

Implementation of a Hybrid Teaching Environment for a Traffic Engineering Course

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Abstract

Students learn in different styles. They learn via hearing and visualizing. They can also reflect and act upon what is presented to them. Afterwards, they start to reason in a logical and intuitive ways as well as memorizing and visualizing, and eventually building mathematical models. Teaching approaches also differ from one course to another and from one instructor to another. Some instructors tend to lecture, others demonstrate or discuss while some focus on principles and applications. The quality of student learning process is controlled by the student's own ability and previous preparation but it also depends on the affinity of the student's learning style and the instructor's teaching delivery style.

This case study illustrates the transition of a four-thousand level traffic engineering course from a pure face-to-face to a hybrid environment. The implemented hybrid teaching style included one face-to-face weekly lecture besides another lecture being posted online as a YouTube video. Analytical comparisons were conducted between two offerings of the course: before and after the hybrid teaching style Implementation. Based on the presented results, including improved overall grades, student enrollment increase, and positive evaluation feedback, it can be concluded that the implementation process was successful.

1. Introduction

Hybrid teaching style has become an interesting learning delivery method in recent years. Many universities are considering generating their own hybrid learning courses as another option for students and instructors who prefer to replace some portion of traditional face-to-face meeting time with online instruction.

In spite of the increased recognition of Internet-based learning or distance learning, pure distance learning has some restrictions. Rovai and Jordan [1] indicated that

students, especially dependent learners, are less self-regulated and need persistent direction and guidance from an on-site professor. Otherwise, they can lose concentration during the extent of the course. To deal with the lack of student-instructor face-to-face contact that occurs in distance learning, a new learning style known as hybrid teaching or blended teaching environment has been established. Dodero et al. [2] indicated that hybrid teaching encourages more student participation, when compared with pure virtual electronic teaching style.

Hybrid teaching tends to benefit both students who work full-time as well as fulltime/on-campus students. The nature of this new teaching style as defined by Garrison and Kanuka [3] deals with the dual environment of the hybrid class, which allows students to meet together in a traditional face-to-face mode and maintaining the connectivity while students are apart or physically separated in an electronic learning style. Hybrid teaching is considered to integrate the optimal desired features of the conventional face-to-face learning with online-learning by dividing the total class time into a web-based learning portion and a face-to-face meeting portion [3-6]. However, the extent of each learning style may vary according to the course design [7].

2. Background of the Studied Course

Traffic engineering course is a four-thousand level course that include Introduction to traffic systems, flow characteristics, data collection, control of urban streets and freeways, operations of arterial streets, freeway, and networks, optimal signal timing design, capacity analysis using computer simulation. Additionally, the course covers a detailed Evaluation of stresses in flexible pavements, materials characterization, and design of flexible pavements for highways and airports. The major learning objectives of the course are:

1. Develop an organized approach to solving traffic engineering analysis and design problems.

2. Explain traffic stream characteristics, volume studies, speed, travel time, delay, accident, intersection design and parking studies.
3. Explain traffic congestion from the supply and demand perspective and classify many intelligent transportation system solutions.
4. Explain uniform traffic control devices including traffic signs, markings, signal, and warrants.
5. Analyze freeway and highway capacity including the unsignalized and signalized intersection capacity, arterial planning and design, identify operational problems and carry out traffic engineering studies.
6. Explain signal components, control and operations, signal timing and systems coordination and evaluate alternative signal timing solutions.
7. Familiarize the students with the procedures used to design pavements.
8. Develop a fundamental understanding of the analysis of pavement structures (develop necessary analytical skills to analyze stresses and strains in pavement system).
9. Understand the concepts and theory behind the materials and drainage characterization requirements for input in pavement structural design and performance.

3. Utilized Hybrid Method

One of the main utilized components of the hybrid teaching style was to post one of the two weekly lectures on YouTube. Students had the chance to watch the lecture at different times that can fit their own personal schedules. Additionally, the lecture notes were posted on Blackboard. Some of the online-posted lectures were followed by a quick quiz in order to insure that students indeed watch the required materials.

The Hybrid style also allowed the instructor to add extra video materials on YouTube for the students who tends to be more interested in the topic rather than being limited to the class time in the face-to-face teaching style. Adding extra related materials on YouTube had led to have few undergraduate students to consider start a graduate degree in transportation engineering.

4. Comparative Study

A comparative study was conducted between two offerings of the traffic-engineering course at the University of Texas at Tyler. These semesters were fall 2014 versus fall 2016. In order to compare the implemented hybrid teaching style versus the conventional face-to-face teaching style, several quantitative and qualitative parameters were

utilized. The following is a summary of the three above-mentioned parameters:

4.1 Student Grade Performance

Students performed significantly better in two midterm exams in Fall 2016 with the hybrid style as compared to student performance in Fall 2014. The average grades of the first midterm exam for the hybrid class and the conventional face-to-face teaching style were 86 and 80.7, respectively. In addition, the maximum grade was 97 for the hybrid class compared to 92 for the face-to-face conventional style. Hybrid class minimum grade at that test was 77 compared to 72.5 for the conventional style as shown in Figure 1.

The second midterm performance was confirming the first midterm grades. The average grades of the second midterm exam for the hybrid class and the conventional face-to-face teaching style were 94.8 and 84.9, respectively. In addition, the maximum grade was 99 for the hybrid class compared to 92 for the face-to-face conventional style. Hybrid class minimum grade at that test was 91 compared to 79 for the conventional style as shown in Figure 2.

Based on the illustrated results, it can be noticed that implementing the hybrid style of teaching improved the overall grade performance of the students.

4.1 Student Enrollment

A significant increase in enrollment was observed once it was announced in advance that the class would be taught in a hybrid style in fall 2016. As shown in Figure 3, 16 students enrolled in fall 2016 compared to only six in fall 2014. Hybrid style offered a motivational incentive to the students since they are required to attend one face-to-face lecture rather than two using the conventional face-to-face teaching style. This hybrid style offered the senior students a more flexible class schedule since they can watch the other teaching materials via YouTube at their leisure

4.2 Overall Student Feedback and At the End of the Semester

One of the trigger factors that motivated the instructor to change the teaching style of this course to a hybrid teaching style was student's comments at the end of the semester. One of the students commented in his/her end-of-semester evaluation saying, "The class needs to be changed to a hybrid and only meet on Mondays". Upon changing the teaching style In Fall 2016, student comments changed to be more positive such as "I really enjoyed this course and learned a lot". This was another confirmation that the implemented change was the right decision made by the instructor.

4. Conclusions

This case study presented the conversion of the traffic engineering course from the conventional face-to-face teaching style to the hybrid environment. Quantitative and qualitative comparisons were conducted between two offerings of the course: before and after the hybrid teaching style implementation. Based on the presented results, including improved overall grades, student enrollment increase, and positive evaluation feedback, it can be concluded that the student's perception of the change as well as the teaching implementation process was successful.

References

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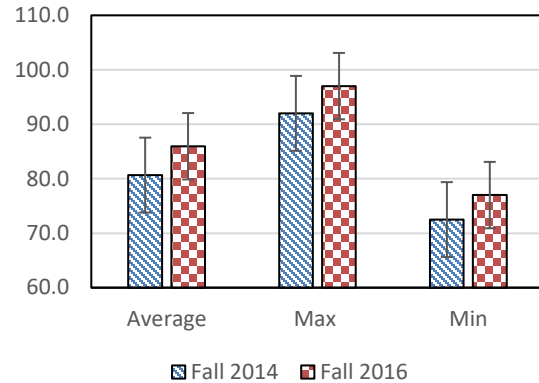


Fig. 1 Student grade performance on first midterm exam (whiskers denotes for standard deviation)

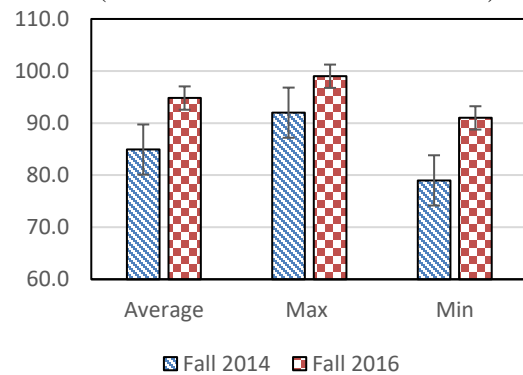


Fig. 2 Student grade performance on first midterm exam (whiskers denotes for standard deviation)

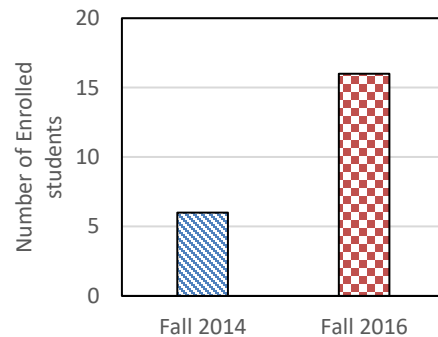


Fig. 3 Student enrollment comparison