

TEACHING LARGE MATH CLASSES: THREE INSTRUCTORS, ONE EXPERIENCE

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REFLECTIONS ON LARGE CLASS TEACHING

In the current university environment instructors are often called on to teach large classes especially to incoming students. There have been some recent studies aimed at improving teaching and learning in a large class environment but we have found no resources specific to teaching a large mathematics course. AUTC ; Carbone 998; Gedalof ; Gibbs 99 ; MacGregor ; Stanley. This article thus aims to identify challenges offer constructive help and share useful techniques for teaching large classes which we define to be classes with 5 or more students managed by 6 Tc e Tj. Tc d Tj. 6 68 Tc r Tjpbu 6 Tc e Tj. Tc d to t

There is no unique solution to the problem of managing a large class since individual instructors vary and different institutions uphold different requirements and maintain a variety of expectations. It is our opinion however that managing a large group of students requires advanced organization and detailed planning. Students in a well set up course are better able to focus on their learning rather than dealing with logistical issues of where to hand in or pick up assignments where to turn for help and so on. Before the course begins the instructor should distribute the course material over the given time period set midterm and final exam dates select questions for homework assignments and assign their due dates select old exams for students to study from choose office hours – typically three per week settle on a grading scheme and define course and lecture policies.

The use of contemporary technology greatly simplifies the huge task of managing a large class. We have found course web pages invaluable for administrating and communicating with large classes. A standard way of maintaining a course web page is through one of many existing learning management systems. LMS: A typical LMS contains a grade book, chat rooms and a discussion board. A course web page thus allows for communication between the instructor and the students as well among the students themselves. With e mail and an LMS each student in the class is easily reachable by the instructor. From the discussion board the instructor can take the pulse of the class. What confused students? Were certain examples helpful or unclear? What additional examples might help? Often common concerns arise in a chat r6 Tc. TI nhhalhhrb Tc.? Tj. 8. 7. Manag

instructor of a large class is much like an actor on a stage and in that role must also rehearse It is important to proof read one's slides and to go through the lecture mentally noting where time can get created and where it cannot New terms and concepts must be clearly and slowly introduced not just orally but also visually Just like an actor an instructor needs to have a vast repertoire of effective lecture methods on hand Students can benefit from being kept on their toes and surprised every once in a while "[Students] would welcome being able to make use of the many different perspectives knowledge bases interests and approaches present in their community of learners when they are learning mathematics" Burton p 79 For example slicing fruit to demonstrate the disk and shell method is an unexpected approach Getting students involved in demonstrations can be effective too Another idea is to bring in graphics or animation projections that further aid visual understanding of a concept Furthermore maintaining high energy and communicating your enthusiasm for the subject throughout the lecture helps to retain student attention. You should use the vast space of the large lecture hall to maximum advantage Moving around the auditorium not only helps to hold students' attention but it also helps to reduce chatter which saves precious class time otherwise spent to get the lecture hall in order

On the technical side delivering a lecture in an auditorium with 5 or more seats generally requires the use of a microphone a couple of overhead projectors and or a computer and data projector. This technology is simply needed to make communicating a lecture more effective. Yet as in a performance technical difficulties can be problematic in teaching. Crackling microphones bad felt pens unavailable internet connections or malfunctioning projectors can cause major disruptions during the lecture. Not only that but the instructor can quickly loose student attention and respect through a technological break down. It is best to recognize these risks to plan ahead to arrive early to test all devices and finally to be flexible enough to deliver differently than planned if necessary. Many institutions provide audio and visual support for lecture halls. It is helpful to find out how to contact an AV person during a lecture before the semester begins and to keep this information on hand for all lectures.

Lastly we address the issue of assessment and evaluation of students which must also be well planned for large classes Paper and online assignments should be seen as formative assessment They are designed for students to practice certain concepts and skills to become familiar with notation and terminology and to provide continual feedback on their learning. Our gn large courses are supported by wsstlineeare skills that merit attention and development" Weimer p Especially first year students are concerned with the letter grades they will be obtaining in their courses. We have found that there are very few student complaints when assessment and evaluation are dealt with up front and based on criteria that are clearly communicated to the students such as setting a grading scheme at the beginning of the course and providing timely feedback on assignments

Despite the challenges outlined above teaching a large class offers unique rewards In particular a large class offers the instructor incredible potential for creating excitement among students When a lecture or demonstration goes well it generates a charge of positive energy that excites the students and instructor alike A collective aha moment with a mass of students is a powerful reminder of what university learning can be We all agree that large class teaching can be enjoyable despite the additional hurdles to overcome We include below a model of our Calculus courses The explanation of the way they are conducted includes specific suggestions from our teaching experience that will hopefully help others make the most of their large class teaching experience

A WORKING MODEL

The Courses: Simon Fraser University SFU offers three introductory Calculus courses serving students who declare business or economics biological sciences or engineering computer science or mathematics as their major Each course is offered every semester at this tri semester univernotc

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sstTcr TcrTj 8TceTj 588Tcl 5 TcsTj 8 Tc7yj 588Tct Ca irCaiaa correctly recorded On average over two sample semesters each student visited the WebCT container about 65 times per semester The WebCT container for Math 57 is used for posting all information about the course and the Applied Calculus Workshop including:

- course outline and lecture schedule
- workshop schedule
- lecture notes
- announcements from instructor and workshop coordinator
- assignment problems with due dates
- assignment solutions
- review material
- sample exams and solutions to exams
- relevant links: old exams online assignments reference websites etc
- students' grades

The Help Centre: At SFU the calculus courses are serviced by two drop in help centres called the Applied Calculus Workshop ACW and Calculus Workshop CW The ACW and CW are coordinated by two faculty members – called coordinators – of the Department of Mathematics and staffed by teaching assistants TAs who are undergraduate mathematics majors or graduate students in mathematics The coordinators handle all scheduling record keeping and TA supervising in addition to spending a few hours per week advising students in the workshop Each course instructor usually schedules two office hours per week in the workshop as well. The workshops are open every weekday for most of the day At any time there are at least two teaching assistants in the workshop to answer student questions and provide individual help. The workshops also serve as the homework clearing house. Students submit their homework to the workshop and also pick it up there after it is marked.

The paid workload of a teaching assistant is broken down into preparation time and duties. The duties are to be available in the workshop to advise students to mark and record assignments to invigilate mark and record midterm and final exams. The coordinator will assign these duties to ensure that there is a good mix of experienced and new TAs represented in all tasks.

Notes: The instructor posts notes in PDF format online so they are available to students prior to the lecture These notes contain an outline of the lecture which includes new definitions new theorems and examples along with blank space for students to add explanations observations details and solutions worked out in class Many students come to class prepared with a printout of these notes which allows them to follow the transmitted information more readily The instructor works through transparencies of the notes during the lecture This method decreases mistakes made by the instructor during the lecture F

also benefit from reading and hearing definitions and theorems expressed differently than they are in the textbook Moreover well prepared students will surely read other calculus textbooks in an effort to understand the material better and in preparation for their exams. It is therefore beneficial to teach students how to read any calculus textbook and not just the suggested textbook. Furthermore while a particular textbook is suggested for the course and most likely with very good reasons it is still a student's individual decision whether to spend the money on it or not. Often an older edition suffices or a different but similarly organized textbook. Lastly a textbook is but one author's decision on how material is laid out. The instructor may for exampleafind infinonce behaticial to do signation. The before sectives for following to c a 8 e Tc 76 Tc a A discussion board provided by LON CAPA accompanies each problem where students exchange their questions and ideas how to come up with the correct answer. Since each student had a different variation of the problem it was impossible just to post a correct answer and give the problem away. The instructor did not need to intervene often regarding students questions since mostly their peers would respond to the posted questions.

A main concern before introducing multiple weekly online assignments was whether students would be overwhelmed by the frequency of assignments. However, the students adapted to the challenge very well. In fact, many students responded on a subsequent survey that the online assignments did indeed make them stay on top of the material. The average mark on online assignments during one semester was 7 which approximates the average mark for written assignments. The main difference in marking between the types of assignments is that

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