

Virtual laboratories in education

by

Roy Eli Kfir

Abstract

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This thesis focuses on the fields of education and computer graphics. Teaching and learning with computers is becoming an important part of the classroom scenario. For educational purposes virtual reality has been proposed as a technological breakthrough that holds the power to facilitate learning. However, virtual reality applications produced for educational purposes are usually of fixed implementations that require programming and technical background. They are also limited for use with expensive virtual reality equipment.

The Intelligent Tiles framework developed in this study attempts to overcome many of the above-mentioned limitations. It is a generic and adaptable framework that supports teacher driven development of virtual laboratories. By using this framework, virtual laboratories can easily be authored and be used in the education of young learners in teaching topics in earth science, such as ecosystems. The simulation of these virtual laboratories allows young learners to explore, understand and gain mathematical skills such as counting, sorting and classification as well as learning ecological concepts and relationships between different animals and plant life. The framework also has the advantage of being affordable, since it is developed for a desktop virtual reality solution, considered the least expensive and most widely used of all virtual reality platforms.

This thesis shows that by using the Intelligent Tiles framework a user-friendly, easily employable and affordable educational tool can be developed, empowering teachers and making learning more fun and effective.

Thesis supervisor: Dr. V. Lalioti

Department of Computer Science

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deur

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Opsomming

Hierdie skripsie fokus op die gebiede van opvoedkunde en rekenaar grafieka. Onderrig met behulp van 'n rekenaar is besig om 'n belangrike deel van die klaskamer te word. Vir opvoedkundige doelwitte is virtuele realiteit voorgestel as 'n tegnologiese deurbraak wat gebruik kan word vir gefasiliteerde onderrig. Die virtuele realiteit programme wat vir opvoedkundige doelwitte geproduseer is, benodig gewoonlik programmering en tegniese agtergrond. Hulle is ook beperk tot die gebruik van duur virtuele realiteit toerusting.

Die "Intelligent Tiles" raamwerk wat gedurende hierdie studie ontwikkel is, probeer baie van die bogenoemde beperkinge oorkom. Dit is 'n generiese en aanpasbare raamwerk wat onderwyser-gedrewe ontwikkeling van virtuele laboratoriums ondersteun. Deur hierdie raamwerk te gebruik, kan virtuele laboratoriums maklik ontwikkel word om gedurende die opvoedkunde van jong leerders in onderwerpe soos wetenskap, soos byvoorbeeld ekosisteme, gebruik te word. Die simulاسie van hierdie virtuele laboratoriums laat jong leerders toe om te eksperimenteer, wiskundige tegnieke soos om te tel, te sorteer en te klassifiseer aan te leer en om die ekologiese konsepte en die verhoudings tussen verskillende plante en diere te leer. Een voordeel is ook dat die raamwerk bekostigbaar is, aangesien dit ontwikkel is vir 'n "desktop" virtuele realiteit oplossing, wat beskou is as die goedkoopste en die virtuele realiteit platform wat die meeste gebruik word.

Hierdie skripsie illustreer dat die gebruik van die "Intelligent Tiles" raamwerk 'n gebruikersvriendelike en bekostigbare opvoedkundige hulpmiddel tot gevolg kan hê wat onderwysers kan in staat stel om opvoedkunde prettig en meer effektief te maak.

Skripsie toesighouer: Dr. V. Lalioti

Department Rekenaarwetenskap

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"If we teach today as we taught yesterday, we rob our children of tomorrow."
John Dewey (1916)

Introduction

1.1. What is a virtual laboratory?

A laboratory is a place that provides the conditions for experiments, observation or practice in a field of study (1). Its main aim is to allow students to gain practical experience, the close direct contact of a laboratory. It is possible to use a virtual laboratory, virtual laboratory provides a safe, virtual or simulated experience to the students. It is possible in ways that were not possible in the real world. Virtual laboratories, and simulation-based learning, are doing "virtual work" that reflects real-world activities, "learning by doing" from education principles. A virtual laboratory is a computer-generated environment, however, which encourages the learner from the field of study to interact, played on educators and learners. In this regard, the virtual laboratory is a tool for education, is still in use.

1.2. Thesis focus

This thesis focuses on the research of young learners. This research is a study on the use of using computers as a medium of education, includes a review of the literature on learning with computers, current perspectives in education, and the use of virtual reality and applications of virtual laboratories as a medium. The main focus of this thesis is to present a generic, user-adaptable framework for the teacher to use virtual laboratories to be used in the education of young learners.