

Can Online Courses Deliver In-class Results? A Comparison of Student Performance and Satisfaction in an Online versus a Face-to-face Introductory Sociology Course

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Abstract

This study uses a quasi-experimental design to assess differences in student performance and satisfaction across online and face-to-face (F2F) classroom settings. Data were collected from 368 students enrolled in three online and three F2F sections of an introductory-level sociology course. The instructor, course materials, and assessments were consistent between the two delivery formats. The investigators compare student satisfaction and student performance on midterm exams and an integrating data analysis assignment. Ordinary least squares regression is used to evaluate the effect of the different course settings, independent of a number of demographic and control variables. Results indicate that differences in student performance between the two settings may be accounted for by the presence of a selection effect and that student satisfaction does not significantly differ across the two settings. These findings are interpreted to mean that when online courses are designed using pedagogically sound practices, they may provide equally effective learning environments.

Keywords

online education, online pedagogy, distance learning, distance education

The prevalence of online education in institutions of higher learning is increasing rapidly (Means et al. 2009). As colleges and universities attempt to reconcile budget reductions and rising student enrollment, online courses offer a cost-effective alternative to the traditional classroom. Currently, nearly 30 percent of higher education students take at least one online course during their academic career, and online enrollment is increasing at a substantially faster rate than that of overall higher education (Allen and Seaman 2010). Consequentially, understanding the relative effectiveness of online learning environments is an issue of increasing importance and the subject of growing debate.

Despite this intensifying relevancy, online education has been relatively unmentioned in the pages of *Teaching Sociology*, outside of Clark-Ibáñez and Scott's (2008) thorough article on best practices for online teaching and a few other studies that examine particular online techniques and strategies (Jaffee 1997; Little, Titarenko, and Bergelson 2005; Pearson 2010). What is especially lacking is empirical

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work that examines the effectiveness of online courses relative to traditional face-to-face (F2F) classroom settings in the field of sociology.

The broader literature on the efficacy of online courses is expansive and divided. A large number of empirical comparisons between online and F2F courses find that online students perform as well as or better than F2F students (Russell 1999; Tucker 2001). Additionally, studies have shown that student satisfaction does not significantly differ across the two instructional mediums (Allen et al. 2002; York 2008), providing further support that online classes can be equally effective learning environments. However, many of the studies within this body of literature suffer from a range of methodological weaknesses, such as relying on small, nonrandom samples; failing to replicate findings; lacking demographic controls; and comparing courses with substantial differences in content, materials, instructors, and methods of evaluating student performance (Bernard et al. 2004; Jahng, Krug, and Zhang 2007; Means et al. 2009; Urtel 2008). Recent work that uses comparisons of larger samples and replicated courses demonstrates that F2F students score higher grades on identical assessments (Urtel 2008).

The current study addresses a number of the methodological shortcomings outlined above by using a quasi-experimental design that compares student performance and satisfaction between online and F2F sections of a course that was taught by one instructor over multiple terms with very little change in course materials and assessments. When the course was designed, deliberate effort was made to keep the two types of classes as similar as possible. By keeping the instructor, course material, and assessments relatively constant between the two sections, we eliminate a substantial amount of the variation that has weakened previous studies. Additionally, this study obtains a higher degree of external validity than the majority of prior studies by incorporating data from multiple sections of the same course offered over multiple terms. Most comparisons of online to F2F classes have relied upon smaller classes, typically only taught once, which leaves those findings of questionable generalizability. Furthermore, by collecting survey data from students, we are able to control for a wide range of potentially mitigating

factors and selection effects including demographics, academic background, experience and comfort with the online environment, and student learning preferences. We also use a more nuanced statistical analysis, as multivariate regression allows for greater elaboration of causal relationships than the analysis of variance and *t*-test analyses that dominate most comparisons of online and F2F courses. Finally, we are unaware of any previous study that has compared online to F2F instructional methods within a sociology course.¹ As course content may produce different results due to different pedagogical approaches and subject matter, it is important to explore the difference between the two formats, specifically pertaining to teaching sociology courses, rather than rely on comparative studies done within other fields.

In the section that follows we examine the debate surrounding the efficacy of online learning and then present a brief review of the literature on best practices within online education to provide a background for the rationale used in designing the course being studied. Following this we briefly describe the course and present our research method. After presenting our findings, we conclude with a discussion of the potential of online instruction and possibilities for making it a more effective teaching medium.

LITERATURE REVIEW

Debates on the Efficacy of Online Education

The online education literature is characterized by a debate on the effectiveness of online versus F2F classrooms. Empirical studies have both supported (McFarland and Hamilton 2005; Parkhurst et al. 2008; Russell 1999; Summers, Waigandt, and Whittaker 2005; Tucker 2001) and refuted (Logan, Augustyniak, and Rees 2002; Urtel 2008) the ability of online courses to provide a learning experience that is equal to that of an F2F classroom.² Meta-analyses performed on the literature as a whole tend to find a lack of significant difference between the two types of classes, but this is often a reflection of an even divide in the literature between studies that find F2F classes outperforming online courses and those that find the opposite

(Allen et al. 2004; Bernard et al. 2004; Jahng et al. 2007; Sitzmann et al. 2006). The arguments surrounding this debate can largely be grouped into two broad categories. On one hand, some argue that the online environment can be an equal or superior medium for education due to its flexibility and student-centered approach (Logan et al. 2002; Russell 1999; Summers et al. 2005; York 2008). On the other hand, others argue that online classrooms have yet to be proven an effective teaching medium and that there is substantial basis for doubt due to online education's "McDonalidized" (Ritzer 2004) nature and the distance that it imposes between students and their instructors as well as students and their peers (Parkhurst et al. 2008; Urtel 2008).

One of the earliest and most significant publications that falls into the first category is Russell's (1999) *The No Significant Difference Phenomenon*. Although looking at a broader range of non-traditional classroom settings than just online courses, this seminal study found that when technology is appropriately and practically applied, it does not necessarily denigrate instruction. Russell's (1999) argument is that the amount of learning that occurs in a course is independent of the instructional medium or the technology involved and instead depends on the pedagogical practices used. Effective teaching can occur in any classroom setting where both students and teachers are invested in the learning process.

The online environment does offer distinct opportunities for flexible, student-centered learning. Within online courses, students are required to take responsibility for their own education and are forced to be proactive in the learning process (Logan et al. 2002). Without an instructor present to provide pace, order, and focus, students must self-regulate their work and assume greater accountability for the learning process. Additionally, the lack of a professor who is immediately available to respond to questions about the material can prompt students to discover answers on their own, a process that usually reinforces knowledge more strongly (Atkinson and Hunt 2008). Essentially, students must participate directly in the construction of knowledge and cannot rely on passive, "instructivist" pedagogy (Summers et al. 2005:236). Although such student-centered, active

learning is certainly possible and does occur in well-designed F2F courses, the remote nature of online education creates a structural impetus for this style of learning that is not automatically present in F2F classrooms.

The online environment can also provide a more comfortable venue for participation among students who are shy or lack confidence and who may be intimidated by the public setting of an F2F classroom (Clark-Ibáñez and Scott 2008). Additionally, online courses provide great flexibility and access to multiple instructional methods that may not be available in the traditional classroom (Sitzmann et al. 2006). Within the online environment, particularly within courses that are structured around an asynchronous design, students have the ability to learn at their own pace, go back and reread or review portions of lectures they found challenging, take breaks when they are tired, and work at times most conducive to their own learning (York 2008).

Within the second category of arguments, numerous doubts and questions have been raised as to the efficacy of the online environment as an instructional medium. Some have argued that the increased prevalence of online learning in higher education represents a "McDonaldization" of the learning process, where standardized courses built around generic content and multiple choice exams are replacing distinctive classes taught by specialized faculty (Ritzer 2004:155). Many of these doubts center on concerns that online classrooms cannot fully replicate the interaction that occurs within the F2F classroom, which is vital to the learning process (Rovai and Barnum 2003). Students learn far more in courses than direct content, and in an online environment they do not have the same opportunities for spontaneous, open discussion with their instructors and peers (Bok 2003:89). Although online courses use a host of electronic forms of interaction (announcements, discussion boards, e-mail, etc.), some scholars argue that these are not comparable to a real-time, in-person discussion (Summers et al. 2005:246).

If online courses are inherently lacking in their ability to provide interaction, then they are at a serious disadvantage in creating an effective learning environment. This lack of F2F interaction can also create impressions of isolation and alienation

among students (Gallager and McCormick 1999; McIsaac et al. 1999). Additionally, the content of discussions can differ between online and F2F classrooms, as some studies have shown that students in F2F classes tend to ask far more technical and logistical questions during discussions, whereas online students voice more content-based questions (Logan et al. 2002). These different discussions may be granting students in the F2F classes a clearer understanding of requirements and instructions. The differences in understanding may account for observations of lower student satisfaction in online courses, as students can feel that the instructor's explanations, concern toward students, and interest in student learning all suffer in the online environment (Summers et al. 2005). Finally, online courses tend to rely more exclusively upon self-regulated learning, and not all students are sufficiently proficient in the skills necessary to succeed in such an environment. Students who are not comfortable with learning-centered experiences may be at a disadvantage in an online classroom.

Studies on both sides of the argument about the efficacy of the online classroom generally use similar strategies to operationalize successful learning. The majority of such research relies on student performance on standard evaluations (Logan et al. 2002; Olson 2002; Summers et al. 2005) and final course grades (McFarland and Hamilton 2005; Urtel 2008; York 2008). Obviously, a wide range of variance exists within the different types of evaluations, exams, questions, and grading rubrics used by the various instructors in the different courses. Additionally, the efficacy of exams and course grades in measuring successful student learning is far from certain, as different evaluations vary in their ability to capture authentic learning (Lombardi 2008). However, they are the most universal and easily accessible indicators and often provide reliable information on how well students are achieving course objectives (Suskie 2004).

Student satisfaction is another widely used indicator of successful learning (McFarland and Hamilton 2005; Parkhurst et al. 2008; Summers et al. 2005; York 2008). This operationalization relies upon the argument that when students report their satisfaction with a course, they are assessing the quality of their learning experience (Piccoli, Ahmad, and Ives 2001). A high level of student

satisfaction can be an indicator of timely and substantive interaction between students and their instructor and it may also indicate that the teaching methods being used strongly reflect learning goals and student expectations (Moore 2005). Additionally, student satisfaction can influence student motivation and attitude, both of which may strongly influence how well students learn in a course (McFarland and Hamilton 2005). As with student performance, the link between student satisfaction and successful learning is debatable, as students may report higher satisfaction with courses that they perceive as easy, fun, or less demanding, none of which are necessarily linked to successful learning. Still, sufficient reason exists to expect that student satisfaction may be higher in classrooms where successful learning is taking place.

Best Practices in Online Education

Although online education is still a relatively recent and growing form of instruction, there is an emerging field of literature that describes (and debates) what teaching practices, strategies, and methods work best to promote student learning in online settings. Although the fundamental principles of quality pedagogy are constant across both online and F2F mediums (good teaching is always good teaching), translating those elements into the online environment presents a unique challenge. Although we discuss the following principles in terms of their importance to online education, it is worth noting that they are also applicable to hybrid courses that use online elements in conjunction with traditional teaching methods.

The most ubiquitous principle that underlies discussions of online teaching practices is that quality online courses must incorporate a substantial amount of interaction, both among the students and between the students and the instructor (Clark-Ibáñez and Scott 2008; Sumner 2000). Interaction in the online environment consists of a wide range of text-based exchanges which, although limited in comparison to in-person conversations, allow for a broad interchange of ideas, questions, and opinions. The level of interaction has been shown to be a predictor of perceived learning in online courses (Rovai and Barnum 2003). Interaction is essential

to the learning process, and incorporating it into the online classroom is one of the primary challenges in designing an effective course (Brooks 1997). Interaction and discussion among peers promote critical thinking and force students to engage with course material at higher levels of learning. Through interaction among students, learning occurs in the social realm where students can benefit from one another's insights and essentially teach each other, learning both as the instructor and as the instructed. Additionally, interaction between students and the instructor is essential for providing feedback and encouragement as well as clarifying instructions, due dates, and expectations, which is most essential for students who have experienced most of their education in traditional classroom settings (Jaffee 1997). Interaction in an online classroom can be fostered through a number of devices, including discussion boards, chat rooms, course announcements, online blogs, and standard e-mail.

One learning device that has been shown to promote interaction in online courses is the use of asynchronous learning networks (ALNs), a term that denotes online classrooms through which students interact with one another and their instructors but at times of their own choosing (Jaffee 1997; Moore 2005). ALNs create opportunities for interaction while preserving the flexibility of time and place that is such an essential component of online education. ALNs are a marked improvement over correspondence-course styles of online instruction, where information is presented in a static form and students are expected entirely to teach themselves. Through the use of computer-mediated activities such as threaded discussions, progressive writing assignments, or group wikis, students can take part in active, collaborative learning that promotes engagement with the course material at higher levels of learning (Jaffee 1997). The meta-analysis conducted by Bernard et al. (2004) found that when online courses relied on synchronous networks (live chats, streamed lectures, etc.) in which students had to adhere to a rigid schedule, F2F classes performed better. However, online courses that used an asynchronous design outperformed the F2F classes. Thus, the use of ALNs is a vital component to a successful online course design.

The effectiveness of the learning environment created within the context of an online course is also highly influenced by course structure. A clear course design and layout are essential elements of an effective online learning environment (Clark-Ibáñez and Scott 2008). As online learning is new to many students, understanding expectations, requirements, and how to access course materials can often be a challenge. A clear and simple course organization can help students overcome that challenge (Ko and Rossen 2008). Students within online courses have indicated a preference for well-organized content and coursework (Tucker 2001). It can also be very helpful to give students some level of "frontloading" in the form of an introductory letter or e-mail that communicates to students some of the differences between online and F2F courses and strategies for being successful in the online environment (Clark-Ibáñez and Scott 2008).

Finally, successful online courses should be designed around strong pedagogical standards rather than new, complicated modes of delivery. Students have repeatedly stated a greater concern for solid teaching over "bells and whistles" (Clark-Ibáñez and Scott 2008:37). When educators adopt curriculum to fit the technology, rather than choose the technology that fits the curriculum, the instructional pedagogy suffers (Bennett and Green 2001). Although the judicious use of technology can certainly enhance the learning process, abuse of multimedia elements can distract and detract from actual content and learning. Students in online courses have reported that they did not enjoy listening to lectures, tapes, and speeches (Tucker 2001). Additionally, the inclusion of more media in online courses does not appear to affect the amount that students learn (Means et al. 2009) and actually lowers student satisfaction levels (Allen et al. 2002). Rather than design an online course around the teaching tools that are available, designers should make course goals and student learning outcomes the foci of a successful online course. Student expectations for learning in online courses should match those of F2F courses in both coverage and level of understanding. Although technology is a key element of a successful online course, its use should always be content driven.

In summary, the literature reports that a well-designed online course is one that stresses interaction and active participation, preferably through the use of ALNs to facilitate higher-level learning while maintaining student flexibility. Such a course should be structured in a clear and consistent manner, and the content and expectations of the course should be equal to those of an F2F class. The technology and media that are used should be content driven and not included for the sake of providing “flash” to the course. Through these practices, an online course can use an active and engaged pedagogy that promotes learning in any medium.

Hypotheses

This study tests whether student performance and satisfaction intrinsically differ across online and F2F classroom settings, independent of student characteristics. Drawing from the arguments above that distance education can be an equally effective teaching format (Logan et al. 2002; Russell 1999; Summers et al. 2005; York 2008), we hypothesize that when an online section of a course is designed around best practices and various measures of student aptitude and background are controlled for, the following will hold true:

- H1: There will be no significant difference between online and F2F students' performance on course exams.
- H2: There will be no significant difference between online and F2F students' performance on the integrating data analysis assignment.
- H3: There will be no significant difference between online and F2F students' satisfaction levels.

METHODS

Course Design

This quasi-experiment was conducted within an undergraduate, dual-listed anthropology/sociology course³ offered at a large urban university in North Carolina. The study qualifies as a quasi-experiment due to our inability to randomly assign or match students to the different study groups (i.e., classes).

As an introductory level course, it was open to all students, possessed no prerequisites, and fulfilled one of the university's general education requirements. The course drew material from both anthropology and sociology and was generally taken by a diverse range of majors. It was a popular course and was regularly filled to capacity. Course subject matter dealt with the role of technology in societies throughout history and in processes of societal change. The course objectives included students demonstrating the extent to which they increased their understanding and mastery of: (1) processes of social and cultural change, (2) basic sociological and anthropological concepts, (3) the social impacts of technological innovation, (4) the role of technology in producing and/or addressing social problems, (5) the unequal distribution of the benefits of technology, and (6) how innovations in communications technology have affected social interaction.

Student success in achieving these goals was primarily assessed through three unit exams and an integrating data analysis (IDA) assignment (see Hilal and Redlin 2004 for a discussion). The exams consisted of a range of multiple choice, short answer, and essay questions that were designed to measure how well students were mastering the content of that particular unit and meeting the overall learning goals for the course. By using questions that required students to apply course concepts, we were able to measure directly our second course goal. We also included a number of questions asking about specific historical examples of technological innovation or requiring that students provide their own, which enabled us to assess how well students were meeting the first and third course goals. The essay questions were particularly designed to evaluate students' higher-level learning. By structuring them around different social problems, historical and contemporary examples, and different course theories, we were able to analyze how well students were meeting all of the course goals. The IDA assignment was a part of the second unit and required students to find various national-level indicators of development, well-being, and technological advancement and analyze those statistics using course content. Students had to discuss both the social impacts of technological innovation and the

unequal distribution of the benefits of technology. Thus, this assignment directly measured how well students were meeting the third and fifth learning goals. These evaluations are certainly limited instruments for capturing how well students were meeting all of the learning objectives for the course, but as a whole they provided a solid indication of how successfully students were learning.

The data used in this study were drawn from six sections of the course that were taught over three consecutive terms (spring, summer, and fall) in 2010. The course was offered as an online section for all three terms and as an F2F section once in the spring term and twice in the fall term. Both types of sections were capped at 80 students, and class sizes ranged from 68 to 79. Within the three F2F sections there were a total of 231 students, whereas the three online sections contained 212. All sections were taught by the same instructor (one of the co-authors) and largely covered the same course material. Given that the majority of the principles outlined above for best practices within online education (interaction, clear organization and structure, and a focus on content over delivery method) are reflective of best practice in education as a whole, the online and F2F versions of this course were purposely designed to be as similar as possible. Some minor refinements were made from term to term, but the books, supplemental readings, and section topics were largely consistent throughout. During the terms in which online and F2F sections were being taught simultaneously, both types of classes were built around identical learning goals and outcomes, covered the exact same content, used the same readings, and were held to identical standards in terms of level of understanding. Both types of courses were taught using the same learning management system (LMS).⁴ Evaluations for both types of classes were administered online through the LMS, allowing all students to take their exams at a location of their own choosing. Students could access their exams at any point within an approximate four-day window. Therefore, both the F2F and online sections took their exams and completed their IDA assignments under identical conditions.

Again, during the terms in which online and F2F sections were being taught simultaneously, both types of classes took the exact same exams

and completed identical IDA assignments, all of which were evaluated using the same grading rubrics. Over the three terms that this course was offered, the instructor made several minor alterations to the material covered in the first and third unit exams but essentially kept the second unit of the course intact. As the exams for the second unit and the IDA assignment that was a part of that unit were mostly consistent across all three terms, they provide the basis for evaluating student performance in this study.⁵

The two types of courses primarily differed in the mode, timing, and location of course lectures and discussions. The F2F sections used standard in-class lectures and unstructured discussions two to three times a week in a university classroom. Although the F2F sections could be qualified as "hybrid" sections due to their use of some online teaching elements (e-mail correspondence, online assessments, and distribution of readings through the LMS), we characterize them as F2F due to their reliance upon traditional teaching methods as the primary mode of delivering information. For the online sections, the content and discussions were entirely housed on the LMS. The material was clearly organized into weekly lessons that mirrored the F2F schedule. The presentation of material in the online sections relied on weekly PowerPoint lecture slideshows and asynchronous, threaded discussion boards structured around specific prompts. These discussion boards were a forum for interaction among students (students were required to comment on each other's posts) as well as interaction with the instructor, as the instructor participated in the discussions, provided feedback on students' posts, posed further questions, and graded the content of students' posts. The discussion boards constituted an ALN, in that students were processing course material with one another but within a flexible schedule that allowed them to work at their own pace and at the times that were convenient for them. The online sections also generated interaction between the instructor and students through the use of regular announcements that were both posted on the LMS and e-mailed to students. These announcements served to clarify instructions and remind students of upcoming deadlines as well as provide broad feedback on the classes' performance and grasp of course concepts.

By constructing the online sections in this fashion, the instructor was able to make the online and F2F sections as similar as possible while designing the online sections according to pedagogically based teaching practices.

Data and General Procedure

This study was approved by the university's institutional review board (IRB# 1371-10). The data used were obtained from two sources: the instructor's records of students' grades on course assessments and student responses to a semi-anonymous online survey. At the end of each term, all sections of the course were sent an e-mail inviting them to participate in the study. The e-mail contained a link to an online survey that was constructed using CALS Survey Builder, a Web-based tool for creating online surveys. The survey required approximately ten minutes to complete and consisted of questions about students' living statuses, learning styles, experience with online education, access to the Internet, satisfaction with the instructor and course, and general demographics (see the appendix for select elements of the survey). To stimulate response, numerous reminder messages were sent to students stressing the importance of the study, and the survey was left open for an entire month. The response rates for the survey were 82.7 percent (overall), 79 percent (online), and 86 percent (F2F).⁶ This gave us a total sample size of 368 subjects (170 online, 198 F2F). Students provided informed consent on the survey and reported the last four digits of their student ID numbers. Those ID codes were used to link the survey results to students' grade records, after which all identifying information was deleted to preserve subject anonymity.

Measures

We drew a number of predictor variables from the survey, including the basic demographic indicators of *age* and *gender*. While exploring the difference in student performance and satisfaction between online and F2F settings, we controlled for a number of confounding factors that could potentially create differences between the two classes through a selection effect. To represent students' general

academic aptitude, we asked the participants to self-report their estimated *student GPA* on a 7-point scale ranging from 1.00-1.49 to 4.00 and above. To measure the amount of time students had available to devote toward this course, we had them self-report the number of *credit hours taken* during that term as well as the *hours worked per week* at any paying job. To control for basic university experience, we had participants report their *year in school*, which we collapsed into a dummy variable for senior versus nonsenior, as preliminary analysis revealed that this was the only distinction that affected student performance. Finally, in order to control for students' experiences with online learning, we had participants indicate the number of *online courses taken* prior to this semester.

In addition to controlling for potential selection effects among students, we measured student preferences for interaction with their peers and instructor. As the online version of this course was structured so heavily on providing interaction, student inclination toward this style of learning could have greatly influenced student performance and satisfaction. Therefore, we asked participants to indicate on a 5-point Likert scale (5 indicating *strongly agree* and 1 indicating *strongly disagree*) how much they enjoyed working with classmates (*like working with others*) and how much they felt that success in a classroom requires frequent interaction with the instructor (*instructor interaction*). Although these measures only capture student preference for interaction, and not the amount of interaction provided, examining the degree to which students with a high preference for interaction were satisfied with the course (one of our dependent variables) does give us an indirect indication of how successful the two types of sections were at providing an interactive learning environment.

For our dependent variables, we used students' scores (on a standard 0-100 percentile scale) on the *second exam* and *IDA assignment*, as these were the two evaluations that were virtually constant across all terms. The second unit exam consisted of a range of multiple choice, short answer, and essay questions that were designed to measure how well students were mastering the various learning objectives for that unit. The IDA assignment required students to research specific quantitative indicators of national development and technology

use and analyze those data using course concepts. For our third dependent variable we measured student satisfaction with the instructor and course, as it is a widely used parameter that may indicate the effectiveness of learning environments (Piccoli et al. 2001). We constructed an additive index measure of *student satisfaction* from a number of questions in our survey that required participants to evaluate both the course and the instructor. Exploratory factor analysis was used to test how well the separate questions reflected a common underlying dimension of student satisfaction. Principle axis factoring revealed that the six items characterize a single factor with a Cronbach's alpha of .865, which strongly supports the validity of the index. The factor loadings for the individual variables ranged from .620 to .836, which is sufficiently high to justify merging them in a single index (Hair et al. 1998).

Analysis

The analysis of our data was performed using ordinary least squares (OLS) regression. As we were analyzing the effect of the type of classroom (e.g., F2F vs. online) on student performance and satisfaction, net of the control variables described above, OLS regression provided a parsimonious tool that allowed us to fully elaborate the causal relationships of interest. Our basic experimental design for all of our dependent variables was to begin with a zero-order model that simply shows the difference between the F2F and the online students (*course type*) and then sequentially introduce our control variables in subsequent models to examine how this alters the influence of the type of course. Our fifth model was fully saturated, containing all of our variables. This experimental design allowed us to see how controlling for various factors may "explain away" any initially perceived difference between F2F and online students and expose potential selection effects that may be at work (such as stronger students being more prone to take F2F courses than online versions).

RESULTS

Table 1 presents the univariate statistics for the variables tested. These basic descriptive statistics

reveal substantial differences between the populations of the two types of classes. Students in the F2F sections of the course generally had higher GPAs and were enrolled in more credit hours than students in the online sections. Students in the online sections tended to be older, to have taken more online courses, and to work more hours during the week. Mean comparisons of the dependent variables show that students in the F2F sections of the course performed better on both assessments than students in the online sections and that student satisfaction did not differ significantly between the different types of courses. These initial univariate comparisons replicate the basic findings of Urtel (2008) and Logan et al. (2002), where in a simple comparison without any controls, F2F students appear to perform better than online students on course assessments. This serves as our starting point for further analysis.

Table 2 contains the results for our first hypothesis, that there will be no significant difference between online and F2F students' performances on course exams. Overall, the regression findings support the tested hypothesis and reveal a potential selection effect that may account for the observed difference in student performance between the two types of classes. In Model 1 there is a negative zero-order effect, as was shown in the univariate statistics, where online students perform significantly worse on the second exam than F2F students. However, once our control variable for student GPA is introduced, this effect is eliminated, indicating a potential selection effect among students taking the two different types of courses. As shown in Table 1, students taking the online versions of the course tend to have a significantly lower GPA than students taking the F2F course. Once included as a predictor variable, student GPA has a positive, significant influence on student performance across all models. This suggests a selection effect, where academically stronger students are gravitating toward the F2F sections of a course and performing better on the exam, creating a corresponding difference in student performance between the two types of classes.

The additional control variables in our analysis of student performance on the midterm are largely insignificant. *Year in school*, *online courses taken*, *like working with others*, *gender*, *credit hours taken*,

Table 1. Descriptive Statistics for Variables in Analysis by Type of Course

		Face-to-Face Classes (n = 198)		Online Classes (n = 170)		Difference in Means
	Range	M	SD	M	SD	
Independent variables						
Student GPA ^a	5	4.75	1.044	4.37	1.084	0.386***
Year in school (senior)	1.00	0.500	0.501	0.577	0.496	−0.077
Online courses taken	10	0.98	1.400	2.22	2.355	−1.238***
Like working with others	4	3.12	1.081	3.11	1.110	0.010
Instructor interaction	4	3.61	1.044	3.72	0.966	−0.105
Gender (male)	1	0.56	0.498	0.55	0.499	0.003
Age	22/16	21.38	3.005	22.63	3.903	−1.251***
Credit hours taken	22/16	14.95	2.282	10.59	4.771	4.365***
Hours worked per week	3.00	1.52	0.804	2.14	1.098	−0.620***
Dependent variables						
Second exam	40/63	81.88	7.565	78.94	10.246	2.940**
IDA	46.5/62.5	87.53	7.615	84.99	10.179	2.540**
Student satisfaction	23/12	25.30	3.652	25.24	3.230	0.060

Note: A t-test for equality of means was used to determine the significance of the difference in means across course type for the independent variables. The Mann-Whitney *U* test (nonparametric test of differences in mean scores) was used for the dependent variables.

^aStudent GPA is self-reported on a 7-item scale, not the standard 4.0 scale (see Methods for details).

* $p < .05$. ** $p < .01$. *** $p < .001$, using a two-tailed t-test.

and *hours worked per week* all show no significant influence on student performance on the second exam.⁷ Additionally, the inclusion of these variables does not affect the predictive power of *student GPA* or the absence of a significant effect for *course type*, indicating that they are not a part of any selection effect. The *instructor interaction* variable does show a significant negative effect on student performance on the midterm in the saturated model, indicating that the more important students think that interacting with their instructor is, the worse they tend to do on the exam. *Instructor interaction* does not differ between the two types of courses (see Table 1) and its inclusion does not affect the impact of *course type* or *student GPA*, indicating that this effect holds true for both types of students and that this variable does not play a role in the potential selection effect.

In examining the adjusted *R*-square values for our models, we are not overly concerned with the total amount of variance explained, as the focus of this paper is not on explaining student performance but rather is on understanding the impact of course type on that performance. Therefore, the relatively

low *R*-square values are not of concern. What is revealing, however, is the pattern of *R*-square values that we see among the different models. In Model 1, when we only examine *course type*, we see that although it is a significant predictor of student performance, it explains very little of the variation within that outcome (2.4 percent). When *student GPA* is included in subsequent models, the amount of variation explained jumps up to 21 to 22 percent. This lends further support to the presence of a selection effect, where student aptitude is the most important predictor of student performance, and it is only the increased presence of stronger students in the F2F sections of the course that creates the appearance of the online classroom being a less effective learning environment.

Table 3 contains the results for our second hypothesis, that there will be no significant difference between online and F2F students' performance on the IDA assignment. Once again, the results largely support our hypothesis and point to a potential selection effect at work. In Model 1, course type shows a significant negative zero-order effect on student performance, again replicating the

Table 2. Ordinary Least Squares (OLS) Regression Models Predicting Second Exam

Independent and Control Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Course type (online)	-2.944** (0.931)	-1.446 (0.848)	-1.105 (0.881)	-1.009 (0.875)	-1.549 (0.995)
Student GPA		3.741*** (0.391)	3.669*** (0.394)	3.547*** (0.393)	3.532*** (0.395)
Year in school (senior)		0.634 (0.834)	0.789 (0.840)	0.727 (0.835)	0.694 (0.845)
Online courses taken			-0.309 (0.222)	-0.369 (0.221)	-0.405 (0.223)
Like working with others				-0.635 (0.398)	-0.579 (0.400)
Instructor interaction				-0.794 (0.428)	-0.890* (0.433)
Gender (male)					-0.950 (0.839)
Credit hours taken					-0.104 (0.122)
Hours worked per week					0.227 (0.471)
Intercept	1.884*** (0.633)	63.788*** (1.984)	64.356*** (2.022)	69.870*** (2.768)	71.902*** (3.633)
Adjusted R ²	.024	.216	.217	.232	.231

* $p < .05$. ** $p < .01$. *** $p < .001$, using a two-tailed t -test. Unstandardized coefficients reported with standard errors in parentheses.

initial difference shown in Table 1. Once student GPA is introduced, however, that effect is eliminated, lending support to the possibility of a selection effect. As the impact of student GPA is both positive and significant, students with higher GPAs tend to perform better on the IDA assignment, and the increased prevalence of those stronger students in the F2F sections may account for those sections performing better on the assignment. None of the other control variables introduced in this analysis yield a significant effect on student performance or substantially alter the effects of course type and student GPA, indicating that those factors are not part of any selection effect. We see a similar pattern among the adjusted R -square values for this analysis as we did with the second unit exam, which provides further support to the presence of a selection effect. With just course type included, only 1.7 percent of the variation in student performance is explained. Once student GPA is included, the percentage increases to approximately 13 percent for all subsequent models.

Table 4 contains the results for our third hypothesis, that there will be no significant difference between online and F2F students' satisfaction with their course. The results support our hypothesis, as there is no observed influence of course type on student satisfaction in any of the models. There is also no evidence of any selection effect at work, as the insignificant effects of course type stay constant across all of the models. Of interest in this table are the results of our two variables that measure student learning preferences, *like working with others* and *instructor interaction*. These variables measure students' preferences for interacting with their classmates and their instructor, respectively. Both show a significant, positive impact on student satisfaction, indicating that students who prefer an interactive mode of learning are more likely to be satisfied with the course. As neither student preferences for interaction nor student satisfaction significantly differ across the two types of classes (see Table 1), it appears that both types of courses were successful in adequately meeting students'

Table 3. Ordinary Least Squares (OLS) Regression Models Predicting Integrated Data Analysis Assignment

Independent and Control Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Course type (online)	-2.546** (0.930)	-1.397 (0.891)	-1.140 (0.928)	-1.137 (0.931)	-1.750 (1.056)
Student GPA		2.973*** (0.411)	2.919*** (0.415)	2.893*** (0.418)	2.953*** (0.419)
Year in school (senior)		-0.064 (0.877)	0.053 (0.884)	0.067 (0.889)	-0.145 (0.896)
Online courses taken			-0.233 (0.234)	-0.250 (0.236)	0.225 (0.237)
Like working with others				-0.261 (0.423)	-0.307 (0.424)
Instructor interaction				0.013 (0.456)	-0.003 (0.460)
Gender (male)					1.383 (0.891)
Credit hours taken					-0.193 (0.130)
Hours worked per week					-0.344 (0.500)
Intercept	87.534*** (0.632)	73.437*** (2.085)	73.864*** (2.129)	74.765*** (2.946)	77.394*** (3.856)
Adjusted R ²	.017	.136	.136	.132	.137

* $p < .05$. ** $p < .01$. *** $p < .001$, using a two-tailed t -test. Unstandardized coefficients reported with standard errors in parentheses.

wishes for an interactive learning environment. None of the other control variables included in this analysis demonstrate a significant effect on student satisfaction or substantially alter the effect of any other variables.

DISCUSSION AND CONCLUSIONS

This study examines the degree to which student attainment and satisfaction are influenced by course type (F2F versus online). It represents a significant improvement over prior studies by including data from one course that was offered in both settings over multiple terms. This course was always taught by the same instructor, and subject material and evaluations were largely held constant over the different terms and between the two types of sections. Through the use of multivariate regression techniques, we were able to explore the impact of the different classroom settings while

controlling for a number of other relevant variables representing student aptitude, learning preferences, and background.

The results of this study support arguments that online education can be an equally effective teaching format when the online course is designed using appropriate pedagogy. There was no significant difference in student satisfaction between the two different courses. The fact that students in both types of classes were equally satisfied supports the idea that the online sections of the course were successful in promoting effective student learning. Furthermore, students who enjoy working with others and view interaction with their instructor as important to learning tended to be more satisfied with the course, independent of the type of classroom they are in. Although our study did not directly measure the amount of interaction provided, these findings are consistent with both types of courses providing sufficient interaction for students who prefer this mode of learning. These results support the proposition

Table 4. Ordinary Least Squares (OLS) Regression Models Predicting Student Satisfaction

Independent and Control Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Course type (online)	−0.053 (0.362)	−0.129 (0.370)	−0.223 (0.385)	−0.305 (0.371)	−0.629 (0.421)
Student GPA		−0.156 (0.171)	−0.136 (0.172)	−0.040 (0.167)	−0.051 (0.167)
Year in school (senior)		−0.155 (0.364)	−0.197 (0.367)	−0.139 (0.354)	−0.154 (0.357)
Online courses taken			0.085 (0.097)	0.131 (0.094)	0.110 (0.094)
Like working with others				0.456** (0.169)	0.490** (0.169)
Instructor interaction				0.696*** (0.182)	0.639*** (0.183)
Gender (male)					−0.597 (0.355)
Credit hours taken					−0.066 (0.052)
Hours worked per week					0.103 (0.199)
Intercept	25.296*** (0.246)	26.115*** (0.865)	25.959*** (0.884)	21.492*** (1.175)	22.836*** (1.536)
Adjusted R ²	−.003	−.005	−.006	.067	.074

* $p < .05$. ** $p < .01$. *** $p < .001$, using a two-tailed t -test. Unstandardized coefficients reported with standard errors in parentheses.

that students equally desire interaction in both online and F2F settings and that a well-designed online course is capable of providing a sufficiently interactive learning environment.

In terms of student performance on course assessments, initial differences in student performance between the two types of class settings are potentially the result of a selection effect, where academically stronger students are more likely to be enrolled in the F2F sections of the course than the online sections. This effect may be partially due to a university policy that allows students on academic suspension, who are not permitted to take F2F courses, to enroll in online courses as a way of demonstrating that they are fit to be reinstated as full-time students. By definition, these students have lower prior academic performance than nonsuspended students and the policy that only allows them to enroll in online courses constitutes a fixed selection effect. The full extent to which this policy accounts for the observed differ-

ence in academic aptitude is unknown, which may limit the generalizability of these findings to universities and colleges with different rules. The increased presence of lower performing students in online sections may also be partially explained by student perceptions that online courses will be easier than F2F courses. This explanation is supported by studies that have found that students who *prefer* an online section tend to perform worse in the class, regardless of whether they take it in an online or F2F setting (Olson 2002). The perception that online courses are easier could have the dual effect of both attracting stronger and more committed students to F2F sections, where they assume they will find a more enriching learning environment, while simultaneously driving weaker, less dedicated students to the online sections, where they think they will encounter a reduced work load and lower expectations.

It is important to note that both student satisfaction and student performance are only proximate

measures of how successfully students are learning and may inadequately capture key differences in the quality of the learning experience between the two different types of classrooms. Future work that operationalizes learning in a more precise fashion should be able to examine this possibility. However, the manner in which student learning was evaluated is fairly consistent with standard assessment techniques (Suskie 2004), which gives our quasi-experiment a greater generalizability (external validity) than we would have had if we had used a more direct indicator of student success in achieving a particular learning goal. Most important for the arguments of this paper is not the accuracy of our measures of successful student learning but the consistency in those outcomes between the online and F2F sections of the course.

Overall, these findings support arguments that there is no inherent deficiency in the effectiveness of the online classroom. They furthermore cast significant doubt on a number of prior studies that, through failing to control for previous academic performance, have found the opposite to be true. Our results suggest that the conclusions of any comparison between online and F2F courses that fails to control for student aptitude should be called into question. Our results also highlight the need for further examination of which students are electing to take online classes and the reasons behind that decision. The students in our study who selected an online section of the course tended to be older, tended to have lower GPAs, tended to have greater experience with online courses, were more likely to be college seniors, were taking fewer credit hours, and were working a greater number of hours per week. These factors indicate a substantially different composition of the student population who take online courses compared with those who take F2F. Future research should examine these compositional differences more fully and explore the motivations behind students' preferences for different learning environments. Furthermore, with the possibility that the increased presence of stronger students in the F2F sections of the course is driven by the specific policies of the university where the study was conducted, there is a need to conduct similar studies at other universities with different policies.

The findings in this study also reinforce the utility of the best practices that were used while designing this course. Deliberate effort was made while designing the online version of the course to incorporate a high degree of interaction both between the students and the instructor and among the students themselves. Through the use of ALNs, primarily in the form of threaded discussion groups, students in the online sections had the opportunity to critically engage with course material, much as students would do in a discussion in a traditional classroom. The online sections of the course were also designed around the exact same content as the F2F sections, meaning the teaching tools were adapted to the content and not vice versa. Finally, great effort was made to keep the online courses' structure clear and consistent, with simple and effective instructions. The fact that students in the online sections were able to perform as well as those in the F2F sections (once GPA was controlled for) supports the use of pedagogically based teaching practices for online courses. Furthermore, it supports the argument that quality pedagogy leads to better learning outcomes, regardless of the medium through which a course is being taught. Many of the best practices that we used in designing the online version of this course would be suitable for use in creating hybrid classes that rely upon both traditional and online methods of instruction.

An interesting and unexpected finding in this study is the negative impact of *instructor interaction* on student performance on the second unit exam. This indicates that students who viewed interacting with their instructor as an important part of being successful in a course tended to do worse on the exam than students who did not. As this variable does not significantly differ across the two types of classrooms or substantially influence any of our main effects, this effect is likely present in both class settings. Although this finding is relatively tangential to our larger arguments, it still merits a brief discussion. One potential explanation is that academically weaker students are more reliant upon their instructors and require a higher degree of interaction with them. These would be students who tend to possess a lower ability to learn independently or to grasp expectations and instructions immediately. These students could possibly be both more likely

to seek interaction with their instructor and more likely to perform worse on exams. It is also possible that the exam is a less effective assessment tool for measuring the type of student learning that occurs through interaction. Regardless, what is relevant to our central arguments is that this finding is consistent with both online and F2F courses providing a satisfactory amount of interaction with the instructor.

Although this study represents a distinct methodological improvement over previous comparisons between online and F2F courses, there is room for further refinement and additional research. This analysis constitutes a quasi-experiment due to the fact that students could self-select into which of the two types of classes they preferred. Had we been able to randomly assign students to the online or F2F sections (see Olson 2002 and Piccoli et al. 2001), the possibility of a selection effect would have been eliminated and we would have been able to more directly observe the influence of the classroom setting. Obviously, there are numerous logistical challenges with such a design, and a true experiment of this fashion would fail to capture the differences that exist between the two distinct populations of students. As these dissimilarities appear to be what drives the differences in student performance, they should be understood better rather than minimized. Furthermore, this study's reliance upon self-reported GPA data could be improved upon through access to student records that included actual GPA data. Finally, although this study used data obtained from multiple sections offered over multiple terms, our arguments would be further enhanced by similar systematic analyses of other courses taught by instructors at different universities.

Online learning is a rapidly growing feature of higher education, and as it increases in both prevalence and importance, we as instructors and

scholars are increasingly obligated to understand its use and improve upon its implementation. As a new teaching medium, online education faces many of the same challenges that accompanied the introduction of the textbook, the chalkboard, and the computer to the classroom. Adjustments to teaching strategies and methods are necessary to use new educational tools effectively, and increased research and discussion of the strategies and methods associated with online learning are required. Learning is a flexible and dynamic process that can be successfully accomplished across a wide range of settings, methods, and strategies. The quality of the learning experience is determined by the pedagogy used, not the medium through which the learning takes place. If designed properly, in a way that stresses interaction, clear structure, and strong content, online courses can offer a learning environment that is as equally effective and enjoyable as the traditional classroom.

APPENDIX

Select Elements of Student Survey: Evaluating the Influence of Individual Student Characteristics and Social Structural Factors on Academic Outcomes in Online Distance Education Courses versus Traditional Face-to-face Settings (To obtain a copy of the full survey, please contact corresponding author.)

Section B: Residential and Employment Status

B7. On the average, how many hours per week do you work for pay? _____ Hours per week

(continued)

APPENDIX (continued)

Section C: Student Self-Perceptions

Instructions: For the following questions, please indicate how much you agree or disagree with the following statements by circling the corresponding number. 5 = Strongly Agree, 4 = Agree, 3 = Neither Agree nor Disagree, 2 = Disagree, 1 = Strongly Disagree.

	Strongly Agree (5)	Agree (4)	Neither Agree nor Disagree (3)	Disagree (2)	Strongly Disagree (1)
C3. I usually get assignments done ahead of time.	5	4	3	2	1
C4. Feeling like I am part of a class is important to me.	5	4	3	2	1
C5. Classroom discussion (including online discussion boards) is helpful to me.	5	4	3	2	1
C6. I feel comfortable taking part in discussions in an actual classroom setting.	5	4	3	2	1
C7. I prefer figuring out the instructions for an assignment on my own without the instructor explaining them to me.	5	4	3	2	1
C8. I always read all of the assigned readings.	5	4	3	2	1
C9. I enjoy working with other classmates on projects or in study groups.	5	4	3	2	1
C10. I usually participate in study groups when they are available.	5	4	3	2	1
C11. Part of doing well in a course involves frequent interaction with the instructor.	5	4	3	2	1
C12. I usually read the online readings on the computer rather than printing them out.	5	4	3	2	1

Section E: Experience with Online Courses

(Please respond if you have *ever* taken an online distance education course, including this semester.)

E1. Prior to this semester, how many DE online courses have you taken? _____

(continued)

APPENDIX (continued)

Section F: Course/Instructor Evaluation

	Strongly Agree (5)	Agree (4)	Neither Agree or Disagree (3)	Disagree (2)	Strongly Disagree (1)
F1. The instructor presented course expectations very clearly.	5	4	3	2	1
F2. The instructor for the course provided prompt feedback on assignments.	5	4	3	2	1
F3. The instructor was actively involved in course discussions.	5	4	3	2	1
F4. The instructor made him/herself accessible to students.	5	4	3	2	1
F5. The interaction I had with my instructor was very helpful for me in understanding the course material.	5	4	3	2	1
F6. Instructions and due dates for assignments and exams were very clear.	5	4	3	2	1

Section G: Demographics

G1. Gender

1. Male
2. Female

G2. How old are you (actual age in years)? _____ years

G5. What is your year in school?

1. Freshman
2. Sophomore
3. Junior
4. Senior
5. Continuing education

G7. How many credit hours are you taking this semester (including courses you are auditing)?

_____ credit hours

G8. What is your current GPA (If unsure, please estimate)?

1. 1.00-1.49
2. 1.50-1.99
3. 2.00-2.49
4. 2.50-2.99
5. 3.00-3.49
6. 3.50-3.99
7. 4.00 or above

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NOTES

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1. Although this course drew from both anthropology and sociology (see Methods section), the instructor is a sociologist and the course heavily favored sociological materials and perspectives.
2. Much of the literature on the efficacy of online education dichotomizes all courses into one of two extremes (online vs. F2F). In actuality, many courses fall somewhere in between and can be characterized as "hybrid" courses due to their use of some manner of online learning strategy (e.g., e-mail correspondence, online distribution of materials, etc.). "True hybrid" courses incorporate online learning techniques into the structure of an F2F course to a substantial degree and can be viewed as a third, middle-ground type of course.
3. The course appears in the catalogue as both an anthropology and a sociology course. Although both classes meet together and the students are treated as a homogenous whole, technically half the students are enrolled in an anthropology course and half in a sociology course.
4. Learning management systems (LMSs) are Web-based software applications that are used to coordinate course materials and activities. Most LMSs possess features that allow for scheduling, posting readings and assignments, conducting discussion boards and live chats, running an online grade book, conducting online quizzes and assignment, and much more. Common LMSs include WebCT, BlackBoard, Desire2Learn, Angel, and Moodle.
5. In the online section taught during the summer term, some material was dropped. Accordingly, 5 of 25 multiple choice questions and one essay question were changed on the second unit exam.

6. A quick comparison between the grades of the students surveyed (our sample) and the overall grades for the course (our population) reveals no substantial differences, which supports our sample being an unbiased representation of the student population. Means for the second exam grades were 81.88 to 81.36 (sample to population) for the F2F students and 78.94 to 77.70 for the online students. Means for the IDA assignment were 87.53 to 87.35 for the F2F students and 84.99 to 84.25 for the online students.
7. Age was also initially tested as a control variable in all analyses but had to be dropped due to multicollinearity issues where it was measuring the same effects accounted for by other variables. Older students were more likely to be seniors in college, to be working more hours per week, to have experience with online education, and to be enrolled in the online section of the course. As further justification for its removal, age did not demonstrate a significant effect on any of the dependent variables in initial bivariate analysis.

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BIOS

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