An Evaluation of Technology Integration in Teaching Statistics: A Multivariate Survey Analysis

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ABSTRACT

Teaching and learning in higher education has been influenced by the rapid rate of innovation in technology. A technology intervention was used to teach Foundation Statistics. This paper reports students’ performance relative to those taught statistics using traditional teaching methods. Failure rate was reduced from 34% with traditional teaching to only 14% with the inclusion of technology, and in order to measure students’ perception towards the integration of technology in the subject, a total of 144 students of 30 different nationalities were surveyed at the end of the semester before the final examination. The analysis of the survey highlighted the students’ positive perception independent of their overall performance. Overall, the survey expressed a significant result showing that the use of technology helped students to perform better.

Keywords: Education Technology, Integration of Technology, Multivariate Analysis, Student Performance, Teaching Statistics

INTRODUCTION

Statistics plays a vital role in enabling us to comprehend the world around us. Its role is especially relevant as a tool to interpret, analyze and evaluate the findings of research inquiries which are crucial to the progress of the human race. Educators, especially those involved in teaching mathematics, are demanding that statistics should be introduced in all levels of education (Garfield & Ahlgren, 1988). Though there is substantial awareness of the relevance of statistics, university students’ approach to it is anxiety laden as they perceive it as a difficult subject (Baharun & Porter, 2009; Fortes & Tchantchane, 2010). Adding to the challenge are the multi-cultural and multi-skilled student cohorts that populate classrooms today demanding diverse teaching methods (Peiris & Beh, 2006; Fortes & Tchantchane, 2010). Teaching statistics effectively has thus become a peda-
This study attempts to improve student learning and performance in statistics using a technology intervention that simplifies operational statistics.

Integration of technology with traditional teaching methods has been perceived by educators as an important tool that aids effective teaching at all levels. This concept has been promoted by the National Council for Mathematics Teachers and the American Statistical Association. In the U.A.E. there has not been any documented evidence of the use of technology in teaching foundation Statistics. At the University of Wollongong in Dubai, Introduction to Statistics a compulsory General Education Subject for freshmen had been taught using traditional methods. Students were required to take down notes and solve problems with the aid of a scientific calculator during lectures and tutorials. Lecture notes and tutorial materials are also made available on the university website. However, this approach was inadequate as students were working with abstract formulae and were unable to explore real, large and complex data. To address these issues, we introduced technology as a tool to effectively teach statistics. Students were expected to get more time to analyse and interpret simple or complex data, and justify their conclusions. Student experience was enhanced through computer-based instruction and collaborative group work.

The objective of this study is to answer the following research questions: (i) Does a technology intervention have an effect on student’s academic performance? (ii) What are the perceptions of the students towards the technology used in teaching statistics?

This study also attempts to fill the lacuna in research pertaining to the teaching of statistics in the region.

INTEGRATING TECHNOLOGY IN TEACHING STATISTICS

The advent of technology and its widespread use in the 21st century warranted the need to integrate technology in teaching and learning in Neiss (2005). This reform radically affects what we teach and alters our methods of teaching. In 2005, Thomas and Hong (as cited in Neiss, 2005) developed a teaching framework namely pedagogical technology knowledge (PTK), later named as TPCK. This framework acknowledges the use of technology as an important instrument for teaching and asserts the role of technology in linking the subject matter with teaching (Neiss, 2005). Figure 1 illustrates the framework of technology, pedagogy, content and knowledge and the dynamics among these as conceived in TPACK. Integration of technology in teaching and learning is about ensuring effective pedagogy. In the case of teaching Statistics too, a substantial change can create strong synergies between technology, pedagogy, and content (Moore, 1997; Velleman, 1995). According to Moore (1997) requiring students to work in groups and discussing their work orally and in writing, using various diagnostic tools to analyze data, and computer-intensive statistical practice facilitates student learning.

In addition, the National Council of the Teachers in Mathematics supports the principle “Technology is essential in teaching and learning; it influences the mathematics that is taught and enhances learning” (NCTM, 2000). It further explained that technology such as calculators and computers are reshaping the mathematical landscape and encouraged school mathematics to reflect the changes. They observed that with appropriate and conscientious use of technology, students can learn mathematics more deeply, speculate and make inferences and be able to work at higher levels of generalization or abstraction (NCTM, 2000). These principles suggest therefore that technology plays a very important role in the learning curve of the students. Similarly, the American Statistical Association (ASA) supports the use of technology for developing conceptual understanding and analyzing real data (GAISE, 2007). Various investigations have been made on the different teaching methods using technology and the impact on student’s learning (Baharun & Porter, 2009; Gorman, 2008; Prabhakar, 2008; Tsao, 2006; Neiss, 2005; Sam & Kee, 2004; Garfield, Chance, & Snell, 2000).
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