

Effects of Virtual Laboratory Applications on Academic Achievement and Six-Month Retention of Learning in Fourth-Grade Science Education*

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Abstract

This study investigated the effects of virtual laboratory applications on fourth-grade students' academic achievement and learning retention in Science education. Utilizing a pre-experimental, single-group pretest–posttest design, instruction on the "Movements of the World" unit was delivered via the EBA portal and Mozaweb 3D simulation platform. The sample comprised 65 students from three public primary schools in Samsun, Turkey, selected through convenience sampling. Data were collected using a researcher-developed 10-item achievement test measuring knowledge, comprehension, and application. This instrument was administered as a pretest, an immediate posttest, and a six-month retention test—a notably longer delay than is typical in comparable literature. Statistical analyses revealed a significant improvement from pretest to posttest, demonstrating that virtual laboratory instruction successfully enhanced academic achievement. Furthermore, no significant decline was observed between the posttest and the six-month retention test, indicating highly durable learning. These findings demonstrate that simulation-based science instruction yields immediate and long-lasting educational benefits, providing valuable evidence for primary school contexts where research on virtual laboratories remains limited.

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