New Technologies and Virtual Reality in Aesthetics and Cosmetology

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Abstract: This paper focuses on new technologies in education. The rapid development of technology and the pandemic of Covid-19 demonstrated the need for the integration of information and communication technologies (ICT), supporting the educational practice and changing the traditional way of learning. At the same time in recent years, virtual reality seems to have a positive impact on learning, with several foreign countries using it as a way of sharing knowledge. Virtual environments, based on the theory of Constructivism, continue to attract the interest of pupils, who are in constant interaction with other users and with virtual items. Through the OP, students can take virtual tour in any place in the world, enjoy learning a foreign language and develop a sense of empathy. With the full-immersion helmet and special tactile gloves, students acquire knowledge through exciting experiences. The beneficial effects of virtual reality could be exploited by the Department of Aesthetics and Cosmetology for the education of students at the University of West Attica. Enhancing education with such advanced technology is not far off as other technologies, such as augmented reality and artificial intelligence, are already being used in the e-form trade.
The purpose of this paper is to explore the benefits of new technologies and OP in education and, in the field of Aesthetics and Cosmetology.

Key-Words: Virtual Reality, Constructivism, Virtual Environments, Aesthetics, Cosmetology, Augmented Reality, Artificial Intelligence

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1 Introduction

Information and communication technologies, as well as virtual reality, have significantly affected all levels of education. In Greece, several universities, such as the Medical School, use digital technologies, focusing on new perspectives and enhancing the consolidation of knowledge. More specifically, virtual reality has been used in various fields with good results, such as improving empathy, anatomy class, dealing properly in an earthquake situation, learning foreign languages, adopting a different culture, avoiding the stress of public exposure and public speaking. Like the case at the Medical School, there is an urgent need to integrate virtual reality into other fields of education, such as the field of Biomedical Sciences, Aesthetics and Cosmetology. In 2018, the branch of Aesthetics attended technological training, in order develop clear understanding of the paramedical courses, that would be offered to pupils. In view of the above, this dissertation aims to propose the use of the virtual reality device in courses taught at the University of West Attica, Department of Aesthetics, such as: 1) Laser safety and dermal laser applications, 2) Anatomical I and II and 3)

Production of Cosmetic products, Biotechnology in Cosmetology and Dermatology.

1.1 Definition of ICT and Education during the Covid-19 pandemic

Information and communication technologies (ICT), possess a multifaceted importance in educational practice for three main reasons. Initially, their use helps in administrative procedures. Board members can use the computer to perform more directly and more simply the bureaucratic obligations to each teacher system such as student enrollment and assessments. Still, ICT has invades the curriculum as a subject. Teachers are called to teach students the programs and opportunities offered by computer. The use of ICT follows the whole educational course of the students, as students search for information through the internet and perform tasks either individually or in groups.

During the Covid-19 pandemic, the need to use new technologies became greater imperative. Teachers and students began to use ICT as the only means interaction for the learning process. All educational institutions were forced to turn to the globalized digital age in order to continue the educational practice smoothly [1]. In the tertiary education tended to create educational platforms to not sideline the semester schedule and curriculum. The rapid spread of Covid-19 led to national quarantines (lockdowns), and therefore to closure of all educational institutions. This unfavorable situation showed that the technology sets new rules in education, establishing electronics, the mixed and distance learning [2]. The Greek educational system had to face a huge challenge, as many teachers had inadequate knowledge of new technologies. On the other hand, the students were overwhelmed with anxiety because they got out of the school routine and had to do homework alone online. Asynchronous learning platforms such as Moodle and e-class, played an important role in Greek education. Research on online learning during the pandemic has given us important findings on student psychology and the problems that existed. One A significant percentage of students (47.5%) reported how long the lectures were boring and the largest percentage (73%) argued that the many hours in front of computer was creating fatigue and lack of concentration. As for the artificial problems, most students experienced network difficulties, with 51.3% of students have an internet connection problem. It is important to note that a percentage of students, 41.9%, attended the class via mobile phone which created problems when a student had to deliver a job. Despite the problems and negative emotions that were created in students, the pandemic improved the use of ICT and signaled that the online learning came to stay [3].

1.2. What is the device of virtual reality?

Virtual Reality (VR), is an innovative technological development, used more for games and entertainment than educational and commercial purposes. In recent years it has been dynamically integrated into many levels of education, giving beneficial results in the consolidation of knowledge. It offers a unique experience that enables the operator to interact with 3D space, which consists of 3D graphics. At the first stage, the device applied to the head connects wirelessly to a computer or console. The most well-known devices include the Oculus Rift and Samsung VR. While users use all their senses (hearing, touch, sight, smell) at the beginning of the process, after few minutes using OP, they start losing all their senses in the real world, as they become completely immersed in an artificial, imaginary, supernatural world. This situation, in which the user loses consciousness of reality, is called immersion. A key element that characterizes Virtual reality is the interaction between the user and the virtual environment. Participants in the virtual environment can touch and grasp virtual objects. Today in the market, there are special gloves that offer a greater sense of touch. The user can participate either directly with active participation or indirectly as an observer [4]. Other feature of the virtual reality is the "Tele-presence", where the person perceives her own presence in the synthetic space as an avatar. The avatar represents the virtual self in the virtual environment. This is better understood, if one takes into account that the avatar can do what a human does in real life, such as run, sleep, read and watch TV. In addition, it has the ability to show emotion, since it may cry, laugh, get angry etc. At the same time, another feature is the sense of security the user feels in all activities and games. Knowing that nothing bad can happen to them, make them feel safe and enjoy the experience fully. OP's association with many scientific areas is also worth mentioning. OP cooperates with AI (Artificial intelligence), which aims to create virtual people endowed with intelligent behaviour. The field of ergonomics aims at better performance and easy use of OP. Graphics are an integral part of the virtual world, because they create the 3D virtual environments. The science of psychology plays an important role in studying and predicting attitudes and behaviors of the person, when he immerses in

the virtual world. Cognitive science contributes to knowledge, learning, thinking and solving problems related to the mental development [5].

2 State of the art

In other universities, teachers use simple teaching methods, which do not enthuse pupils, who often prefer not to attend the classes. Such methods are lecture, case study and demonstration. This leads students to temporarily retaining knowledge, in order to pass their exams. Unfortunately, while pursuing a student-centered education, teachers do not use new and digital tools to attract their interest. Many educators do not feel confident in incorporating these technologies in their classroom, as they have not been offered training on the benefit and the use of these new digital methods. An example of how useful VR can be in educating pupils, can be found in the earthquake safeguarding training. Earthquake is an environmental phenomenon that occurs very often in Greece. At the beginning of each academic year, students get some anti-earthquake booklets, but this move is not a strong teaching method. Students report that in the event of an earthquake they will not be able to react quickly just by reading a booklet at the start of the academic year. VR came to contribute to the training in case of an earthquake with hypothetical simulation scenarios, which aim to trigger an automatic reaction from the pupils, if this event occurs. This simulation is designed based on actual situations, such as on one's fear of being in a room where objects start falling from the shelves. To protect oneself, one must quickly cover her head and eyes and crawl under a desk or beam. On this scenario the person becomes the protagonist and is trained in the movements she must make to avoid injuries from the floating objects by virtually taking part in such situation.

The most realistic example of simulation is designed with the actual scientific data of the seismologists. Thus, in the virtual world, an earthquake lasts 70 seconds as it happens in real life. For the effectiveness of the OP in seismic education, a study was conducted with three groups of students. The first group was trained with an OP immersion device, the second by watching a video and the third by reading a leaflet.

The results showed that students with full immersion had gathered more information about earthquake precautions. In fact, they were able to retain this knowledge in the long-term and recall it at a later stage. That was demonstrated by the responses they provided several days later. Compared to the other group of students, the group who was trained with the VR technology, was able to recall the information more accurately and more consistently. These results should be attributed to the effectiveness of simulation in providing a more efficient learning environment due to its immediacy and practicality. When compared with the traditional teaching methods, one can conclude that simulation prevents pupils from experiencing boredom and helps them maintain their attention. [6].

2.1 Constructivism and virtual reality

Jean Piaget and John Dewey, founders of this theory of learning, argued that the student must constantly interact with the environment and construct new knowledge. Their previous experience also contributes to students discovering and exploring the new knowledge in an easier and more exciting way. In the theory of constructivism, students are not passive recipients, but on the contrary, they are active subjects who constantly analyze and process the new information.

At this point, it is important to clarify that in the framework of this model of teaching, pupils have a central role and discover the knowledge more independently instead of being constantly guided by the teacher[7]. This additionally indicates that constructivism enables pupils to step away from sterile memorization of knowledge and encourages them to use knowledge to produce critical thinking. Virtual reality is fully intertwined with the above pedagogical theory, as the individual interacts with the virtual environment and learns by acting through his experience.

The virtual world consists of three important elements: a) interaction, b) presence and c) navigation [8]. The term "presence" refers to the situation in which the OP operator loses consciousness in real world and sees his presence in the world of virtual reality. The nature of the individual's interaction with the virtual environment is sensory-motor based, as it enables the individual to think, observe, experiment and make abstract concepts [9]. According to Jonassen (1997), there are some variables that confirm the correlation of virtual reality with the pedagogical theory of constructivism. The first and dominant element is solving a problem, which reflects a real world problem.

The more real a problem seems, the more attracted the student is to solving it. Still, being able to

manipulate the virtual environment instills a sense of freedom to the student, who can use her own intellectual ability to use her surrounding/virtual objects, in order to find the solution to the problem. This again shows the importance of Piaget's theory, as the individual controls the environment, make her own decisions and reconstructs new knowledge, if the old ideas prove to be wrong.

Another important element is the hands-on experience, which is gained by navigating the virtual environment. Undoubtedly, humans learn through experience, comparing and evaluating previous experiences with new ones. Even the VR device gives people the opportunity to experience things that it would be impossible to experience in real life.

VR enables any individual to navigate the World Wide Web and get this basic knowledge that is a prerequisite for building new knowledge. Also, the three-dimensional environment helps students acquire multiple perspectives of thinking. Finally, the collaboration is another factor that unites constructivism with virtual reality [10].

2.2 Virtual reality in educational practice

The use of OP can have a positive impact on education for many reasons. Simulation and visualization are elements that enhance the aims of the education. The teacher must integrate the OP, guided by specific learning models, in order to achieve the optimal educational result. This is a new teaching method, which increases the interest and motivation of students. The idea that a student can explore an environment that would be impossible in normal life, like the galaxy, makes it an exciting tool for all students. The learning theory framed around virtual reality is that of constructivism, which concerns the construction and discovery of knowledge through search. The OP responds to this theory as it promotes interaction, teamwork and collaboration. Students are motivated by virtual environments and are constantly active, as they are required to write one text or word via the remote control. Therefore, there is always a constant interaction of the individual with the virtual environment. The student ceases to be a passive recipient, but on the contrary, is constantly in action maintaining her own pace of learning. She takes a leading role, as long as she makes decisions and performs activities that can be automatically evaluated by the application. For example, the student may be part of an experiment and acquire knowledge, whilst she performs a particular role in the process. At this point it would be good to note, that for these experiments the individual has the ability to use materials and utensils that may not exist in the school laboratory in real life.

Visualization helps students understand various concepts that would be difficult to understand written on a piece of paper. The VR device is a tool that helps pupils explore things in a more direct way. The effectiveness of the VR becomes more illustrated, when is compared with the observation and understanding of materials printed on a piece of paper. In this case, learners are deprived of the opportunity to experience the different elements and uses of something, when this is given in the form of an image or is part of a booklet. In contrast, through the VR, students have the ability to observe an object in close distance or respectively to examine it from a very big distance. Also, learners can do activities, which would require exceptional physical strength in real life or activities that could cause unintentional destruction of the natural environment. This new form of teaching also promotes interculturalism. After all, one can get in touch and explore countless cultures, as children from a young age are given the opportunity to expand their horizons by learning different cultures, and customs, without being intimidated by language barriers. The OP includes symbols and codes that provide learners with the ability to communicate and interact with learners from other countries, thus contributing to socialization. Most importantly, the great adaptability offered by the VR enables pupils with disabilities to take part in a wide range of activities, that would be unfeasible under normal conditions. This means that individuals can adapt their education according to their needs. The advantages of this model can be found in the role of simulation. Learners can be directly transferred in any virtual place they want, such as in a museum or a castle. Additionally, simulation allows them to construct their own experiments and conduct various analyses. Another benefit is that learners are ready to virtually experience a situation that may occur in the future. Such an example is that of an interview. Simulation can alleviate one’s stress before an interview, since it can prepare them by providing a realistic interview environment. [11].

3 Proposed scheme: Scenarios of aesthetic’s education

As the beauty industry grows rapidly, so do the demands on training of Aesthetics. In Greece, the field of Aesthetics is at a high level, as the studies related to the specific field reach the third level of education. Aesthetics and Cosmetology are included in the Field of Biomedical Sciences with four years

of study. During the first two years, the curriculum includes courses in Biomedical Science, of which the following are: Anatomy I and II, General and Inorganic Chemistry, Cell Biology, Biophysics, Informatics of Biomedical Sciences, Mathematics of Biomedical Sciences, Biochemistry, Organic Chemistry, Introduction to Biomedical Sciences, Physiology, Biostatistics and Biomedical English Terminology. For the next two years, students take theoretical and laboratory courses that correspond entirely to the field of Aesthetics. Some of the ones that could be taught with virtual reality are: Laser Safety, Dermatological laser applications
And Photonics, Cosmetics Production, Biotechnology in Cosmetology and
Dermatology [12].

3.1 Scenario of laser in Aesthetic field

The course "Laser Safety" aims to teach students about protocols, regulations and ergonomics of lasers that are used, either for medical or aesthetic purposes. Students through virtual reality could stay protected from potential dangers of such machines, whose use is often complicated and require specific knowledge. For example, a student could understand virtually that the laser beam can lead to partial or more rarely total destruction of the retina of the eye. Therefore, the student can feel safe knowing that she sees this unfavorable situation virtually, without being involved in this situation in real life. Virtual reality in such lessons could prepare learners to avoid mistakes and dangers in practical application, not only in the laboratories of the university, but also in her professional career.
The course "Laser Skin Applications" aims to teach students to distinguish the different types of lasers that exist ex. Alexandrite, Diode and Er: YAG, while doing practical training. Virtual reality would help students experience all the lasers in the market and practice six-stage. This means that they could interact with them, make a virtual application for any treatment and not be afraid of making mistakes, as long as the application is part of a virtual process. This situation would be of great use to the educational institution, because of the cost of these machines, education institutions often face difficulty in buying these machines, which can additionally be used for staff training. Usually, these trainings focus on construction sites, ergonomics, radiation characteristics and the dangers of laser. OP simulations are usually related to learners' concerns and questions. A common question of individuals is for the selection of suitable goggles for protection against laser beams. Individuals trained in such simulations have assimilated the protective symbols and alerts of the machines. In fact, the virtual representations push the individual to perform Laser applications, and understand the science of physics that is hidden behind such devices. Such an application has been made with Oculus glasses Rift S, where it allows teleportation and tactile ability with visual objects [13].

3.2 Scenario of Anatomy in the Aesthetic field

The aim of the course is to know the anatomy of the musculoskeletal system. This lesson could be done with the help of virtual reality, since it allows learners to interact virtually with the anatomical structures of their human body. The important advantage of this method over traditional teaching
of anatomy, is that any student, who is part of the virtual environment can change the size of anatomical structures ex. heart, in an effort to see details that would be almost impossible to access on a sheet of paper. The student is enabled to thoroughly explore the human body and focus on its points of interest. The traditional way of learning, includes 3D pictures in books, which often confuse students, who struggle to understand the human system.

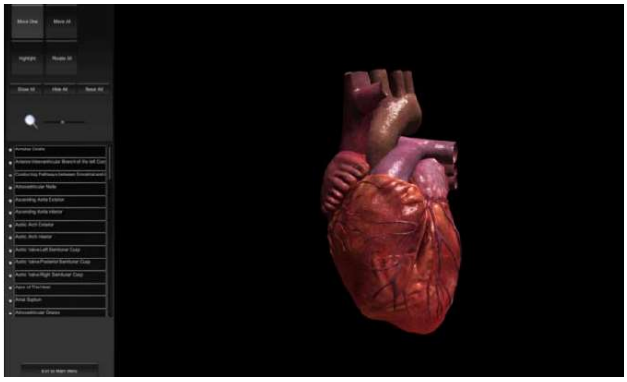

Figure 1. The illustration of the heart in 3D.

At the Medical School, the anatomy course is approached with human corpses, which has a high cost and involves several limitations. For this reason, several doctors worked together to give the OP the most realistic structure of the human body. For example, after a lot of research in 3D form of anatomy, the nodes and fibers of the myocardium can be imprinted, which was difficult to capture in any other way. Also, several attempts were made to achieve a very realistic imprint in the color of the organs, which stands out from the flesh of the corpse. The OP offers users the anatomy interface, where learners are given all the tools to explore a structure, such as to rotate the digital image and study it from many perspectives. Anatomical simulations contain a quiz, where through 25

questions, one can evaluate her knowledge, while receiving the answers at the same time. In the same way, the teacher can evaluate the students in the exam [14]

3.3 Scenario of Production of cosmetic products in Cosmetology

OP simulations have a prominent place in experiments in laboratories, such as those of Chemistry and Cosmetology. These courses require good theoretical knowledge and well-organized laboratories with basic equipment. The educational benefit is that students participate and collaborate in conducting experiments without the fear of lacking equipment and materials. However, in realistic laboratories, it may take lots of hours to carry out an experiment. Sometimes there is even some danger that incorrect results will be produced as a result of rapid a chemical activity. The OP ensures that these parameters are controlled, and they do not hinder the effectiveness of the experiment. Experimental chemistry processes have emerged from secondary education through the VR-Assisted Chemistry Education application. Initially, students immersed in the virtual world can touch utensils and equipment, without the fear of causing any harmful damage. Another advantage of such applications is that the individual can repeat them as many times as she wishes, in order to consolidate all stages of an experimental process. At the end of the process, the application proposes feedback, which intends to boost the pupils' confidence and improve their understanding. Such applications operate at different levels. At the first level, the aim is to assist learners to develop their theoretical background. After passing this level, the aim is to increase their familiarity with the objects of the laboratory and finally to reach the stage, where they can execute the experimental process on their own. Any student has to follow all the steps in the exact way she would do in a physical workshop, i.e., from preparing the workbench to getting the final result making calculations [15]

4 From virtual reality of university in commerce of beauty

In the world of beauty, any customer looks for products that meet her desires and needs. The Covid-19 pandemic accelerated the availability of applications offering personalized solutions to customer problems. The platforms that played a crucial role during the pandemic, are based on augmented reality and Artificial Intelligence, (AI) and will continue to exist after the end of the pandemic. The use of surgical masks exacerbated and brought to the surface skin problems, such as acne and cystic acne. Technology today offers advice and guidance to customers, to overcome such issues. Artificial intelligence has contributed to the establishment of an 'intelligent' cosmetics industry. Any customer can have constantly with them a beauty consultant to inform them about the products that are ideal for them. This has been achieved through the virtual reality, which has allowed customers to see a product online and try it before they buy it. For example, a customer who is looking to renew her cosmetic products, can try a lipstick, a make-up and whatever else she needs through our platform. Aesthetics platforms provide personalized information for each client. The color, the skin resolution and the shape of the face provide information that stimulates consumers' interest. Predicting satisfaction or dissatisfaction is another advantage. The application displays on the screen the customer reviews of a product worldwide. The dynamics of forecasts is great, as consumers are influenced by social media and by positive "likes" reactions. Plastic surgery, as an extension of aesthetics takes part in such platforms, since the individual can see how he will be after a simple surgical practice ex. after a botox or hyaluronic acid in lips. Hygiene and how to avoid infections is another benefit of this technology. The customer is informed about everything and has an order history and favorite store products. Below are some examples of Enhanced and Technically Intelligent in the cosmetics trade: 1) The "Foreo Luna Foto" is a smart machine that combines technology with aesthetics. This is a cleaning machine that that can be used by customers at home. Its operation is simple, since at the back of it there are skin sensors that detect the amount of moisture and dirt on the skin. When customers place it on their face, the machine analyses their face and records this information.

The application "FOREO for you", informs the customer and answers the following questions:

1) What skin type does the client have?
2) How should he take care of her skin according to her skin type?
3) Does the elasticity and firmness of the face correspond to the age of the client?
4) How much moisture and dark spots does the skin have?

Application information can be stored in the application, since the "smart" application informs about the proper operation of the machine step by step.

After cleaning the face, the customer can scan it again with the machine skin and record on the application the difference on the face before and after its use. When applying Foreo Luna Foto, a consumer can control the volume of the machine and the pressure exerted on the skin via the mobile. Personalized tips are offered depending on a client's skin and massage movements are suggested for decongestion and relaxation.

Figure 2. The "Foreo Luna Foto" application.

4.1 "Modiface" from L'Oreal

Another application that attracts many customers is L'Oreal, which created a virtual make-up application. The customer takes a photo of her face and through the "Modiface" application, and she is able to try all the company's products. After the customer has selected the products, she wants to buy, she, can scar the barcode of the product through the application ensuring that she makes the right purchase. This technology became particularly useful and popular during the pandemic, as customers were not allowed to test cosmetic products on their face.

Figure 3. The "HelloAva" application.

4.2 "HelloAva"

In 2018, the application "HelloAva" changed the data of Aesthetics and Cosmetology. Through this application, customers get some personalized suggestions for skin products based on the answers they have given previously on the application.
In case, the customer has more questions, there is an AI beautician who converses with the client and also confirms the correct choice of product.

4.3 The augmented reality mirror

The augmented reality mirror is an advanced technology in the industry of Aesthetics. Customers choose the suggested cosmetics and sees themselves try these products on. The mirror appears as a consultant, making further recommendations on how certain cosmetics suit clients' skin and color. During the pandemic, the mirror looked very helpful, as customers could see what their lipstick looked like under their mask [16].

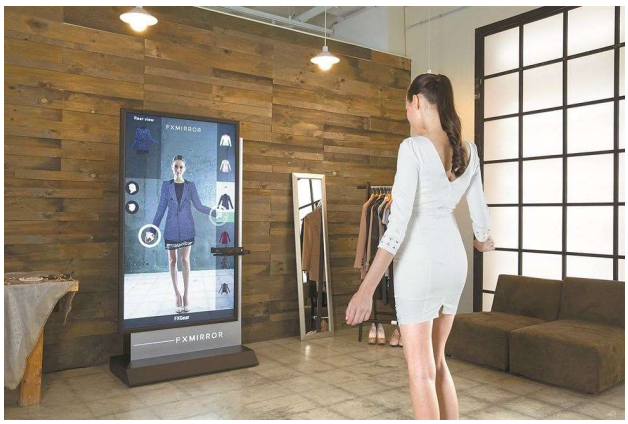

Figure 4. An Augmented Reality Fitting Mirror.

4.4 Technical Details of VR Applications

Human eyes have a horizontal field of view (HFOV) of about 120 degrees per side and a vertical field of view (VFOV) of about 135 degrees. The two eyes produce an overall field of view of 200 degrees x 135 degrees (HFOV & VFOV), most of which is peripheral vision. For stationary eyes, a stereopsis of 160 degrees * 135 degrees (0.17 or 1/6 of the 360 degrees field of view). The abstract concept of immersion can be quantified by the immersive index and in theory it is equal to:

$$Immersive\_Index = \frac{Display\_Area}{\frac{1}{6} * 4\pi R^2} \quad (1)$$

However, in reality the curved display cannot provide a spherical shape and it is approximated by:

$$Immersive\_Index = \frac{Display\_Area}{\frac{1}{6} * (2\pi R)^2} \quad (2)$$

On the other hand, 3D models for VR applications can be based on mesh generation. By subdividing a continuous geometric space into discrete topological and geometric cells, a mesh is created and a simplicial complex is formed by these cells. In a more formal way, a set that is composed of triangles, points, line segments and their n-dimensional counterparts is called a simplicial complex.
The standard n-simplex is the following subset of $\mathbf{R}^{n+1}$:

$$\Delta^n = \{(k_0, \dots, k_n) \in \boldsymbol{R}^{n+1} | \sum_{i=0}^{n} k_i = 1 \; and \; k_i \geq 0\} \quad \text{for } i=0, .., n \tag{3}$$

A canonical mapping from the standard n-simplex to an arbitrary n-simplex with vertices (vr_0, …, vr_n) is given by:

$$(k_0, \dots, k_n) \rightarrow \sum_{i=0}^{n} k_i vr_i \tag{4}$$

And the n-simplex (corner of the n-cube), which is a standard orthogonal simplex is given by:

$$\Delta_c^n = \{(k_0, \dots, k_n) \in \boldsymbol{R}^{n+1} | \sum_{i=0}^{n} k_i \leq 1 \; and \; k_i \geq 0 \; for \; all \; i\} \tag{5}$$

An n-simplex's volume in an n-dimensional space with vertices (vr_0, ..., vr_n) is given by:

$$Vol = \frac{1}{n!} |\det (vr_1 - vr_0 \quad vr_2 - vr_0 \; \dots \; vr_n - vr_0)| \tag{6}$$

By incorporating a Gram determinant, the volume is estimated by:

$$Vol = \frac{1}{n!} det \left[\begin{pmatrix} vr_1^T - vr_0^T \\ vr_2^T - vr_0^T \\ \vdots \\ vr_n^T - vr_0^T \end{pmatrix} (vr_1 - vr_0 \quad vr_2 - vr_0 \; \dots \; vr_n - vr_0) \right]^{\frac{1}{2}} \tag{7}$$

In order to compute the volume of an n-simplex using a more symmetric way in R^n is:

$$Vol = \frac{1}{n!} \left| det \begin{pmatrix} vr_0 & \dots & vr_n \\ 1 & \dots & 1 \end{pmatrix} \right| \tag{8}$$

Let us also define an affine simplex that is positively oriented as:

$$\sigma\rho = [vr_0, vr_1, vr_2, \dots vr_n] \tag{9}$$

Then the following chain is the boundary ($\partial\sigma\rho$) of $\sigma\rho$:

$$\partial\sigma\rho = \sum_{j=0}^{n} (-1)^j \left[vr_0, \dots, vr_{j-1}, vr_{j+1}, \dots vr_n \right] \tag{10}$$

Then a simplex provides a zero boundary of boundary:

$$\partial^2\sigma\rho = \partial\left(\sum_{j=0}^{n} (-1)^j \left[vr_0, \dots, vr_{j-1}, vr_{j+1}, \dots vr_n \right]\right) = 0 \tag{10}$$

Finally, we can embed a chain and a simplex into a manifold using a differentiable and smooth map:

$$f: \boldsymbol{R}^n \rightarrow L \tag{11}$$

Then the boundary operation and the summation convention commute with the embedding such as:

$$f(\sum_i \beta_i \sigma\rho_i) = \sum_i \beta_i f(\sigma\rho_i) \tag{12}$$

In Equation (12), multiplicity and orientation are denoted by β_i, which are integers.

5 Results

The use of OP can have a positive impact on education for many reasons. Simulation and visualization are elements that enhance educational results. The teacher must integrate the OP, guided by specific learning models, in order to achieve the optimal educational result. This is a new teaching method, which increases the interest and motivation of students. The idea that a student can explore an environment that would be impossible in normal life, like the galaxy, makes it an exciting tool for all students. The learning theory framed around virtual reality is that of constructivism, which concerns the construction and discovery of knowledge through search. The OP responds to this theory, as it promotes interaction, teamwork and collaboration. Students are motivated by virtual environments and are constantly active, as they are required to write one text or word remotely in the virtual environment. Therefore, in any case there is a constant interaction of the individual with the virtual environment. The student ceases to be a passive recipient, but on the contrary, is constantly in action maintaining its own pace of learning. The learner undertakes a leading role, as long as she makes decisions and performs activities that can be automatically evaluated by the application. For example, the student may be part of an experiment have a very active role in it. At this point it would be good to note, that for these experiments an individual has the ability to use materials and utensils that may not exist in the school laboratory in real life.
Visualization helps students understand various concepts that would be difficult to understand written on a piece of paper. The VR device is a tool that helps in many lessons making the observation of various objects easier. The usefulness of this becomes more apparent, if one considers that due to

lack of equipment in schools, pupils cannot fully examine and appreciate the different qualities of these objects from the books. Also, students can do activities that in real life would require physical strength or activities that could cause unintentional destruction of the natural environment. This new form of teaching also promotes interculturalism, after all one can get in touch and explore countless cultures. Students from a young age begin to expand their horizons, as they learn different cultures, manners and customs, without being discouraged by the fact that they don't speak foreign languages. The OP includes symbols and codes that allow learners to communicate and interact with other students in other countries, thus contributing to socialization. Even more important is the potential OP offers to pupils with disabilities. It enables them to interact with the learning and adapt it to their needs, thus maximizing the learning outcome.

VR is the factor that can transform learning to a more exciting experience compared to the traditional learning environment. Students can be found directly in any place they want, such as a museum or a castle. Through simulation, they can construct experiments and make statistical analysis. [11].

The teaching of computer systems is facilitated by the OP. Study by Ray and Deb 2016, argued that apprentices trained in engineering computer software, for example, had a gradually better scoring performance compared to those who did not use the immersion method to be trained [17].

6 Conclusion

All of the above contribute to the view that new technologies enhance quality education and create human personalities with vision, ideas and values.

Education has faced a new challenge: virtual reality. Although its beneficial effects in various fields are obvious, studies should be done that provide teachers with more specific educational models, making them feel safe and prepared. Still, the state is advised to take care of the training of teachers in Virtual Reality. Many researchers wonder how far technology can go. This question does not have a specific answer and that is why it is a question that scares many scientists. Technology is constantly evolving and so, there are no limits. As long as technology is on the side of man and helps him, we must take advantage of it and use it in the best possible way. It would be helpful for the paramedical branch of Aesthetics, to succeed in integrating new technologies in the curriculum, because if that happens, the future of Aesthetics and Cosmetology will be bright not only in Greece but internationally.

References:

[1] Jose Antonio, M.-C., Uribe-Hernandez, Y., Buendia-Aparcana, R., Vertiz-Osores, J., Isla Alcoser, S., & Rengifo-Lozano, R. *Integration of ICTS and Digital Skills in Times of the Pandemic Covid-19. International Journal of Higher Education,* vol 9, no 9, pp 11-20, 2020.

[2] Ali, D. W. Online and Remote Learning in Higher Education Institutes: A Necessity in light of COVID-19 Pandemic. Higher Education Studies, vol 10, no 3, pp.16-25, 2020.

[3] Stampoltzis, A., Kounenou, K., Kalamatianos, A., & Giannoulas, A. How Greek Students Experienced Online Education during Covid-19 Pandemic in Order to Adjust to a Post-Lockdown Period. The Electronic Journal of e-Learning, vol 19, no 4, pp222-232, 2021.

[4] Piovesan, S. D., Passerino1, L. M., & Pereira, A. S., Virtual reality as a tool in the Education, Iadis international conference on cognition and exploratory learning in digital age, 2012.

[5] Lepouras G., Antoniou A., Platys N., & Xaritos D., Systems development of virtual reality, Greek academic electronic books and aids, 2015.

[6] Li, A., Montaño, Z., Chen, V. J., & Gold, J. I., Virtual reality and pain management: current trends and future directions. *Pain Management*, vol. 1, no. 2, pp.147- 157, 2011.

[7] Onyesolu, M., Nwasor, V., Ositanwosu, O., & Iwegbuna, O., Pedagogy: Instructivism to SocioConstructivism through Virtual Reality. *International Journal of Advanced Computer Science and Applications*, vol. 4, no. 9, pp. 40-47, 2013.

[8] Sharma, S., Agada, R., & Ruffin, J., Virtual Reality Classroom as an Constructivist Approach, *IEEE,* 2013, doi: 10.1109/SECON.2013.6567441

[9] Aiello, P., Di Tore, S., D'Elia, F., & Sibilio, M, A Constructivist Approach to Virtual Reality for Experiential Learning. *E– Learning and Digital Media*, vol. 9, no. 3, pp. 317-324, 2012.

[10] Chen, C. J., Theoretical Bases for Using Virtual Reality in Education. *Themes in Science and Technology Education*, vol. 2, no. 1-2, pp. 71-90, 2010.

[11] Pantelidis, V. S., Reasons to Use Virtual Reality in Education and Training Courses and a Model to Determine When to Use Virtual Reality. Themes in science and technology education, *Klidarithmos Computer Books* pp. 59-70, 2009.

[12] University of West Attica https://aesthcosm.bisc.uniwa.gr/, 2021
[13] Owczarek, G., Wodzyński, M., Szkudlarek,J., & Jachowicz, M., Virtual reality (VR) for laser safety training. *IEEE 2nd International Conference on Human-Machine Systems (ICHMS)*, pp. 1-3, 2021.
[14] Falah, J., Khan, S., Alfalah, T., Chan, W., Harrison, D. K., & Charissis, V.,Virtual Reality medical training system for anatomy education. *Science and Information Conference,* pp. 752-758, 2014
[15] Dimitropoulos, K., Georgiou, J., & Manitsaris, A., A Virtual Reality Laboratory for Distance Education in Chemistry. *International Journal of Social and Human Sciences*, pp.306-313, 2007.
[16] Mangtani, N., Bajpai, N., Sahasrabudhe, S., & Wasule, D., Importance of artificial intelligence and augmented reality in cosmetic and beauty industry post covid 19. *World Journal of Pharmaceutical Research,* vol. 1, no. 8, pp. 2296-2308, 2020.
[17] Hamilton, D., Wilson, C., McKechnie, J.,& Edgerton , E., Immersive virtual reality as a pedagogical tool in education: a systematic literature review of quantitative learning outcomes and experimental design. *Journal of Computers in Education,* vol.8, no.1, pp.1-32, 2021.