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# Virtual Reality, Augmented Reality and Mixed Reality - Trends in Pedagogy

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## ABSTRACT

Virtual reality has recently become a trend that each and everyone appreciates, which everybody wants – and constantly tries – to understand, is a topic that is stirring interest at all times. Using virtual reality, along with several other fields related to it, may seem unstable at first, but once the necessary information is assimilated, their utility starts to sound promising. Our study aims to bring together the benefits of virtual, augmented and mixed reality within a classroom, emphasizing their use in the formation of a teacher. Starting with an investigative approach based on J. C. Flanagan's Critical Incident Technique, and combined with P.C. Smith and L.M. Kendall's Development of Behaviorally Anchored Rating Scales (which is purposed to identify the main competencies a teacher that is correctly adapted to the Digital Natives era should possess), this study aims to emphasize the potential applicability of virtual reality in constructing certain competencies, such as communicative, informational, technological, instrumental, decisional, appreciative or competencies related to using new technologies. The conclusions reflect a series of advantages and disadvantages of the virtual environment and the applicative way in which these can be used to complete what we already possess or we aspire to obtain.

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## INTRODUCTION

Concepts like virtual reality augmented reality and mixed reality are quite popular nowadays when technology manages to reach a point where it can raise tough questions and can give people an opportunity to form a perspective for the future, regardless of the field in which it operates. However, the use of technology has a prominent influence in the field of education and – ultimately – pedagogy. The idea of exploring the virtual environment has been taken into consideration many times in the past when technology was not advanced enough to sustain potential projects. Around the years 1980 and 1990, when the idea of utopias began to attract scientists and make them interested in achieving such a thing, the concept of virtual reality was finally outlined (Ferrington & Loge, 1992; Rosca, 2017).

To briefly define the idea of virtual reality, it can be represented by the term version, meaning that it thoroughly signifies an accentuated version of the immediate reality, a version that was created with the help of technology which was supposed to combine the mass information with devices that are capable of transposing it into a virtual environment. Living an immersive experience was an open opportunity for the large audience with the emergence of headset systems. Around the year 1986, Ivan Sutherland creates the very first head-mount device that he calls The Sword of Damocles. Nowadays, headsets are more than popular, the possibility of purchasing them along with matching smartphones being possible at any given moment. Many schools already decided to purchase different VR setups to make learning more effective, and professors will be able to take advantage of the benefits of virtual reality too (Pan, Cheok, Yang, Zhu, Shi, 2006; Vlăduțescu, Negrea & Voinea, 2017). Teaching is the starting point of the entire educational system, taking into account that – without a well-prepared teacher – students will never be properly trained.

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Thinking a little bit further, augmented reality and mixed reality will surely find their place in the future pedagogy system. Augmented reality refers to a combination between the virtual and the real environment, meaning that the virtual set user can interact with real objects around him, as long as he is located in a specially designed AR room. The field in which augmented reality is mainly used is medicine, where future physicians get to learn different techniques using devices built to mimic reality as close as possible (Gallagher, McClure, McGuigan, Crothers, Browning, 1999; Teodorescu & Bușu, 2015). The same goes for pilots who get to learn how to fly a new aircraft model. The possibilities are truly numerous. For example, in pedagogy, a teacher will be able to experience the impression of sustaining a speech in front of a large crowd. This opportunity would offer a teacher the necessary instruments to enhance his communication skills and, at the same time, all the competencies included in the repertoire of his profession. The competency involved in this process is mostly the communicative one, which will be explored later in this paper.

## SKILLS STUDIED IN A CONTROLLED ENVIRONMENT

As far as communication is concerned, a teacher needs to possess a whole system of skills in order to cope with his attributions. A person who is not able to create an atmosphere that is somewhat conducive to learning, to interact effectively with students or to ensure the active participation in learning would require a longer period of time to train students properly. This is the exact reason why introducing the virtual reality to learning is more of a necessity rather than an option. Virtual reality is meant to improve both didactic skills and the learning process itself.

Communication represents an instrumental competency, which means that it uses several factors to effectively transmit a message. This is the moment when virtual, mixed or augmented reality intervene. This concept can be slightly contradictory, given that specialists tend to consider this type of interaction a kind of pseudo-

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communication since the act is not actually happening. Being part of the Digital Natives era, people are caught up in a continuous informational flow in which communication is possible without actually studying the real meaning of the word. A VR headset, combined with different feedback haptic tools could replace certain learning environments that were previously impossible to imitate, giving the user the possibility to interact with either other VR users or virtual realities somehow included in the real world. This way, the user doesn't have to actively involve, in the respective activity but just experience it (Mateu, Alamán, 2015). In this sense, a competency can surely be improved without the presence of an active effort from the user. The virtual environment allows information to be manipulated at will, sending it in the desired direction, which makes the process of learning easier for anyone. Where there were initially required a lot of resources and substantial efforts from a person is now enough room for saving time, money and effort.

The benefits of learning in a virtual environment are numerous, especially if taking into account the present learning methods. Let us consider Second Life as an example. Initially perceived as a game, this second life offers the users the chance to build their own type of society, based on their preferences and mentalities. At the same time, this society can be used to teach other people around the world, giving professors the occasion to get better at their job or to train themselves for the real situation beforehand. This system was already adopted in medicine (Schmidt, Stewart, 2009).

Yet the problem of the budget is still present. Because this is a topic that's rarely adopted and discussed, people are still reticent to the idea of purchasing and implementing VR devices in schools or institutions (Bricken, 1991).

It is worth knowing that the products of this late technological revolution are no longer inaccessible, as can be seen in the following table:

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| Apparition date | Device | Type |
|---|---|---|
| 1970 | Flight simulator, simulation headsets in the military field | VR & AR |
| 1980 | Interactive maps, stereo viewfinders | VR & AR & MR |
| 1990 | Surge Sense8, Virtuality, MotionCabinas | VR & AR & MR |
| 2000 | Oculus Rift, Morpheus | VR |

*The most popular VR/AR/MR devices and their apparition date*

To bring the value of VR/AR/MR technologies inside the classrooms and laboratories of all schools in order to train both young students and teachers is not a bold project anymore; it became a necessity or even an obligation of future teaching.

## WHAT ARE THE COSTS AND THE GAINS?

Starting from these premises, as well as from the conclusions of other researchers that substantiated the present actions (Călin & Cernat, 2016; Călin & Bîrsănescu, 2017; Strungă & Bunăiaşu, 2013; Bunăiaşu, 2013; Vlăduţescu, 2018; Negrea & Voinea, 2016) – ideas that are organized within the particularities of the Romanian socio-cultural and educational context – out study intends to identify what the competencies that could be developed are (only if the pedagogical-formative approaches were implemented effectively, including VR/AR/MR technologies) and what the advantages and the disadvantages, respectively, of the implementation, are in training young people and adults.

The research was based on J. C. Flanagan's Critical Incident Technique (Flanagan, 1954), combined with P.C. Smith and L.M. Kendall's Development of Behaviorally Anchored Rating Scales (Smith & Kendall, 1963), the desired outcome being obtaining an inventory of the competency elements that can be formed or developed through approaches that are related to these new technologies, as well as the

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advantages and disadvantages of these approaches in view of the importance perceived by the main beneficiaries of the training – young students, 186 students of the Faculty of Automation, Computers and Electronics from the University of Craiova, fresh graduates of the teacher-training courses, were subjects for this study. They were asked the following questions:

*If you were to use and implement technologies in teaching, such as those associated with the concepts of virtual reality, augmented reality or mixed reality, which skills do you believe you'd develop?*

*In your opinion, what are the advantages and disadvantages of using and implementing virtual reality, augmented reality and mixed reality technologies in teaching?*

Our study focuses on a two-stage exploratory process, associated with the aforementioned questions, each stage sectioning in four different steps.

Stage I – identifying possible competency elements that can be formed using VR, AR, MR

*Step 1*: Initially, the subjects who participated in the study were asked to come up with a list with all the conduits, skills, competencies that they think they could develop by using VR, AR, MR technologies. The lists have been centralized, the ones with similar meanings have been separated and only the top ten ones were included in a singular list (the ones with the highest occurrence answers). The ones that were redundant for the study were left behind, and the final list was subject to a new debate. Students were requested to develop explanatory definitions for each dimension (the duration of the whole step was approximately 30-60 minutes).

*Step 2*: The dimension list, together with all the definitions, were distributed to a group of 20 different specialists in the field of employee training and new technologies. They were supposed to give one or two examples to describe the

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competency present in the list. After collecting all the examples, they have been synthesized on one single list (without repeating or trivial answers).

*Step 3*: A new group of 20 experts has been gathered. They were given a list of their own dimensions and definitions and another list of examples (from step 2). The lists were arranged in a random manner. The task of this group was to assign each example to the category it was written for. The operation is called retroversion and its purpose was to observe is the examples corresponded qualitatively. The examples that couldn't be assigned to the category they belong were removed. Only the items with a relay frequency greater than 67% were kept in the study. Also, a dimension was removed if not assigned at least 60% of the items originally allocated.

*Step 4*: Subjects were asked to choose the elements of competence they consider most clearly constructive from the final list, by using and implementing teaching technologies such as those associated with virtual reality, augmented reality and mixed reality concepts. We also note that only those formulas with a percentage higher than 10% out of the opinions expressed have been kept.

The centralized results are shown in Table 1.

| Competency Element description | Opinion percentage (%) | Rank |
|---|---|---|
| Communicative – clear, coherent communication | 74 | 1 |
| Informative – relevant and actual information | 53 | 2 |
| Technological – understanding and using new technologies | 50 | 3 |
| Instrumental – the transition from theory to practice | 42 | 4 |
| Decisional – efficient decision-making skill | 32 | 5 |
| Evaluational – objective evaluation | 12 | 6 |

*Table 1. The inventory of form conditions*

Stage II

As for stage two, a similar manner was approached to evaluate the advantages and

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disadvantages that young students think that the implementation of VR, AR, MR technologies in the learning process would include. The results obtained are presented in Tables 2 and 3.

| Advantages | Opinion percentage (%) | Rank |
|---|---|---|
| A new perspective on the learning process | 57 | 1 |
| Encouraging practice over theory | 49 | 2 |
| Developing imagination and creativity | 45 | 3 |
| Long-term, powerful motivation | 33 | 4 |
| Efficient long-distance learning | 26 | 5 |
| Affordable technology | 22 | 6 |
| Exploiting domains easier | 13 | 7 |

*Table 2. The inventory of advantages*

| Disadvantages | Opinion percentage (%) | Rank |
|---|---|---|
| The lack of trained teachers (in using VR, AR, MR technologies) | 56 | 1 |
| Inexistent digital infrastructure | 46 | 2 |
| No funding for digitalization | 33 | 3 |
| Medical affections caused by VR, AR, MR technologies | 25 | 4 |
| Technology addiction and ignoring other types of teaching | 19 | 5 |

*Table 3. The inventory of disadvantages*

## FINAL THOUGHTS

Teacher training gives us the opportunity to change the level of professional preparation and even culture. A virtual classroom involves instructional and formative activities that can capture exactly the essence of long-term training, in an effective manner. Our study is by no means an exhaustive one. It certainly contains a dose of

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subjectivism, which is inevitable in a research that is based on the opinions of some subjects. The benefits and disadvantages of VR, AR and MR are numerous, so it wouldn't be possible to go through all the existent possibilities in terms of ups and downs. However, it is essential to note that by integrating VR, AR, MR into the classroom, both students and teachers are given a new perspective on learning. The collaboration between students and teachers is maximized by the need to find new solutions for new situations. In addition, integrating an innovative classroom system will keep students engaged, by keeping their attention stimulated.

Also, VR, AR and MR technology can help students widely develop their imagination, their creative spirit through the opportunities they offer. In this manner, a student is encouraged and motivated to overcome his limits, enjoying – and not avoiding – the new. It also acts in the direction of developing the ability to empathize with others. Disadvantages are part of the picture too. Certain educational institutions cannot afford even the cheapest VR, AR and MR technologies sue to the financial situation of the respective region. Most teachers are not quite ready to include these technologies in the education system. This is also caused by the preference of many teachers to emphasize theory instead of practice, along with the fear of new. Limitations can also come from the manner in which an institution is legislatively managed. Technology can also cause addition that can lead to completely ignoring traditional study materials. Students are more likely to show their preference for technology to the detriment of books, textbooks or other traditional materials. The frequent and long-term use of certain VR, AR and MR technologies may have medical repercussions, such as the occurrence of migraines or vision issues.

However, paraphrasing the conclusions of a study on the current requirements of a school manual (Calin RA, 2016), this approach allows us to (re)remember that the students and young people of the present are different; that school, manuals or teachers are no longer taking advantage of their volens nolens attention. This attention

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is now won by avoiding a war against the interactivity and the attractivity of technologies and the Internet in general. Instead of a war, the opportunities offered by them should be fructified and backed up by a masterly discourse, argumentation, explanation, conviction, and fascination.

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