

# Tutorial Style Discussion Sections for a Large Enrollment Physics Class

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**Abstract.** This talk will detail our experience in pioneering a Tutorial-style discussion section to facilitate small-group teaching and active learning in a large enrollment class for Physics majors using Undergraduate Tutors, supervised by a Graduate Teaching Assistant and the course Instructor. We will discuss the benefits of this model, improvements, scalability, and compare this model with models used at other institutions.

## 1. Background

Traditional-style Physics courses at American universities have two components – a lecture and a discussion section (sometimes referred to as “recitation section”). The lecture component is taught by a faculty member and the discussion section is led by a Teaching Assistant (TA), who is a graduate student pursuing a Ph.D. Depending on the class-size, there are multiple discussion sections held for each class. The discussion sections are typically 50 minutes in duration, during which the TA works through several problems related to the material being covered in the class.

A major challenge in recent years at large US public universities is the increasing enrollment in the Science, Technology, Engineering and Mathematics (STEM) majors such as Physics. The first year introductory level Physics classes consist of students with a broad range of preparation, in particular due to students entering college with varied preparation in Calculus. This disparity results in one set of students lagging behind in the Mathematical preparation needed to learn topics such as Electromagnetism, which rely on Vector Calculus.

The diversity of preparation is clearly best addressed by individualized instruction, especially in the discussion sections. Although discussion sections are smaller (typically 40 students) than the lectures, since resources including number of TAs assigned to classes are limited, the more traditional way of achieving individualized instruction by having smaller sections (“tutorials”) of, say, 10 students is not viable. The question then is how to improve the learning experience of students when faced with larger sections, with limited resources.

Over the years, in grappling with the challenge, the author slowly moved away from the traditional discussion sections, where the TA solves a selection of problems on the board, where the learning is largely passive, to a hybrid model where the Instructor and the TA select a set of problems during weekly planning meetings, which the TA then assigns during the discussion section, after having summarized key concepts needed to work through the problems. The students in the discussion section were asked to self-organize into groups of 3 or 4, work through the problems as a group, with the TA circulating, helping students through difficulties and summarizing the results of the problem once sufficient progress was made.

This model was tried by the Instructor in a variety of Physics courses including first and second year Physics courses for both Physics majors and for Engineering majors, as well as third and fourth year core and elective courses for Physics majors. In all cases, it was observed that the model, though sound in principle, fell short in two areas – the TA manpower required to effectively facilitate small-group teaching and the ideal class-room infrastructure for collaborative work.

## **2. Tutorial Style Discussion Sections**

This talk will address how the author improved the above model to achieve small-group teaching and active learning in a successful tutorial-style discussion section in a collaborative teaching studio environment for a second year course for Physics majors. A classroom with collaborative work tables equipped with computer screens and whiteboards near each table was identified for the sections. With departmental and institutional support, the author was able to hire a number of senior undergraduate tutors that were assigned to two tables each to facilitate discussions, help with problem solving and clarify conceptual difficulties as the students worked through a set of problems from tutorial sheets designed by the author. The graduate student TA coordinated the tutors and the sections were overseen by the author as well.

## **3. Conclusion**

This model of discussion section was a resounding success in terms of student engagement and student satisfaction of their learning experience. The small-group teaching environment allowed students who are typically shy to raise their hand in a larger section, to ask questions to their tutors. A small participation credit ensured high attendance. The author is considering further refinements of this model and these will be discussed in the talk. The talk will address how this model relates to other models that are used in departments which the author has visited, along with a brief literature survey (for example, [1, 2]).

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## **References**

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