Virtual Reality (VR) as a Source for Self-efficacy in Teacher Training

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# Abstract

This article seeks to explore the experiences of pre-service student teachers in a teaching unit on the subject VR as a part of a special course designed to enhance student-teacher growth processes and 21st century skills, in particular how their experiences change their self-efficacy. The research population was made up of 170 students in the second of a four year training course to become teachers in the K-12 educational system. The main research question was: Are there any effects of teaching approaches using VR on student teachers’ self-efficacy, interests, and creativity? If so, what are they? How does collaboration in VR classroom foster learners’ social integration? The main findings show that using challenging VR learning environments with student teachers helps them increase their self-efficacy and allows them to be more innovative and creative. VR poses challenges of active teaching and learning in which the learner is an active participant, both creating and being creative.

*Keywords*:

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# Virtual Reality as a Source for Self-efficacy in Teacher Training

Education and technology are interconnected and are a significant part of modern life. Using technology in education makes learning and teaching more meaningful, advanced, and future-oriented. VR is an educational theme that is used increasingly to enrich learning processes. It increases student interest and concentration by providing learning through otherwise impossible experiences, allowing the use of experimental tools, presented as virtual objects, directly with their hands. (Hee-Sook Ahn & Yoo-Mi Choi, 2016).

The literature is rich with descriptions of successes of student teachers who learn new subject matter in many domains related to their academic discipline of study when their teacher accompanies their advances in a constructive manner and shows empathy with their behavior in the process. However, in the VR domain there is a research gap that requires a pedagogical examination in situations where students create an educational VR creation. The current research seeks to assists in narrowing this gap.

VR enables teachers, lecturers, or anyone in an educational setting to devise and deliver complex information in a visually attractive way. There is a tendency to think that many students find it easier to learn when presented with a visual explanation, one that they also find easier to retain and recall. Chen (2006) asserts that:

although VR is recognized as an impressive learning tool, there are still many issues that need further investigation, including identifying the appropriate theories and/or models to guide its design and development, investigating how its attributes are able to support learning, finding out whether its use can improve the intended performance and understanding, investigating ways to reach more effective learning when using this technology, and investigating its impact on learners with different aptitudes.

Her research has resulted in insights on a feasible instructional design theoretical framework, as well as an instructional development framework for VR based learning environments (Chen, 2006, p. 39).

Pantelidis (2010) suggested that VR motivates students. It requires interaction and encourages active rather than passive participation. Some types of VR encourage or require collaboration and provide a social atmosphere to support it: for example, using text input in virtual worlds. VR allows the learner to proceed through an experience at their own pace, over a broad time scale that is not fixed by a regular class schedule. It allows the disabled to participate in an experiment or learning environment when they cannot do so otherwise. It transcends language barriers. VR with text access provides equal opportunity for communication with students in other cultures and allows the student to take on the role of a person in different cultures.

Therefore, it allows a virtual world in order to learn about the real, historic, contemporary, and futuristic world experientially; a significant learning program in its travel outside the goal of the conventional learning boundaries of the class, place, and space; and for the purposes of layered learning space, allows ample room for creativity and almost boundless learning. The goal is to make the learning environment of VR a learning lab, another classroom online, a learning method used by empowering abilities, learning skills, and creativity (Ko & Kim, 2012).

## **VR and Emotions**

Several recent studies show the connection between emotions and Virtual Reality. Good VR acts like an emotion amplifier. This amplification is most easily demonstrated with emotions that can be amplified: for example, happiness, sadness, awe, curiosity, pride, and even emotional attachments to other characters. All these are likely to be much stronger when executed well in VR. Moreover, this ability to create strong emotions also makes VR ideal for education and learning.

Emotion plays a significant part in teachers’ work. Teachers regularly deal with situations involving emotions, and it is very important to develop and nurture their emotional abilities (Kremenitzer & Miller, 2008). Although emotions are integral to the work of the teacher and have an impact on behavior and motivation, as well as having an effect on the efficiency of teaching, only a limited number of studies have been carried out in the field (Sutton & Wheatley, 2003). Developing and nurturing emotional intelligence among teachers in general, and especially among younger teachers, could be done using different tools that would increase the awareness of the components of emotional intelligence and allow teachers to be more aware of what is happening, both to themselves and to the children. Increased self-awareness among teachers would also help in imparting awareness and emotional intelligence to children (Kremenitzer & Miller, 2008). The teacher training framework is intended for training and fostering teaching skills, but the success of the teacher also depends on their abilities and sensitivity. Introducing awareness among teachers of components of emotional intelligence helps to develop these skills (Cherniss, 2000).

## **VR and Self-efficacy**

Self-efficacy beliefs are an important factor in human motivation and behavior, and a very important element of that which influences emotion and actions. The basic idea behind the Self-Efficacy Theory is that performance and motivation are in part determined by how effective people believe they can be (Bandura, 1982; as cited in Redmond, 2010). Bandura (1995, p. 2) explains that it "refers to explanation required to manage prospective situations." The most important component of self-efficacy is the self-belief of a person in their capabilities (Snyder & Lopez, 2007). Self-efficacy is a task-specific version of self-esteem (Lunenburg, 2011). The basic principle behind Self-Efficacy Theory is that individuals are more likely to engage in activities for which they have high self-efficacy and less likely to engage in those for which they do not (Van der Bijl & Shortridge-Baggett, 2002). Self-efficacy has influence over people's ability to learn, their motivation, and their performance, as people will often attempt to learn and perform only those tasks in which they believe they will be successful (Lunenburg, 2011).

Self-efficacy among teachers has been the focus of several studies in recent years. Most studies indicate that high efficacy teachers are better teachers (Bautista, 2015). Several studies describe the extensive use of VR as a therapeutic tool or as an element of self-efficacy empowerment.

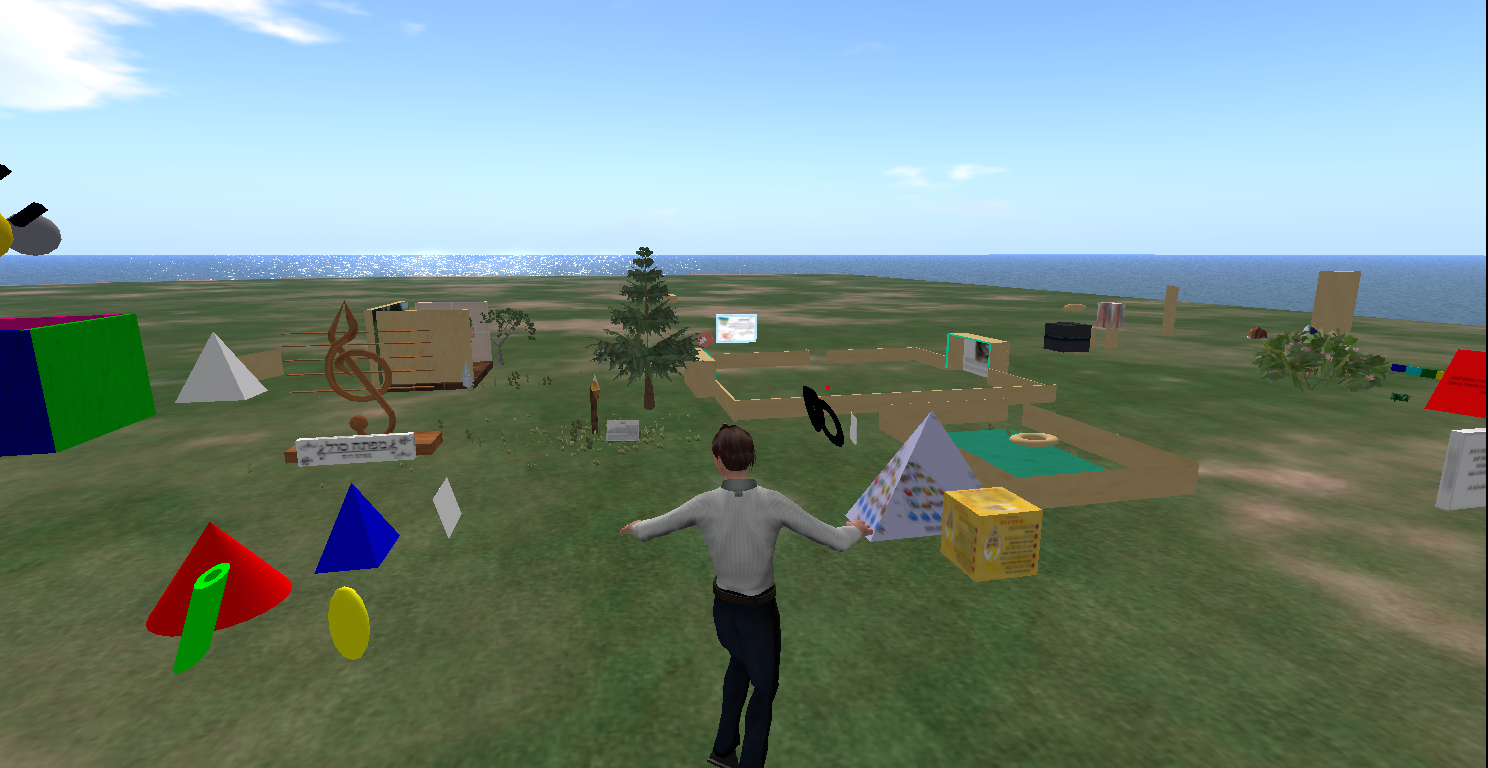
Most of these studies used Gist & Mitchell (1992). Their model is based on four distinct factors that contribute to the increase and empowerment of students’ self-efficacy. These factors are: physiological arousal, verbal persuasion, vicarious experience, and enactive mastery. Their theory was formed within a psychological framework in a pre-information technology revolution. Thus, we wanted to test this theory in a futuristic learning environment using VR. Further investigation was based on the emotional aspects of student teachers during training for the construction of VR learning environments.

## **Research questions.**

1. Are there any effects of teaching using VR on student teacher interests and creativity? If so, what are they?
2. Does teaching using VR have any effect on self efficacy of preservice student teachers? If so, what are they?

# **Method**

In the current research, we used a qualitative research methodology which was based on reflective narrative reports written by 170 students who took part in a course designed to enhance pre-service student teachers’ preparedness for 21st century skills educational field work in their schools. Students took part in a 4 s.h. course entitled ‘Educating for the Future’ (EFTF) aimed at enhancing the growth processes of student-teachers. This is described elsewhere (Weissblueth, E., Nissim, Y., & Amar, S., 2014). The course introduced a new learning module that required students to construct an educational creation in a VR environment. It required them to be creative, to teach and learn online, to collaborate with their peers, to develop problem solving strategies, and to cope with unfamiliar and sometimes complicated technical situations while producing an educational structure in a VR world (see figure 1).



*Figure 1.* The virtual world “Ohalolandia” in which students produced their educational VR creations. Every element seen in the figure was created by students with the purpose of learning how to harness VR OpenSim platform in the educational arena.

## **Research Population**

170 students in second year of their 4 years training to become teachers in K-12 educational system.

## **Research Tools**

Open simulator Diva distro (0.8.2.1) as a VR platform on i5 Intel XXX MHz, 16 Gb RAM.

Voluntary group assignment and work

Reflections written by students.

## **Research Hypotheses**

We speculated that students will perceive VR as a difficult theme. They will experience difficulties and a range of emotions in fulfilling the task. However, they will succeed in their task and thus develop an interest in VR

## **Analysis**

Qualitative content analysis

# **Findings**

Upon summing up and analyzing the reflections of 170 students, several main themes arise. We summed them up as follows:

* Learning processes became more amusing than before.
* Better understanding and use of Tech and VR in teaching.
* Better development of creative learning/ creativity in teaching than before.
* Higher interest in technology than before.
* Better problem solving.
* Better stamina and learning endurance.
* Better ability to associate what was learned with real life.

Some of the themes followed the classical model of factors contributing to self-efficacy (Gist & Mitchell, 1992). We chose to keep the authentic expression of their words.

**Physiological Arousal (Emotional Arousal)**

Students experienced difficulties. They were bothered by the requirement, and they even gave up on ideas they thought to be good. For example, “After many hours I gave up and left this idea. The idea bothered me because my thoughts were dispersed.” However, “... after consulting and a setback, took a pen and paper and began to write down everything that comes to mind.” This was achieved by “...brainstorming helped me a lot to focus the direction.”

In this reflection, we can see in a single paragraph an emotional thought process which passes through the negative frustrating to the good feelings of efficacy and empowerment. Other students enjoyed their work and commented that they went through a transition, from being concerned to being enabled. Like in the following excerpt:

I felt very good in this process and it was relatively nice job. Frankly, saying the first class assignment, I had many concerns. After all, this is a learning process based on complex technology. A project that incorporates many skills such as creativity, imagination, higher level thinking, technological capabilities and more. Some of the necessary skills I know I'm good, and unfortunately some less.

Many of the students said that the constructed support of the process laid down by the lecturers was very significant and helped to allay concerns and fears, as one of the students wrote: “...it was very hard for me to connect to the virtual world and here I was very comfortable to express myself. I felt difficulty in the way,” and “... it was not easy.” Another student wrote:

The use of the software is very easy. Ohalolandia did not require much intelligence relative to the use of “Second life.” I understood what to do when it was first explained by the lecturer guiding and did not need further explanation. It was very convenient and catchy. The instructing table (provided by the lecturers) was very helpful and built understanding of the work or the final project. At first, we did not think about all the things that appear in the table, and while filling out the table, I was able to be creative.

This expression reflects a gradual emotional advancement in the way students related to the VR task. It was enabled by mediating the VR world and assignments by a table that students needed to fill in according to pre-specified instructions together with instructions and guidance by the lecturers.

## **Verbal Persuasion (Verbal Encouragements)**

Throughout the course, students were given reinforcements by their peers and the lecturers. Students felt comfortable and thus were provided with a positive atmosphere that enabled them to learn:

…first class assignment I had many concerns. After all, this is a learning process based on complex technology. A project that incorporates many skills such as creativity, imagination developed, higher level thinking, technological capabilities and more. … we received guidance and tools such as help from lecturers, clear instructions model, group consultation and support, cooperation etc. I noted that the instructions were detailed and easy to understand. It helped replace the feeling of fear with a sense of confidence and motivation.

Consultation with the group was fruitful and interesting. All of us helped each other. It allowed us to be focused, and contributed to our strength and personality structure. Each of us had a final framework and a clear objective, and used each other to find the way there. Group dynamics and individual contribution of each team member is remarkable.

The concept of team work, consultation, and discussion built dynamics that had a strong effect on the students. In one student’s words: “The thinking process took time. At first I did not understand the mission and what exactly was expected of me, but after consulting with my team, we were able to begin to formulate ideas.” And in another student’s words: “Personally I found this work more accessible, understandable, and clear worded than previous works. This is because the way in which instructions are detailed in the table, numbered step-by-step, greatly helped me.”

As seen in student reflections, VR combines cognitive, emotional, and psychomotor skills. One can make mistakes while in VR platforms without having physical ill consequences. It seems that VR allowed students to experience the needs of peers so as to be encouraged, and it supported them by allowing them to be expressed freely.

## **Vicarious Experience (Self-modeling)**

Usually this refers to the success of the other that is seen in the eyes of the individual and serves as a motivational boost that assists in challenges to be overcome. At first the students experienced difficulties as in “...when the course instructor introduced the task I was very frustrated feeling no control over it and I could not cope.” Then seeing the success of their peer, they were helped in fostering their own success. “First it is important to note that in this course I discovered my strengths and weaknesses. Tasks were very hard for me but I saw my friends within the group succeed. This helped me to cope with the tasks.”Their success in fulfilling the task at hand was accompanied by the social success of working in teams. “Think about the process I went through in the course, both personally and socially. That set me is the experience of working in groups I had not done before.”

## **Enactive mastery (performance outcomes).** Since success nurtures further success, it serves as the core requirements for developing self-efficacy. At the end of the course, students produced an “educational creation,” a final piece that brought about the concept of success. Students related to their experience as follows:

First I will say that the course "Educating for the future” demanded from us to use all higher order thinking skills. For us as students this is important, necessary, useful and comprehensive. Although we had many difficulties, ultimately, to my great joy, I was able to overcome them and did the job the best way possible for me anyway.

In the words of another student: “I think VR can help students change their way of thinking positively and not give up. The hard work started with easy and low level requirements and gradually allowed for success and achievement. It was worth all the efforts.”

Further to developing or increasing their self-efficacy, students were able to carry over its effect to rationalize difficulties on their way to becoming future teachers. Oneof the students wrote the following:

... Summing up my remarks and rationale, I want to convey through the VR creation that "Knowledge is power" and therefore we need to explore, to discover, try and experiment with everything that goes on around us to become wiser. It is important and right for us to know more new and intriguing things in our lives!

This is one of the objectives of education: the move from concrete mission to wider educational thought.

## **VR Encourages Interest and Creativity**

Reflections of students regarding the development of creativity showed that VR allowed them to express their creativity. The different VR experience created thinking processes that led to the fulfillment of the required creation. It opened their minds to a different mode of thinking. For example, one student reported: “The experience required me to think more creatively. It also helped to create more novel and innovative creations.” Another student wrote: “It was very interesting to create a great work of our choice. Personally, I believe that there are all kinds of different and challenging works that can be done with software, really impressed.”

Students recognized that VR could assist them and their future pupils in developing interest and innovation: “I think it develops different ways of thinking, and it also allows self-study after. Of course, the use of technology gives us prepare for the future and understand uses of all kinds of important technological inventions.” Students were also able to identify unorthodox and irregular thinking patterns: “I think the curriculum is interesting and challenging, and relevant to us as educators in the future. It teaches us to be creative and combine different teaching methods and thinking out of the box.”

## **VR Fosters Social Interaction among Learners**

While working on their VR creations, students acknowledged the importance of their interactions with their peers in improving their social skills. For example, one student reported: “I noticed that we needed group’s consultation, support and cooperation. Consultation with the group was fruitful and interesting and group dynamics and individual contribution of each team member was remarkable and we enjoyed it.” Another student commented on how VR required him to put more time and effort into his interactions with the others in his group: “We needed to be creative, and this needed more work and investment in others. I enjoyed the work with them during our work together.”

## **Drawbacks of Using VR in Education**

The main difficulty encountered was that not all students felt “connected” with VR. Although not quantified, the general notion was that about half of the students felt the “wow” effect and were committed to “discovering” the new world presented to them through VR.

Another difficulty encountered was related to the technological and logistic barriers to be overcome. We used the technology available to us without further expenses. The Open Simulator platform is one of the most popular platforms since it is an open source and available. However, for it to serve its purpose without user frustrations (e.g. delay in online activity, etc.), bandwidth needs to be wide enough and a computer with server specifications is required.

# **Discussion**

The study brought to light a number of key insights: Reflections showed a wide range of negative emotions and thoughts: fears, misunderstanding, and confusion. As the students progressed in their work on the VR platform, those feelings became more positive and empowering. Students gained a sense of self-efficacy and satisfaction with their acquisition of a different and challenging tool for teaching in accordance with the modern age.

As is clear from the reflections cited above, there are a number of central key themes that continue to arise. These are feelings of self-efficacy and a variety of emotions ranging the spectrum from initial frustration at the beginning of the mission to the satisfaction and sense of competence that result from the product quality and adequacy.

Working in VR provides students with new challenges which are completely different than normal frontal teaching. Presenting the challenging learning environment of VR to the student teacher demonstrates something else that is innovative, different, and creative. It poses challenges of active teaching and learning in which the learner becomes an active participant, creating and being creative.

In addition, we saw that the creative processes that meet a virtual reality environment have an impact on feelings and emotions in general, and in particular on the sense of self-efficacy of students facing a complex challenge and unfamiliar with dealing with it. Thus, it presents intellectual and emotional challenges.

We propose to give VR more prominence in teacher training, with active experience that includes technology rich environments, VR environment in particular, and the accompanying process of reflective thinking and collaboration that allows for constructing new competencies, beliefs, and personal empowerment aptitude of a student and as a teacher in the future. The unique environment of the imaginary inventions allows and invites the construction of knowledge and thinking on creative doing or concrete guidelines. It creates a bridge between the real world and imaginary worlds of content (real or virtual), thereby promoting the learning of the teacher, facilitator, and learner, a student or a student teacher.

This experience enriches students: as a teaching tool in the area of advanced technology, it stimulates interest in a wide range of emotions and feelings.

Some researchers even point out that VR, using different technologies and computer simulation, represents a realistic understanding of different situations (Wan et al, 2013). Hence, this process can change perceptions, attitudes, feelings, and emotions and give particularly meaningful and creative learning experiences. These, in turn, empower the learner's perception of emotional space and personal capability.

We recommend seeing VR environments as a wider educational concept and not just another educational technological tool. It could be added as a new teaching module, included as part of an innovation within an existing course of training the teachers of tomorrow. In addition to developing or increasing their self efficacy, students were able to carry over its effect to rationalize difficulties on their way to becoming future teachers. This is one of the objectives of education: the move from concrete mission to a wider educational thought.

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