist philosophy argues that knowledge is constructed through an individual's interaction with the environment and learners can learn better, when they are actively involved in constructing knowledge in a learning-by-doing situation. The learner may make mistakes because of wrong decisions but s/he takes an active role in their learning, since they not only absorb information, and these individual experiences change and affect the conditions for altering existent assimilated knowledge and thus constructing new knowledge [45]. Many instructors in colleges and universities have tried to make it for their students by creating opportunities for them to apply their learning in realistic in solving a real-life problem, if simulated, situations [46]. Virtual reality as an immersive technology can support constructive learning.

Virtual reality support constructivist philosophy that argues "learning-by-doing" situation with "experiential learning" which can be defined as an instructional model that begins with a direct "experience" involving a learner, followed by reflection, discussion, analysis and evaluation of the experience [47–49]. One of the most famous theories of experiential learning was developed by Kolb [50].

Kolb [50] explains that learning from life experience is described as "experiential learning" by which learners transform their experiences into meaningful knowledge. In other words, experience is the main feature of VR which is a great benefit to all learning styles. VR with immersion or simulation features might provide a good level of realism and interactivity and offer valuable learning experiences as formulated by Dewey [45].

Same as Kolb [50], Edgar Dale [51], who often cited as the father of modern media in education, emphasizes "Experiences may be direct or indirect and of concrete and abstract can be summarized in pictorial device" Same Dale [52] found that the more active and participatory a learning activity, the longer the material remained in memory. Dale explains that in his audio-visual methods in Teaching Textbook [51] as "two weeks after learning the new information we remember no more than 20% of what we hear and read, but up to 90% of what we say and do". By the way, the retention data that was used by Dale, cited before Dale by Haskell [53] to explain Montesorri education method. Edgar Dale was the first who defined with theoretical frame.

Psychologist Bruner [1], in a different perspective, declared a descriptive scheme, which is called "*The Discovery Learning Model*" for labeling instructional activities that, parallels Dale's. Bruner's concepts of enactive, iconic, and abstract learning can be superimposed on Dale's Cone of Experience [54]. Edgar Dale's model as "Cone of Experience" (**Figure 4**) or the "Pyramid of Learning" is shown in **Figure 4**.

The Cone of Experience [52] is a visual model that demonstrates scopes of experience arranged according to degree of abstraction. Besides, Baukal [55] expressed an updated version of Dale's Cone of Learning (**Figure 5**) that includes virtual reality, in **Figure 5**.

Baukal's Multimedia Cone of Abstraction is the improved model of Edgar Dale's Cone of Experience because some current forms of multimedia such as virtual reality (VR) were not available to instructors and researchers. Some of the subjects in Dale's model would not be sufficient in a computer-based learning environment. According to Baukal [55], "The lowest and least abstract level on the Multimedia Cone of Abstraction is Virtual Reality" and "Today's VR is so realistic that the experience is almost like being there".

Virtual reality technology deserves extensive attention as an instructional tool. It relatively enables simulations so realistic in a variety of fields, such as aerospace, military, video games,

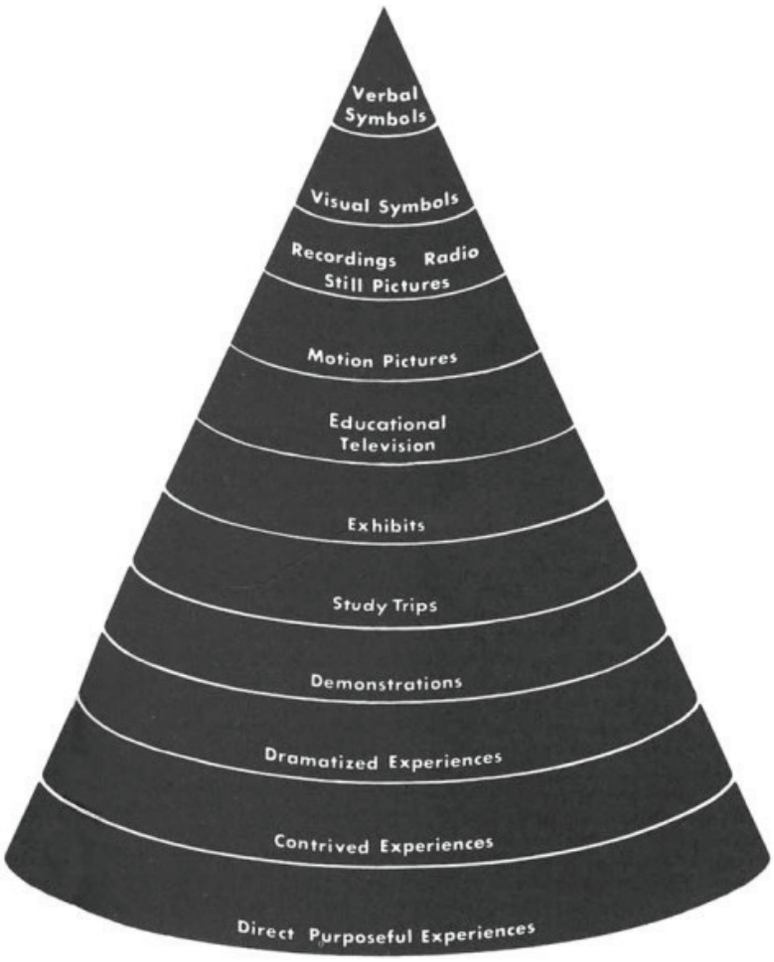

Figure 4. Edgar Dale's cone of experience [54].

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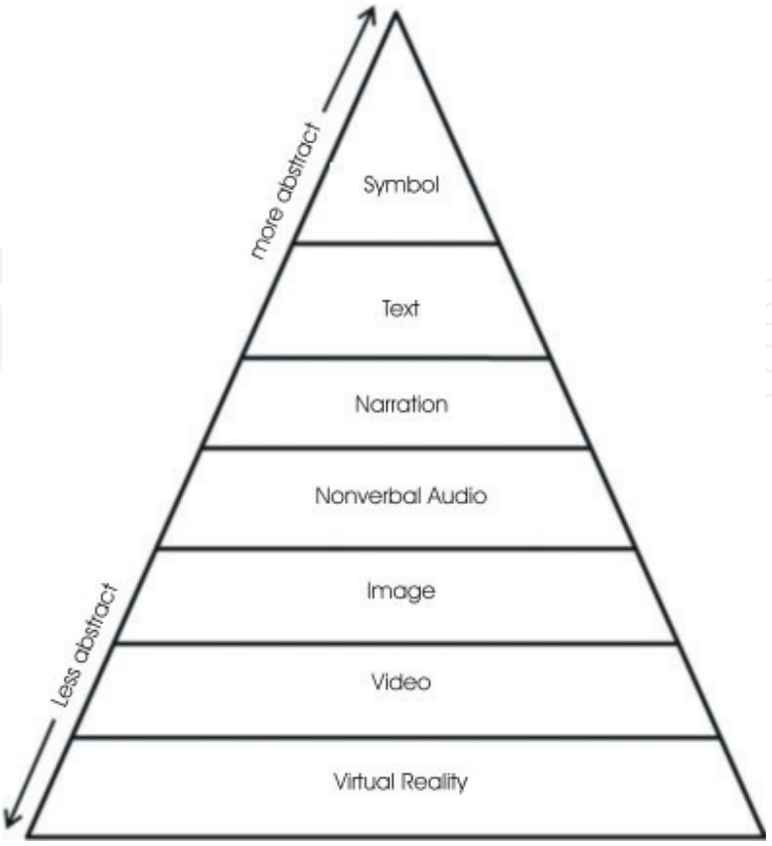

Figure 5. Charles Baukal's multimedia cone of abstractions.

industrial applications, medical, sports, tourism, education, and training [45]. People react spontaneously and automatically to the environment as if they were really experiencing it with full briefing on the mission, weapons, political factions, strategies, and immersion in the culture of the city.

According to Mayer and Moreno [56], animation's "effects are most consistent with the cognitive theory of multimedia learning". In educational learning, animation is considered a tool which has three characteristics: picture, motion, and simulation. As a "simulated motion picture", an animation is a group of images that show an object's motion in real simulation.

In recent decades, simulations have become popular in industry and retail areas such as in producing process, aerial processes, construction, architecture and interior design where the facility to create an immersive 3D representation for planning, evaluation, marketing, and training.

Virtual reality simulation allows an opportunity for learners to be in hard and dangerous situations, which are not usually accessible in the real world. Additionally, VR permits to take to the students' complex themes of hard learning to interact with a simulated environment in real time [57] and sometimes situations impossible to show [58]. A goal of a VR, or a simulation-learning experience for learners to perceive they are as closely as possible to a real learning experience.

According to Dewey [7], the environment affects the learner and an interaction will take place between the environment and the learner. In other words, virtual reality training is very well suited for providing, controlled exploratory learning environments, for self-directed "learning-by-doing" [59] which enable learners to learn through experimentation for daily life, and increase learners' understanding [60].

VR educational application assessments emphasize that, influence of the interaction experience, such as immersion, presence, engagement, motivation, and usability [61]. The purpose is to explore student's positive learning outcomes and greater sense of presence after VR interactions. According to Roussos [62], presence is the (mental) feeling of being in a virtual space. Immersion is the complete visual and auditory submersion into the virtual world through VR systems such as the head-mounted display (HMD) or interactivity refers to how reactive the system is in response to the user's actions. A collaborative VR learning environment named "multipresence or multiparticipant" [63].

Immersion and presence are unique affordances of immersive VR that can have a positive effect on learning processes and outcomes. Wang [64] declares that, "Learning depends more than the transmission of knowledge; it also requires the ability of an educator to engage students to be immersed in a meaningful activity so that they can internalize the knowledge received". Immersive and interactive VR can provide better learning of physical movements than a 2D video and motivate learners to learn and solve the problem adequately [45, 65]. Namely, the use of immersive virtual reality in education can have a positive effect on learning [66, 67].

According to Claxton [68], creativity can be learned. VR applications allow students to fully engage with content, control, feedback, navigate, and imagination. Students' problem solving, creative thinking, and creativity learning correlation via the use of computer-generated 3D virtual worlds helps them practice their cognitive process as they interact in the virtual reality learning environment to gain experience of immersion and imagination [46, 58, 69] that broaden their imaginations, improve their skills.

Based on Roussos [62] that the virtual reality environments for education classified into two categories:

- Desktop virtual reality simulations (virtual reality learning environments), where interactivity is usually limited but varies according to the control given by the program, and immersion also varies but is not easily provided. It can be named "non-immersive".
- Immersive VR environments, where immersion is high, but interactivity may be limited, depending on the complexity of the virtual world.

In this research, we are focused on desktop virtual reality simulations and immersive VR environments.

Desktop virtual reality simulations (VRLE) provides learners an interactive and focused learning environment allowing the learners to collectively understand and solve visualization

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problems in a group [70], and simulate a realistic environment in which users can perform specific tasks [35, 71].

Immersive VR environments is features of interaction, imagination, and immersion are the main characteristics to attract and motivate students to learn in it [62]. The results show a positive attitude toward VR in the education process [71]. Teacher and learner are both placed in an immersive VLE simultaneously [72].

Brooks [73] gives three reasons why most researchers do not pay attention to desktop display systems as true VR:

1. Block out the real world is very limited.
2. The VR content cannot be presented in life size.
3. The level of immersion is low or inaccessible.

Various head-mounted displays (HMD) for virtual reality systems has been developed since 1965 Ivan Sutherland's device widely considered the first virtual reality head-mounted display (HMD) system has been used in the military field called "The Sword of Damocles" [74].

Especially for children and younger learners, combining computer games into the VR learning could be an appropriate way to motivate their learning. There is a clear advantage to students who learn better with the "hands-on" learning style [75].

Virtual reality learning has proved to be a smooth shift for younger generations grown up Nintendo, Xbox, and Play Station computer games. With immersive consumer HMD products such as Oculus and HTC Vive, learners will be able to adopt easily to the immersive virtual reality simulation trainings.

Lecture VR application was developed by Immersive VR Education Ltd., which simulates a lecture hall in VR environment [76]. Lectures designed and placed by images, videos, and immersive experiences, which enhance the lesson in order to get experience such as to be in famous ship Titanic via VR simulation with whole class and trainers. Lecture can be accessed from anywhere in the world, which makes education more accessible.

Begley [77] emphasizes that, VR trainings would be cheaper alternative for international students in countries such as Australia, who would otherwise pay high fees to study overseas. For example, Mondly VR is VR platform to learn several languages by VR technology. Project is the first to launch a VR experience for learning languages featuring speech recognition and chatbot technology [78, 79].

Roussos [62] summarizes the educational values of virtual reality as accessing the unreachable or the unrealizable, multiple or alternative representations, abstractions become more concrete. A research surveyed by Taylor and Disinger [80] was one of the first empirical studies on the acceptance of VR in education.

Video-capture VR is called 360-degree (360°) VR video, which use HMD, headphones, or data gloves to provide first-person point of view [81], brings the learner in the center of a fully immersive environment such as live events and locations in the same way as VR as if they were actually there. 360° video creates mirrored images so that users can see themselves on the screen.

Even, users can also directly interact with objects in a video-capture VR environment including a first person view of a realistic experience, showing a film from a real location, freedom from obstacle, intuitive and interesting interactions, and controls, which does not happen in traditional VR environments where users interact with other objects or avatars on the screen. VR video allows users to experience their body's natural movements [82–84].

Gay [85] found advantages for VR over video for teaching cell biology, but found no benefits of immersive VR over desktop VR. Naturally, producing 360° video content has some limitations such as additional light cannot be used or director cannot stay on backside, because there is no front or back side, it is recorded 360-degree.

YouTube and Facebook social media platforms' 360° video support has changed the penetration of production. Also cheaper 360° video recording cameras, defined in this paper before, empower the 360° video ecosystem. Same as computer-generated VR projects, 360° VR video has educational capabilities for VR training simulations. The most important power of 360° video VR simulation is the direct effect of experimental learning and training.

Google also launched Expeditions, a tool that builds on the company's Cardboard platform to provide children with a "field trip" experience from the classroom [86]. In such an application, students and the instructors will see the same things and be in the same session, nevertheless the instructor will be able to lecture and highlight certain things that are relevant to the lesson.

The goal of VR technology is to enable the user to learn about or experience a target environment in a safe and controlled way that minimizes the costs compared to using the real environment no matter how expensive the simulation is or not. In spite of the high cost of advanced simulation technologies, the retrenchment made because of reducing training and medical errors costs justifies the use of such technologies. According to Piovesan et al. [58], it supplies the situations which are impossible to be experienced in the real world. For example, exploring the Mars, traveling inside the human body, doing submarines or inside caves, visiting molecules or very expensive or very far away place which is in the past (historical places).

The use of virtual reality with low-cost immersive VR hardware (e.g. with head-mounted displays and gloves) and software for training is now readily available to create safe and cost effective highly interactive educational training simulations, no need for physical and often costly equipment, for the learners and/or trainees [87–89]. For these reasons, VR is an affordable alternative which could be used in schools at the current time, because it can shorten training time and possibly increase long-term retention of knowledge and skills [90] with increased efficiency and selectivity [91]. Sadagic [90] also defines that "VR include increasing the trainees' motivation to train and learn providing safer and less costly training scenarios".

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8. Conclusion

Classical education is a teacher-centered education consisting of teaching, management, and supervision. In the arrangement of the subjects such as courses, programs, assignments, lectures, etc. the interest, learning style, and needs of the students are hardly taken into consideration. Curriculum and teachers are kept in the forefront. In this system where the teacher is active and the student is passive, the actual learning of the student remains in the knowing and comprehension stages. The student cannot demonstrate in analyzing, synthesizing, applying, evaluating, and learning behavior. However, real learning performance expresses the behaviors of application, analysis, synthesis, and evaluation together with knowing and comprehension in relation to the subject that the student has learned.

Teacher-student relations are structured extensively in classical education, which can be expressed as an authoritarian system that restricts the student. There is a vertical communication between teachers and students where teachers are upper level and students lower level. While the student is directed, the authority is emphasized with the supervision. In this case, the student makes the statement to please the authority, fulfills the task given, etc. Therefore, students are expected to behave harmoniously. Students are not involved in the decisions taken.

In certain mold, one-way thinking, cultivated an environment where individuals have faced one of the biggest obstacles for the development. It is difficult to expect creativity, tolerance, problem solving, functionality, and so on from individuals who grow up in this way. In other words, classical education prepares students to learn, leads them to memorize, decreases the sense of curiosity, and leads to the development of unqualified individuals. However, today's conditions necessitate the development of people who access and use information, inquire about the information they receive, produce new information, research, solve problems, take responsibility for their own learning, etc.

In the contemporary learning approach, the student is at the center of education and training, and aims to help him develop his/her self in all aspects of social, emotional, and mental. In other words, the physical, affective, and cognitive developmental characteristics of the student are taken into account. STEM and flipped learning are some techniques to improve these kinds of skills and development of self. The student is the agent and the teacher is the passive. The teacher chooses the elements of the learning and teaching process, such as subject, method, equipment taking into account the student. There is a motivating environment for learning and creativity. In this environment, the individual can become a self disciplined one by participating in decisions at will, taking his/her (sometimes group) responsibilities and enjoying the sense of accomplishment.

When we summarize the classical education:

- There is an understanding of teaching that focuses on conveying information.
- Teaching methods that students accept without being interrogated.

- The ready-made information conveyed to students.
- Comments, personal opinions, and creative ideas do not take much place.
- Individual differences and learning needs are not considered.
- Overloaded to textbooks and exams.
- Students are not encouraged to search, and no effort is made to reach knowledge.
- It is required to repeat the information transferred to the evaluation.
- Classroom interaction and information exchange are limited.
- The student is a passive listener.
- It is difficult to attract the attention of the learner, to provide care for a long time.

In fact, the teaching activities should be competence and abundance to meet the student's expectations and requirements of learning in a harmonious way. In recent years, digital learning tools and techniques have also changed drastically. With digital media, teaching and learning experiences have become enriched and more widely used. Today's technologies offer a wide range of options and offer opportunities for different learning styles.

When designing learning processes, to enable learners to learn better in digital environments such as virtual reality learning, it is necessary to consider the learning styles of the students. It can be said that learning styles are an important determinant in determining these learning environments. Because every single student is prepared to learn new and/or difficult knowledge, s/he can use his/her different and unique ways (visual, audial, kinesthetic, etc) to learn and remember. In other words, some people prefer to learn by reading, they can use image memory. Some may prefer to learn by listening, using voice, listening, and discussing. Others can use their muscular memory, learn by doing physical contact with things they will learn such as traveling, dramatizing. In this direction, students will select and use information-communication technologies according to their own style. VR technology is to enable the user to learn about or experience a target environment in a safe and controlled way that minimizes the costs compared to using the real environment.

Virtual learning has the ability to produce products in a personalized learning approach where each student can learn in his/her own way. Indeed, motivation and success may be higher if the teaching process is organized according to learning styles.

The main technological characteristics of VR learning can be defined as direct experience, intuitive interactivity, visual representations, memorability, and immersion.

With the sense of "being there" ability, VR Learning has the great opportunity to become an inestimable method of training in situations where actual hands-on training is too dangerous or impossible to show, which are not usually accessible in the real world.

Using virtual reality in the field of education offers to enhance students' learning experiences by exploring new ideas to develop positive learning behaviors in the learning process.

Furthermore, there is some evidence that VR learning seems to be useful tool for young generations, as they are excited to use the new technologies involved.

Such technology and various apparatus required for the VR experience such as head-mounted-displays and data gloves are available at the purchasable prices hereafter.

Overall, the VR technologies prove the potential to the change the nature of education and training foundations for the future. When we are not able to have the real experiences, the virtual reality is unique. We believe that virtual reality will be a new and useful tool for distance learning.

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