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Entitled
VIRTUAL LABORATORIES FOR STEM EDUCATION: AN EVALUATION SCALE AND COMPARISON
by
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Abstract

Laboratory work is highly important in science education. Virtual environments play a vital role in remote learning. This thesis is concerned with the evaluation of virtual laboratories used in educational fields, mainly in STEM courses. The main objective of this research is to investigate what are the basic criteria for evaluating virtual environments used in Science education in order to create an evaluation scale. We reviewed the literature to highlight the main guidelines of evaluating virtual laboratories. We found the most common evaluation features in virtual tools are Ease of Use, Usefulness, Motivation, Interface Design and Realism. Upon generating the assessment scale, we selected two web-based interactive simulations to perform the experiments, 201 students replied to the survey that followed our online practical exercises. A set of one-sided T-test was used to determine whether survey responses for each variable varied from one another. Further, we compared the results on two online virtual environments and found that Lab 2 PHeT interactive simulations show better results compared to the Microscope Virtual Laboratories in terms of Ease of Use, Motivation, Interactivity and educational Usefulness. In both assessed labs Motivation and Realism were rated lower than other aspects. Realism is a key feature in developing virtual worlds to reduce the gap between remote and actual learning settings. The scale created addresses three general evaluation aspects: the didactic usefulness, the usability criteria and the learners' perspectives. The scale provided through this research serves as a guide for evaluating, comparing and developing virtual labs.

Keywords: Virtual Laboratories, Virtual Reality, Remote Laboratories, STEM, Evaluation Scale, Usability