

Chapter 93

Comparison of Student Achievement and Problem–Solving Techniques for Integration Between Online and Face–to–Face Calculus Courses

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ABSTRACT

Understanding the learning online students acquire through online course experiences is important as online course options and availability continue to expand. This study seeks to compare problem-solving techniques and course learning outcomes of Calculus students through the comparison of work completed by online and face-to-face Calculus students. Four assessment questions, regarding integration, will be reviewed in an effort to distinguish commonalities and/or differences in understanding and problem-solving strategies deployed by online and face-to-face Calculus students. Statistical analyses of question scores will include usage of Levene's test, Welch test, Brown-Forsythe test, and F-test. A qualitative analysis will also be conducted to analyze problem-solving strategies used by the online and face-to-face Calculus students.

INTRODUCTION

Online learning and higher education seem to be terms that are quickly becoming synonymous. With a society where connecting through technology is commonplace, abounding online learning opportunities seem to be gaining acceptance and notoriety. With online learning opportunities becoming prevalent, and even seemingly expected by students, it is important to understand the quality of learning students are gaining through online courses.

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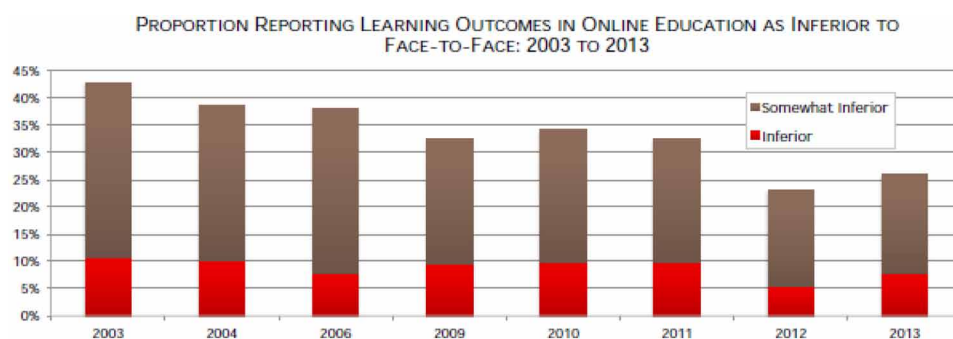
The focus of this study is to examine student problem-solving techniques utilized on a four-question integration assessment. For this study, work from online students and face-to-face students will be examined. Student misconceptions, integration techniques, and problem-solving approaches will be reviewed and compared between an online Calculus course and a face-to-face Calculus course.

BACKGROUND

Allen and Seaman (2014) have been conducting a multi-year study to track the growth of online learning, explore the strategicness of colleges and universities offering online learning options, and investigate student learning outcomes as a result of taking online courses. When their study began in 2002, Allen and Seaman found 1.6 million students were enrolled in at least one online course. In their most recent report, Allen and Seaman commented 7.1 million students embarked on online learning experiences in 2012. This 16.1% annual growth rate in online enrollments dwarfs the 2.5% annual growth rate experienced by overall higher education enrollments from 2002 to 2012 and equates to 33.5% of all higher education students taking at least one online course (Allen & Seaman, 2014).

In addition to online course enrollments increasing, faculty buy-in to the quality of online learning opportunities has also improved. Figure 1 shows a steady increase in faculty perception of online education quality. Allen and Seaman (2014) reported 77% of academic leaders at colleges believed equivalent to or superior learning outcomes were being produced by online education relative to face-to-face instruction. At the onset of their study of online education and its inception into the higher education spectrum, Allen and Seaman found only 53% of academic leaders saw online instruction as on par with face-to-face instruction.

Figure 1. Online learning quality
(Allen & Seaman, 2014)



LITERATURE REVIEW

Literature relative to comparing online and face-to-face student learning outcomes is not prevalent. Zhao, Lei, Lai and Tan (2005) conducted a meta-analysis of works to review achievement differences between online and face-to-face learning modalities and concluded there was no differences relative to the effectiveness of learning based on the course delivery modalities. Sitzmann, Kraiger, Stewart, and

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