Teaching Your First Large Lecture: Surviving with Attentive and Engaged Students

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Abstract

The usual and customary appointment for a graduate teaching assistant or even new instructor in engineering is a recitation, workshop, laboratory or small classroom of typically 30 students or less. Hence, most practical advice for promoting attentiveness and engagement centers on that type of environment. In those environments, individual student-instructor interaction is easily possible in order to keep students attentive and engaged. Although less common, some new instructors are assigned to teach large lectures (>75 students), in which it is much more difficult to achieve student-instructor interaction and to encourage attentiveness and engagement. However, interaction, attentiveness, and engagement are no less critical for student learning in large lectures compared to smaller learning environments. This paper summarizes the student-centered-instructional approach in order to motivate new and future instructors to take responsibility for student attention and engagement regardless of classroom size. Additionally, the authors provide recommendations or *tricks of the trade* for promoting interaction, attention, and engagement in large lectures based on classroom observations and personal experiences.

Introduction

Many graduate students do not have experience teaching large lectures (>75 students). Often, especially in introductory engineering courses, they are responsible for labs/workshops or recitation sections[1,2]. When they are ultimately assigned a large lecture as senior graduate student or new faculty member, it can be a "trial by fire" experience where they simply try whatever seems like it will be successful. While there are numerous books and materials that can assist new and developing instructors [e.g., 3-8], studying these materials can be a daunting task when balancing new teaching, research, and service responsibilities.

In this paper, we briefly summarize the student-centered instructional approach in order to motivate new and future instructors to take responsibility for student attention and engagement regardless of classroom size. Then, we identify six practical recommendations to help new instructors survive their first large lecture assignment. While many (not all) of the tips have been previously reported in literature, we support the recommendations with engineering classroom data and personal experience with the belief that others can benefit from the previously unreported experience of graduate students assigned to large lectures. The recommendations presented in this manuscript provide a starting point for promoting student attention, interaction, and engagement in a variety of classrooms regardless of size.

Though both authors of this paper are relatively new to teaching large lectures, the generalizability of the recommendations presented in this paper is strengthened by the authors' multiple semesters of teaching experience at various institutions. Before teaching large lectures sections, both authors taught several courses fitting into the traditional recitation, workshop, and laboratory categories. Furthermore, the authors have taught multiple large lectures ranging in

size from 75 to 300 students contributing to their knowledge on *tricks of the trade* related to this topic.

Background

Student-centered instruction and classroom interaction can have a great educational impact in any size classroom. While various classes require different types of activities due to structural limitations, incorporating such elements into a class have been shown to improve both student engagement and learning.

Student-centered instructional approaches (i.e., pedagogies of engagement) follow from the idea that increased interaction with students and faculty leads to increased learning. In their synthesis of the history of pedagogies of engagement, Smith and others[9] identify Astin[10] and Light[11, 12] as key researchers in the field whose work emphasizes the importance of interaction. Both Astin and Light found that the level of interaction – both student to student and student to teacher interaction – played a critical role in a student's academic development. Furthermore, interaction had more impact than any other factor Astin evaluated, which even included curriculum details.

Importantly, the level of student interaction or engagement is not exclusively determined by the student; instructors can have a direct effect on the level of interaction. When instructors participate in meaningful interactions with students, both in and out of the classroom, they promote increased student engagement[13]. Furthermore, the delivery system for course content and pedagogical techniques can directly affect student engagement[9, 14]. With this in mind, instructors, not just students, are challenged to take responsibility for student engagement[9, 13]. One of the ways instructors can take responsibility for student engagement is by employing pedagogies of engagement such as active learning exercises or collaborative learning. These instructional techniques support student-teacher and student-student interaction, and ultimately foster learning[9, 14].

In addition to increasing interaction, pedagogies of engagement improve student learning by addressing limitations with students' attention spans. The typical implementation of active learning involves breaking up the lecture into short segments of lecture followed by activity. As an example, an instructor could ask students to divulge their Muddiest Point[15] after a mini-lecture period. In this activity, students are asked to report on the topic or item for the class that is the least clear or of most concern. This approach to instruction where the teacher breaks up lecture with active learning exercises increases student learning by addressing limitations in student attention span[9, 14]. Building on research findings that attention span is limited to 10-15 minutes, instructors who provide mini lectures followed by an activity, allow students to restart their attention span for each mini-lecture[14]. Although certain activities could encourage deeper learning than others, from an attention perspective, simple activities such as the one presented above are equally as productive.

At the heart of pedagogies of engagement is increasing interaction. The level of interaction varies according to implementation. For example, an informal collaborative learning

implementation could use a group Think-Pair-Share[15] to increase student-student interaction (during the Pair) and student-teacher interaction (during the Share). For this type of activity, students first think on a topic by themselves, pair with a partner discussing their thoughts to discover similarities and differences, and finally, share their findings with the entire class. Incorporating informal collaborative moments such as this into a class can have a great effect in terms of increased interaction. More formal implementations could involve a multi-week group assignment with several teacher-team advising sessions. Such projects could include either problem-based or project-based learning assignments[16]. These implementations would provide for more student-student and student-teacher interaction compared to the traditional lecture.

Increased interaction is valuable not only due to Astin's[10] work establishing interaction as one of the most important predictors of students' academic success, but also because increased interaction can provide students an opportunity to elaborate on material. In learning theory, elaboration refers to meaning-enhancing processes such as finding additional information on a lecture topic or connecting new information to prior knowledge and alternate situations[17]. Elaboration has been shown to aid long-term learning[17]. By requiring students to discuss material in groups, they are forced to elaborate on the material as they work to create meaning and share their own prior knowledge and understanding. This elaboration can turn into a form of peer tutoring where students can correct each other's misconceptions creating positive learning experiences both for the learner and for the tutor[17].

In summary, student-centered instruction and classroom interaction have been found to be at the heart of student engagement and have been found to directly contribute to student learning. These concepts can take many forms such as simple classroom assessment techniques to extensive projects, but whatever the form, they are pedagogical practices that can enhance instruction in classrooms of any size.

Large Lectures vs. Small Lectures

While this paper is titled <u>Teaching Your First Large Lecture: Surviving with Attentive and Engaged Students,</u> it is important to keep in mind that large and small lectures often have many similarities. Examples of potential commonalities that we have experienced include:
1. The course content and high-level learning objectives remain the same regardless of size.
2. Students in both sized classes are at the same place in their program (e.g., small or large, a first-year course often has first-year students).
3. Regardless of class size, an individual student's initial interest in the course topic is usually the same.
4. There is only one instructor (you!) in both large and small classes.
5. Not everyone wants to be there (especially if it is a required class).

While there are similarities between classes of varying size, there are also key differences. Some inherent differences that we have observed include:
1. The student-instructor ratio is higher in large classes (more questions, more emails).
2. It is easier for students to hide or avoid individual accountability in larger courses.
3. It is nearly impossible to learn all your students' names (depersonalization) in large lectures.

4. Routine tasks (e.g., handing out papers) take longer as the class size grows.
5. As the enrollment rises, the class has a wider range of prior knowledge and experiences because there are simply more people.

The similarities between a small and large class give a new instructor a starting point as they begin teaching a large lecture for the first time, but the differences make leading a large lecture a new challenge.

Sources of Data

As this manuscript is set to establish some *tricks of the trade* for graduate students and new instructors teaching lectures, two sources of data support the recommendations in this paper: 1) observations conducted during research and 2) personal experience/evaluations. First, naturalistic observations of six experienced large lecture instructors were conducted over two semesters in order to identify strategies used by experienced instructors and perceived changes in student attention[18, 19]. These observations are part of a research project investigating students' time on task in technology-infused, student-centered large lectures. The observation data was collected in large, first-year engineering lectures at a large research university located in the Southeast United States (University A). Each fall semester, the College of Engineering at the site enrolls approximately 1400 new general engineering students, and lectures in the program currently range in size from 100-300 students. The College of Engineering at University A has an established personal computer requirement, and students are required to bring their computers to lecture to use a specific interactive learning software. The software relies on a server to pass content between the instructor and students, and includes visual depiction of which students are "on-task". This visual depiction was observed and recorded during observations for software validation pusposes[20]. Second, the roles were reversed, and senior faculty observed and evaluated the two authors' of this paper in their own lectures providing feedback on instruction and ways to improve student interaction, attention, and engagement. Both authors have personal experience teaching large lectures at University A. One author taught large, first-year engineering lectures (75 students) at a second large research university (University B) while the other author had extensive laboratory experience at a third university (University C) before teaching at University A. Additionally, both authors are involved in a graduate student learning community focused on enhanced pedagogical practice. The two data sources combine to provide empirical evidence to support the recommendations provided in this paper.

Tricks of the Trade for Large Lectures

Now that a baseline has been established addressing the need for student-centered class interaction and the similarities and differences between a small class and large lecture have been examined, we would like to share our recommendations or *tricks of the trade.*

1. Be cautious when reminding students that a homework assignment, survey, quiz, etc. is due later in the day.

In large classes, this simple reminder often causes students to start working on that assignment, thereby decreasing or even removing their attention to your lecture. This is especially problematic in large lectures since students are able to "hide". This type of student behavior was consistently observed during multiple courses with multiple instructors. One way to combat this issue is to save announcements for the end of lecture, but this requires strong time management skills and lesson planning. Another way to combat this issue is to make general announcements and then immediately follow the announcements with an active learning activity to reengage the students.

To illustrate the problem and solution, we present the case of an instructor who asked students to submit a survey during the middle of class. Figure 1 is a graph of the percentage of students who were logged in and using the required course software (obtained from the interactive learning software on-task widget) prior to the announcement. To reiterate, students in these classes are required to bring a computer to class and are required to use the appropriate interactive learning software. At 9:43:10, the instructor requested that students complete an online survey. The graph clearly illustrates that majority of the students switched to a web browser, and the observer in the back of the class witnessed this event. However, when students finished their short survey, many of them remained in their web browser reading news articles, sports pages, or even visiting Facebook. At 9:45:00, the instructor requested that students read a word problem and start sketching in the course software. After this request, the graph in Figure 1 illustrates a steady return to the course software, and this was also recorded in the observation notes. In other observed courses in which the instructor restarted lecture by lecturing after the survey, the "return" to lecture was slower. This example illustrates the ability for instructors to control student attention, and to reengage students in lecture activities after an assignment or comment that could disengage students.
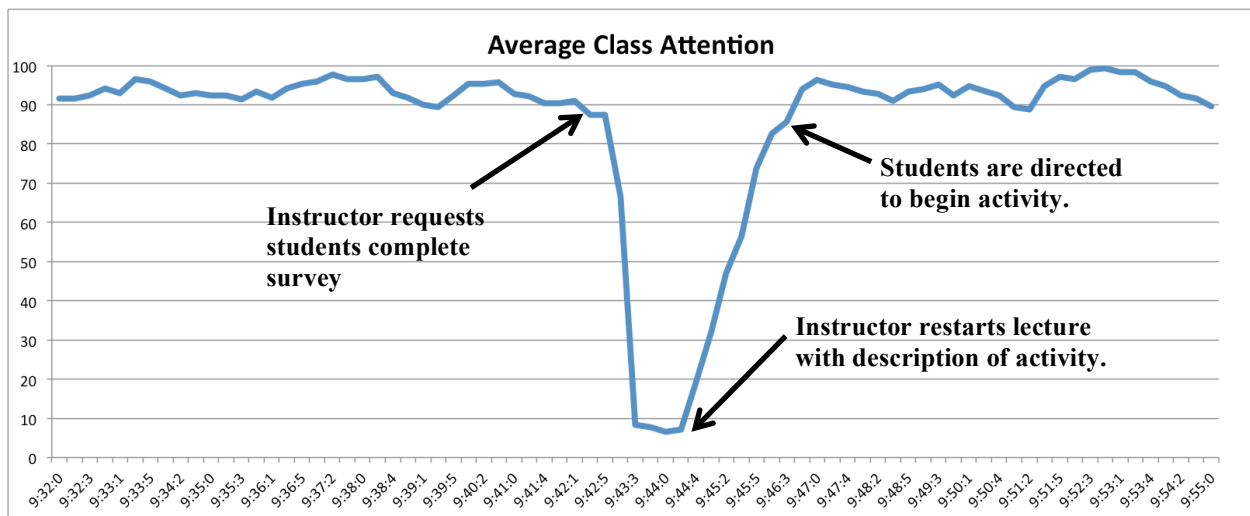

Figure 1. Snapshot of percentage of class in course software during lecture

2. Active exercises can be used to reengage students.

As shown in the previous recommendation, active exercises can be used to reengage students in a lecture. As an example, an instructor could ask students to divulge their Muddiest Point[15] after a

short lecture period to stimulate a group discussion. An informal collaborative learning implementation could use a group Think-Pair-Share[15] to increase student-student interaction (during the Pair) and student-teacher interaction (during the Share). Another example would be to work problems aloud and force the class to give you the answers as they work along with you (e.g., counting in binary – make students count aloud). You can also have a selected student work a problem in front of the class, since, from our experience, students often engage with peers more readily than with the instructor. Finally, in large lectures, instructional technology can assist with active learning implementation if you have access to such tools[18].

When implementing active learning exercises, the lecture must have a planned flow of engagement. In large lectures, you cannot wait for every student to finish, but if you constantly cut them short, they will not participate in the activity and instead will wait for you to answer the problem for them. Also, immediately after the activity, relevant discussion or sharing of student work is necessary to retain engaged students. In the observations, without a planned follow-up for each active learning exercise, students who were off-task and then engaged in the active exercise were often observed returning to their off-task work. Likewise, students who finished an activity before their peers would participate in off-task activities, but a powerful summary or discussion of the exercise would often reengage those students in lecture.

To illustrate the benefits to active learning exercises and the requirement for timing activities appropriately, we present the case of an instructor who asked students to respond to a robotics question and then submit their answer through the interactive learning software. Figure 2 depicts the percentage of class on-task. Prior to the activity, the on-task level was between 40 and 50%, during the activity on-task level increased to a maximum of 71%, and towards the end of the activity, on-task level declined as students submitted their work and moved on to other off-task activities. By the time the instructor restarted lecture, the class on-task level was lower than before the active exercise. In this case, the active exercise negatively affected student attention and engagement. However, slightly shortening the activity, or following up the activity with a discussion of student submissions could have promoted positive effects.
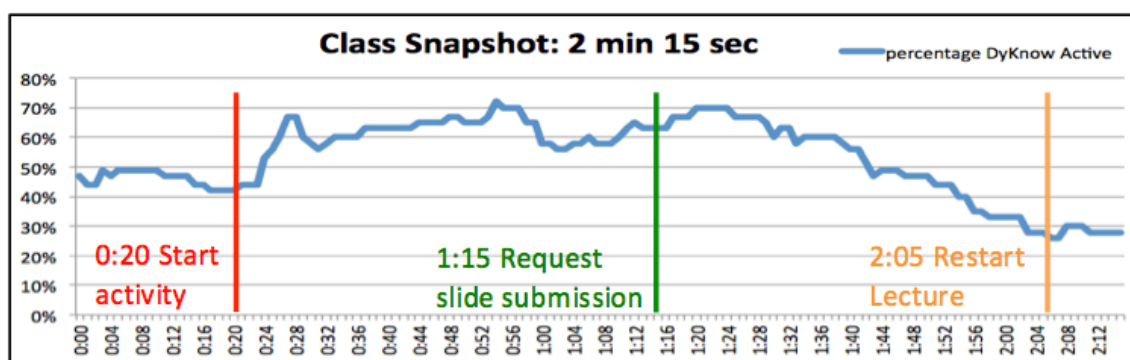

Figure 2. Snapshot of percentage of class in course software during active exercise

3. Walk around the room to check on students' status, but leave the problem statement up on the board/projector.

Walking around the classroom forces students to work on the problem, but also allows you to address questions/concerns individually, thereby increasing student-teacher interaction. However, when you assign a problem and drop to the floor to talk one-on-one, make sure the problem statement is still written on the main projector screen. If there are students who dozed off during the introduction of the problem statement, they will wake up to wonder what is going on and can read the projector to get started or resume their assigned tasks. During classroom observations, the simple act of walking near students was enough to stimulate students to stop off-task activities (e.g., reading websites, responding to email) and begin to participate in the class activity.

A word of caution: while you want all your students to be attentive and engaged, in a larger lecture this can often be very difficult. Be sure you set your own goals of classroom engagement. A strict attendance policy means some students will attend class solely due to the requirement. In that case, some instructors accept an overall lower level of engagement, as long as off-task students do not disturb others (e.g., no talking to neighbors).

4. Find creative ways to interact "individually" with students.

In large lectures, having students raise hands for individual questions is not always possible – you miss hands or students are not comfortable asking questions due to class size or desire not to appear unknowledgeable in front of peers. Nonetheless, interaction is important. Recall that both teacher-student and student-student interaction is key to student learning[10-12].

During classroom observations, numerous creative interaction techniques were used. For example, the chat feature in the course software was used to allow students to ask questions of the instructor. During the lecture, teaching assistants could respond to individual questions or make the instructor aware of questions relevant to the entire class. Also, occasionally one instructor would use the chat feature to pause lecture and answer questions in a rapid-fire session. In other courses, course software on students' computers or hand-held clickers were used to allow students to answer multiple-choice questions or polls assisting with real-time classroom assessment and interaction. It should be noted that these techniques can be used even if technology is not available. For example, if technology is limited in your large lecture, you can give students colored or numbered cards to hold up to answer multiple choice questions. As another form of creative individual interaction, in other large lectures, students were required to place a nameplate in front of them (i.e., a folded piece of paper with their name on it). This allowed the instructor to call on students by name, even though the instructor did not know each student individually, and appeared to promote attentiveness since anyone could be called on at any time.

5. Divide large lectures into small groups.

Based on personal experience, a class of 100 in groups of 4 reduces the class to 25, which is a more manageable number for you to individually interact with. Also, students can correct or uncover each other's misconceptions more easily in small groups[17]. Do not be afraid to have the groups tackle a big(ger) problem early when using this format of instruction. Let the teams sort it out and teach each other[17]. This helps foster an environment where students attentively listen

to your explanation of a complex problem because you have not given them answer while working individually with the groups[21].

6. Plan ahead, but always have a backup plan.

In large lectures especially, technical difficulties or unforeseen circumstances can derail a class quickly, but having a backup plan can keep up engagement. In one observed class, the instructor could not get their computer to connect to the projector system. The instructor was able to continue with class by opening their computer and placing it on the document camera to "project". In another class, an instructor was used to relying on the interactive learning software to distribute content to students. When the server connections were not working, the instructor was able to seamlessly continue lecture by using their notes and writing on the chalkboard. Finally, in another class, a planned guest speaker did not show up. The instructor continued with the second half of the lecture in order to stall and await the speaker's arrival. When the speaker still had not arrived, the instructor continued with the lecture adlibbing through the planned slides interjecting personal experiences where needed. While each of these examples seems like common sense – figure out a way to continue your lecture – in other cases, instructors have not had backup plans nor been prepared for difficulties. In those cases, instructors have become increasingly stressed and ultimately cancelled class or had an unproductive lecture. These reactions can derail a course and directly affect student learning.

Conclusion: Keep Lecture Interactive!

The authors anticipate that the recommendations in this paper will support any instructor assigned to teach their first large lecture, or really any lecture, allowing them to survive with attentive and engaged students. It is easy to fall into the teacher-centered mode of instruction so we suggest starting off by incorporating at least one interactive activity per 50-minute lecture to engage your students. As you get more comfortable with the large lecture format, incorporating multiple activities will allow you to plan around the 10-15 minute cycle of attention creating an environment that actively supports student engagement and therefore learning. In addition to the tips listed in this paper, we also recommend sitting in on another lecture for the same course, if you have the opportunity. In our experience, you will benefit from observing another way of teaching (possibly better, possibly worse) the same content you are teaching. We hope the *tricks of the trade* presented in this paper supported by empirical data and personal experiences are beneficial to future and first-time lecturers and serve as a source of inspiration for making your classroom more interactive and engaging.

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