Chapter 12

Multimedia Learning: Simulated vs. Real-World Digital Logic Circuit Curriculum

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ABSTRACT

Instructors, professors, and lecturers are always seeking to provide students with real-world experiences that provide hands-on instruction, particularly in technical, engineering, and professional education environments. Many barriers to providing realistic project-oriented classroom experiences include safety, overall cost, procurement of necessary laboratory components, and available physical space. The study conducted analyzed the two randomly sampled student groupings of digital experiences and real-world experiences at a midwestern university, with groupings named traditional hands-on lab and MultiSim, respectively. Grouping 1 utilized digital labs simulations utilizing MultiSim while Grouping 2 used the traditional form of physical labs. The analysis did not indicate a statistically significant difference in student performance between groups using MultiSim (M=26.38, SD=14.527) and students using traditional hands-on methods (M=21.39, SD=16.284) t(45)=-1.11, p=.274. Implications, and recommendations are featured to provide context.

INTRODUCTION

For the past ten years, higher education has seen consecutive post-secondary year-over-year average enrollment rates increase, until the 2016 - 2017 school year (Inside Higher Ed, 2018). The enrollment data from that semester year indicated that 90,000 students decreased, and this was nearly half a percentage point nationally. During this same year cycle, the number of students that had enrolled in 1 or more online courses grew by 350,000, which was a 5.7 percent increase in the national average. Thus,
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on-campus students are seeing a sharp decline in enrollment, while students enrolling at a distance is on the rise (Ginder, S., Kelly-Ried, J., & Mann, F., 2019). This has been made evident by individual institutions to desire to extend and market existing on-campus bachelor’s programs for distribution via distance learning portals. This sentiment is also true at Indiana State University.

Indiana State University (ISU) is a regional institution located in west-central Indiana in the city of Terre Haute. First established in 1865 as the state’s teachers college, ISU is now a doctoral granting institution with an enrollment of over 13,000 students. As of 2017, the College of Technology’s current enrollment is 1759 undergraduate and 349 graduate students.

The College of Technology (CoT) at ISU is made up of five departments covering a diverse range of engineering technology and related areas including advanced manufacturing, mechanical engineering technology, aviation technology, technology management, industrial safety, and technology education. The college also houses the Air Force and Army ROTC programs. A number of Master of Science degrees are offered as well as a Ph.D. program in Technology Management which uses a consortium approach. ISU serves as the degree-granting institution to the Ph.D. consortium program in Technology Management which includes as member institutions Bowling Green State University (Ohio); University of Central Missouri; North Carolina A&T; and East Carolina University (N.C.).

The Department of Electronics and Computer Engineering Technology (ECET) offers four undergraduate programs: Electronics Engineering Technology, Computer Engineering Technology, Automation & Controls Engineering Technology, and Information Technology. The ECET department offers a Master of Science degree in Electronics and Computer technology with concentrations available in either automation or information technology. The Department faculty participates in the Ph.D. consortium program in the digital communications and manufacturing concentrations.

The Information Technology (IT) program provides students with a real world, hands-on program that bridges the gap between computer scientists and general users. The Information Technology program is multidisciplinary involving hardware, software and IT management focused courses. The 2014-2015 academic enrollment for IT majors was 193 full-time undergraduate students. At present there are no courses that provide experiential learning opportunities in the fields of technology that are offered in virtual reality. These virtual experiential learning opportunities for students in these courses are limited by lack of access to up-to-date laboratory virtual reality curriculum and equipment to deliver it.

There is also a 33 credit hour Master of Science program in Electronics and Computer Technology (MS-ECT), with concentrations in Information Technology or Automation and Control-Systems. The program’s required core courses includes research development, computer systems management, and independent project development. A thesis course is available but not required for graduation.

BACKGROUND

The goal of this work is to contribute to the growth and development of future generations of scientists, engineers, and technologists through educational materials delivered primarily through virtualized and simulated learning environments. This study has the potential to impact the field of education in several ways. Due to the increased availability of Simulation, Virtual Reality, and S3D instructional technology in the classroom, and the lack of available research documenting its efficacy, this study would act as
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