AC 2007-2525: THE BLENDED CLASSROOM: THE BEST OF BOTH WORLDS?

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The Blended Classroom: The Best of Both Worlds?

Abstract

Most universities offer the traditional face-to-face class. With the rise in technology, online courses are now becoming popular. Although not a new concept, the blended classroom has the opportunity to blend the best features of the online and classroom environment. This research was conducted to determine if blended courses provided evidence of student satisfaction and cost savings compared to face-to-face courses. A Five Pillar Quality Framework was used to assess blended courses. Five engineering education courses offered in both the face-to-face format and blended format were used. Grades were analyzed using a t-test, and the results of a survey given to students are presented. The results supported prior research that a blended course offers student satisfaction. Cost savings were also realized based on reduced travel time to off-campus locations. The blended classroom may be the best of both worlds.

Introduction

Highly trained engineers are needed in the workforce. With technological change, traditional training methods are being transformed; making blended learning one of the hottest buzzwords. This training mixes various learning approaches, including e-learning, face-to-face classrooms, self-paced modules, interactive television, and videos. Although blended learning is not a new concept, universities are seeing the advantages of offering different course formats to aid in student learning. Most universities give students the choice of face-to-face or online courses. Engineering education programs are usually harder to teach in a fully online environment because of the need for laboratories, machinery, chemicals or equipment. The structure of the classroom blended with the Web could be the answer for engineering education. Blended learning can be described as the optimum balance of online and face-to-face classes that foster student learning at reasonable costs. The limited literature on blended learning is full of examples from all disciplines. A number of universities (State University of New York, University of Massachusetts, University of South Florida, and Penn State University) have converted entire programs to the blended format[1]. Other universities are considering the blended format as an option to increase student learning and decrease costs. The purpose of this paper is to reflect on the increase of blended learning course formats and provide evidence of student satisfaction and cost savings using a quality assessment model. While the research on blended learning is just beginning, colleges and universities are seeing the pedagogical advantages. It is hoped that this paper will get a dialog started. The blended classroom: Is it the best of both worlds?

Theoretical Background

What is blended learning?

The traditional face-to-face classroom is still the norm in most universities. With the availability of Web-based technologies, numerous classes also include a Website where students have access to assignments and grade books[2]. This type of class is called Web-enhanced. A Web-enhanced class is considered an extension of the traditional face-to-face class. While face-to-face classes

are effective, physical distance can prevent some students from attending. Online courses allow students to take classes anywhere at anytime. Although location is not an issue in an online course, there are some engineering education courses that need to meet in a classroom for experiments and activities. Blended classes have the capability of utilizing the Web and meeting in the classroom at pre-determined times. Offering different course formats provides students with more choices that fit their busy schedules. Studies[3] have shown that students perform better in classrooms where multiple technologies are used. Table 1 defines the current course formats.

Type of Course	Definition	Portion in classroom/online
Traditional face-to-face	Course with no online components	All classroom meetings, no online
Web-enhanced	Course that is face-to-face with some Web components for grades, assignments, and materials	Meets in the classroom with some Web components
Blended (sometimes called Hybrid)	Course that blends face-to-face classes with online classes	Typically any combination of online content and face-to-face class meetings
Online (sometimes called Distance)	Course with no synchronized classroom meetings	No class meeting, all online

Table 1. Course format classifications

Blended learning is not just a thrown together mix of online materials and classes. The Sloan Consortium defined a blended course as "a course that integrates online with traditional face-to-face class activities in a planned, pedagogically valuable manner in which a portion (institutionally defined) of face-to-face time is replaced by online material and classes"[4]. There are many forms of blended courses. The simplest form includes a residential course that splits online classes with face-to-face classes. It is far more difficult to blend a course where students are geographically spread. Structured periods of time that include weekends or week-long classes seem to work well in these situations. Some universities partner with other schools or libraries to help facilitate face-to-face class meetings. Another form of a blended course is requiring students in an online course to meet for a synchronized chat. A truly blended course combines both synchronous and asynchronous instruction.

Elements of a blended course

Students like the flexibility of meeting in a classroom for interaction with the instructor and fellow students. Osguthorpe & Graham[5] verified that this interaction through face-to-face learning activities with fellow students and the instructor is vital for student learning. Without having class meetings with the instructor present in the room, the teaching style, personality and mannerisms of the teacher are missed[5, 6]. Students prefer structured material online and interaction and advanced knowledge in the classroom[3]. There are certain elements that need to be present for a blended class to work. Elements recognized for effective blended course formats include: audience, learning outcomes, context, scale, time, organization, content, infrastructure,

and business application[7, 8]. Designers and instructors of blended courses have the chance to choose the best teaching and delivery methods based on the course objectives. Woodall[9] established the following eight key steps of blended learning from the student perspective.

1. Prepare me
2. Tell me
3. Show me
4. Let me
5. Check me
6. Support me
7. Coach me
8. Connect me

Successful implementation of a blended course is focused on utilizing the best pedagogical aspects of the online and classroom environment. Understanding the audience and course planning are extremely important in developing an effective blended course[10]. It is not the blending of the classroom and the Web that makes a course effective; it is the right blend for the goals and objectives of the course[11]. The emphasis is on the learning and not the technology.

Benefits of a blended course

The popularity of blended courses is only going to increase. Seaman[12] conducted a survey in 2002 of over fifty institutions and found that 7% of the students were enrolled in a blended course and that growth is expected to increase to 20% by 2005. The intent of this paper is not to say that a blended classroom is the best class format, but to simply describe an additional class format that universities might consider. The blended approach can allow faculty to teach a large number of students online and meet a smaller number of students in face-to-face classes. Blended courses are being used by the university of Phoenix (1/3 classroom, 2/3 online) to maximize the use of classrooms and increase the accessibility of the number of students being served. Northern Virginia Community College also offers a blended approach using field trips and classes for labs to improve access and effective student learning experiences[1]. At this stage in the game, it is often difficult to track the number of blended courses being offered at different universities. There may be more blended courses being offered than the research suggests because many institutions may not have the appropriate computer systems to capture the data. Individual faculty members opt for the blended format because they consider it to offer the best learning opportunities for students. Administration is beginning to spot the prospect of giving more students access to courses and possibly attracting and retaining more students. Potential benefits of a blended course format include[13]:

- Greater access to a range of appropriate, personalized, and individualized learning, teaching, and resources
- Greater accommodations for learners and teachers of diverse ages, styles, expertise, nationalities, and cultures, who can connect from multiple settings such as homes, workplaces, libraries, and countries
- Greater flexibility and cost-effectiveness in terms of mission, scalability, breadth, time, value and infrastructure

- Greater student and faculty satisfaction

In addition to the above-mentioned benefits, there are many potential gains. First, blended courses can satisfy the laboratory requirements needed in engineering education. Criterion 6 for engineering technology accreditation (ABET, as stated in the handbook) maintains that universities must have appropriate facilities that foster student/faculty interaction and activities[14]. With the huge investment involved in creating and maintaining laboratories in the engineering education curriculum, class meetings provide experiential learning and use of equipment. A second potential gain is the flexibility and convenience of the blended format for busy students trying to juggle individual responsibilities and receive a quality education. Blended courses may help eliminate the alienation that some students feel with online courses by having selected face-to-face meetings. The structure of the blended format allows students to access the Web for content with the flexibility of only having to go to campus for a selected number of pre-determined classes. In other words, there is a convenience factor in getting material online while also being able to have meaningful learning experiences in the classroom. When developing blended courses, instructors are capable of offering adult learners options, including variety in learning styles, self-directed learning, demonstrations, and interaction. Instructors enjoy placing content online and using class time for face-to-face meetings, answering questions, or going deeper into class discussions[5]. Instructors also reported increased convenience and flexibility by spending 25% less time per week (500 minutes) in blended courses compared to traditional classrooms (693 minutes) [15].

A third gain to an effective blended course is cost savings. Universities must weigh customization of courses with cost effectiveness[16]. It is often costly in terms of time and money for students to travel to campus for multiple class meetings, especially if the students live far away from campus. Brigham Young University and Michigan State University have found that using online components in the classroom can reduce cost[17]. In addition, Douglas conveyed cost savings in the blended format through the condensed use of classrooms and equipment[7]. Cost savings can also be realized by less travel time for both instructors and students. For example, if a university has a cohort of off-campus students and another cohort on-campus, the instructor can travel fewer times to the off-campus sites, therefore reducing travel costs. Both cohorts benefit from the combined Web portions and individualized class time with the instructor. Geographically spread students were one of the main reasons this research was undertaken.

Fourth, a blended class can connect students to other aspects of their learning[18]. Sometimes, the student's connection to other students is lost in the online environment. The interface between the physical environment (classroom) and the virtual environment can provide the advantage of engagement and interaction in the classroom. Students like to socialize with fellow classmates in and outside of the classroom. Fifth and finally, blended class formats allow different opportunities for students to engage in activities that increase learning. A recent study indicated that student learning was not only greater, but more consistent in the blended format than the traditional classroom[15]. Another study showed that student learning actually increased, with the blended students receiving more A's (40%) compared to the face-to-face students with fewer A's (22%) in a chemistry course[19]. Despite the fact that there are many benefits to a blended course, quality of the course is important.

Assessing the quality of a blended course

At a minimum, all courses regardless of their format should adhere to quality standards like Chickering and Gamson's[20] Seven Principles of Good Practice in Undergraduate Education:

1. Encourages contact between students and faculty
2. Develops cooperation among students
3. Encourages active learning techniques
4. Gives prompt feedback
5. Emphasizes time on task
6. Communicates high expectations
7. Respects diverse talents and ways of learning

There is evidence of student learning in the traditional and online environments, but only a handful of studies assessing blended classes. The Sloan Consortium established a process for assessing quality of online courses. Its Five Pillars are a framework for measuring and improving the quality of online education. The Five Pillars of Quality Online Education[17] are:

1. Learning effectiveness
2. Student satisfaction
3. Faculty satisfaction
4. Cost effectiveness
5. Access

A common thread in all of the pillars is productive interaction which coincides with the principles of undergraduate education. Universities are finding ways to increase learning effectiveness while at the same time decreasing cost through blended courses. Lorenzo and Moore[17] described the pillars as continuous quality improvement through defining goals, identifying the resources to meet the goals, measuring the progress toward the goals, and closing the loop by making appropriate changes to improve quality. According to the Sloan Consortium, the quality of a blended course should be equivalent to the quality of any online or face-to-face course. This approach is the same approach that the author of this article proposes. Using the Five Pillars, this article provides a quality framework for universities to judge the student satisfaction and cost savings of blended courses.

Research Questions and Methods

The purpose of this paper was to reflect on the increase of blended learning course formats and provide evidence of student satisfaction and cost savings using a quality assessment model. In 2004, discussions concerning blended courses in the department of Industrial and Engineering Technology in a Midwest university began. With one group of students on-campus and one group off-campus, the decision was made to move to the blended format. Off-campus students wanted the physical presence of the instructor and use of equipment in engineering labs. The decision focused on student access and cost savings by reducing travel time to off-campus sites. The department started offering blended courses in 2005.

Research Questions

1. Does a blended course provide equivalent student satisfaction compared to a face-to-face course?
2. Does a blended course provide cost saving compared to a face-to-face course?

With the lack of research on blended courses, the Five Pillars were used to determine if a blended course provided student satisfaction and cost savings. To assess student satisfaction, five engineering education courses with 263 students were used. All five courses were offered in the face-to-face format in 2003-2004 and offered in a blended format in 2005-2006. In addition, the courses were taught by the same two professors in the face-to-face format and the subsequent blended format. The blended courses were online with four to six pre-determined class meetings. All of the courses were offered in the Industrial and Engineering Technology department at a Midwest university. A t-test with the probability of .05 was used to analyze student learning. Students in the blended classes (N=145) were asked to voluntarily give feedback on a questionnaire. Thirty-five students (24%) gave feedback on the questionnaire. The summary of the students' responses is provided. To assess the cost savings of a blended course, travel time (270 miles) to and from the off-campus location was multiplied by the mileage rate of .375. A travel stipend of $1500 (for 16 weeks of traveling) was also calculated in the cost savings.

Results

Student learning is a key aspect to student satisfaction. One of the pillars of quality is learning effectiveness. Semester grades for blended courses were compared to face-to-face courses. To assess learning effectiveness, the average grades for five courses offered in both formats are provided in Table 2.

Course	**Face-to-face average grade**	**Blended average grade**
1.0	85	87
2.0	79.4	79.7
3.0	82	78.8
4.0	87.2	86
5.0	88.5	88.6
Total	**83.8**	**83.1**

Table. 2 Comparison of semester grades

A t-test was chosen to analyze the data with the probability of .05. The t-score was .510186 with the critical value of 1.960. The data indicates that there is no significant difference between the face-to-face classes and the blended classes. The average grade for both the face-to-face classes and the blended classes was 83%. With equivalent student learning, this research focused on student satisfaction and cost savings of blended courses.

Research Question 1: Does a blended course provide equivalent student satisfaction compared to a face-to-face course?

The quality pillar of student satisfaction was used to answer this research question. Students were asked to fill out a five-question survey on their perception of the effectiveness of blended classes. The following are the questions asked and a summary of the responses.

Question 1: What parts of the course Webpage are most useful?
For a blended class to increase student learning and increase student satisfaction, the Website needs to be structured. The students surveyed responded that the parts of the Website most useful were:

- Content page (where assignments are located)
- Video clips and PowerPoint presentations (visual aspects)
- Grade book
- Forum
- Test and quizzes

This question suggests that in a blended class, students use the Website to understand the structure and expectations of the course. It was also indicated that students liked the Website to address various learning styles like visual and auditory.

Question 2: What parts of the Web page were not useful?
The most common response for this question was the chat feature. Students replied that the chat was noisy and that the discussion was too fast. Overall, students thought that the chat was not needed because of the face-to-face class meetings. The calendar was also mentioned, largely because the content page contained due dates.

Question 3: What suggestions do you have for improving the Website?
Comments on improving the Website were mostly geared toward ease of use and structure. The most common responses were:

- Some dates were confusing
- Some assignments lacked explanation
- More back buttons
- Would like the Web pages to reinforce the book concepts
- Add instant messaging

Overall, students wanted clear directions and due dates. Blended classes allow students to get feedback and directions on the Web and in face-to-face classes.

Question 4: What suggestion do you have for improving the face-to-face classes?
One great benefit of a blended class is the opportunity for student and instructor interaction. Students responded that they wanted more demonstrations in class. This is not surprising, with many engineering education classes using class time for labs. Another common response was that students would like to understand the structure of the Website in conjunction with the class meetings. They wanted the classes to build on or reinforce the lessons from the Web. Students also commented on wanting more team activities in classes. They wanted to discuss case studies in the classroom.

Question 5: What suggestions do you have for improving blended classes in the future? The most common response was more class sessions. Not every week, but one or two more classes. Several students commented that organization of the class was the biggest key to a successful class. Students believe that a lot of thought needs to go into the face-to-face classes because they are limited, but can provide excellent productive learning opportunities. Another comment relayed by students was that they wanted to learn from each other in both the Web and classroom environment. Several students felt that the optimal number of class meetings should be 4-5. It was interesting that a few students wanted the first class meeting to be face-to-face in order to explain the structure of the blended course. Overall, students want the Web content to connect to the activities in the face-to-face classroom.

The results of the survey show that students were satisfied with the blended format. The structure and interaction of both the Web portions and the classroom portions were important to the students. According to the students in this research, a blended course does offer equivalent student satisfaction compared to a face-to-face course.

Research Question 2: Does a blended course provide cost saving compared to a face-to-face course?

The quality pillars used to answer this research question were cost effectiveness and access. To determine the cost effectiveness of a blended course, only the travel time was calculated. The travel cost was the mileage (.375) for 270 miles. The stipend for traveling over 100 miles for 16 weeks is $1500. It should be noted that this cost figure is a reflection of this university only. Other universities will have to use their current systems to calculate cost savings. Table 3 shows that the potential cost saving for a blended was $2,340. This cost saving can be realized per class. Bear in mind that time and use of classroom equipment was not calculated, so it can be assumed that the cost may be greater.

	Face-to-face (16 classes)	**Blended (4 classes)**	**Potential Savings**
Travel cost	$1,620	$405	$1,215 savings
Stipend for traveling	$1,500	$375	$1,125 savings
Total	$3,120	$780	$2,340 saving

Table 3. Potential cost savings of blended classes

The results of the cost analysis indicate that there can be substantial cost savings depending on the distance and financial compensation of the university. The cost savings realized by this example may not be the same for all universities. The blended format allows an additional class format option for students to choose. It allows students to have access to online material and interaction with equipment and the instructor through class meetings. Campus-wide, Institutional Research asked graduating students in 2006 if they had taken a blended course. The result was that 63% had taken at least one course. The data show that students do have access to blended courses. Students have access to blended courses and universities can incur cost savings compared to face-to-face classes.

Discussion

Research supports student satisfaction and learning with the traditional classroom and online course format, but only a handful of studies assess blended learning. The purpose of this paper was to reflect on the increase of blended learning course formats and provide evidence of student satisfaction and cost savings using a quality assessment model. This study was limited to the five courses assessed at a Midwest university. The results of this study validated prior research that student learning in a blended format is equivalent to face-to-face formats. Blended courses adhere to the principles of good practice in undergraduate education[20]. Table 4 describes features that connect the principles of good practice to blended course components.

Principle	**Blended Components**
Encourage student-faculty contact	• Class • E-mail • Office hours • Announcements • Listservs • Forums • Chat
Encourage student cooperation	• Class projects & teamwork • Evaluation of student work by other students • E-mail • Listservs • Forums
Encourage active learning	• Teamwork • Online assessment • In-class assessment • Interactive modules
Give prompt feedback	• In-class discussion • In-class assessment • Office hours • Online assessment • E-mail responses • Interactive modules
Emphasize time on task	• Syllabus • Clear grading criteria • Assignment deadlines

Communicate high expectations	• Syllabus • Ask questions • E-mail • Splash page • Provide examples of quality work
Respect diverse talents and ways of learning	• Visual learning • Auditory learning • Kinesthetic learning

Table 4. Summary of good practices for a blended class

Results of this study illustrate that blended classes should to be structured based on the pedagogical needs of the class. Students believe that a blended course provides an opportunity for student and instructor interaction, making learning collaborative and not isolated. Frequent student-faculty contact in and out of class is an essential feature in student motivation. Blended classes allow engineering education programs to fully utilize the equipment and software, which can support ABET accreditation criteria and allow universities to make use of the investments in specialized labs. The growth rates of blended courses are continuing to rise and can be interpreted as student satisfaction with the blended format. In addition, blended courses can reduce cost compared to face-to-face classes.

Conclusion and Recommendations

Blended courses integrate online classes with face-to-face classes in a planned pedagogical manner. The benefits of blended classes include greater access, flexibility, student satisfaction, and cost savings. Another advantage of the blended format is that it teaches students to manage their time. The research indicates that the presence of the teacher is important and students preferred content knowledge online and interaction and advanced learning in face-to-face classes. Instructors liked the flexibility of putting content online and using class-time for labs and interaction. This study confirmed prior research that blended courses are equivalent to face-to-face courses in terms of teaching effectiveness and can provide student satisfaction and cost savings. With the popularity of blended courses increasing, engineering education should look at the blended class as a format choice for appropriate programs. The blended class allows experiential learning and use of expensive laboratories which help fulfill ABET accreditation standards. Whatever format is chosen, quality should not be abandoned. It is important for faculty considering a blended course format to think about objectives of the course. Is the blended format best for that class? Planning of the course is essential. For the student to have a meaningful learning experience in the blended classroom, the instructor must connect the online lessons with the face-to-face classes. The emphasis in the blended class should be on the learning and not the technology. The following are recommendations for an effective blended course:

- Training for instructors may be useful. They must adjust to the new format.
- Structuring the course for the learning effectiveness requires careful planning.
- Link the Web lessons with the face-to-face meetings.

The number of blended courses in engineering education will continue to increase. Faculty and students will demand more blended modalities as the benefits to teaching and learning are explored. Blended courses can offer student satisfaction and cost savings. The blended classroom can be the best of both worlds!

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