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An Innovative Approach to Impacting Student Academic Achievement and Attitudes: Pilot Study of the HEADS UP Virtual Molecular Biology Lab

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Introduction: The Virtual Molecular Biology Lab is an innovative, computer-based educational program designed to teach advanced high school biology students how to create a transgenic mouse model in a simulated laboratory setting. It was created in an effort to combat the current decrease in adolescent enthusiasm for and academic achievement in science and science careers, especially in Hispanic students. Because studies have found that hands-on learning, particularly computer-based instruction, is effective in enhancing science achievement, the Virtual Lab is a potential tool for increasing the number of Hispanic students that choose to enter science fields.

Purpose: To present results from the beta-test of one module in the Virtual Lab.

Methods: A randomized clinical control design was utilized with a group of 44 high school students from two science/medical magnet schools in Mercedes, Texas. Five paper-and-pencil formatted questionnaires were used to assess student demographics, knowledge of molecular biology, attitudes towards science and computers as a learning tool, and usability of the program. An internal "lab notebook" was used to measure student skills for selecting the correct laboratory procedures.

Results: The Virtual Lab was found to significantly increase student knowledge of molecular biology over time ($p < 0.005$) as well as significantly increase student knowledge with each use ($p < 0.001$). No significant differences in science attitude scores were seen between the two groups. A positive change in attitudes towards computers as a learning tool was found in the treatment group ($p < 0.001$), and a significant difference in skills for choosing the correct laboratory procedures was observed between those who used the program and those that did not ($p < 0.005$).

Conclusion: The results from this pilot study provide evidence that the HEADS UP Virtual Molecular Biology Lab is a potentially effective educational tool for increasing high school student knowledge about molecular biology and molecular biology laboratory techniques.