Learning Management System Use to Increase Mathematics Knowledge and Skills in Puerto Rico

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ABSTRACT

The purpose of this study was to compare the results of a mathematics comprehensive exam of two first-year university mathematics groups in Puerto Rico and measure the benefits and effectiveness of a learning management system (LMS) in math teaching and learning. The experimental group engaged in the use of a LMS and traditional teaching methods, while the control group was only engaged in traditional teaching methods. The population of the study was comprised of 579 first-year university students. The control groups included 287 participants, and the experimental group included 292 participants. The experimental group entered the university with significantly less mathematical knowledge (18% or less), and as such, had to learn more content (55% more). The learning outcomes of both courses expected students to acquire mathematical knowledge. The study revealed that the students who engaged in the use of the LMS in their teaching and learning methods, obtained significantly greater achievement of mathematical knowledge than the students who soley received traditional instruction.

KEYWORDS

E-Learning, Learning Management Systems (LMS), Management Information System, Math Education, Puerto Rico, University Mathematics

INTRODUCTION

Students’ lack of proficiency in college-level mathematics has been an ongoing problem for some time. Usually, deficiencies in math skills begin in early education and continue through higher education. One study reports that many universities admit students who are underprepared in college-level mathematics. For example, in Ohio, 40% of incoming students need math remediation and in Kent State University, 75% of freshmen student require math remediation. As such, universities are searching for new approaches to address the needs of students (LaUrillar, Klein, Hani-Hong, 2012). This problem is more exaggerated in the math skills at the community college level, as indicated...
by 70% of their students requiring remedial mathematics (Okimoto and Heck, 2014). Furthermore, for decades, the academic performance of students in the mainland United States, Puerto Rico, and other developing countries has been considerably lower than developed countries (Allen and Seaman, 2008). Many institutions of higher education attempt to address this problem by offering some form of remediation, usually by requiring student to take remedial mathematics course or tutoring. Most often, college mathematics remediation has followed a traditional face-to-face approach. Yet, this approach has not yielded optimal results as students in the American educational institutions continue to underperform in mathematics when compared to other nations. Consequently, this has provoked debates, dialogues, and ideas about alternatives to improve mathematics skills throughout the nation. One tendency for many educational institutions is to include the use of technology in the mathematics curriculum to explore innovative tools that facilitate the teaching and learning experiences in mathematics. Consequently, educators have also been implored to implement new teaching strategies which utilize learning management systems, online, interdisciplinary collaborative learning, and the integration of mathematics and statistical software in their courses (Faulin J., Juan A., Fonseca P., Pla L.M., and Rodriguez S. V., 2009; Hardin J. and Ellington A., 2005). In addition, universities are exploring additional alternative approaches, such as the use of Computer Assisted Instruction and Learning Management Systems (LMS) to improve students’ poor math skills.

The objective of this study was to compare mathematical knowledge learned through a Learning Management System (LMS) versus that of traditional teaching methods, and measure the benefits and effectiveness of this technological teaching and learning method. The teaching strategy that the student engaged in was the independent variable and the acquired mathematical knowledge was the dependent variable of the study.

LITERATURE REVIEW

When comparing the United States mainland and Puerto Rico with other nations, the achievement gap in many areas are cited in the research. However, achievement in mathematics is notable lower than other disciplines. Although the United States scores have made small gains, the US ranking in mathematics is 32nd in the world among the most competitive nations, and only 6% of students attained an advanced level in math (Hanyshek, Pertsin, and Woesmann, 2012). This lack of proficiency in math is widespread throughout the US. However, math skills deficiencies are significantly lower in Puerto Rican students. This is exemplified in the mean score of college-bound Puerto Rican students who took the SAT in 2010-2011, which was only 452, as compared to the mean score of all students, which was 514 (US Department of Education, National Center for Education Statistics, 2012). Additionally, the 2013 math scores for grades 4, 8, and 12 have gone virtually unchanged for the last few years, with Puerto Rican students still lagging behind the general population. Note however, that the 2011-2012 SAT scores actually declined six points to for all students who took the test (US Department of Education, National Center for Education Statistics, 2014). More alarming is that Puerto Rican students who took the SAT during this time frame scored an average of 452, while white students scored 536. This illustrates the problem that Puerto Rican students still score far below the general population, and their white counterparts who take the SAT (US Department of Education, National Center for Education Statistics, 2014).

Note however, the majority of the Puerto Rican students who took the SAT were residents of the mainland United States (Bersin, Howard and Leonard, 2010). Nonetheless, it is noteworthy to mention that this lack of achievement in math is more disheartening and widespread among many developing countries, and the island of Puerto Rico. The Commonwealth of Puerto Rico when compared with the mainland US has a considerably lower rank in math achievement. Additionally, math scores in Puerto Rico were very low when compared on a global scale. In 2012, Puerto Rico ranked in the bottom 20% in Math and was ranked 58 out of 65 countries on the Program for International Student Assessment (PISA) for 15 year olds. PISA testing examined scores from 1,688 private and
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