

An Assessment of Student Performance in an Introductory Statistics Hybrid Course

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Abstract

To assess the impact of a hybrid course in introductory statistics, students were given three enrollment choices: They could choose sections with no course content via computer-based learning (CBL) or sections with partial CBL or full CBL course content. The students voluntarily enrolled in the course format of their choice. When comparing examination scores among the three treatment groups, overall there was no evidence of a difference in the students' mastery of statistical concepts. This finding is consistent with previous studies.

However, in an ordinal two-way analysis with students grouped by grade level, there was a linear association between student grades and the proportion of CBL content in the course. It was found that the highest performing students did even better as the amount of CBL content increased while the lowest performing students did even worse.

These results suggest that the attributes of the hybrid course that are beneficial to the top performing students may be detrimental to the lowest performing students. Consequently, a pre-assessment of student abilities should be conducted to provide guidance to students in choosing a course format that would provide each student the greatest opportunity for academic achievement.

1. Introduction

Students by Hilton and Christensen (2002), Allredge and Som (2002), Zhange (2002) have consistently found no significant difference in learning outcomes when technology is incorporated into the learning process.

Similarly, studies by Ward (2004) and Utts et al (2003) compared a traditional course format in an introductory statistics course with a "hybrid" course integrating classroom-based and web-based instruction. As in previous studies, they reported that the students' performance was the same in the traditional and hybrid courses.

Similarly Fields and Collins (2004) reported on a two-semester study spanning one academic year that assessed the impact of computer-based learning (CBL) on student achievement in introductory statistics. Consistent with previous studies they found that using the hybrid approach did not produce a significant difference in student performance as measured by examination scores when up to 20% of the course was delivered via CBL.

However, Fields and Collins showed that student opinion of the hybrid format was very positive primarily due to the students' perception that the hybrid course provided them with greater flexibility to fit the lessons into their weekly schedules. This suggested the possible benefit that better student time management could lead to better overall student learning. Further, since the hybrid course format offers the opportunity for most basic course material to be covered by the student outside the classroom, more time can be used during the class sessions for enrichment activities. This also suggested that improved student learning outcomes could be achieved in a hybrid course.

In a one-semester study we examined the potential impact of the benefits of the hybrid format when students were offered the option of taking the entire course via computer-based learning. In contrast, in the previous study no more than 20% of the course content was provided by CBL.

2. Method and Findings

In a large undergraduate introductory statistics course, during course registration students were given the choice of enrolling in three course formats:

1. No CBL course content,
2. Partial CBL course content, or
3. Full CBL course content.

Of the 1524 students in the course, 782 chose the "no CBL" format, 395 chose the "partial CBL" format and 347 chose the "full CBL" format.

In all three formats the students had the same text book with an accompanying CD containing eight-four multimedia presentations covering the entire course material. In the "no CBL" format the students attended class three days per week and were presented the eight-four multimedia lessons by an instructor. In the "partial CBL" format, students attended class twice per week and were presented approximately two-thirds of the lessons by an instructor and then viewed the remaining lessons on their own outside of class. In the "full CBL" format, the students viewed all eight-four lessons outside of class and then had the opportunity to attend two optional supplementary class sessions per week. One of the optional class sessions was a "question and answer" session with the instructor while in during the other optional session the instructor conducted an enrichment activity with the class to reinforce and extend the concepts of the course.

In all three course formats each student attended an assigned lab help session once per week and could attend additional "open lab" help sessions during the week. Students in all three formats took the same multiple-choice examinations administered at the university testing center.

3. Summary of Results

For students performing in the middle grade ranges (B, C and D grade students), there was no difference in the average examination grades for the students regardless of the amount of course content delivered by computer-based learning.

However, the students in the A grade range did show a statistically significant improvement in their average examination score under the “full CBL” format. Further, there was a significantly higher percentage of students earning an A grade under the “full CBL” format compared to the “no CBL” format.

At the other end of the performance scale, the examination scores of the failing students were lower on average under the “full CBL” format. Also, there was a significantly higher percentage of students failing under the “full CBL” format compared to the “no CBL” format.

	Full CBL Content	No CBL Content	Significance
Overall Exam Average:	82.7%	82.9%	$p > .5$
A Students Exam Ave:	94.6%	93.7%	$p = .034$
F Students Exam Ave:	52.0%	55.4%	$p = .026$
Proportion of A's:	35.2%	24.8%	$p < .001$
Proportion of F's:	11.8%	8.2%	$p = .046$

The results for the “partial CBL” format sections ranged between those of the “no CBL” and the “full CBL” format sections.

In addition, there was a significant positive linear ordinal association from the C to the B to the A grade categories as the proportion of CBL content increased in the hybrid course ($p < .001$). Conversely, there was a significant negative linear ordinal association from the F to the D to the C grade categories as the proportion of CBL content increased in the hybrid course ($p < .01$).

4. Discussion and Recommendations

As in other studies, this study found that overall there was no significant difference in student learning using the hybrid format. However, this study has shown a significant association between the proportion of course content delivered via computer-based learning and the learning outcomes for the top performing students and for the lowest performing students.

We found that the proportion of CBL content has the greatest impact among students at the extremes of the performance spectrum. Given greater learning resources and more latitude to achieve, the top students can do even better. At the same time, under the same conditions the weaker students can flounder.

Thus, it appears that students with greater academic ability and motivation take advantage of the greater learning opportunities offered by the hybrid format, while the students with relatively less academic ability and motivation find the flexibility of the hybrid format to be a disadvantage. This

suggests that the lowest performing students need greater structure and discipline imposed externally by an instructor than the highest performing students.

Clearly, in education “one size does not fit all”. The hybrid course with “full CBL” course content is highly advantageous to the top students, neither advantageous nor disadvantageous to the middle range students, but distinctly disadvantageous to the lowest performing students. As a minimum, the traditional format course needs to be offered as an option in parallel with the hybrid format along with guidance to the students in selecting the format in which to enroll.

Consequently, it is recommended that an assessment be conducted of students’ abilities and motivation before registration or during the initial class session to provide students guidance in selecting the course format that offers each individual student the greatest opportunity for academic success.

Validation of these assertions and development of appropriate student pre-assessment instruments will be the subject of further research. In addition, the impact of self-selection bias due to voluntary enrollment in a treatment group needs to be assessed as well as any possible instructor-effect that may impact the response measures.

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