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Large First-Year Course Re-Design to Promote Student Engagement and Student Learning

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Executive Summary

This paper presents the findings of a research study on a complete course re-design of a large first-year class, which changed the learning environment and reduced boundaries to allow for more meaningful student engagement and improved student learning. The specific purpose of this study was to determine if a blended course design can increase student engagement and influence students' approach to learning in a large first-year course.

During the fall semester of 2010, GPHY 101: Human Geography was taught at Queen's University as a traditional large lecture course of 438 students, with three lectures of 50 minutes per week (Model 1) for 12 weeks. In the following winter semester of 2011, the students in GPHY 101 were offered an intensive blended course (Model 2). In this new offering to 157 students, the lectures that were captured during the fall semester were made available for students to view online. Instead of attending actual large lectures, students were required to view the three weekly lectures on their own time prior to attending an interactive class of approximately 50 students for 90 minutes, once per week. In this weekly class with the professor, students were actively engaged in small-group problem solving, discussion, debate and other forms of cooperative learning activities.

In the fall semester of 2011, GPHY 101 was taught as a reduced resources blended course to 324 students (Model 3). This model used a similar approach to Model 2 but was developed to accommodate more students in the course and reduce the workload for both the students and instructor. Students were once again expected to watch recorded lectures online, although the number of lectures they were expected to watch was reduced to 25. Instead of gathering for weekly sessions of 90 minutes, students attended four small-group sessions of 60 students for three hours each during the course of the semester. During these sessions, students were once again actively engaged in small-group problem solving, discussion, debate, presentations and other forms of cooperative learning activities.

We assessed the impact of redesigning the structure, delivery and opportunities for engagement within a large class by comparing Model 1 (Traditional), Model 2 (Intensive Blended) and Model 3 (Reduced Resources Blended). This comparison included: (1) the level of student engagement in the classroom, measured using the Classroom Survey of Student Engagement (CLASSE); (2) students' approaches to learning, assessed using a study process questionnaire (R-SPQ-2F); and (3) students' perception of their experience in the course, determined through an online survey and focus groups after the completion of each model.

This study found that an intensive blended course design can have a positive impact on student engagement and students' approach to learning the course material. Students in the intensive blended course showed significant improvement on 25 of 38 CLASSE (Student) questions when compared to those in a traditional course design. These improvements in student engagement occurred in four of the benchmark categories similar to those used in the National Survey of Student Engagement (NSSE). The number of questions which showed significant improvements in levels of student engagement across four of the five NSSE benchmarks demonstrates the breadth of the transformation that occurred with this design. Students in the intensive blended course also displayed a significant change in their approach to learning. Scores on Biggs' Study Process Questionnaire were significantly higher for a deep approach to learning and significantly lower for a surface approach to learning when compared to scores of students in a traditional course design.

These findings were less evident for the reduced resources blended course design. Here, students reported a

lower level of satisfaction with the course and exhibited only slight improvements in student engagement as measured by CLASSE when compared to the traditional course design. Students also did not show any change in their approach to learning, as they scored at levels for surface approaches similar to the traditional lecture-based course. The most common student criticisms of the reduced resources blended course design related to the extent of the online components of the course, the unclear structure of the course and the integration of all components, the lack of interaction and the infrequency of face-to-face meetings.

Overall, it was clear that an intensive blended approach to course design can significantly impact levels of student engagement and can modify student approaches to learning when compared to a traditional course and a reduced resources blended course. However, it was also evident that such an approach presented students with a much more demanding workload and created challenges for instructors in delivering the course while managing their own and students' workload, TA support, traditional scheduling and room allocation. Such challenges would need to be addressed to make this approach sustainable and expand it to accommodate a greater number of students.

The findings of this study demonstrate that it is possible to re-think and re-design a large first-year course in such a way as to reduce obstacles to student engagement and improve students' approach to learning. Having students access lecture material online affords the opportunity for more interaction and more discussion during face-to-face class time. It takes advantage of students' ability to use such technologies and provides flexibility for all students, catering to their diverse needs and approaches to learning. This new course design very specifically targets the challenges of teaching large classes, which traditionally adopt a didactic style and can thus have difficulty in achieving meaningful student engagement and often create barriers to diverse perspectives and diverse learning styles.

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Introduction

First-Year Experience at Queen's University

Like most universities, Queen's struggles with balancing the push for an increased enrolment with the learning experience of students, especially those in their first year. First-year classes are among the largest in the institution, especially for core courses in the Faculty of Arts and Sciences where the smallest class size can be in the order of 250 students. As departmental resources are reduced, there is a push to increase the number of students per course while decreasing teaching assistant (TA) support and in some cases eliminating the small-group tutorials often associated with these courses. These realities can have a significant impact on the experience of first-year students.

The National Survey of Student Engagement (NSSE) has become a widely used tool for exploring institutional practices and student behaviours that are known to be associated with good learning outcomes. Institutions participating in the national administration of the NSSE receive a detailed analysis of the survey results, including customized reports on how first-year students respond to all survey items, statistical comparisons against peer group and national norms, and a comparison of institutional findings to the national benchmarks of effective educational practice. Queen's results on the NSSE have similarly illustrated these issues, with the lowest scores among first-year students occurring in the NSSE benchmarks of Student-Faculty Interaction (SFI) and Active and Collaborative Learning (ACL). In recent implementations of NSSE, Queen's scores below the mean for SFI when compared to other Ontario universities and other US doctoral-extensive universities, and well below the mean for ACL when compared to other US doctoral-extensive universities. The lowest scores have been obtained on questions about how frequently instructors work with students in class, how often students ask questions and discuss in class, and how often students make presentations in class. In general, the NSSE scores for first-year students corroborate concerns about class size, suggesting low levels of in-class activity and course-based faculty interaction with students.

In a study by Russell (2009) on students' perceptions of the quality of their learning, 470 first-year Queen's students expressed their concerns about the university's reliance on large didactic lectures in first year and the teaching and learning environment that it created. When asked how their first-year experience was different from what they expected, student comments included:

- "…attending Queen's has definitely depersonalized the learning experience."
- "You have to teach yourself, professors talk to you, they don't teach."
- "Lecture format provides rapid-fire knowledge without adequate time to fully absorb the knowledge."
- "Learning in first year at Queen's is like going to a presentation and listening to an expert talk about a subject…"
- "The course that I have struggled greatly in throughout the year is by far the largest class I have attended. It is huge and impersonal, and there is no opportunity for personalized help."
- "I thought there was going to be more interactive courses rather than mainly just lectures."

These comments demonstrate a concern among students with large first-year courses and highlight the need to change approach to a course delivery model that focuses on the student experience and supports a more meaningful learning environment. They also demonstrate that students recognize the issues with large first-year classes and can articulate the impact these have on their learning.

An Approach to Blended Learning

Blended learning has become popular in North America, both as a result of declining relative funding to the university sector and the increased availability of technology on our campuses. The assumption behind its popularity is that face-to-face instruction is both time-consuming and inefficient and can be replaced effectively with the strategic use of technology. Blended courses combine face-to-face interaction, such as in-class lectures and discussions, with web-based educational technologies, such as online course modules or resources, assignments, discussion boards and other web-assisted learning tools. The degree to which the design of a blended course utilizes traditional classroom and online learning environments varies and is largely dependent on a course's subject matter and overall approach (Albrecht, 2009; Dziuban et al., 2004). Furthermore, the extent to which this approach can benefit students and can address the concerns associated with growing class sizes in the face of declining resources is also highly dependent. Studies on blended learning models and the value of online learning have demonstrated that, given the proper support and environment, these approaches can benefit student learning and experience (Means et al., 2010).
One form of blended learning uses online resources to change the use of classroom time, allowing an instructor to spend more time interacting with students instead of lecturing. This is commonly made possible through the use of instructor-created videos that students view outside of class time. This approach to blended learning takes advantage of the students' ability and willingness to use technology. It requires them to be more actively engaged in their learning and to use technology independently to complete the online components and gain the required background knowledge necessary to participate in active learning during class, an approach to learning that has been shown to be effective (Springer et al., 1999; Mazur, 2009). A significant body of literature indicates that student engagement is highly correlated with positive learning outcomes when students are active participants in their education and when they interact with faculty and other students (Conway, 2010).

The use of online technologies allows students to approach and assimilate the material at their own pace and therefore frees up valuable contact hours for other activities. In the classroom, students apply the knowledge gained from the online lectures by solving problems and doing practical work. The role of the instructor during this time is to create the problems and direct the student rather than to deliver the initial lesson. This form of blended learning allows class time to be used for learning-based collaborative activities and can directly impact the level of student-faculty interaction and the type of learning that occurs. Engaging students in this way makes it more likely that students will learn. Recognizing the importance of structured practice time and time on task, a blended learning model with active learning opportunities uses face-to-face time for engagement and moves the transmission of course content online. In this way the instructor can focus the time together to understand, discuss and engage with the course material.

One of the keys to the blended learning model is not only the opportunity to facilitate learning activities, but also the opportunity to take large class sizes and create smaller interactive sessions. The valuable contact hours for the student and the instructor that would normally be used for lecture time can now be redistributed to allow for smaller group sessions. This can allow for more interaction, more immediate feedback and more effective teaching.

Research Objectives

The purpose of this study was to determine if a blended course design can improve student engagement and influence the students' approach to learning in a large first-year course. To answer these questions, two models of blended course design with varying levels of online and face-to-face components were developed and delivered in two separate course offerings of Geography 101: Human Geography (GPHY 101), a large first-year course. A comparison was then made between these two blended course designs and a traditional offering of GPHY 101.

It was expected that students who participated in the intensive blended course and the resource reduced blended model would report higher levels of engagement with the course material, feel more confident about their ability to complete the course, report a higher level of interaction with classmates about the course material and develop superior learning strategies than students in a traditional large lecture course.

Methods

Overview of Study Design

This study involved three successive offerings of the same course from the fall of 2010 until the fall of 2011. Geography 101: Human Geography is a core half-course within the geography department. It is a mandatory course for students who wish to major in geography and can be taken as an elective for students in other departments in the Faculty of Arts and Science, and often attracts students from commerce, engineering and nursing. For the purpose of this study the three separate iterations of the course were taught by the same instructor, with the same basic syllabus and approach to assessment, with some variations. Students who chose to take the course in either of the three iterations had little prior knowledge on how the course would be offered and were assigned to the course in a given term based on fit with their schedules.

In Phase 1, which took place during the fall semester of the 2010/11 academic year, Geography 101 was taught as a standard large lecture course of 438 students, with three lectures of 50 minutes per week for 12 weeks. All lectures were captured, uploaded and streamed online through the course's learning management system after the lecture was given, such that students could use them to supplement their in-class learning. Students were assessed based on a midterm, final exam and assignments during the term. In this course offering, students did not attend small group tutorials and the TA support for the course was for marking only. This course model, Model 1, was considered to represent a traditional approach to course design and formed the basis for comparison for the two experimental course designs.

Phase 2 of the study occurred during the next offering of the course in the following, winter semester of 2011. It is during this second offering of the course that a new course design was implemented. Students in this version of the course covered similar material to Model 1 but in an intensive blended format (Model 2). As this was an experimental design, the enrolment in the course was limited to 157 to decrease the risk and to explore the implementation of the new course elements. In this new offering, the lectures that were captured during the fall semester were made available for students to view online and replaced attendance at actual large lectures. Students watched a total of 30 online lectures during the 12-week term. In this model the number of online lectures required was reduced compared to Model 1 by combining some topics and eliminating others, such as the introductory and review sessions. Students were required to view the weekly lectures prior to attending an assigned 80-minute interactive class of approximately 50 students. In this weekly class with the professor, students were actively engaged in small-group problem solving, discussion, debate and other forms of cooperative learning activities. This course design and the activities chosen for the

small-group sessions were determined by the instructor based on a desire to cover the course material but also to increase student engagement and have more meaningful faculty-student interaction. The instructor facilitated all three weekly sections of the small-group sessions with the aid of one of four TAs for the course. In total, students participated in 11 weekly small-group sessions during the course of the term. These sessions did not occur at the beginning of the semester, during the heavy workload midterm period or at the end of the term. Students were assessed on what they did in preparation for the class and on in-class presentations during the small group sessions by peer evaluation, in addition to weekly in-class quizzes, a midterm and final exam. A comparison of this model with the traditional model is shown in Table 1.

Phase 3 occurred in the following academic year, in the Fall 2011 semester. During this phase, a resource reduced blended (Model 3) course design was used. This new blended course design was implemented in order to accommodate more students (324) with fewer resources, in the form of TA support per student, and to decrease the workload of the students and the time commitment of the instructor. In this design, students were only expected to watch 25 hours of lectures online over the course of the term and only met for four small-group sessions within the term. These four sessions were scheduled in succession during the middle of the term. Each small-group session lasted 170 minutes and was held with groups of approximately 60 students. The instructor, with the assistance of two TAs, facilitated two simultaneous sessions in rooms that were adjacent. These interactive sessions employed small-group activities designed by the instructor and similar to those used in Model 2 to facilitate active learning and improve student engagement. Students in this model completed weekly online quizzes, a midterm exam using clickers, peer evaluation during the small group sessions and a final exam. A comparison of this model with the traditional and intensive blended model is shown in Table 1.

Table 1: Summary of the Three Models Studied Highlighting the Component Differences and Similarities

	Class Size	Lectures	Hours of Lectures	Number of Students per Small Group Session	Number of Small Group Sessions	Total Student Time in Small Group Session	TA Support Student/TA Ratio	Quizzes	Use of Professor's Time
Model 1	438	In person	36 hours	N/A	None	0 hours	73	None	Lecturing
Model 2	157	Online	30 hours	50 students	11 per term (80 minutes each)	16 hours	39	In-class using clickers	Facilitating small groups, managing technology and TAs
Model 3	324	Online	25 hours	60 students (2 groups at the same time)	4 per term (170 minutes each)	12 hours	54	Online weekly	Facilitating small groups, managing technology and TAs

Data Collection

In order to reach our research objectives and to determine the effect of each of the three course models, information was collected at the completion of each phase. Data collection sources included an in-class clicker survey, an online survey, student focus groups and information from the records of the Student Data Warehouse. Ethics approval for all data sources and survey questions was granted by the University Research Ethics Board. Students were asked to participate in the study during the in-class clicker survey. After an explanation of the study and its components in the form of a letter of information, students could agree to participate in the study by answering yes to the first clicker question, which asked if they agreed to participate. A similar agreement to participate occurred before the online survey and focus groups.

Demographic Data

To determine the characteristics of the study population in each of the three course models, students were asked demographic questions as part of the in-class clicker survey. With student permission, further data were also pulled from the University Student Data Warehouse for those that agreed to participate. Demographic data included:

- Final mark in other first-year courses
- Gender
- Program of study
- Year of study
- Domestic or international student
- Full-/part-time status
- Disability
- OSAP funding
- Visible minority
- Live on campus
- Employment status while at university
- English as first language

Student Engagement in the Classroom

In order to evaluate student engagement, all students in the class were asked to complete the Classroom Survey of Student Engagement (CLASSE) using clickers during one of their final review classes. CLASSE is a version of the National Survey of Student Engagement (NSSE) that is appropriate for course-specific studies. NSSE measures institutional practices and student behaviours across numerous dimensions of the student experience that are known to be associated with positive learning outcomes. CLASSE was developed to evaluate the effects of classroom-based interventions on student engagement by examining a complex mix of factors related to course content and delivery, curriculum structure, personal relationships and the integration of academic and social experiences (Smallwood & Ouimet, 2009). CLASSE as a measure of course-level effects has been shown to be an effective measurement tool for those interventions able to use it

(Conway, 2010). CLASSE is comprised of 38 questions, which ask students to reflect upon their experience, their learning and their level of engagement in an individual course. Questions focus on how frequently they engage in various educational practices. Students are asked to self-report how often they engaged in an activity or behavior using an ordinal scale ranging from “never” to “more than 5 times” or “very often.”

Approaches to Learning

The Study Process Questionnaire (R-SPQ-2F) (Biggs, 2001), which measures approaches to learning in higher education, was administered using clickers in one of the final review classes towards the end of each phase. The instrument included 20 items in two subscales evaluating the uses of a surface approach or deep approach to learning. A surface strategy would occur when a learner memorizes facts and accepts information for the purpose of an exam; long-term retention and understanding is unlikely. A deep approach occurs when the learner analyses new information and ideas and links these to previous knowledge with the goal of long-term retention. In this survey, students respond to questions about their approach and motivation for learning by rating their level of agreement with each item on a five-point scale. In order to determine the level of each approach to learning that a student uses, a cumulative score for each strategy can then be calculated (see Appendix 1 for the instrument and scoring scheme).

Understanding Engagement, Student Learning and Student Experience

An online survey of open-ended questions and focus groups were held at the end of each phase of the study to gain a deeper understanding of the factors that impacted student engagement in the course, as well as their learning experience and their perceptions of the course model.

Open-ended questions in the online survey included:

- What was the most positive aspect of the way that GPHY 101 was offered?
- What was the most negative aspect of the way GPHY 101 was offered?
- What suggestions can you make to improve GPHY 101?

Focus group questions included:

- When you first heard about the new structure of GPHY 101, what did you expect?
- Why did you decide to sign up for the course?
- What did you find most challenging?
- How did the structure of 101 impact your learning?
- Did you establish friends/social networks in the class?
- Describe your experience in GPHY 101 in a word or two.

Data Analysis and Results

Number of Participants and Response Rates

The number of participants in each model of our study is shown below in Table 2. In all components of the study, for each of the three models, the response rate is consistent and high. Using the clicker in-class facilitated high response rates for our main survey components, giving us some confidence in our analysis and findings.

Table 2: Number of Participants and the Response Rates for the Three Models

	Model 1	**Model 2**	**Model 3**
Total enrolment	438	157	324
In-class clicker survey	N = 298 % enroll = 68	N = 126 % enroll= 80	N = 220 % enroll = 68
Online survey	N = 199 % enroll = 45	N = 82 % enroll = 52	N = 183 % enroll = 56
Focus groups	N = 15	N = 5	N= 12
Student Data Warehouse	N = 298	N = 126	N = 215

Demographics

Based on the demographic questions asked during the in-class clicker survey (Table 3) and the data pulled from the Student Data Warehouse (Table 4), the participants in our study appear to be similar across each of the three models. There was no evidence of self-selection in any one of the three course models. To further determine the effect of any one demographic variable on any changes that were seen in the CLASSE responses, and to reinforce that the populations were similar, a forced multivariate linear regression for design effect, using the demographic variables in which all independent variables were included regardless of whether or not they were statistically significant, was carried out. The results for this analysis are shown below. Based upon the results of this analysis, it was evident that no single demographic variable significantly contributed to the differences in the outcomes measured in our three models, thus eliminating the need for propensity matching of our subject populations for comparison.

Table 3: Demographic Data for the Three Models Collected from In-Class Clicker Surveys Expressed as %

Clicker Question	Model 1	Model 2	Model 3
Do you have a disability that affects your learning in this course?			
Yes	5.8	2.3	7.6
No	84.3	92.2	78.7
Unsure	9.7	5.5	13.8
Are you currently receiving funding from OSAP?			
Yes	32.5	29.4	27.6
No	67.5	70.6	72.4
Do you identify as a member of a visible minority?			
Yes	18.1	13.6	23.5
No	81.9	86.4	76.5
Are you employed while attending school?			
1-5 hours/week	8.9	7.9	5.8
6-10 hours/week	7.5	6.3	6.7
11-20 hours/week	4.6	8.7	8.0
20-37.5 hours/week	3.9	0	2.2
No	75.1	77.2	77.2
Do you live on campus (in residence)?			
Yes	49.8	65.1	55.6
No	50.2	34.9	44.4
Is English your first language?			
Yes	85.7	88.8	86.4
No	14.3	11.2	13.6

Table 4: Demographic Data for Each Model Collected from the Student Data Warehouse Expressed as %

Student Data Warehouse	Model 1	Model 2	Model 3
Gender:			
Male	38	33	32
Female	61	67	68
Year of study:			
1st	70	62	64
2nd	9	22	18
3rd	13	10	11
4th	7	6	7
Full-time	97	99	99
Part-time	2	1	1
Average in other first-year courses:			
Additional Course 1	72.6	70.6	76.3
Additional Course 2	72.0	68.2	78.0
Additional Course 3	72.9	71.1	78.6
Additional Course 4	73.4	70.9	77.4
Additional Course 5	73.7	73.2	75.5

CLASSE

CLASSE is an adaptation of NSSE that has been developed and authorized to examine student engagement at the classroom level. Classroom-level insights about the quality of student engagement can help identify engaging pedagogical practices and enhance teaching and learning. The responses from the 38 CLASSE questions were scored into ordinal means for analysis, as is the practice with NSSE questionnaires (see Table 5 for the means for each course model). Each question is scored on a five-point scale.

Table 5: CLASSE Questions and Mean Scores for each Model

Q#	Question	Model 1	Model 2	Model 3
1	Asked a question in class	1.15	2.11	1.68
2	Contributed to a class discussion that occurred in class	1.08	3.03	2.41
3	Prepared two or more drafts of a paper or assignment before turning it in	1.57	1.64	1.40
4	Worked on a paper or project that required integrating ideas or information from various sources	2.02	3.77	2.92
5	Included diverse perspectives in class discussions or writing assignment	1.78	3.2	2.15
6	Came to class without having completed readings or assignments	3.48	2.32	1.93
7	Worked with other students on projects during class	1.24	3.99	3.12
8	Worked with a classmate outside of class to prepare class assignments	1.47	1.50	2.42
9	Put together ideas or concepts from different courses when completing assignments or during class discussions	1.82	2.58	2.00
10	Tutored or taught other students in your class	1.28	1.73	1.38
11	Used electronic medium to discuss or complete an assignment	1.96	2.90	3.07
12	Used email to communicate with the instructor	1.74	2.11	1.87
13	Discussed grades or assignments with the instructor	1.41	1.68	1.47
14	Discussed ideas from your course with others outside of class	2.46	2.37	2.25
15	Made a class presentation	1.04	3.97	3.86
16	Participated in a community-based project as part of your class	1.09	1.16	1.03
17	Discussed ideas from your readings or classes with the instructor outside of class	1.24	1.27	1.17
18	Received prompt written or oral feedback on your academic performance from your instructor	1.28	3.00	2.29
19	Worked harder than you thought you could to meet your instructor's standards or expectations	1.81	2.00	2.16
20	Memorizing	2.78	2.78	3.05
21	Analyzing	2.44	3.11	2.14
22	Synthesizing	1.99	2.79	1.88
23	Making Judgments	2.02	2.85	1.99
24	Applying	1.82	2.65	1.79

Q#	Question	Model 1	Model 2	Model 3
25	How often in your class have you been required to prepare written papers or reports of more than 5 pages in length	1.54	1.11	1.06
26	To what extent do examinations in your class challenge you to do your best work	2.43	2.55	2.15
27	In a typical week, how many homework assignments take you more than one hour each to complete	1.92	2.81	2.63
28	In a typical week, how often do you spend more than 3 hours preparing for your class	1.76	3.04	2.78
29	How often have you been absent so far this semester	2.43	1.52	1.12
30	How often do you take notes	3.51	2.43	3.23
31	How often do you review your notes prior to your next scheduled meeting of you class	1.37	2.34	1.54
32	How often have you participated in a study partnership with a classmate in your class to prepare for a quiz or test	1.68	1.43	2.90
33	How often have you attended a review session or help session to enhance your understanding of the content of your class	1.27	1.14	1.63
34	How interested are you in learning the course material	2.71	2.72	2.49
35	How comfortable are you talking with your instructor	2.59	3.08	2.27
36	How much do you enjoy group work with your classmates in your class	2.0	2.42	1.91
37	How difficult is the course material in your class	2.0	2.06	2.23
38	How easy is it to follow the lectures in your class	2.14	2.42	2.02

It was decided to express the difference in CLASSE means as a function of the intervention or course model delivered and the demographic factors of the sample using a forced multivariate regression analysis. This method was chosen as there appeared to be no differences between each of the groups in our experiment with respect to demographic factors, as the nature of the experiment did not allow for subjects to self-select their participation in an individual approach or course model, nor did students have any knowledge of the other approaches and their potential benefits or challenges. By using such an approach, it was expected that each of the demographic factors chosen to enter the regression equation would have no significant effect and that only the experimental effect of the course model would be significant for those CLASSE questions targeted by the different course models. Furthermore, it was expected that all factors, including the course model, would not be significant for those CLASSE questions that were not targeted by the intervention.

By choosing such an approach and reporting the adjusted R^2 values, we accept the fact that these scores may be elevated due to the contribution of the demographic factor to the regression equation, but feel confident that such scores are able to represent the strength of the differences in CLASSE means and the contribution of the course model used. The regression analysis was performed to provide a measure of engagement change between the control or traditional approach (Model 1) and our intensive blended approach (Model 2). A parallel set of regression models was run to measure change in engagement between Model 1 and Model 3, as well as between Model 2 and Model 3. The regression coefficients generated by each of these parallel sets of models were compared; where differences exist and where the experimental group coefficients themselves are significant, it is reasonable to assume that the differences are associated with the intervention itself.

The resulting output using forced multivariate regression using all factors for CLASSE question 1 (Q1), with course Model 1 as the reference and Model 2 as one of the factors, is presented below in Table 6 to provide an example of the output generated.

Table 6: The Resulting Regression Output for CLASSE Q1 with Course Model 1 as the Reference and Model 2 as one of the Factors

CLASSE Q1	β	Std. Err	t	P value	
Model 2	.9596	.0720	13.33	0.000	
Male	.0797	.0717	1.11	0.267	N = 296
Disability yes	.2307	.1711	1.35	0.179	R^2 = 0.3796
Disability no	.0685	.1260	0.54	0.587	
BSCH	-.0326	.0959	-0.34	0.734	
BCOM	-.1084	.0927	-1.17	0.243	
Other major	.2294	.1225	1.87	0.062	
OSAP	-.0537	.0727	-0.74	0.460	
Minority	.0691	.0977	0.71	0.480	
Employed	.0372	.0840	0.44	0.658	
Residence	-.0714	.0749	-0.95	0.342	
English first lang.	-.0108	.1065	-0.10	0.919	
Constant	1.13	.0845	13.38	0.000	

From Table 6, it is evident that the model (the first variable in the table) is the only significant factor contributing to the difference in the CLASSE Q1 mean and that none of the other factors contribute significantly. For a comparison of Model 1 and Model 2, we ran this analysis for each CLASSE question. We ran similar comparisons for each question for the other two course models. This resulted in many (114) multivariate regression equations with few demographic co-variables reaching significance and without any pattern or consistency. This once again provided good reason to report the significance of the contribution of the course design effect only for each of the questions and not to use propensity matching for the subject populations, as the demographic factors were not deemed to contribute to the difference.

Table 7 reports the regression analysis output for the contribution of the model only, for each of the CLASSE questions, when Model 1 (Traditional) was compared to Model 2 (Intensive Blended). Tables 8 and 9 show the regression analysis output for Model 1 (Traditional) compared to Model 3 (Reduced Resources Blended) and Model 2 (Intensive Blended) compared to Model 3 (Reduced Resources Blended), respectively. The highlighted P values indicate those questions in which the model had a significant ($p < 0.000$ to $p < 0.5$) impact on the response.

Table 7: The Regression Analysis for all CLASSE Questions when Model 1 was compared to Model 2

CLASSE Q	β	Std. Err	t	P value	R^2
Q1	.9596	.0720	13.33	0.000	0.3796
Q2	1.963	.0896	21.91	0.000	0.6386
Q3	.0719	.0937	0.77	.444	-0.0139
Q4	1.815	.0567	32.0	0.000	0.7886
Q5	1.360	.1132	12.01	0.000	0.3394
Q6	-1.244	.1264	-9.84	0.000	0.2723
Q7	2.687	.0699	38.46	0.000	0.8474
Q8	-.0654	.0914	-0.72	.475	0.0093
Q9	.6564	.1122	5.85	0.000	0.1322
Q10	.4171	.0983	4.24	0.000	0.0556
Q11	.8637	.1350	6.40	0.000	0.1120
Q12	.3674	.1069	3.44	0.001	0.0327
Q13	.3061	.0850	3.6	0.000	0.0458
Q14	-.1666	.1212	-1.37	.170	0.0294
Q15	2.913	.0406	71.79	0.000	0.9507
Q16	.0432	.0516	0.84	0.403	0.0037
Q17	.0365	.0796	0.46	0.647	-0.0046
Q18	1.618	.1069	15.13	0.000	0.4765
Q19	.1766	.1149	1.54	0.125	0.0171
Q20	.0267	.1266	0.21	0.833	-0.0172
Q21	.7110	.1115	6.38	0.000	0.1512
Q22	.7198	.1064	6.77	0.000	0.1667
Q23	.6941	.11476	5.9	0.000	0.1525
Q24	.7696	.1110	6.94	0.000	0.1625
Q25	-.4368	.0642	-6.81	0.000	0.1694
Q26	.1083	.1146	0.95	0.345	-0.0124
Q27	1.014	.1128	8.98	0.000	0.2303
Q28	1.261	.1367	9.22	0.000	0.2418
Q29	-.9042	.1139	-7.94	0.000	0.1792
Q30	-1.061	.1305	-8.13	0.000	0.2262

CLASSE Q	β	Std. Err	t	P value	R^2
Q31	.8912	.1110	8.03	0.000	0.1958
Q32	-.2834	.0970	-2.92	0.004	0.0444
Q33	-.1122	.0786	-1.43	0.155	0.0401
Q34	-.0478	.1209	-.040	0.693	0.0453
Q35	.4042	.1158	3.49	0.001	0.0245
Q36	.4688	.1265	3.71	0.000	0.0414
Q37	.0150	.0896	0.17	0.867	-0.0334
Q38	.2583	.1231	2.10	0.037	0.0167

Table 8: The Regression Analysis for all CLASSE Questions when Model 1 was compared to Model 3

CLASSE Q	β	Std. Err	t	P value	R^2
Q1	.5328	.0638	8.36	0.000	0.1528
Q2	1.3024	.0840	15.5	0.000	0.4175
Q3	-.1878	.0716	-2.62	0.009	0.0393
Q4	.9362	.0583	16.04	0.000	0.4189
Q5	.3830	.0935	4.10	0.000	0.0340
Q6	-1.551	.1110	-13.99	0.000	0.3612
Q7	1.858	.0710	26.16	0.000	0.6635
Q8	.9703	.0916	10.59	0.000	0.2494
Q9	.1241	.0922	1.35	0.179	0.0210
Q10	.0777	.0804	0.97	0.335	-0.0062
Q11	1.054	.1013	10.40	0.000	0.2406
Q12	.0855	.0946	0.90	0.367	-0.0238
Q13	.0237	.0685	0.35	0.729	-0.0039
Q14	-.1755	.1094	-1.61	0.109	0.0199
Q15	2.866	.0380	75.42	0.000	0.9435
Q16	-.0614	.0309	-1.98	0.048	-0.0029
Q17	-.1431	.0578	-2.48	0.014	0.0279
Q18	.9080	.0848	10.71	0.000	0.2717
Q19	.3271	.1051	3.11	0.002	0.0466
Q20	.3224	.1055	3.06	0.002	0.0503
Q21	-.2413	.0974	-2.48	0.014	0.0795
Q22	-.1116	.0874	-1.28	0.202	0.0256
Q23	-.0405	.0961	-0.42	0.674	0.0507
Q24	-.0261	.0851	-0.31	0.759	0.0075
Q25	-.5061	.0448	-11.29	0.000	0.2865
Q26	-.3038	.0967	-3.14	0.002	0.0434
Q27	.7465	.0981	7.61	0.000	0.1692
Q28	.91938	.1210	7.59	0.000	0.1694
Q29	-1.304	.0857	-15.22	0.000	0.4048

CLASSE Q	β	Std. Err	t	P value	R^2
Q30	-.2710	.0992	-2.73	0.007	0.0878
Q31	.1660	.0892	1.86	0.064	0.0115
Q32	1.283	.1152	11.13	0.000	0.2811
Q33	.3025	.0713	4.24	0.000	0.0617
Q34	-.2606	.1037	-2.51	0.012	0.0552
Q35	-.3205	.1024	-3.13	0.002	0.0188
Q36	-.0464	.1076	-0.43	0.667	-0.0044
Q37	.2097	.0841	2.49	0.013	0.0408
Q38	-.0752	.09993	-0.76	0.449	0.0479

Table 9: The Regression Analysis for all CLASSE Questions when Model 2 was compared to Model 3

CLASS Q	β	Std. Err	t	P value	R^2
Q1	-.4509	.1065	-4.23	0.000	0.0491
Q2	-.7176	.1411	-5.09	0.000	0.0991
Q3	-.3082	.1071	-2.88	0.004	0.0334
Q4	-.8949	.0855	-10.47	0.000	0.2934
Q5	-.9778	.1140	-8.57	0.000	0.2339
Q6	-.3654	.1392	-2.62	0.009	0.0402
Q7	-.8247	.0732	-11.27	0.000	0.3373
Q8	1.0069	.1198	8.40	0.000	0.2239
Q9	-.6065	.1110	-5.46	0.000	0.1214
Q10	-.3790	.1102	-3.44	0.001	0.0367
Q11	.1683	.1152	1.46	0.145	0.0241
Q12	-.2688	.1202	-2.24	0.026	0.0132
Q13	-.2869	.0940	-3.05	0.003	0.0157
Q14	-.0216	.1381	-0.16	0.876	-0.0057
Q15	-.0395	.0486	-0.81	0.417	-0.0153
Q16	-.13334	.0478	-2.79	0.006	0.0344
Q17	-.1825	.0739	-2.47	0.014	0.0464
Q18	-.7043	.1339	-5.26	0.000	0.0987
Q19	.1318	.1311	1.01	0.316	0.0433
Q20	.2297	.1321	1.74	0.083	0.0492
Q21	-.9775	.1149	-8.50	0.000	0.2533
Q22	-.8386	.1112	-7.54	0.000	0.1981
Q23	-.7704	.1222	-6.30	0.000	0.1287
Q24	-.8523	.1160	-7.35	0.000	0.1694
Q25	-.0580	.0378	-1.53	0.126	-0.0149
Q26	-.4133	.1183	-3.49	0.001	0.0202
Q27	-.2715	.1243	-2.18	0.030	0.0543
Q28	-.3405	.1499	-2.27	0.024	0.0469
Q29	-.4546	.0697	-6.52	0.000	0.1392
Q30	.7748	.1413	5.48	0.000	0.1715
Q31	-.7482	.111300	-5.75	0.000	0.1176
Q32	1.6432	.1476	11.13	0.000	0.3362
Q33	.4572	.0709	6.44	0.000	0.1736
Q34	-.1643	.1178	-1.39	0.164	0.0900
Q35	-.7377	.1188	-6.21	0.000	0.1435
Q36	-.5114	.1147	-4.46	0.000	0.1281
Q37	.1898	.1012	1.87	0.062	0.0545
Q38	-.3503	.1231	-2.85	0.005	0.0861

The CLASSE instrument was used to help us understand the effect of targeted changes in the teaching and learning environment in our two blended learning models when compared to a traditional course design. Given the relative strength of regression results (many significant variables with corresponding strong R^2), it was evident that both blended learning models had a significant impact on student engagement. To test the sensitivity of the CLASSE instrument to the existence of change in student engagement in the blended course designs, we might identify those items that should not show an experimental effect. It is encouraging that numerous items that were not targeted by the intervention, such as an increase in written assignments or participation in a community based project, showed no significant differences between models. Many items did show significant differences; most of these have a direct connection to the blended learning format (i.e.,

encouraging oral session participation, increasing peer interaction, improving student-faculty interaction and encouraging academic effort). These items include:

- Asking questions in class and contributing to class discussions
- Including diverse perspectives in discussions or writing assignments
- Working on a paper or project that required integrating ideas or information from various sources
- Working with other students on projects during class
- Spending 3 or more hours per week in class preparation

Of the 38 CLASSE questions, it was hoped that 19 of the questions would show a change in student engagement as a result of the course design. The remaining 19 questions were not specifically targeted by any of the course design elements and were therefore not expected to change. The fact that a few other questions did change demonstrates the extent of the effect of the course redesign on student engagement broadly speaking. The fact that most of the 19 remaining questions remained constant in all three models reinforces the usefulness of the CLASSE tool to measure changes resulting from targeted course redesign. The preponderance of evidence in the CLASSE results, in terms of the number of significant individual items and the consistency of item significance expected, indicates that experimental effects were detected.

Results from the NSSE have been useful in helping universities identify the quality of the undergraduate learning experience on their campus. The NSSE results fall into five key clusters of activities which studies suggest are associated with heightened levels of student learning. These Benchmarks of Effective Educational Practice include:

Level of Academic Challenge (LAC)
Active and Collaborative Learning (ACL)
Student-Faculty Interaction (SFI)
Enriching Educational Experiences (EEE)
Supportive Campus Environment (SCE)

To help us better understand in what ways the blended course designs contributed to increased levels of engagement, we grouped the CLASSE questions into themes that were the same or similar to the questions used to create the NSSE benchmarks.[1] Table 10 shows the benchmarks, the number of questions in each, and how they were influenced by each of the models. By recreating the benchmarks, it becomes clear that increases in student engagement are seen in all four areas when the blended learning models are compared to the traditional model. It is also evident that Model 2 was superior in improving engagement when compared to Model 3, especially in the areas of LAC and SFI.

[1] There are no questions in CLASSE that are similar to those used in the NSSE for SCE.

Table 10: The NSSE Benchmarks and how the Questions of CLASSE Changed with each Model Comparison

Benchmark	Model 1 vs. Model 2	Model 1 vs. Model 3	Model 2 vs. Model 3
Level of Academic Challenge (17 questions)	11 questions ↑ 6 questions no Δ	7 questions ↑ 4 questions ↓ 6 questions no Δ	2 questions ↑ 12 questions ↓ 3 questions no Δ
Active and Collaborative Learning (9 questions)	6 questions ↑ 3 questions no Δ	6 questions ↑ 3 questions no Δ	2 questions ↑ 5 questions ↓ 2 questions no Δ
Student-Faculty Interaction (5 questions)	4 questions ↑ 1 question no Δ	1 question ↑ 2 questions ↓ 2 questions no Δ	5 questions ↓
Enriching Educational Experience (7 questions)	4 questions ↑ 1 question ↓ 2 questions no Δ	4 questions ↑ 1 question ↓ 2 questions no Δ	3 questions ↑ 2 questions ↓ 2 questions no Δ

Study Process Questionnaire

Responses for the 20 SPQ questions were collected and converted to ordinal data. The individual responses to ten of the questions were then summed to form a cumulative score for the surface approach category, and the remaining ten summed to form a score for the deep approach category (Biggs, 2001). The means and standard deviations for each of the three course models were determined for the two scales (see Table 11). A comparison of each of the three course models was then performed using a simple t-test (Table 12) to identify significant differences in both surface and deep approaches to learning.

Table 11: SPQ Means and Standard Deviations for the Cumulative Deep and Surface Scores

Approach	Model 1	Model 2	Model 3
Surface	26.7 (6.0)	25.1 (6.3)	27.5 (6.6)
Deep	22.6 (5.6)	24.7 (5.4)	22.7 (6.1)

Mean (SD)

Table 12: Comparisons of Deep and Surface Approaches to Learning

Model 1 vs. Model 2		Model 1 vs. Model 3		Model 2 vs. Model 3	
Deep	Surface	Deep	Surface	Deep	Surface
-3.14 (0.001)	2.21 (0.028)	-0.066 (0.947)	-1.19 (0.234)	-3.24 (0.001)	-3.02 (0.0026)

t score (p-value)

The highlighted P values in Table 12 indicate a significant ($p < 0.5$) difference in the approaches to learning when the intensive blended model was compared to the traditional approach. Students in Model 2 demonstrated a higher measure on the deep approach to learning scale and a lower surface approach. Such

a finding demonstrates that Model 2 not only influenced student engagement but also fostered a shift to a deeper learning approach. This difference was not found when the traditional approach was compared to the resource reduced blended learning model (Model 3), as students in both models exhibited similar approaches to learning.

Qualitative Data Analysis

At the end of each term or phase of the study, students were asked to participate in a focus group to provide more detailed comments than in the online survey. Students who indicated their willingness to participate on the online survey were contacted by email by a research assistant unfamiliar with the various course designs. The students who attended the focus groups were randomly chosen, partially based on their availability. The research assistant was experienced in focus group facilitation and was provided with the general questions to ask. Once completed, the focus group recordings were transcribed and prepared for analysis. Each focus group transcript was then read in its entirety before the coding began. All responses were then combined into a single pool of responses for analysis by emic themes; common themes that emerged from the responses were identified and individual comments were then sorted by theme. Responses to the questions in the online survey were similarly read and grouped by responses and emerging themes. The following tables show the emerging themes, with representative comments for each of the models separated into positive and negative domains. In each of the tables, the order of the themes represents the frequency and significance of the comments made.

Table 13: Positive Themes with Representative Comments for Model 1

	Class Structure	In-Class Lectures	Online Lectures	Clickers in Class
Positive comments (175 comments)	Having actual lectures. I think that is extremely important for every level in university. Having a professor speaking in front of you willing to answer questions in the class setting is beneficial.	The instructor provided very enthusiastic, detailed lectures and, overall, delivered the information well. I enjoyed how each lecture presented a different topic relating to the course, it allowed me to learn about many different issues.	Video lectures were very helpful because I was able to refer to it to find out things I've missed during the class. I also liked the fact that online lectures were available online, because if I missed something in class or wanted to go over a certain part of the lecture that I didn't understand I was able to do that.	Clicker questions, they allowed students to become engaged in the lectures. Grading participation using the clicker was a great idea. I felt more engaged during the lectures and it was a good way to review concepts.

Table 14: Negative Themes with Representative Comments for Model 1

	Class Structure	In-Class Lectures	Online Lectures	Clickers in Class
Negative comments (140 comments)	A smaller class would have been better to allow for discussions/debates. Class is way too big. Lack of tutorials sometimes made clarification difficult to acquire.	During the lectures, sometimes it was too rushed, and as a result it was difficult to take notes and fully understand the material. Some material was taught too quickly. I did not like how the teacher said SO much information very quickly in lecture, and did not provide us with the notes.	The lectures recorded on Moodle were difficult to watch. It's one thing to attend and sit through a formal lecture and quite another to watch a recording on your own time. Unfortunately, the online lectures also had a big downside. I began telling myself that it was not important for me to go to class because the lectures were going to be online anyway.	Participation is actually measurable with clickers... but people cheat and take friends' clickers etc. ALL THE TIME!!!

Table 15: Positive Themes with Representative Comments for Model 2

	Online Lectures	Group Dynamics	Course Structure	Clicker Quizzes	Learning	Small Group: Skill Building
Positive comments (77 comments)	Allowed you to access lectures at a convenient time for the student. Having the lectures online was helpful; I was able to pause when there was too much information being presented at once. Online lectures offered me to have a more flexible schedule.	Active participation and contribution in group activities. Interaction with other students and the professor. They were an alternate way of learning material.	I really enjoyed the personal and interactive seminars. It gave students a better chance to get their points heard and questions asked. The interaction and collaborative thinking that supported the lessons that were taught in the week.	Gave the chance to apply and tested the lectures and readings we just learned. This actually got me to do my work. …so that you had to keep up with lectures and could practice the information you learned that week and see if you were studying the material properly.	…we must take the main initiative to teach ourselves the course. It is our responsibility to read the material, and watch the lectures, which greatly helps us gain an aspect in learning how to understand concepts on our own. Working in groups and presenting weekly, not only helped students remember the information, but also helped students further examine, question and challenge the information.	It allowed me to better develop my presentation skills. I learned a lot about how to work as a group throughout this semester, a skill I'm glad I'm better at now since it seems very useful in the real world.

Table 16: Negative Themes with Representative Comments for Model 2

	Workload	Online Lectures	Group Dynamics	Course Structure	Clicker Quizzes	Peer Grading	Learning
Negative comments (76 comments)	I think that there was simply too much work. It took a significant amount of time to prepare for each class – watching the lectures, doing to readings, researching for the in-class assignment. Not being able to have lectures at a set time therefore having to find personal time to watch the videos. Having to prepare before class for the assignments, the readings and the videos was a lot of work and sometimes could not all be finished.	The online lectures do the opposite of what the course was meant to do – it completely distanced students from the material. When there are lectures set up in halls, I would never ever miss one. However, since these were online and there was no specific time allotted to watch them, if I didn't have time and other classes had things due, I would not watch the lectures. It is hard to get the same amount of information out of a lecture when you can't ask questions or hear other students' questions.	I didn't feel like I had any control over my mark. It was very difficult to do well on the group assignments when not everyone did the same level of preparation and was willing to contribute. How dependent we were on other people for a huge portion of our grade… I'd often get to class, sit down with my group, and find that I was the only person, or one of only two or three out of eight to ten students who had actually bothered to do prep work for the group assignment. The actions of others would hurt the group's performance, and subsequently, hurt people's marks.	Cramped timeslot/not enough time to present- or flesh out arguments. Material that was talked about in the lectures and readings were not reviewed in the class setting. The classroom activities seemed somewhat random and off topic at times in comparison to the weeks work. The most negative aspect of the course was the short amount of time given for the weekly assignment.	Multiple choice questions... although it did force me to do the readings Although there were quizzes, there was no real motivation to do the work. Rote learning for quizzes.	Receiving group grades for vaguely described assignments with no grading rubric, uneven distribution of effort towards project from group members. The group marking was often not taken seriously and has an impact on our overall grade, so I thought this was rather unfair.	Extra seminar class that did not help the understanding of course content. The group assignments did not fully help me understand what was discussed in the week's lectures and readings. I feel like there was emphasis on the wrong part of the course… The physical in-class portion of GPHY 101 was definitely the least productive/informative part of the course.

Table 17: Positive Themes with Representative Comments for Model 3

	Online Lectures: Time Management	Online Lectures: Review	Quizzes	Seminars	Course Structure
Positive comments (166 comments)	Ability to devote time to course when it fit your schedule. The ability to structure my week by choosing when I could watch the lecture that best fit my schedule, and not be obligated to attend it when it was being held since I could watch them whenever I wanted. Allowed for independent work; course was extremely flexible. I felt that finding time to watch the lectures online really helped me to keep on top of my work for this course.	The ability to go back and review previous lectures. Ability to re-play and slow down lectures. I enjoyed the fact that the lectures were posted online to Moodle. This would be a beneficial resource for every class. The online lectures made it really easy, especially for a student like me with a learning disability, to get the most information possible by being able to pause and replay material that I either missed or didn't fully understand.	Weekly tests – keeps us on track! The consistent evaluations made sure we were on top of our work and the grade breakdown was fair. The quizzes were a good time length and were offered over the course of the weekend which was a really good idea. They tested your knowledge and showed if you were keeping up with the course.	The seminars were challenging but they were a good way to research and fully understand instead of tutorials every week, the way they were dispersed throughout the term was much better. The seminars – it was a good way to meet others in the class to collaborate. Seminar sessions were a good attempt at improving interaction in the course. I thought the most positive aspect of the way GPHY 101 was taught would be the seminars. It gave me a chance to communicate with my classmates, and also voice my opinions with an audience. I got a chance to ask questions and actively participate in class discussions. I also liked presenting our topics of discussion and hearing other groups present. The time also flew by so it wasn't as bad as I initially thought it would be.	Didn't have to go to lectures, many opportunities to get marks. The subject material was presented in a way that enabled not only understanding of the material, but also challenged the students to consider other viewpoints or understandings of topics covered. In short, the presentation of lectures, readings and seminars encouraged critical thinking and depth of understanding of the material covered.

Table 18: Negative Themes with Representative Comments for Model 3

	Online Lectures: Time Management	Online Lectures: Lack of Interaction	Quizzes	Seminars Disconnected from Course	Seminar Group Sizes	Seminars Unfair Grading	Course Structure	Workload
Negative comments (165 comments)	Because of the online lectures, I had less structure in my weekly schedule, so I would tend to cram all the material over the weekend in order to do the online quizzes. The online format, while sometimes practical, was mostly an excuse to procrastinate... and did not provide structure in this course. Having to spend my own time to watch the lectures and do the quizzes. I much prefer classes in person. I like a scheduled time and place class.	Because it was mostly online, there was not a lot of time for interaction between the instructors and the students. I didn't like how we didn't have much one on one time with the professor or the TAs. I think this is beneficial to students, especially in first year, to be able to confront these individuals if any questions come about. Lack of connection with the teacher, being an online course there was no interaction with an actual human being making it difficult to stay focused.	The fact that the quizzes required lots of time and work just to complete one quiz. The tests were on weekends which interfered often with where I would be at the time or my plans. Instead of being able to put it off for a week to concentrate on something else, there were always quizzes to worry about. In that case I'd end up not studying and doing poorly.	The seminars were way too long and kind of pointless, didn't really mesh well with the remaining of the course. The seminars. I do not think that they represented our knowledge and learning well. The amount of time that was needed to do the work properly. The inability to ask questions or to form a relationship with a TA or professor enough to feel comfortable to ask said questions. Similarly the presentations were not as helpful as attempting to solidify concepts which could have used more broad examples that were complex.	The large sizes of the seminar groups. A group of 10 is too large to work with; 2 people usually do the advance work and the other 8 people coast along and contribute very little. I disliked the fact that as a group it was nearly impossible to produce a quality in-depth presentation that meets marking requirements in the time given.	Grading and evaluation in this course did not reflect any individual efforts – everyone collaborated on quizzes, most people cheated on the midterm, and the seminars were graded based on group efforts. Essentially everyone should have the same grade. The seminars were a huge part of our mark and did not reflect individual effort at all whatsoever.	I found that there was no good way to recognize proficiency or understanding in the course. The most negative aspect was learning how to study and prepare in a completely different course set up. It was more difficult to retain information from the presentations as well. I did not learn as much from them.	Amount of work required for weekly quizzes and seminar preparation was overwhelming, especially for a first year course. The seminars were a lot of work to prep for, especially if they were held two weeks in a row. The course was incredibly time-consuming, especially during weeks with seminars. I found that I consistently spent more time studying for this course than any other.

The comments received from the qualitative data sources provided insight into the students' experience in the three course designs. In the traditional course, student comments were similar to those found by Russell (2009): although some students enjoy well-delivered and structured lectures, they recognized that the large class size and the nature of the lecture environment makes it difficult for meaningful interaction. The positive comments for Model 2 focus on the flexibility of having online components to the course and the way in which the structure of the course allows for group interaction, group activities and more active learning. Overwhelmingly, the most negative aspect of this design was the workload that was required. Students commented on the time required to watch the online lectures as well as prepare for the weekly small-group sessions. Students also expressed concern about the reliance on group work and peer evaluation.

Model 3 decreased the number of online lectures and of small-group sessions. Students still commented on the usefulness of the online component to the course for flexibility, but expressed more concern about the structure of the course and the need for more self-discipline and scheduling to stay on track. The students in this model also enjoyed the small-group sessions as opportunities to meet and work with others, but felt that because there were so few during the course of term that they were disconnected with the course and therefore were less effective. The students in this model thought that this was predominantly on online course with an unclear structure and that there was not enough opportunity to meet and ask questions about the course material. Although Model 3 attempted to decrease the workload for the students and the instructor, students still expressed concern about the amount of work they had to do when compared to a traditional course.

Summary of Findings

Overall, the findings of this study were encouraging and demonstrated how the use of the blended learning format can influence how students approach, engage with and learn in large first-year courses. Students in this study described their experience in a traditional lecture course as large and impersonal, and although they found the lectures interesting, they did not get to know their professor well, had a low level of engagement, and predominantly took a surface approach to learning the course material. Generally speaking, the experience of students in this course design would be typical of most large year first-year courses.

In comparison, it was clear that an intensive blended course format (Model 2) dramatically increased the level of student engagement, increased the interaction with the professor and the TAs, and allowed for more opportunities for active learning. Students in the intensive blended course showed significant improvement on 25 of 38 CLASSE questions when compared to a traditional course design. These improvements in student engagement occurred in four categories similar to those used in the NSSE benchmarks, indicating the breadth of the transformation that occurred with this design. The categories with the greatest number of changes were Level of Academic Challenge and Active and Collaborative Learning, the benchmarks on which Queen's rated lowest in first-year classes on NSSE. The CLASSE questions that illustrated the greatest changes in student engagement involved measures of how frequently students asked questions and contributed to discussions in class, integrated ideas and included diverse perspectives, worked with others and gave a class presentation. Students in this course design also felt that much more learning occurred as a result of the small-group collaborative activities and exhibited a deeper approach to learning the course material. For the most part, they found the online lectures useful and effective for accessing the course material and in preparation for the small group sessions. The greatest concern expressed by students for this course design was the workload and time that was required. Students felt that this course design had a much higher workload and required more time than any of their other courses taught in the traditional way.

In an attempt to decrease the workload for the students and the faculty while at the same time increasing the number of students, a resource reduced blended model (Model 3) was designed. Although the students in this format did demonstrate a higher level of engagement than in the traditional model, it was far less than in the intensive blended model. Students in this model also exhibited a return to surface approaches to learning the course material, similar to those used in the traditional model. For the most part, students expressed the least satisfaction for this course design. They felt that there was too much reliance on technology and online independent learning and they felt a lack of connection with the course. They expressed concern about the perceived lack of structure in the course and lack of opportunity to meet and interact with the instructor and with other students. Despite the decrease in the amount of material online and the number of times the students met in small groups, they still reported a high workload as one of their primary concerns with this model.

The results of this study show that it is possible to rethink how we design and deliver our large first-year courses to make them more engaging and meaningful learning experiences for students. It is possible to redesign large first-year courses based only on traditional lectures to create smaller, interactive group sessions. Clearly Model 2 was the superior course design and accomplished what was hoped for. Students in this design interacted with each other and the instructor more, were more academically challenged and took a deeper, more active approach to learning. However, the concern with Model 2 was the workload that was required by the students and the instructor and the fact that it only accommodated 157 students. Although Model 3 attempted to address these issues, it presented new challenges of its own. Although this model could accommodate more students with fewer resources, the decrease in opportunity and frequency of interaction minimized its effectiveness.

In order to build upon the lessons learned from this study, it would be warranted to construct and evaluate a blended course designs that lies somewhere between Models 2 and 3. This model would include a course design with some online components but with frequent small-group interactive sessions, in order to maintain frequency of contact with students for structure and guidance. This may require decreasing or at least rethinking the course content and the form in which it is delivered. A balance will need to be found between the online requirements, the time required to complete them and face-to-face time with students, such that the workload is reasonable for both student and instructor. In such a model, students must understand the purpose of each of the components of the course, the expectations of them, and how to be successful. Students will need to understand that such a course model is unlike the traditional course and that they will need to be independent in some aspects of the course and active participants in others.

The success of such a model relies on technology for increased student flexibility and access. This requires institutional support and development. The technologies that are available on campus are sufficient, but rarely are they challenged such as they were by the blended courses in this study. If such an approach were to be successful and implemented in more first-year courses, greater infrastructure and technology support would be required.

Such an approach, with an increased number of students, also requires a number of rooms of the appropriate size and configuration, spaces which accommodate groups of 60 or so students and are appropriately designed and within proximity of one another. Such spaces are often difficult to find and schedule. Once again, institutional support in the form of space and scheduling is necessary. As we design new buildings for teaching and learning, there will need to be less emphasis on the large lecture hall and more thought given to smaller teaching spaces which can be used for these types of courses.

Finally, the blended approach fundamentally changes the role of the instructor from providing information and insight to managing the learning environment for students and TAs. The instructor will still require an

understanding of the course content but will need to think about how best to integrate all of the course components. They will need to think about what components are best suited for independent online learning and how best to actively engage students in the course material to direct the level and type of learning that occurs. Learning objectives, assignments, activities and approaches to evaluation will all need to be modified to reflect the change in focus of these courses. Faculty will need to think differently about the role of TAs in their courses, as they play an integral role in the small-group sessions. They will need to manage the technology to make it easy and accessible for students to use, while constantly challenging the technology beyond its traditional capabilities. In all, faculty members who embrace this approach will need to understand the value of doing so, but also be mindful of the workload associated with it. Institutions must also recognize that a blended course with frequent small-group sessions is possible in large first-year courses and that such a design can profoundly change the level of engagement and learning that occurs. However, this cannot occur without support for and recognition of the effort and workload involved for faculty members who teach this way.

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