Available online at www.sciencedirect.com

ScienceDirect

Procedia - Social and Behavioral Sciences 114 (2014) 360 – 364

Procedia
Social and Behavioral Sciences

4th World Conference on Psychology, Counseling and Guidance WCPCG-2013

Experiments on the Internet - removing barriers facing students with special needs

Žaneta Gerhátová[a] *

[a] University of Trnava, Faculty of Education, Department of Physics, Priemyselná 4, 917 43 Trnava, SR

Abstract

Experiments play a decisive role in science and technical education on all levels. Active participation of students with special needs for skills improvement in higher technical education was rare until recently. One of the reasons was their inability to complete experimental measurements in university laboratories. Existing remote experiments on the Internet remove barriers facing disabled students and provide a novel option - to conduct laboratory tasks anytime and anywhere, even multiple times. The aim of this paper is to demonstrate the methodology of implementing e-experiments and virtual simulation dealing with the given topic by means of a prepared project assignment. As the topic of utilizing Internet accessible experiments has not yet been examined from the psychological point of view, we would like to address specialists and to initiate a discussion.

Selection and peer-review under responsibility of Academic World Education and Research Center.

Kewords: barriers;experimentson the Internet;students with special needs;

1. Introduction

An experiment is an integral part of natural science and technology education at all school levels. In university education, experiments are carried out mainly as part of laboratory exercises in natural science laboratories. According to Ma and Nickerson (2006), real laboratories are characterised by two basic features:

1. The equipment necessary for running the experiment is situated in the laboratory.
2. The students who carry out the experiment must be physically present in the laboratory.

The second feature can sometimes exclude physically challenged pupils and students from lessons and does not allow distance teaching of technical and natural science subjects. In addition, laboratories require a special room, their equipment is costly and time consuming (Farrington et al., 1994) and, moreover, specialised laboratories must be provided with materials and equipment, and are becoming more regulated. This trend is linked to increased computer usage, such as data analysis and experiment management. In computer controlled experiments, the quality of interaction with the pupil does not depend heavily on whether the pupil is or is not present in the laboratory (Ma, Nickerson, 2006).

2. Natural Science Experiments on the Internet

The rapid development of personal computers and information and communication technologies (ICT) in recent years has created favourable conditions for the creation of computer-supported laboratories. The first computers

* Corresponding author: Zaneta Gerhatova Tel.: +421917866026
E-mail address: zaneta.gerhatova@truni.sk

Selection and peer-review under responsibility of Academic World Education and Research Center.
doi:10.1016/j.sbspro.2013.12.712

in laboratories were used exclusively for data collection and subsequent simple processing of the data.

Information and communication technologies (ICT) provide basic means to make the aims of the Vygotskian classroom achievable. The teacher's task is to guide students whilst they are experimenting, moderate discussions about given problems and solutions, be a source of information and eliminate potential risks associated with constructivist teaching, such as diversion from teaching objectives, incorrect interpretation of acquired knowledge, excessive subjectivity, inaccuracy, use of unprofessional terminology and so on (Lovászová, Turčányi, 2004).

Martinéz – Jimenéz and Climent – Bellido (2003) speak about the transition from behavioural theory based teaching to constructivist theory based teaching and the importance of using computers in this type of teaching. Computers can be useful in designing experiments and solving problems, which is of value in natural science subjects and technological subjects. In the constructivist approach, these activities are designed as a process of exploration. Computers are also useful in analysing students' previously acquired knowledge. Moreover, computers help students to design their own hypotheses with regard to the problem, choose between multiple options, analyse results and draw conclusions. A computer can help students become active participants in the learning process. A further penetration of ICT into the development of real laboratories was dependent on the introduction and good knowledge of the Internet and its corresponding maintenance.

The Internet enables the construction of laboratories of the client-server scheme. The first real remote experiment based on the ISES WEB Control, created in 2001, is on www.ises.info. The real remote experiment and its placement on the web is designed so that it is possible to transmit images, the arrangement and functions of the experiment and data to the client. Remote laboratories are characterised by a mediated reality. E-experiments via the Internet are interactive, they take place in real time with the possibility of acquiring data which provides the opportunity to make technical and natural science subjects more attractive (Schauer et al., 2008). Similarly to the real laboratory, the real remote laboratory needs equipment and space. (However, the space can be smaller, as the presence and operation of students not required.) It is the distance between the experiment and experimenter that makes a real remote laboratory different from a real laboratory. In real remote laboratories, experimenters obtain data from remote devices. In other words, the reality of a remote laboratory is transmitted to a distant space (Ma, Nickerson, 2006). Then it is possible to work with the measured data in the same way as if the student obtained it in a classic laboratory. All this is possible thanks to the use of the ISES school hardware kit with powerful software (Internet School Experimental System - http://www.ises.info), which is an important instrument, enabling conduction of real experiments, monitoring of their progress and results, processing and management via computer (Válková, Schauer, 2007). In Slovakia, the Ministry of Education grant KEGA No. 3/4128/06 initiated the project „E-Laboratry of Interactive Experiments as a Continuation of the Project of Multimedia Teaching of Physics at Slovak Universities“, which initiated the establishment of the first Slovak e-laboratory of real remote interactive natural science experiments based at the Department of Physics, Faculty of Education, University of Trnava (DF FE UT) http://kf.truni.sk/remotelab (Ožvoldová et al., 2010).

In connection with the development of ICT and students with special needs' experimenting we cannot ignore the possibility of conducting laboratory exercises, i.e. virtual laboratories on the Internet. All the listed possibilities of conducting experiments in teaching natural science and technical subjects can be appropriately incorporated into project assignments for laboratory exercises in Physics, where appropriate.

The following section shows a practical example of a project assignment created by us, the use of a freely accessible e-experiment from the DF FE UT e-laboratory in Trnava, and one also freely accessible virtual experiment, related to the topic. In this way we also present the methodology of working with remote experiments in the bachelor Physics course for future Physics teachers. The remote experiment “Mathematical pendulum” (http://remotelab5.truni.sk) is available in an English and Slovak version.

3. Project Assignment

Project Topic: **Pendulum**

Motivation: Would you like to experiment with a pendulum (Fig. 1)? Click on http://www.walter-fendt.de/ph14e/pendulum.htm.