

An Experimental Study on Measuring the Impact of Using Virtual Laboratories in Developing Some Metacognition Skills (Planning, Monitoring, and Control) in the Subject of Physics

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The aim of this research is to investigate the impact of using virtual laboratories in developing some Metacognition skills in the subject of physics among third-grade female students. The research adopted a quasi-experimental design, with a sample of 30 students evenly divided between the control and experimental groups, with 15 students in each group. To achieve the research objectives, the researcher designed a scale for Metacognition skills. The results revealed statistically significant differences between the average scores of the experimental group and the control group in some Metacognition skills (planning, monitoring, and control) in the post-application phase in favor of the experimental group, which studied using virtual laboratories. Furthermore, the results indicated a significant effect size of using virtual laboratories in developing Metacognition skills among third-grade female students in Jeddah. Based on the findings, the research recommends the utilization of virtual laboratory technology in teaching physics and the organization of training courses for physics teachers.

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INTRODUCTION

Our current era is witnessing a tremendous technological revolution that has profoundly impacted all aspects of life, including education, which aims to transmit knowledge and wisdom from one generation to another. As educational institutions are increasingly embracing online learning methodologies, educators and students have discovered the exceptional significance of digital learning tools, which have played a significant role in fundamentally transforming our cultural experience during critical times. This transformation has been achieved through accessing modern technology, enhancing productivity, fostering collaboration, and nurturing creativity (Tayan, 2020).

The use of technology in its various forms serves as a means to efficiently transmit knowledge to learners, reducing time and effort while maximizing the benefits derived. This approach to education embraces modern communication mechanisms, encompassing computers, networks, and diverse multimedia tools such as audiovisual elements, graphics, search functionalities, electronic libraries, as well as internet gateways. These resources can be effectively utilized both in remote learning environments and within traditional classroom settings (Al-Moussa, 2016).

Hence, educational processes have witnessed rapid strides in the utilization of technology and its applications within the teaching and learning domain. One of the most significant educational transformations in the field of applied sciences has been the integration of virtual laboratories, which have gained widespread popularity in advanced nations in recent years due to their unique ability to bridge the gap between theory and application (Albadri, 2016).

The researcher believes that providing learners with the opportunity to experiment and critically think about their actions in problem-solving and fostering creativity empowers them to become conscious learners who are aware of the solutions to the tasks they undertake, rather than mere recipients of instructions. This approach aligns with the 21st-century skills that the Saudi Ministry of Education strives to achieve in the educational process.

Furthermore, Migdadi and Al-zou'bi (2020) emphasize the importance of individuals' awareness of their cognitive processes and their ability to control and regulate them while solving problems. This leads to improved performance and greater goal attainment, surpassing mere thinking and delving into what is beyond cognitive thinking known as metacognition. The term "Metacognition" emerged in the 1970s in the research of Flavell, which focused on understanding the learner's self-awareness as a learner and their capacity

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