# Online Engineering Education Using Blackboard Collaborate

**David C. Paulus, PhD, PE and Daniel M. Settlage, PhD**
**University of Arkansas - Fort Smith, Fort Smith, AR**

## Abstract

On average, students in online learning conditions perform modestly better than those receiving face-to-face instruction.  Blackboard Collaborate was used for live online lectures for mechanical engineering students that enrolled in a face-to-face machine analysis course.  At the end of the class, the students were given a survey to assess their attitudes and opinions about using Collaborate.  All the students found it easy to use and access; however, the top students generally report a greater level of satisfaction with using Collaborate than the bottom students.  In addition, the top students reported a greater comfort and ease with online participation and a better self-reported learning outcome than the bottom students did.

## Background

Introduction to Machine Analysis (IMA) is a required sophomore-level mechanical engineering course that teaches kinetic and kinematic analysis techniques for mechanisms.  Mechanical engineering students at the University of Arkansas in Fayetteville (UAF) enrolled in a five-week face-to-face traditional IMA course in the summer 2013 semester.  Dr. Paulus was hired as an adjunct professor to teach the course via live video link from the University of Arkansas - Fort Smith (UAFS) because of the two-and-two transfer agreement between UAFS and UAF in which UAF classes are taught on the UAFS campus via video link for the second two years of the curriculum.

Because of technical difficulties with the live video link system, Blackboard Collaborate was used instead, and a screen-shot is shown in Figure 1.  Students would log-in to Collaborate during normal lecture time and participate in the live lecture by pushing their "Video" and "Audio" buttons in Collaborate to be seen and heard by the rest of the class. Students could also use a "Chat" feature to make comments and ask questions by typing.  The instructor's Audio and Video link were always engaged, and live lectures were given using PowerPoint slides and by writing and drawing on the "white-board" feature in Collaborate using a Bamboo brand tablet and stylus.  All lectures were recorded and could be reviewed by students throughout the semester.  In addition, the instructor made recorded videos working additional problems to serve as a review for the exams.

Figure 1.  Screen-shot of Blackboard Collaborate.

## Introduction

A common misconception about online learning is that it is a solitary, self-paced, non-instructor led activity [1].  Using Collaborate retains the social and participation aspects found in a traditional lecture which is a key factor in the success of online learning [2].  The 2010 meta-analysis performed by the U.S. Department of Education [3] found that, on average, students in online learning conditions performed modestly better than those receiving face-to-face instruction.   Moreover, using the live interaction instruction possible with Collaborate could help address the Sloan-C quality elements including: learning and cost effectiveness and institutional commitment, access, faculty and student satisfaction [4].  Although the successes and student opinions of online learning are well established, the fact that the students in the present study initially signed up for a face-to-face class may affect their opinion of the course.  Most studies related to online learning begin with a class of students that have self-selected into an online course.  This study begins with a class that self-selected into a face-to-face class which was subsequently changed to an online class.  This provides a unique opportunity to examine the opinion of students without suffering from sample selection bias.  Therefore, a survey was constructed to assess how the students' felt about using Blackboard Collaborate for their class.

## Methods

At the end of the five-week summer course the students completed the non-anonymous Likert Scale survey found in Figure 2.  The questions only deal with their experience with Collaborate and not with the performance of the professor or student in class.  Thus there was no need to make it anonymous, and the students volunteered their names with the survey.  The survey asked questions relating to the following aspects of using Blackboard Collaborate:  Technology, Accessibility, Participation, and Learning.  All "questions" are actually statements written in the affirmative toward Collaborate such that answers that strongly agree or agree with the statement

are a 1 or 2, respectively and answers that disagree or strongly disagree with the statement are 4 or 5, respectively. An answer of 3 means the student feels neutral and neither agrees nor disagrees with the statement.

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**Student Experience using Blackboard Collaborate**

1 strongly agree , 2 agree, 3 neutral, 4 disagree, 5 strongly disagree

**<u>Technology</u>**

1. Blackboard Collaborate was easy to use and access.
2. The audio and video quality of the online lectures was acceptable.
3. I preferred the professor writing directly on the PowerPoint slides in Collaborate to writing on the board in a traditional classroom.
4. Watching and listening to the professor in Collaborate was comparable to sitting in a traditional lecture.
5. I preferred using Collaborate over the live video link from UAFS to UAF.
6. I preferred using Collaborate over a traditional classroom lecture

**<u>Accessibility</u>**

7. I liked having the ability to re-watch recordings of the online lectures.
8. I preferred being able to log-in to class from anywhere rather than a designated classroom.
9. I preferred being able to watch the pre-recorded video reviews whenever I wanted rather than during a set time for a review session.
10. I would prefer to take all of my classes online.

**<u>Participation</u>**

11. I was able to communicate via Collaborate as well as in a traditional classroom.
12. I am more comfortable asking questions in an online lecture than in a traditional classroom.
13. I was comfortable using the Talk button to be heard by the class.
14. I was comfortable using the Video button to be seen by the class.
15. I was comfortable using the Chat feature to participate in class.
16. I preferred communicating with the professor during class using the "Chat" feature over the Talk and Video features.

**<u>Learning</u>**

17. I feel like I learned as much with the online environment than I would have in a traditional classroom.
18. I feel like I would you have learned more if I had more face -to-face time with the professor.
19. It found it easier to pay attention on Collaborate than in a traditional lecture.
20. Pre-recorded review videos improved my understanding of the material.

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Figure 2. Survey assessing student experience with Blackboard Collaborate

## Results

Twenty-four students participated in survey out of the twenty-five students in the class. Figure 3 shows the modal (most frequent) response to the survey, and Figure 4 shows the percentage of students who agreed or strongly agreed with each question.

*Proceedings of the 2013 Midwest Section Conference of the American Society for Engineering Education*
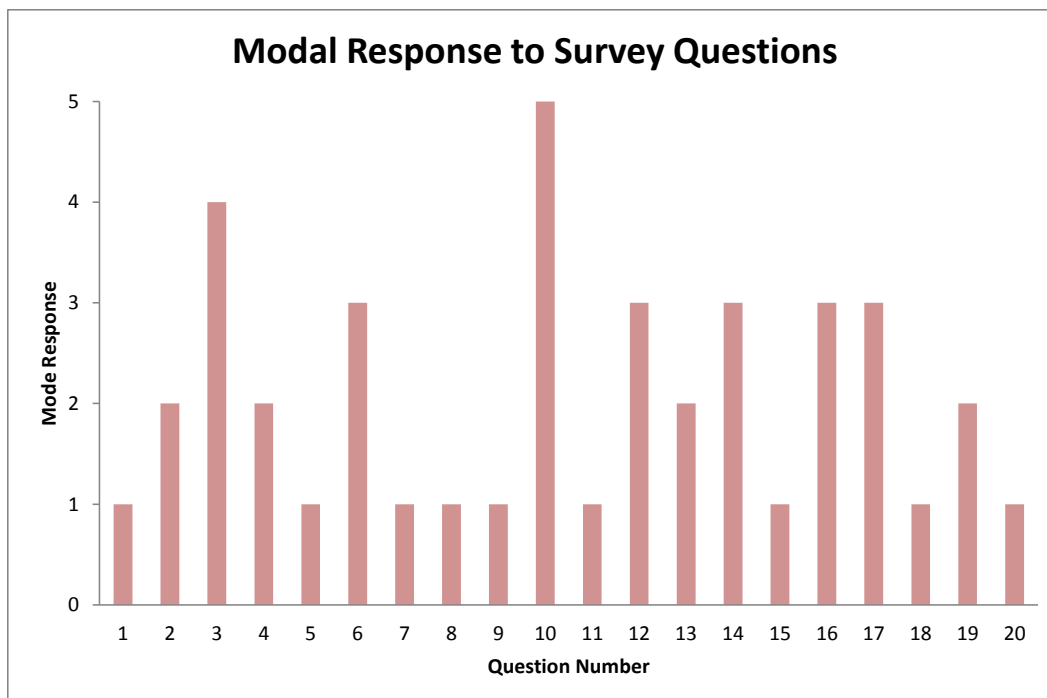
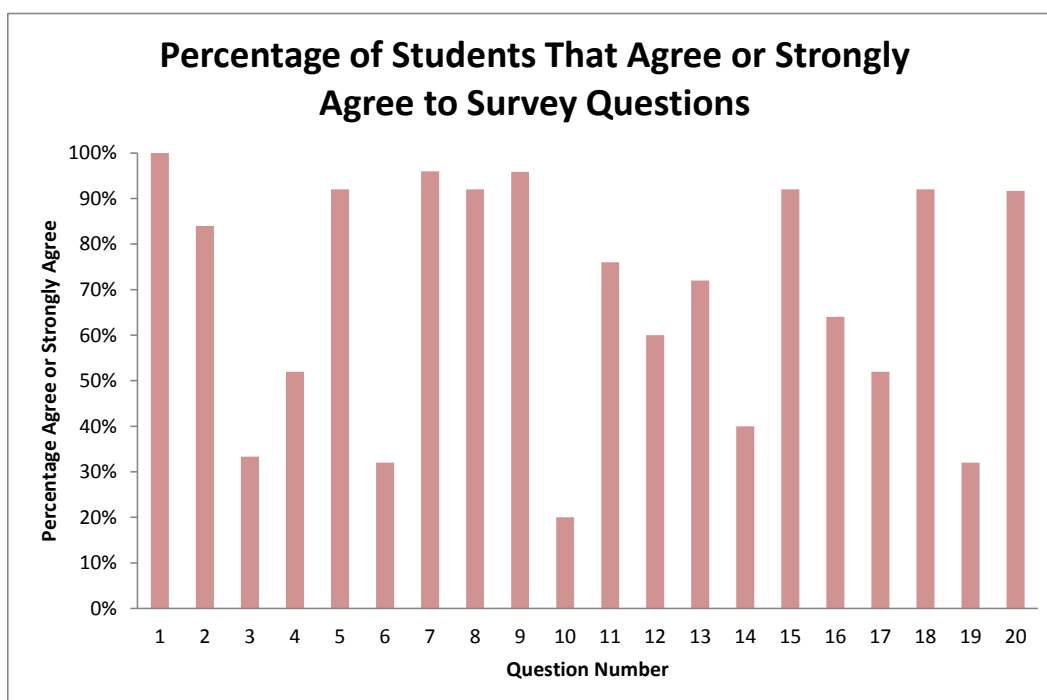Figure 3.  Modal (most frequent) response to each survey question



Figure 4.  Percentage of students that agree or strongly agree with each survey question

Because the survey was not anonymously given, the survey results could be grouped by class ranking of top, middle, and bottom one-third of the class' final grades.  Figures 5 through 8 show the modal response results separated by the top, bottom, and middle thirds of the class ranking.
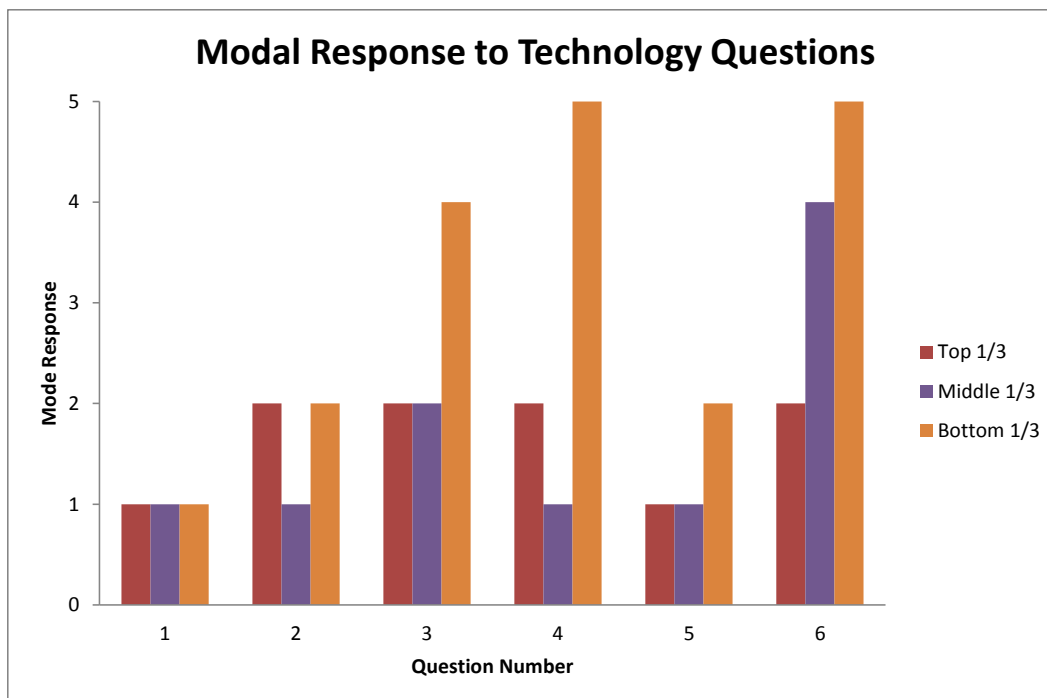
Figure 5.  Modal response to survey questions relating to Collaborate technology separated by class rank
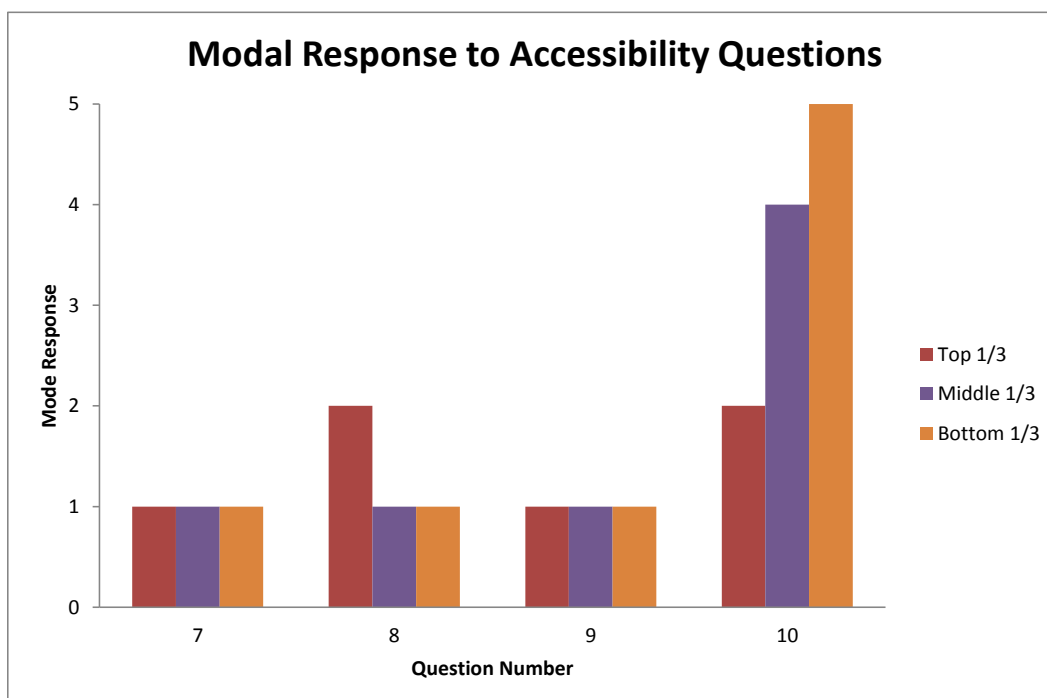


Figure 6.  Modal response to survey questions relating to the accessibility of Collaborate separated by class rank
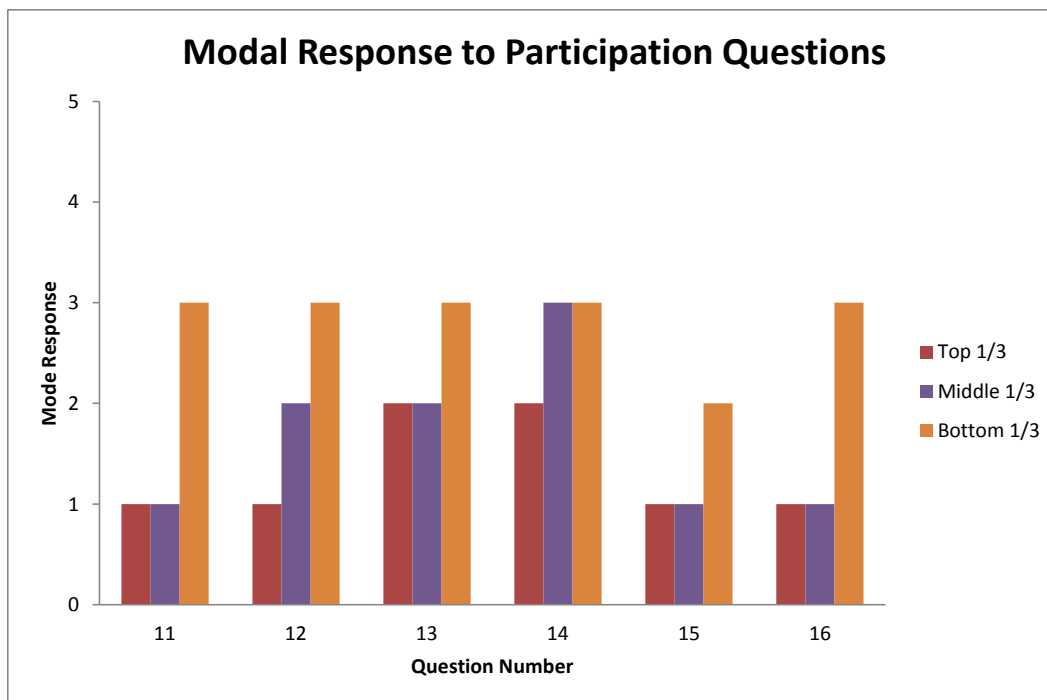
Figure 7.  Modal response to survey questions relating to the ability to participate in class using Collaborate separated by class rank
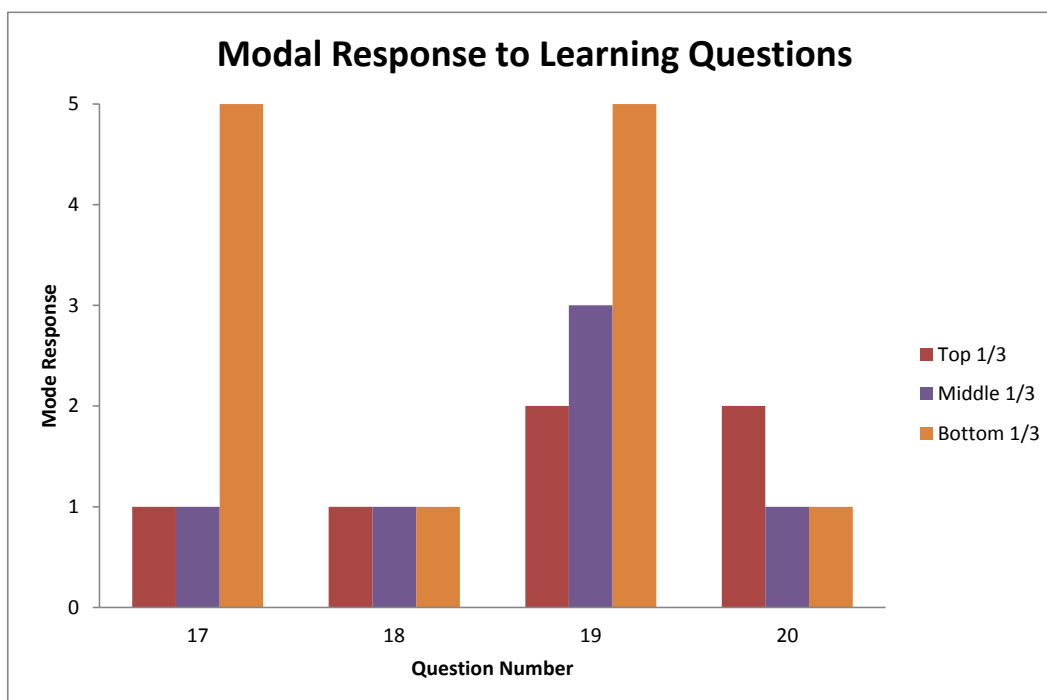


Figure 8.  Modal response to survey questions relating to learning associated with Collaborate separated by class rank

**Conclusions**

The data from Figure 3 indicates that the most frequent response to question one is to "strongly agree" that Collaborate was easy to use and access, and Figure 4 shows that 100% of the students agree or strongly agree with that statement. Figure 3 also shows the most frequent response to question ten is to "strongly disagree" with the preference to taking all of their classes online, and Figure 4 shows that only 20% of the students agree or strongly agree with wanting all of their classes online. That suggests that the reason students would not choose to take all their classes online is not because of difficulty using Collaborate technology.

Figures 3 also shows from question three that students most frequently answered that they disagree with the preference of taking notes that are written on PowerPoint slides in Collaborate compared to writing on the board in a traditional classroom, and Figure 4 reveals that only 30% of the students agreed with preferring notes in PowerPoint via Collaborate.

Figure 4 shows that over 90% of the students agreed with question five that they preferred using Collaborate to the video link between UAFS and UAF. This is very interesting for other universities that have a similar agreement because there is a lot of overhead in equipment and technical support that could be eliminated by adopting Blackboard Collaborate instead.

Over 90% of the students agree that they preferred the accessibility of Collaborate over a traditional class as seen in Figure 4 from question seven, eight, and nine. Question fifteen in Figure 4 reveals unanimous comfort using the "Chat" feature to participate in class, and the authors can attest to the frequency of questions and comments from the Chat feature were far more frequent during class than the rest of the communication methods. Thus it is very important for instructors to pay attention to the "Chat Board" to answer questions in a timely manner.

Question four in Figure 5 shows that the bottom one-third of the class strongly disagree that watching lecture on Collaborate is comparable to a traditional lecture, whereas the top one-third agreed that it was. Next, Figure 6 shows relative homogeneity among the class ranks as to the accessibility of Collaborate. After that, Figure 7 shows the bottom one-third students tended toward neutrality about participation questions and top and middle students tended to agree that they were comfortable using Collaborate's audio, video, and chat features to communicate and participate in class.

Figure 8 shows an interesting difference in learning opinions between the top and bottom one-third of the class rank. In question seventeen the top and middle ranked students strongly agreed that they learned as much online as they would in face-to-face environment, and the bottom students strongly disagreed. One could deduce that online learning may be more appropriate for higher ranking students. However, question eighteen reveals that all ranks felt that they would have learned more with more face-to-face time with the professor.

**Discussion**

The survey results were analyzed by calculating the modal response for each question. Because Likert survey data is ordinal in nature, it is inappropriate to report mean response values or use parametric testing procedures [5]. Although many authors ignore this distinction and erroneously apply parametric methods to Likert survey data, the results cannot be properly interpreted.

The results suggest that students generally hold a favorable view of online learning in general and Blackboard Collaborate in particular. This is consistent with the findings of other research [6]. In addition, by partitioning the data by class performance, the authors found that there are substantial differences in the way the top students felt about online learning versus the bottom students. The top students generally reported a greater level of satisfaction with using Collaborate than the bottom students. In addition, the top students reported a greater comfort and ease with online participation and a better self-reported learning outcome than the bottom students did. An interesting extension of this research would be to gather additional demographic characteristics in an attempt to explain the factors that drive student preferences and learning outcomes.

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**Bibliographical Information**

Dr. David C. Paulus, PE is an Associate Professor of Mechanical Engineering at the University of Arkansas – Fort Smith and serves as an Associate Editor of Journal of Online Engineering Education. David.Paulus@uafs.edu

Dr. Daniel M. Settlage is an Associate Professor of Economics at the University of Arkansas – Fort Smith and frequently teaches Business Statistics courses. Dan.Settlage@uafs.edu