Involvement of Student Teachers and Pupils in Designing and Manipulating Virtual Learning Environments Impacts Reading Achievements

A Successful Attempt at Teaching Novice computer Users

Esther ZARETSKY

Giv'at Washington Academic College of Education

D.N. Evtah, 79239, Israel

ABSTRACT

The research is aimed at investigating the involvement of student teachers and pupils in designing and manipulating virtual learning environment and its impact on reading achievements through action research.
In order to understand the connection between the real and virtual worlds, the design of such simulations is based on applying the virtual environment to the real world as much as possible. The objects were taken from the pupils' everyday environment and unique motivation. The researcher taught the method to 30 student teachers. Such procedures were held among different populations.
The findings showed that as the student teachers practiced the simulation design through the PowerPoint Software, it became clear to them how the computer can be implemented in their practical work. Consequently, their presentations became highly animated, and applied to the pupils' natural environment. The student teachers used their presentations in their practical work and reported their pupils' improvement in reading skills.
The student teachers could integrate theory and practice in their teaching and improved their level of academic writing. The motivation of the student teachers and their pupils to design and manipulate virtual environments was also enhanced.

Keywords: Action research, Application, Design, Manipulation, Simulations, Technology, Learning Environments, Reading skills, Simulations, Virtual Reality.

1. INTRODUCTION

Most Teachers in academic colleges of education teach basic computer courses without requiring its application, neither through action research. Besides, most special education teachers and student teachers are not aware of the pupils' capability to design and manipulate virtual simulations on their own. It is usually done by computer designers. According to Piaget & Inhelder's theory (1), reativity leads to a significant construction of knowledge. Developing control over the reality and compatibility with the natural environment occurred while creating virtual simulations.

2. THEORETICAL REVIEW

For better understanding of virtual design and the contribution of manipulations to the advancement of pupils with special needs, we will explain the main concepts such as computer simulations and virtual reality.
Computer Simulations are computer-generated versions of real world objects. They may be presented in two dimensional, text-driven formats, or increasingly, three dimensional multimedia formats. Computer simulations can take many different forms ranging from computer renderings of 2-D geometric shapes to highly interactive 3-dimentional multimedia environments (2).
Virtual Reality learning environments allow entirely new capabilities and experiences. The users have unique capabilities, such as the ability to fly through the virtual world, to occupy any object as a virtual body. Observing the environment from many perspectives is both a conceptual and social skills: enabling pupils to practice this skill in ways we cannot achieve in the physical world may be an especially valuable attribute of virtual reality. Dynamic programming software enables the addition of viewpoint control, command structures, object behaviors (3).

Situations which are complicated to perceive in usual learning environment can be presented and viewed in many different perspectives in a virtual environment (4) (5).

The Usual use of Virtual Reality in Special Education

Most virtual reality research and software programs for special education ad hoc have been developing for physically handicapped populations (6) (7), where the pupils participate as observers only. Inman & Loge (8) have created virtual reality programs for helping physically disabled children to operate motorized wheelchairs successfully. Virtual Reality researchers have pioneered the use of VR (Virtual Reality) technology to help training orthopedically impaired and sight-impaired children.

Writing as a preceding stage of Reading trough Computers

According to Goodman & Goodman (9) and Smith (10), the writer serves as a reader and not only for editing and revising the text. The use of computers enables us to exemplify the writing and thinking processes of the reader–writer.
The use of the word processor for writing instructions results in adopting writing strategies of expert writers (11) (12). Bereiter & Scardamalia (13) focused on building complex representation of writing tasks, planning and revisia of programs, comparing results to objectives and considering varied information kinds, enabling to check the spelling for improving the writing process. These options will be checked in further expansions of the methods suggested in the present research such as writing the relevant words in the PowerPoint presentations and typing it in the Internet search website for finding appropriate images and/or written information.

The findings of Zaretsky's research (14) showed an improvement of a learning disabled and mentally retarded pupil

in reading thanks to her creating multimedia presentations on her own during the meetings. A transfer to the reading level in the classroom without using computers was also observed. Then the pupil could be included in the regular reading lessons in the classroom and understood the texts being read. It seems that utilizing the pupil's unique motivation by fitting the contents to her fields of interest enhanced her improvement in writing and reading in the class, either with or without vowels
.

Reading by Using Computers

Applying software to pupils' needs serves as a basic condition of integrating computers into teaching pupils with special needs (15). The multimedia might compensate for auditory or visual deficits according to the kind of exceptionality (16). Images focus the attention of the reader and motivate him to read the text (17). Success was observed in using drawings (18), motion (19) (20), textual and graphic information (21), and asking questions related to the text (22).

Like the computerized live books in multimedia environments, the computer user is exposed to enormous amount of varied stimuli in real time and rapid effective functioning. Therefore, a computer user is required to simultaneously manage all the stimuli. He also needs orthographic perception (23).

Thus, the characteristics of 3-D interactive environments, namely virtual reality, are closely aligned with those of an optimal learning environment. The perceived advantages of the virtual environment as an instructional tool include, among others, multi-perceptual engagement (24), the opportunity to change perspectives at will (25) and abstract concept representation (26) (27).

Designing and Manipulating Virtual Dynamic Learning Environment through Action Research

Student teachers' educational programs are being called on to provide models of authentic teaching, and to help teachers to develop their knowledge of the content, discourse, and content-specific pedagogy. They also must provide multiple perspectives on K-12 student teachers as learners, and offer meaningful opportunities for teachers to develop skills in using the technology (International Society for Technology in Education, (28)). It is essential that all K-12 teachers will be able to demonstrate an ability to use technology tools in their standards-based curriculum in order to promote student learning, improve student achievement, and provide student teachers with the skills they need in their future education and/or workplace careers. In 1999, the U.S. Department of Education established the Preparing Tomorrow's Teachers to use technology programs in order to support organizational change in teacher education so that future teachers will be able to use interactive information and communication technologies for improving learning and achievement (29).

Learners actively construct concepts through the process of mediated actions (Vigotsky (30)). According to the notion of mediated actions, human beings use cultural tools (such as language as well as tangible features of the environment) which fundamentally change the structure of the cognitive functioning and activity (31) (32). Beaufort (33) and Kezar (34) believe that the faculty instructors can be affected by changes such as integrating technology in their teaching program if only they are actively engaged in creating the change that is taking place.

Zaretsky & Bar's research (5) proved that carrying out action research by virtual reality significantly affected the academic achievements of special education pupils regarding their spatial perception, measured by their ability to solve the Standard Progressive Matrices of Raven (35). These pupils' abilities to read, write and compute was also improved. Computer-simulated environments are becoming more and more realistic, offering a real-world experience. The computer-generated environment simulates a busy street much as in a computer game, and through virtual reality technology, the child has the experience of driving the wheelchair (36).

This research is aimed at preparing student teachers to design virtual environment and apply it for improving their pupils' reading skills and writing academic reports.

The examples of works presented in this paper are based on the theory of preceding the writing to reading (37).

3. RESEARCH PRESENTATION

Procedure

The research group was composed of 30 student teachers majoring in special education. The tests were conducted for 2 meetings per a pupil, a total of 25 minutes per a pupil before and after the intervention program, which lasted six weeks, 12 meetings, and twice a week. This is a pilot research.

The Research Method

The student teachers planned their study and reported on each stage they completed. The method of training focused on the simulations of the objects on the computer screen relating to the real world. The objects were taken from the pupils' everyday environment.

The Stages of Designing the Virtual Environments and its Applications

The research design focused on the mode of a longitudinal qualitative research (38) during one semester (3 months) and included four stages:

Stage 1: Learning the basics of designing PowerPoint presentations

Stage 2: Planning a research:

- Choosing a pupil with special needs,
- Testing the achievements in the examined skills.
- Creating professional simulations through PowerPoint presentations in the relevant domain.

Stage 3: Using the presentations in the practical work,

Then the pupil adds his/her own simulations.

Stage 4: Writing the research report

The student teacher writes his/her analysis through PowerPoint presentation, and relates the practice to the theory.

Research Tools

Reading Tests

Reading Comprehension tests for the 4th grade (39)

Reading Comprehension tests for the 5th grade (40)

Readiness for Reading test (41)

Media

The PowerPoint Software was used for designing virtual simulations, training the pupils with special needs and writing the research report.

Case Presentations (Pre-intervention)

Case No. 1

Gam's project (42) was aimed at investigating the reading ability of a 13 year old autistic pupil with a medium-to-low educational, social and emotional functioning. After he had already learned in the past some of the Hebrew vowel symbols and he had just begun to recognize the rest of them, he became confused. Therefore the student teacher was not aware of the pupil's ability to read and

write more than a few words with the vowels *patach* and *kamatz* (a) only.

The main objectives of the project were learning various Hebrew vowel symbols, reading words and even sentences. The secondary objective was enhancing concentration skills and motivation for learning.
The student teacher chose the subject "animals" for the PowerPoint presentation since this was the pupil's unique motivation. He got therapy in the zoo and enjoyed it very much. In order to motivate the pupil and reinforce what he had learned, the student teacher added the pupil's photo image and an animated butterfly's image that flies over the computer screen background which is composed of a field and sky.

The stages:
1. Choosing the appropriate word (among four words) for a specific image which appears in the center of the slide.
2. Selecting the image which matches the written word, in this case: animals like dog, cat etc.
3. Typing the same word by copying it.
4. Typing words according to the student teacher's words.
5. Connecting between animal images in the center of a sheet of paper to the appropriate word that appears at one of the corners around the image (choosing among four words).

Case No. 2 (Pre-intervention)
Ovadia's project (43) was aimed at investigating reading ability of a pupil 9.6 years old learning in a regular 5th grade class.
The pupil made spelling mistakes in some words and did not understand the meaning of certain words in the texts. He also was not interested in reading the texts and answering questions, especially when he was required to correct mistakes.

The main objectives of the project were to diagnose and increase the reading comprehension level of a text passage and correcting spelling mistakes. The secondary objectives were to enhance the motivation for reading, writing and designing computer simulations.
The application was based on recording the pupil's reading and adding effects of sounds and animation of objects over the computer screen. Consequently, the pupil created slides on his own. The pupil became actively involved in the performance of the activity.

The stages of training are the following:
- The student teacher and the pupil typed the text and copied the images from the Internet to the PowerPoint slides.
- The pupil recorded himself reading the text. He knew all the recording process, created animations on his own and enjoyed seeing the results of his activities

The intervention computer program included three meetings. The training method was based on presenting the word, globally; then, correctly analyzing the word (phonetically) either in written or oral form.

Case No. 3 (Pre-intervention)
Hageage's project (44) was aimed at investigating the reading skills of a learning disabled pupil 10.6 years old. The student teacher was not aware of the pupil's ability to read sentences and do home assignments. The pupil could not exactly read the text with vowelization. He also read words without Hebrew vowel symbols slowly. He used to guess the words he knew. In addition, he made spelling mistakes.

The stages of learning:
The student teacher varied the computer learning activities.
For example a quiz, focusing on animals and gathering information from the Internet, "cloze" (completing sentences), memory games, etc.

Evaluation
Evaluations were made on comparing the level of:
- The student teachers' writing of the action research and designing the computer simulations
- The pupils' achievements before and after the training.

4. FINDINGS

It was found that the computer-based intervention program affected the achievements in the examined skills as following:
The student teachers became aware of the relationships between the pedagogic-didactic achievements and the theoretical scientific approaches they used as the basis of their studies. The student teachers' reports became then clearer and more detailed as well (See table no. 1). Furthermore, the motivation and self-confidence of the student teachers and pupils were enhanced.

Table No. 1: Example of Differences between the Level of Research Performance of the student teachers at the Beginning and End of the Course

Starting Course	**Ending Course**
Focus exclusively on theory.	Apply the theory to the practical work.
Edit the research, in general, without using authentic examples.	Edit the research according to the standards.
Write long complex sentences.	Write brief sentences.
Copy the articles' text.	Write the text in their own words.
Focus on some objectives. Have difficulty differentiating between main and sub objectives. Have difficulty formulating the assumptions.	Focus on the main objective/s and assumptions.
Mix results and discussion.	Differentiate between results and discussion, Summarize briefly each table showing the results. Then concentrate on the discussion, Analyze the results according to the theory.

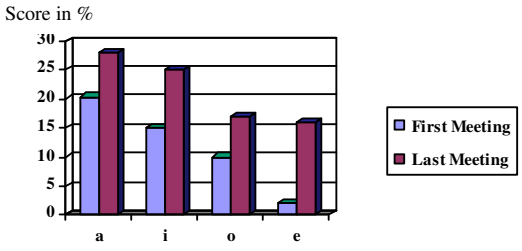
All the student teachers succeeded in their studies, while their pupils achieved high scores in the post-intervention tests, relatively to those in the pre-intervention tests. This improvement was clearly observed in the pupils' class scores.

The student teachers' reports relating their pupils' improvement strengthen the three cases exemplified in this paper.
We may highlight the progress noted among the student teachers by demonstrating each one of the projects that they performed.

Case Presentations (Post-intervention)

Case No. 1
The pupil improved his capability to read vowelized words with the help of vowel symbols patach (a), kamatz (a), hirik (i) and learned the vowel symbols full holam (o), tzerei and segol (e).
The student teacher hypothesized that "at the beginning I thought the pupil would improve his reading ability only, and merely in the vowel symbols patach (a), kamatz (a), hirik (i), Since he confused these three symbols, I did not figure I would succeed to teach him more Hebrew vowel symbols and surely I would not succeed to teach him writing".
But the results revealed that "the pupil improved his reading skills. Unexpectedly, the pupil made a deliberate choice to continue working. Even before this project, I had repeatedly worked with this pupil. I always believed he would advance, but I did not figure he would type words on the computer on his own. I also did not figure he would ask to continue working".
The student teacher summarized:
"I did not believe he would be so interested to learn and perform reading and writing activities. I figured he would like to finish his work quickly and pass to other activities which are more interesting for him. The learning became a **pleasant experience**". (See diagram no. 1).

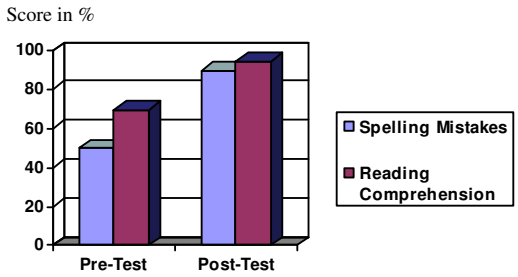
Diagram no. 1:



The data displayed in diagram no. 1 show an improvement in all the vowel signs. The improvement prominents in the tzerei (e) and segol (e) vowel signs.

Case no. 2 (Post-intervention)
Unexpectedly, the pupil succeeded in reading and understanding most words and had only a few spelling mistakes in his writing (See diagram no. 2).

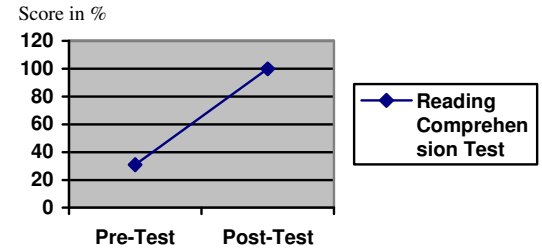
Diagram no. 2:



The data displayed in diagram no. 2 show that the pupil's achievements increased from 50% before the training to 90% after the training.

Case No. 3 (Post-intervention)
The pupil could read without vowelization (See graph no. 3).
Besides, his motivation for learning was enhanced. The pupil asked to continue working even at late hours at night. Consequently, he improved his performance in additional disciplines. Then, the pupil's mother worked with him according to the same method and he continued to improve his achievements. Also the teacher indicated that he advanced in his regular studies at school too.

Graph no. 3:



The data displayed in diagram no. 3 show an improvement from 31% before the training to 100% after the training.

Changes in the Teaching Staff

- The action research developed the student teachers' awareness of the pupils' capability to improve their computer and reading skills.
- The student teachers learned to diagnose the pupils objectively.
- Student teachers' self-confidence in using the computer, designing and manipulating simulations was enhanced.
- The student teachers improved their academic writing.

The Progress of the Pupils in their Learning Process

- The pupils learned to create virtual simulations on their own.
- The use of computers changed the learning gradually from mechanical to meaningful and relevant to the pupils' everyday environments. The reading achievements were improved.

5. DISCUSSION

The question raised in this research is whether the involvement of student teachers and pupils in designing and manipulating virtual learning environments impacts reading achievements.
In spite of the short time of training as novice computer users, before the training, the design and manipulation of virtual environments and an improvement in reading skills was recorded, as a result of the different non- routine mode of training.

Virtual Reality and Active Learning
According to Bagley and Hunter (45), students become empowered and spend more time in active construction of knowledge when using technology. Since our knowledge is constantly increasing, and there is now too much information to memorize, students should learn how to access information.

The investigation method of Mintz & Nachmias (46) was based on active learning. According to such a kind of learning, the learning is directly involved in the environment through natural direct experience and planned experiments in the laboratory. The Internet enables high accessibility to information in any area from any place in the world. Information and data achieved in real time through the net constitute a rich environment, where the learner explores gathering information.

The Role of Technological Manipulations in Learning and Thinking

Strommen & Lincoln (47) stress the importance of the way in which the technology is used. Computers and other technology should be viewed as tools which are an integral part of a child's learning experience. Manipulations must be used in the context of educational tasks to actively engage pupils' thinking with teacher guidance (48).

Educators can enhance the use of the technology of designing and manipulating virtual learning environments, and may affect the educational change by participating in the development of virtual reality.

Computer assisted design and manipulations guide student teachers to alter and reflect upon their actions, always predicting and explaining. The virtual reality environment is unique in its dynamic representation. Success in building and designing simulations of the real world has its motivating effect on the participants and thus enhances the effect of the training. In this research, the impact of the computer simulations on reading achievements and concentration skills was shown.

The findings indicated that the student teachers could integrate theory and practice in their teaching. Such a research work enables the student teachers to:

- Translate theoretical concepts into practical language,
- Apply them during the practical experience in a variety of educational contexts, and
- Interpret the results of the experiences by looking at them through the perspective of the theoretical approaches he/she has applied. Such courses usually focus on the basics of the use of computers only.

6. SUMMARY AND CONCLUSIONS

The scientific importance of the research lies in the student teachers' increased ability to carry out action research and write high level theoretical report (49) (50). The contribution of the research is also observed by their awareness of their ability to advance their pupils' reading and concentration skills by designing and manipulating virtual learning environments. In a technology-rich environment, technologies are merely tools/ or vehicles for delivering instruction (51).

The present study showed that this technology enhanced the theoretical and practical work of 30 student teachers majored in teaching pupils with special needs. The design of computer simulations and their manipulation showed the student teachers, that it serves as a mediator for developing academic skills, such as reading skills etc. While designing virtual instructional simulations, it became clear to the student teachers how they should read and which methods they should use for improving the planning and designing curriculum units. As the student teachers became more experienced in planning and designing virtual learning environments, they became more convinced regarding its impact on special education programs for their pupils in their practical work. Consequently, the pupils showed improvement in the trained skill.

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