

Discussion Classes: Complementing the Lectures in a more Efficient Way

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Abstract

Although learning can take place in a class during a lecture, it is more likely to occur in discussion classes where feedback and the concept of “give-and-take” prevail. The inclusive classroom setting provides an atmosphere conducive to more personal attention for each student. A discussion (or a tutorial, as it is sometimes called) compliments a regular course lecture. In this paper, we revisit the concept of discussion classes to include a variety of teaching approaches which focus on learning, especially reinforcement of concepts, knowing the students better and instilling in students a sense of appreciation for the subject on the whole. The teaching assistant’s primary role as a facilitator and a link between the course instructor and the students is addressed. The effectiveness of the discussion sessions in addition to regular lectures is highlighted. This is followed by some key recommendations for the discussion leaders.

1 Introduction

The term *teaching assistant* (TA) is an umbrella term used by the Government to describe paid permanent or contract staff employed in a variety of functions in support of teachers in Graduate schools. Teaching assistants can make an important and valuable contribution in supporting teachers and pupils in their work. However, if all those teachers don’t agree on what’s important to teach and how it should be taught, student learning is more likely to be hurt than helped by the well-intended teaching assistants for a course. Teamwork, before and during the course, is a must if students are to get the real benefit of having a teaching *team*. Discussion classes help in bridging the gap between the course instructor, TA and the students. Moreover, close collaboration between instructor and teaching assistant(s) can provide excellent opportunities for mentoring and training those graduate students who plan on pursuing academic as well as careers in business and industry of national labs [1] - [5].

Every reader undoubtedly has an idea of what is meant by a *lecture*, and dictionary definitions do not shed much light: lecture – an exposition on a given subject delivered before an audience or class for the purpose of instruction (or a method of teaching by discourse as opposed to seminar). In this paper, a discussion is defined as a lecture in an informal setting. This allows for two-way communication which may be hampered in

a traditional class setting, during regular class hours. Discussion approaches are suited to a variety of course goals, including providing the instructor with feedback about student learning [7], [8]. Here, the teaching assistants for the course serve as the critical link. However, it should be also be noted that the discussion sessions are not well suited to covering a significant amount of content. So, the TA must wrestle with the issue of quantity of content to be covered versus the depth of students' learning, and must learn to optimize discussion hours.

This paper aims at revisiting the necessity and the impact the discussions (especially those conducted by the teaching assistants) have on student learning, and presents suitable recommendations. The organization of this paper is as follows. In Section II, the strengths of an effective discussion class are highlighted. Section III has the experimental set-up while section IV contains a summary of recommendations. Section V contains the conclusions of this paper.

2 Strengths of Discussion Hours

In the spirit of transition to the learning paradigm [2], the mission of the TA is not instruction but rather that of producing *learning* with every student by *whatever* means work best [5], [7] - [9]. Discussions not only get students to verbalize and consolidate what they are learning, but also can provide a socializing mechanism. Discussions can examine and clarify confusing concepts, and can raise valuable questions, which could even be revisited during regular class hours.

Consistent with the concept of regular lectures, these classes permit and encourage the student to introduce, explore, analyze, compare, and refine approaches in ways which are impossible in a lecture. Discussions can also be deployed to meet certain affective goals: to help students appreciate the subject and feel more confident about the whole course and to help the student develop interests and change attitudes. It is in these *mini-sessions*, that astute teaching assistants can do more than change minds; they can change hearts, the way students feel about an issue and their perspective of it. This informal setting, in spite of being inside the four walls of a classroom, allow students to become more relaxed and is an ideal platform to motivate group thinking and active participation. This increases their motivation to learn and makes learning more interesting. Unlike lectures, which presume that all students are learning at the same pace and level of understanding, discussion sessions are meant to proceed at a pace determined by every individual student. From the teaching assistant's perspective, this serves as a means to garner information about the *potential* difficult topics in the course, their views on the course in general and also provide important feedback to the course instructor.

Recapitulating, discussion sessions can be useful for any of the following goals of instruction:

- integrate the concepts presented during regular class hours with numerical-solving,
- give students opportunities to formulate applications of principles,
- help students identify and formulate problems using information gained from reading or lectures,

- encourage students to think and asking pertinent questions without any inhibitions,
- gain acceptance for information or theories counter to previous beliefs of students,
- develop motivation for further learning,
- get prompt feedback on how well objectives are being attained.

3 Experimental Setup

This research work was carried out in the University of Wisconsin-Madison during the academic year 2003-04. The undergraduate course titled Circuit Analysis (ECE 230), for which I am the teaching assistant, is an elementary course in electronic circuit analysis. The course is a degree-requirement for many engineering majors and is also a pre-requisite for some higher level undergraduate courses in the ECE and Biomedical Engineering (BME) departments at the University. Typically, the students comprise of freshers and sophomores from these two departments. Most of them are introduced to the basic concepts and laws of electricity and circuits in this course. Hence, a good discussion is absolutely essential in addition to some good regular class hours.

During my discussion hours, as a teaching assistant, I conducted some experiments in an attempt to understand student learning. For instance, I deployed two teaching approaches on the same batch of students: explaining the concept and then giving the problem; and giving the numerical and then explaining the concept. Statistics targeting *student-learning* and *student comfort at grasping the concepts* were collected. The students were asked to vote and comment on the learning approaches deployed. The feedback and the assessment techniques were rather informal on most occasions. Sometimes, a problem was given to test the understanding of the student. Based on these experiments, the next section presents the key recommendations with a view to promote student-learning. This research is in consonance with the concept of teaching as research (TAR). It is planned to incorporate the recommendations during discussions this forthcoming semester.

4 Recommendations

This section summarizes the recommendations about improving the discussion classes. These arise from the experiments conducted during regular discussion hours for two different undergraduate classes in the University of Wisconsin-Madison titled Circuit Analysis (ECE 230) during the academic year 2003-04. The results are stated in percentages and the sample size for both classes was about the same, comprising of 33 students (68 students in all).

4.1 Preparation and Organization

Discussion sections differ from lectures in many ways. A major difference is that the students can be more active and that there can be more personal contact. Good discussion sections give students an opportunity to formulate principles in their own words and to suggest applications of these principles; they help students become aware of and define

problems implied in readings or lectures; they can also increase students' sensitivity to other points of view and alternative explanations. There seems to be an unfortunate misunderstanding about the amount of preparation that discussions require. It is a common misconception that with a basic understanding of the subject, the TA can rely upon their students for 40 or 50 minutes. However, a good discussion takes a great deal of prior planning and review of the subject matter.

To begin with, the content itself must be reviewed and brought up to date with the regular class lectures. It is also helpful to be knowledgeable about the backgrounds and interests of your students, and the *information and background sheets* and *get-acquainted* sessions at the beginning of the term are useful. This is particularly useful, when one tries to concatenate a particular concept with applications (for example) in their respective fields. All this definitely helps in sustaining the interests of the students and make numerical examples more meaningful.

Following is a summary of recommendations concerning what should be done when the discussion is being planned, before the teaching assistant enters the classroom.

1. Fit the discussion to your audience – Try to make the discussion session as relevant to the audience and therefore, lay emphasis on the practical applications. This approach especially could work well in elementary courses, for example a course on electronic circuits is one class where you can always cite applications of the concepts. While explaining the concept of passive and active devices, it was found that 85% of the students felt comfortable with the mathematical equations and understood the implications of graphs, when the devices were brought to class or an application was explained (or demonstrated). 90% of the students could appreciate the numerical examples, once they understood the applications relevant to their fields.
2. Organize your points – Usually the weekly discussion sessions span 45-60 minutes. The teaching assistant should list the important points (or concepts) which are coherent with the regular classroom lectures. A typical approach could be including 3–4 concepts (done in class since the last discussion meeting) and chunking them throughout the discussion hour is most favored. An additional topic (the next topic to be covered in class) could also be touched upon to give the students a head-start in class and acquire the subject flow. The object of a discussion session is not just to cover and revise the material, but to have the *listeners learn*. It was found that topics which are in the order presented in class and pertinent from the assigned work generally promotes student interest. More succinctly, one should organize the points in a way, keeping the students in mind.
3. Use illustrations – Illustrations help people both to understand and to remember. So, including pertinent pictures are definitely something which the teaching assistant should strive to include in each discussion. In the study carried out, 85% of the students understood a concept (or the working of a device) better when they could associate the equations with a graph (figure) or a physical entity (applications, real object). The more complex or abstract the material becomes, the more helpful illustrations become.
4. Select examples –The numerical examples chosen for each discussion must be coherent with the subject. One could be using the same example to explain several

related concepts. In a circuits course, having a single circuit and applying several related concepts to it and verifying that the each approach yields the same answer helped 96% of the audience tackle home-work problems with confidence, thereby, gaining a broader perspective of the concepts.

5. Give an outline – Before the section meets, decide what kind of discussion is most useful for your class. Is there a certain topic to be discussed (perhaps arranged previously by the supervising instructor) ? Is there subject matter that must be learned ? Is the section a forum for expressing and comparing approaches ? Once you have decided what kind of discussion you want, tell the students. It is easier for everyone if the goals for the class have been clearly stated. As far as possible try to link the topics and ensure a logical flow throughout the discussion. Sometimes, it is advisable to quickly recap the previous discussion meet and concatenate it with a topic from the current discussion. An astute teaching assistant would use this opportunity to incite some class participation.

4.2 Cognitive Aspects

This part of the paper enlists some key points regarding the aspects of improving cognitive or intellectual learning.

1. Encourage and recognize students' contributions – Broad student participation in discussions enhances their value. The teaching assistant ought to be alert to non-verbal clues that the students who do not participate much. When they have something to say; do call on them. Occasionally commenting positively on students' contribution encourages them to participate more.
2. Test consensus – If everyone agrees, then there will be no discussion. Beware of premature agreement. If the group seems to have reached a consensus, test this by paraphrasing your understanding of the agreement or by giving a counter-example. 95% of the students found this *informal on-the-spot quizzing* really helpful as a means to test their understanding of the topic.
3. Encourage interaction with thoughtful questions – The following are suggestions which encourage interaction among the students and the discussion leader:
 - Ask students for clarification if their comments or answers seem to you (and so probably to many others) to be incomplete or unclear.
 - Ask students to support their answers. Sometimes, a student might give the correct answer, but the approach or the reasoning maybe incorrect. Make the students go beyond their initial, perhaps superficial reactions.
 - Use open-ended questions, that is questions which permit students to elaborate and thin through their answer rather than just give a brief response, or a “yes” or “no”.
 - Rephrase questions if students cannot respond to your first question. Your second question can help students focus on previous material that might be relevant or understand the limitations in their previous responses.
 - Pause, give students time to reflect and think through their responses.

4. Repeat your points – Repeating the points in two or three different ways helps in both understanding and remembering.

4.3 Affective Aspects

Many academics tend to conceive of college as primarily, if not exclusively, an intellectually cognitive experience. Such a conception of college ignores at least two considerations. First, individual students often bring to college feelings, interest, and values that hinder their learning or understanding of content which we consider objective. Second, college is about values, at least values like logical thinking, clear expression, knowing the data or literature, and even appreciating the subject and being responsible for one's own work. Our teaching is value-laden and appropriately so. Discussion approaches are well suited to many of these concerns about feelings, interests, and values; hence, this section on affective aspects of a discussion class is included in this paper.

1. Know your students – Start the discussion with something relevant to the students' interests and goals, something related to their experience. It is also vital to know their names and all these factors help in creating that informal setting which is different from the regular lectures.
2. Be patient – Discussions are scheduled, typically at the end of a busy day for both the students (and the teaching assistant). Students could get delayed while some others may take time to settle inside the classroom. It is vital for the teaching assistant to tune and pace himself/herself appropriately. For instance, he/she be careful and not talk too much, especially at the beginning.
3. Be aware of student feelings – Sometimes students suppress their negative feelings. But those feelings still remain an obstacle to learning. Sometimes students get into arguments which does not foster learning. They might be dissatisfied with the teaching approaches adopted by the course instructor or burdened by other courses. It is a good idea to get these feelings out in the open and talk about ways to tackle them. A teaching assistant is a link between the course instructor and the students.
4. Do not threaten students – Do not question a student for too long. You want to arouse the students enough to stretch themselves, but not so much it becomes counterproductive. If the student cannot respond after a second, focusing question, move onto other students. It is advisable to skirt issues such as how much an individual student knows.
5. BE an effective discussion leader – Often the teaching assistant is given the title of a discussion leader. Here are some general points to pay heed to under this category.
 - Call the class to order.
 - Constantly remind the class about the goals of the discussion session.
 - Keep the entire class on the same page.
 - Summarize and draw conclusions from time to time.
 - Control excessive talkers.
 - Solicit responses from “non-talkers”.
 - Talk to students outside class hours.

5 Conclusions

This paper has attempted to summarize some key recommendations to make the discussions sessions more effective. Emphasis is laid on the salutary effect such classes have on student learning. This mode of instruction is a form of lecturing, but in a more inclusive environment. Discussion classes are an ideal platform for the teaching assistant to develop as a teacher and contribute to the educational system of the institute. Effective discussions require more forethought than regular lectures and entail taking into consideration some affective aspects in addition to those of cognitive nature. The reader must be aware that most of the recommendations have been made based on the experimental data obtained from small experiments conducted during regular discussion hours. No case is being made that one must do these things to conduct a successful discussion. Helpful suggestions regarding these finer points in lecturing are made with a view to enthruse the audience as well as the speaker. If these recommendations are helpful, please use them.

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Appendix

A typical discussion outline and a questionnaire conducted to garner information pertaining to this paper are presented in this section. The questionnaire shown in Table II, would be distributed in the class, or emailed to the discussion attendees seeking their answers. Sometimes, the questions were asked to the class and students voted in favor of a particular teaching approach or strategy. The assessment is a key to the process of teaching as research. Depending on the feedback, a particular technique was concluded to be a more suitable one compared to the one with which it was compared. For example, the problem-based-learning to explain related concepts was identified as being a more preferred approach. The questionnaire was tried out while teaching more than one different concept. Moreover, the same questionnaire was used for two independent batches during the course of an academic year.

Table 1: Sample Assessment Questionnaire

- Comment on the teaching approach – Likes and Dislikes
- Did it help in understanding the new concept ? Why ?
- How confident are you in solving the homework questions ?
- Explain the laws just discussed in your own words (or using pictures).
- In a line, point out the necessity for the Kirchoff’s laws.
- A numerical example illustrating the laws
- A short quiz testing the application aspects and the definitions.

Table 2: Discussion Outline

Topic – Kirchoff Current and Voltage Laws

Approach

- Revisit resistor networks – Series and Parallel
- Discuss basic flaws of analysis – Elicit need for Kirchoff’s laws
- Make them tackle a numerical before introducing the concept
- Introduce Kirchoff Laws
- Make them solve the SAME numerical

Assessment

- Facial expressions (Immediate feedback)
- Informal Strategies
- Questionnaire

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