

Analysis of the Effectiveness of Traditional Versus Hybrid Student Performance for an Introductory Computing Course

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Abstract

This paper investigates the performance of students enrolled in traditional versus hybrid Introductory Computing course at Georgia Gwinnett College (GGC). For this study, we collected and analyzed student performance data for the course goals over two semesters (Fall 2010 and Spring 2011). GGC is unique as it is an open access undergraduate institution, which has experienced rapid growth since its recent foundation in 2006. This presents a distinct challenge because there is a diverse student population, with various degrees of computing expertise and learning capabilities.

Keywords: Hybrid vs. Traditional, Student Performance, Information Technology, Computing, Undergraduate Education, Computer Skills.

1. INTRODUCTION

The Georgia Gwinnett College (GGC) is the first four-year public college to open in Georgia in more than a century. GGC opened its doors in 2006 with only two buildings, 11 full-time faculty, a handful of administrators and staff, and 100 transfer students. The institution has experienced explosive growth since that time, and now has a new library, student center, dorms and academic buildings, close to 500 full-time faculty, and enrollment is expected to top 8,000 students in the Fall of 2011. In June, 2011, GGC awarded diplomas to the first class of students who started there as freshmen.

As GGC is an "open access" undergraduate institution, any eligible student who applies will be admitted. In addition, GGC serves a diverse student population, with a wide range of cultures, languages, educational preparation and experiences. This combined with its explosive growth presents a special challenge in delivering the introductory ITEC1001 computing class. There are no 100% online courses offered at GGC; rather traditional and hybrid models of course delivery are utilized.

Hybrid courses at GGC refer to courses where some sessions take place face-to-face while

others take place online. The Sloan Foundation believes hybrid reflects an average of 50% online coursework (Diaz, 2011). Currently, all courses at GGC delivered in the hybrid format have a combination of reduced "face" time, and online components that may be as high as, but not exceed, 50% (Smith, 2011).

There are varying opinions at our institution concerning the effectiveness of the hybrid model. The common perception among some faculty and administration is that students do not perform as well in hybrid classes. However, the evidence to support this perception is largely anecdotal; therefore, a quantitative study is needed to determine the true situation. In this paper, we will describe our study which examined the effectiveness of traditional vs. hybrid introductory computing courses at GGC based on student performance.

2. PRIOR LITERATURE

A review of the literature revealed that there are many empirical studies related to the comparison of online and traditional learning. A recent meta-analysis conducted by the U.S. Department of Education and Evaluation (U.S. Department of Education, 2010) identified more than one thousand empirical studies of online learning published from 1996 through July 2008. Meta-analysis is a technique that combines the results of multiple independent studies to obtain composite results.

Analysts for the U.S. Dept. of Education screened these published studies and identified 46 studies (with 51 effects) that could contribute to the meta-analysis. These studies included both online and hybrid method of instruction. The meta-analysis determined that, on average, students in online learning conditions (this means both online and hybrid) had slightly higher performance than those students who received only traditional face-to-face instruction. Furthermore, student performance was even slightly higher for those students who received hybrid instruction. Note that the meta-analysis included those studies involving higher education, i.e. K-12 studies were excluded.

Here is a partial summary of the results of the meta-analysis (pp. xiv - xv):

- *Students in online conditions performed modestly better, on average, than those*

learning the same material through traditional face-to-face instruction.

- *Instruction combining online and face-to-face elements had a larger advantage relative to purely face-to-face instruction than did purely online instruction.*
- *Most of the variations in the way in which different studies implemented online learning did not affect student learning outcomes significantly.*
- *The effectiveness of online learning approaches appears quite broad across different content and learner types.*

The interested reader can refer to the following individual studies: Keller compares student performance in accounting courses (Keller, 2009), Riffell in biology (Riffell, 2005), and Vernadakis in computer science courses (Vernadakis, 2011.) Keller found that student performance was not significantly associated with the type of class delivery (traditional or hybrid.) Riffell determine that performance on a post-course assessment test by students in the hybrid model was better or equivalent to the traditional course. The findings of Vernadakis indicate that the hybrid approach might be a superior option for students who are learning Microsoft Office PowerPoint 2003.

3. ABOUT GGC

GGC is called "the campus of tomorrow" because its mission is to be creative, experimental, and innovative. Faculty do not hold office hours; rather they are given smart phones and students call or text them at any time. Classes are limited to 26 students, and faculty is encouraged to learn their students' names and to be involved with each student's learning. Student engagement and the innovative use of educational technology are two of the fundamental tenants of the institution.

Unlike conventional institutions, some GGC policies challenge long-held practices in higher education. For example, GGC does not offer tenure to its faculty, which is considered to be one of the cornerstones of higher education. The college has four schools, but no departments, which promotes faculty collaboration across disciplines. Many of its policies and practices are evolving as the institution grapples with the exponential growth.

GGC serves a five-county area in the northeast metro Atlanta area. It is located in Gwinnett County, which is now a "minority majority" county, since the sum of the minority populations now constitute the majority. Most students are admitted as freshmen, which accounts for the largest student population (53%) followed by sophomores (20%) (Kaufman, 2011).

4. INFORMATION TECHNOLOGY 1001 – INTRODUCTION TO COMPUTING

The focus of this study is the course Information Technology 1001 (ITEC 1001), which is a traditional computer literacy class offered in the School of Science and Technology (SST). ITEC 1001 is a requirement for all students, and as previously mentioned, its class size is limited to 26. Therefore, we offer a large number of sections each semester, some of which are traditional face-to-face, and some of which are hybrid courses. The traditional class meets 4 hours per week, and the hybrid meets 2.5 hours per week, with the remainder covered by asynchronous online activities.

The course contains components common to those for most freshman-level computer literacy courses. Concepts such as hardware, application and system software, telecommunications, security, and legal/ethical issues are covered, along with the three MS office productivity applications, i.e. Word, Excel and PowerPoint (Kakish, 2010).

The course goals are as follows:

- G1) Understand the evolution of information technology and future trends.
- G2) Describe ethical issues surrounding the uses of digital information.
- G3) Understand the functionality and interaction among the main hardware components of a computer and appropriate terminology.
- G4) Acquire basic knowledge of computer security, protection mechanisms and privacy threats on the Internet.
- G5) Understand the role of computing tools in supporting collaborative projects.
- G6) Understand the principles of computer networking.
- G7) Understand the different types of application and systems software and their roles in computing.

- G8) Demonstrate proficiency in the use of various personal productivity software (Mundie, 2009).

The use of technology to teach the course is pervasive, i. e. Blackboard is utilized as the Course Management System, and MyITLab (Pearson Education) system supports learning and testing of the Office applications. The Center for Teaching Excellence provides support to faculty in designing and implementing creative learning activities and environment for the hybrid component of the course.

5. THE STUDY

Justification for Study

While there have been other studies regarding the effectiveness of the hybrid model (U.S. Department of Education, 2008), they may not apply to our institution due to the "open access" admission policy, the diversity of the student body, and the tremendous growth of the institution.

Based on verbal feedback, there are concerns among instructors and some administrators regarding student performance in the hybrid model (Napier, 2011). Clearly, there have been copious observations and assumptions linking the impact that hybrid teaching models have on the effectiveness of the multi-disciplinary freshman and sophomore level students, but research following a quantitative method (statistical analyses) approach is needed as evidence to the validity of such assumptions in our particular environment.

Two common complaints among students and instructors revolve around the uncertainties surrounding the outcome of the hybrid model, and the lack of student participation during the "hybrid session". The assumption commonly made by those instructors is that the hybrid model can play an equally effective role in maximizing the learning value, but the specific configuration of the hybrid model role remains questionable. Such conjectures can be misleading, and they may potentially cloud these issues.

Research Questions and Hypothesis

The question at hand deals with the extent to which teaching the hybrid model of ITEC-1001 is as effective as the traditional model, based on

student performance. The research hypothesis for this study is:

"The performance of students in ITEC-1001 hybrid model is not equivalent to the performance of students in the traditional model."

The null hypothesis is then:

"The performance of students in ITEC-1001 hybrid model is equivalent to the performance of students in the traditional model."

Methodology

Data was obtained from the ITEC 1001 common assessment exam, given to 1,680 students across 48 sections during the Fall of 2010 and Spring of 2011 (Heinz, 2010, 2011). This is approximately 95% of all students who were enrolled in the course during this time frame. The exam directly measures student performance in each of the 8 course goals listed in Section 3. The first seven of those goals (G1 – G7) deal with computer concepts, and are assessed by multiple choice questions given on the common assessment exam.

Goal 8 (Microsoft Office applications) is assessed by hands-on assessments using MS Word, Excel and PowerPoint. These assessments are standardized, i.e. all students take the same assessment in all sections, both hybrid and traditional.

At the end of each semester, faculty electronically submitted a course assessment report, which reported the mean for each goal on each section taught. The data was then entered into MS Excel where it was evaluated using the statistical analysis functions.

Analysis of the study

We took the means for each section (30 sections for Traditional, and 18 sections for Hybrid) and computed the mean scores, standard deviations, t-statistics, and p-values for traditional versus hybrid sections, with $n = 48$. The results for the concept-related goals (all except G8) are shown in Figure 1 (see appendix).

Examination of Figure 1 shows that the mean student performance in hybrid sections is greater than or equal to the mean of student performance in traditional sections for each of

the seven goals (G1 through G7). (G8 is measured separately as Word, Excel, and PowerPoint hands-on performance exams.)

The results of significance tests between the traditional and hybrid sections for the goals show that for goals G1 through G6, there is no significant difference in the performance of students in traditional or hybrid ITEC 1001 courses at GGC (statistically significant correlation at $p = .05$). Goal G7 shows that there is a significant difference in the means; however, it is actually the hybrid mean that is the greater of the two.

We then took the mean of the means for all of the seven goals, shown in Figure 2. This reveals that the overall average student performance is approximately 2.5 points higher in the hybrid sections than in the traditional sections. Based on this sample, the student performance is slightly higher for hybrid sections, as shown in Figure 2.

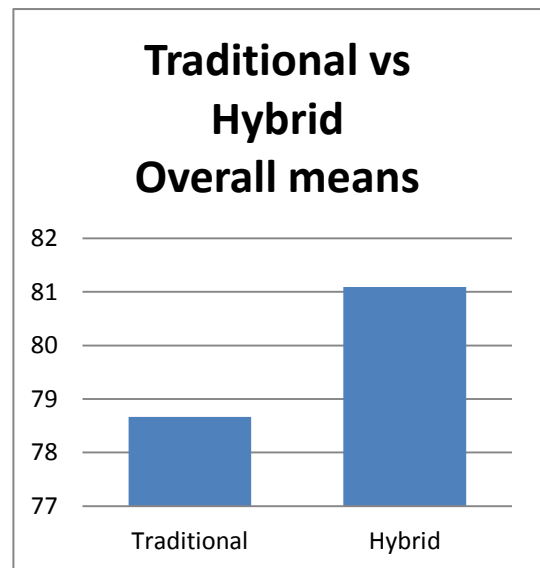


Figure 1. Comparison of Overall Student performance

Examination of the scores for Goal G8 (see appendix Figure 3) shows that student performance in Microsoft Office applications reveals comparable results. Based on the data, there is no significant difference among the means of traditional and hybrid students for each of the three applications - MS Word, PowerPoint and Excel.

6. CONCLUSIONS

The purpose of this study was to determine if students enrolled in the hybrid sections of ITEC 1001 were performing as well as students enrolled in the traditional (face-to-face) sections at our institution. To assess this question, we collected and analyzed student performance data for the eight course goals over two semesters (Fall 2010 and Spring 2011).

Based on the results of our findings, we have discovered that there is no significant difference between the performances of the two groups, with 95% level of confidence. In fact, the data shows that students in the hybrid sections perform slightly better than their counterparts in the traditional sections.

This is an important result to address the concerns of faculty and administration regarding the effectiveness of the hybrid model. The current trend at GGC has been to slightly reduce the number of hybrid sections of ITEC 1001 offered to students each semester. However, the results of the study show that the hybrid model is working effectively and we should look at reversing this trend.

ITEC 1001 is undergoing a major course redesign; therefore future work will include measuring the student performance before and after the course redesign. Other opportunities for Improvement will include a more specific analysis of the hybrid learning activities to determine which of these are most effective.

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Appendices and Annexures

Goal	Mean scores		Standard deviations		t-stat	p-value	Statistical Significance
	Trad	Hybrid	Trad	Hybrid			
G1	86.34	86.89	4.76	6.76	0.30	0.762	<i>ns</i>
G2	84.71	88.73	7.37	6.45	1.98	0.054	<i>ns</i>
G3	73.20	73.34	9.70	11.34	0.04	0.966	<i>ns</i>
G4	76.32	78.27	9.68	5.60	0.88	0.381	<i>ns</i>
G5	80.28	84.10	10.23	9.51	1.31	0.196	<i>ns</i>
G6	74.08	75.36	10.40	9.14	0.44	0.659	<i>ns</i>
G7	75.74	80.96	8.08	8.68	2.07	0.044	<i>s</i>

ns: non-significant p < 0.05

Figure 2. Results of Comparison of Student Performance for Individual Goals

	Mean scores		Standard deviations		t-stat	p-value	Statistical Significance
	Trad	Hybrid	Trad	Hybrid			
Word	90.2869	91.9825	9.214489	4.724554	0.840448	0.405005	<i>ns</i>
PPT	86.15103	88.71467	10.07802	7.157356	1.026971	0.309804	<i>ns</i>
Excel	86.97897	88.62688	7.852125	5.668909	0.840884	0.404763	<i>ns</i>

ns: non-significant p < 0.05

Figure 3. Comparison of Student Performance on MS Office Applications