

Engaged Lecturing in Lecture-Based courses

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Abstract

Numerous teaching styles are implemented by educators to capture the attention and interest of engineering students. Lecture-based courses can be significantly less engaging than inductive or project-based courses, however, lectures continue to be necessary. For this reason, there is a deliberate effort to explore all avenues that aid retaining the student's interest-level and content-assimilation while participating in long (50 to 75 minute) lecture sessions.

In this paper, we specifically discuss simple methods (systemic pauses and group in-class assignments) that can be used in any lecture-based course. These methods were implemented at our lecture sessions. To gauge the efficacy of these methods, collaboration between two instructors was established and these methods were implemented simultaneously in different lecture based classrooms.

Our goal is for students to retain the subject matter of a course and achieve mastery of the course learning outcomes. As methods to evaluate goal attainment, we provide an overall assessment of student interest-level and understanding of the course materials over the duration of lecture sessions. It is noted that, while we present the impact engaged lecturing has with students, we also discuss the process (orientation to teaching techniques, feedback/assessment practices) that goes with instructors to establish a culture of engaged learning in a program.

1. Introduction

Academic institutions use a lecture based approach and a problem-based-learning (PBL) approach to teach core/foundational subjects and to convey content. These are distinctly different in that, while lectures are considered deductive, PBL approaches are deemed inductive. While there may be a discussion [1] as to which is more effective, in either scenario, students are generally educated over a period of over 45 minutes in a room setting. The issue that we wanted to consider was to improve the efficiency in learning within that span.

Since the 1970's [2], it has been reported, that the typical attention span of a student in a lecture deteriorates rather rapidly, after the first 10-15 minutes. Wankat [3] has

indicated that the effective learning happens during the first ten minutes after considering various studies on this topic. If we were to map out the students paying attention as a function of time, after an initial "warm-up" it will reach a maximum around 10 minutes and from then it will start dropping steadily; that trend can be plotted as shown in Fig. 1 [4].

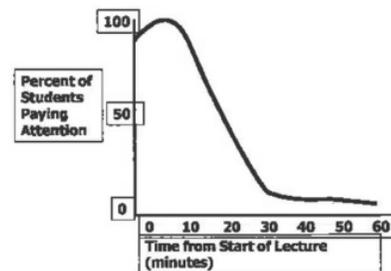


Fig. 1 Percentage of students paying attention, as a function of lecture-time. Adapted from [4] slides.

At the University of Texas at Dallas, for a three credit hour lecture based course, the lecture sessions are either two 75-minute long sessions or three 50-minute long sessions in a week. For this discussion, we have considered two courses, Statics (MECH 2310) and the computer aided design (MECH 3305), both of which had 75-minute long lecture sessions, twice in a week. The students enrolled in these courses were at sophomore or junior levels.

While both courses had project based learning components, in this discussion we want to focus on the study conducted during the lecture sessions.

The instructors, while attending a workshop on engineering education [4], were exposed to how ineffective lecture sessions can be to student-learning when a mindful effort is not made by instructors to keep them engaged. While engaged classroom may be accepted as a general teaching philosophy across different institutions, the authors realized the need to study, systematically, the impact different teaching methods had to student classroom learning experience at their University. In this paper, we report our data from the first such study related to the impact of interruptions (by introducing pauses during lectures and in-class-assignments) during 75-minute lecture sessions. The effects of these were assessed by voluntary student survey at the end of the semester.

We note that this study stemmed out of an intentional collaboration between instructors in a program to study and understand the benefits or the lack thereof such methodologies can have to student learning experience within the institution. Collaborators had established regular meetings to discuss the feedback from students and ideas to improve the implementation of such methods to their lectures.

It is anticipated that future implementations will permeate other courses and data will be cumulatively studied over several semesters, across different courses and with different instructors. Such studies, in the future, can help address questions that essentially require data from across a wide spectrum of teaching institutions. Some of these questions are: do these methods have a dependence on the level of the teaching institution? Do they have student demographic dependence? What is its impact when teaching conceptual versus analytical content?

It is further noted that the 10-15 minute attention span, that is generally expected, has been challenged [5] due to the type of data/method that had been used to estimate those durations.

In the sections below, we first provide discussions related to the 10-second pause method, followed by discussions on the in-class-assignment method and summarize in the end.

2. Systematic 10-Second Pause

While delivering a lecture, the professor applies a systematic pause by simply stopping to talk for 10-seconds and then proceeds with the lecture. While receiving a lecture, this brief occasional pause gives students a break during the lecture and allows for a fresh start several times during the lecture. The value of this pause, for the assessment of student's retention of knowledge, is reported in the literature [6]. The purpose of this paper, however, is to describe the author's positive experience with the pause.

When applied for the first time, it was very interesting to find that 10 seconds can be perceived as a very long time. The professor smiles and counts to 10 slowly and silently. Students look up during this break to see the professor smiling quietly. Several students smile back. A trust is developed and a fresh start is achieved several times within the lecture.

The pause does not require changes in the lecture material or class description. It is very simple to implement and may already be subconsciously used by a professor. However, when used intentionally, the pause helps to establish a break from the voice of the professor, which can be monotonous in a long lecture regardless of the professor's enthusiasm and interest in the engineering subject.

A survey was conducted at the end of the class seeking response to specific statements about the 10-second pause. Forty-three students who took MECH 3305 answered the survey. These are the statements:

- I never noticed the professor's pause
- When the professor pauses (stops talking), it helps to regain focus.

The results are presented in Fig. 2. In this figure, 16% of the students agree or strongly agree that they never noticed the pause. Almost half the class (47%) noticed the pause. The remaining students were neutral to this statement.

More than half (53%) of the students agree or strongly agree that the pause helps them refocus. Only 18% felt contrarily while others were neutral.

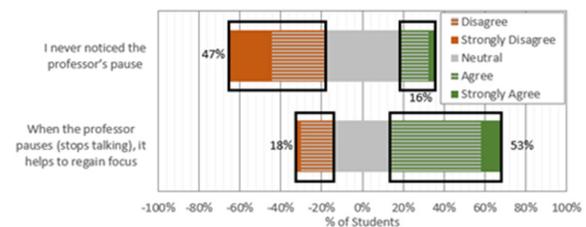


Fig. 2 Student's Response to Survey Questions About the 10-Second Pause

3. In-Class-Assignments

In the Statics course, to break the lecture continuum, in-class-assignments (ICAs) were often assigned during lectures. The instructor employed these not as an assessment tool. Instead, they were short exercises that directly relate to the content discussed prior to the assignment. During these assignments, students were allowed to work collaboratively. Besides providing a break to the continuous listening process, this also provided an avenue for students to be engaged with the content.

At the end of the semester, a questionnaire that gathered student responses to such interruptions provided the data for the study. Twenty-seven students participated in this survey. Shown in Fig. 3 are the student's response to statements related to loss of concentration and the corresponding impact of ICAs. 85% of the students agreed that ICAs were useful to minimize loss of concentration.

We noticed that, in these responses, the majority of students could agree but only 30% and 15% could agree strongly to our statements. This survey was taken about a week after the last lecture session in the semester and students had to rhetorically reflect back on the lecture portion of the course and comment on these questions. Further, when lectures were delivered students were not

aware that ICAs were given to introduce interruptions deliberately. Therefore, we believe that the lower percentage to a strong agreement to the questions may be an indicator of the genuine and sincere reflection from the students.

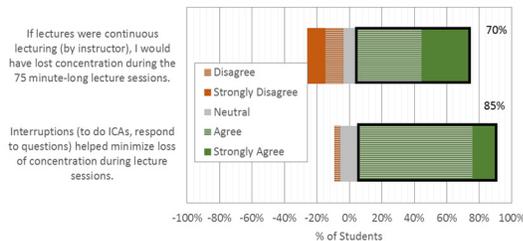


Fig. 3 Student responses to interruptions via ICAs

In Fig. 4, the responses from students to two diabolically opposite questions, but related to learning-gain during the lecture duration, are shown. These questions were chosen to get a correct feedback on the focus of the survey, that is, to know if interruptions helped students during the 75 minute long lecture sessions. About 56% of the students disagreed that they did not gain anything in the last 20 minutes of the lecture. 70% agreed that they were able to learn more because of interruptions. Collectively taken, responses to both these questions show that they had effective learning experience over the 75-minute duration.

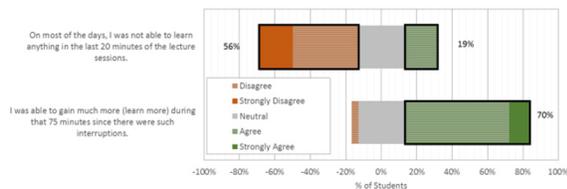


Fig. 4 Student responses to learning-gain during 75-minute sessions with interruptions

Although the ICAs assigned in the statics course involved working on a problems very similar to those that one might get in a pop-up quiz, since it had no direct impact on grades, students approached these assignments with an interest to understand the question, to setup/solve them and to understand their misconceptions while working on the problems.

In Fig. 5 we see the response of students to the question that asked them if they benefitted from such an exercise even if they did not successfully solve the assignment. About 89% agreed that they benefitted by engaging with the problem.

In the same figure, we have also shown the response to the frequency of ICAs during lectures and about 86% of the students did not find them to be too many. We learn that this teaching methodology improves

student engagement and it does not create an anxiety for them.

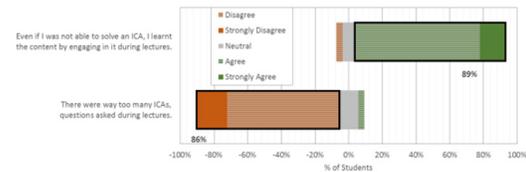


Fig. 5 Student responses to the frequency of ICAs and their content-engagement experience with ICAs

4. Summary

Educators often strive to improve the impact that lectures have in student learning. We have, in this paper, presented our attempt at improving our lectures by introducing simple teaching methodologies (systematic pauses and ICAs) and provided initial results from the study.

Data from a voluntary student survey indicate that these methodologies were helpful to students to

- stay focused and not loose concentration
- gain more due to such interruptions during the 75-minute long lecture sessions.

While we are encouraged by the positive responses shown and discussed in this paper, we realize our study can be strengthened by a larger data set from several semesters and from different instructors/courses. We are planning to pursue along that direction. We will also seek student's feedback on methods they may be using to stay engaged.

References

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