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Research Brief

The Impact of Lab Delivery Method on Student Achievement, Transfer of Learning, and Self-Perception in an Anatomy and Physiology Course

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Abstract

Distance education has become increasingly popular among college students over the last two decades and institutions have responded to this demand by offering more online and hybrid courses. However, science, technology, engineering, and math (STEM) disciplines have been slower to create online courses, likely due to the laboratory component that most STEM courses contain, which has traditionally been completed in a face-to-face setting. Using a quantitative, causal comparative design, this study explored the impact of lab delivery methods on the achievement of learning outcomes, transfer of learning, and self-perception as it relates to persistence among higher education students in an anatomy and physiology lab course. Pre- and post-tests were used to assess student achievement and learning transfer, while pre- and post-surveys were used to assess changes in students' self-perceptions related to persistence in college and persistence in the sciences. The results indicated that students who completed an in-person lab displayed higher achievement than the students who completed a virtual lab; however, there was no significant difference in the transfer of learning between the two groups. Additionally, the students who completed the in-person lab experienced a significant increase in their self-perceptions related to persistence in the sciences, while the virtual lab students did not. Based on these results, the recommendations are that virtual labs should be offered in conjunction with, rather than in place of, in-person labs and that lab experiences should be interactive and engaging, regardless of the delivery method.

Aim

The aim of this quantitative study was to examine the impact that lab delivery methods have on the achievement of learning outcomes, transfer of learning, and self-perception as it relates to persistence among higher education students in an anatomy and physiology lab course.

Problem

Despite growth in distance education over the past decade, STEM disciplines have been slower to create online courses. STEM courses often include a laboratory component, and many faculty, administrators, and national organizations have indicated that labs should only be offered in an in-person, rather than in a virtual, format (American Chemical Society, 2020; Jeschofnig & Jeschofnig, 2011; Mathiowetz et al., 2016; National Science Teachers Association, 2007). There is limited research available on the use of virtual labs to support achieving desired learning outcomes and facilitating the transfer of learning to future coursework and real-world contexts.

This study is significant because of the COVID 19 pandemic, which caused a global shift to distance education. Researchers argue that after this pandemic, there will be permanent changes in the way courses are designed and delivered to students (Neuwirth et al., 2020). Therefore, it is important that distance education courses be carefully examined to ensure they are meeting the needs of students and are providing high-quality education (Meng et al., 2020).

Research Findings

A causal-comparative quantitative approach was used for this study based on the nature of the research problem and research questions, and due to the researcher's stance, which is grounded in the postpositivist paradigm. Post-positivists take a scientific, logical approach to their research to understand causal relationships (Creswell & Poth, 2018; Scotland, 2012). In quantitative research, the relationship between variables is explored to determine whether one variable influences another (Cresswell & Guetterman, 2019).

A pre-test and multiple post-tests were used to obtain data regarding student achievement and knowledge transfer. In addition to obtaining data through experimentation, post-positivists also seek to obtain individuals' perspectives and attitudes to help explain relationships (Scotland, 2012). Therefore, this research study also used a survey to obtain this type of subjective information pertaining to students' self-perceptions to supplement the data obtained from the pre- and post-tests.

This study was guided by three research questions: (1) Does student achievement of learning outcomes differ for students who perform in-person labs compared to students who perform virtual labs in an anatomy and physiology course?, (2) Does the transfer of learning differ for students who perform in-person labs compared to students who perform virtual labs in an anatomy and physiology course?, and (3) To what extent do lab delivery methods affect self-perception of persistence among students who perform in-person labs compared to students who perform virtual labs in an anatomy and physiology course?

Conclusions

After data collection and analysis, four results emerged from the findings of this research study:

Result One: Student achievement of learning outcomes was higher for students who performed in-person labs compared to students who performed virtual labs

Result Two: There was not a significant difference in the transfer of learning that occurred among students who performed in-person labs compared to students who performed virtual labs

Result Three: Only the in-person lab delivery method significantly increased participants' self-perceptions related to persistence in the sciences

Result Four: There was not a significant difference in self-perception related to persistence in college among students who performed in-person labs compared to students who performed virtual labs

Research Implications

The following recommendations are proposed based on the findings and results of this research study to provide possible solutions to the problem of practice.

Recommendation One: Utilize virtual anatomy and physiology labs in conjunction with, rather than in place of, in-person anatomy and physiology labs. Despite the lesser learning gains seen among the virtual lab participants, many of the findings from this study were similar for the two

groups of participants, likely due to the many benefits that each lab delivery method offers. While in-person labs have already proven to be an effective instructional method, the use of both virtual and in-person labs together may be an even more useful strategy for achieving the goals of a laboratory while also meeting the needs of a diverse student population.

Recommendation Two: Anatomy and physiology labs should be interactive and engaging, regardless of lab delivery format. Based on this study and previous research, lab experiences that are interactive and engaging promote learning, transfer of learning, and persistence. Initially, a basic understanding of concepts is required before learning transfer can occur, and engaging students as active learners will increase their understanding (Galoyan & Betts, 2021). The use of active and engaging teaching strategies increases student engagement, which then increases the likelihood that learning will occur (Hanauer et al., 2016). When activities that engage students, such as group discussions and case studies, are incorporated into lab experiences, they provide students with the opportunity to apply their knowledge to new situations, thus promoting the transfer of learning (Egan, 2020; Galoyan & Betts, 2021; Goldstone & Day, 2012).

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Author Biography

Dr. Laura Bianco is the Chairperson of the Science Department at Delaware Technical Community College. In addition to her role as department chair, she also serves on the collegewide Core Curriculum Competency Committee, which involves finalizing core competency intended outcomes and assessment standards and making improvement recommendations. She completed Delaware Tech's Leadership Development Program, which provides professional development to emerging leaders at the college, in 2019. Dr. Bianco received her EdD in Educational Leadership and Management from Drexel University in June 2022. She has participated in Drexel's Annual Assessment Conference for the past two years as both a Planning Committee member and a presenter at the conference. Her research interests include the brain and the human learning process, transfer of learning, and lab delivery methods used in STEM fields.