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Getting To Grips With Large Groups

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Abstract

Small-group instruction is generally seen as preferable to large-group instruction. However, with funding constraints and decreasing staff-student ratios, large-group instruction is becoming increasingly prevalent in the tertiary sector. Class size significantly affects the mode of instruction chosen by instructors, with lectures being the preferred choice for large classes. Key problem areas for large-class lectures include: the passive approach usually adopted by students, attention spans typically of 15 minutes, student anonymity, lack of personal contact between instructor and students, the maintenance of classroom order, and the implementation of frequent and effective assessment coupled with prompt feedback. For large groups, lecturing and course organization require well-developed management skills on the part of the instructor. This paper is based on the premise that large-group lecturing is here to stay. Problems with this mode of instruction are discussed and some solutions are outlined.

Introduction: doing more with less

Worldwide, academics are being asked to do more with less. In the UK per-student funding in higher education decreased by over 50% in real terms from 1985 to 1990[1]. One immediate result of such funding reduction is increased class sizes. 50 years ago in the UK the median lecture size was 19 while the average number of students in a discussion group was just 4[2]. Numbers such as these are now a distant memory: in the University of Auckland's Department of Electrical and Computer Engineering (DECE), class sizes are currently as large as 560 at year one, 250 at year two and 180 at year three.

Large classes such as these almost invariably lead to lecturing being chosen as the dominant mode of instruction. For example, in DECE, the year-one course entails for each student 36 hours of lectures, 11 hours of tutorials (group size over 30) and 6 hours of scheduled laboratory time. A year-two course involves 48 hours of lectures, no tutorials, and up to 6 hours of scheduled laboratory time. Furthermore, while the majority of year-one students attend lectures, under 50% attend tutorials on a regular basis. Laboratory attendance is compulsory. The inference is that students see lectures as the central part of the educational process. Clearly, with lectures playing such a central role, it is essential that instructors understand their nature well and can use the format effectively.

Is bigger better?

Some might regard delivering a lecture once to 210 students as better than delivering a lecture 7 times to groups of 30 students. Fewer hours of lecturing leaves more hours for preparation. Also, lecturing to a large group should be more motivating than lecturing to a small group. These increases in preparation time and motivation should result in students in larger classes enjoying a superior educational experience. The above of course assumes that education is largely a process of one-way knowledge transmission. Unfortunately this does not appear to be the case: a number of commentators and researchers have spoken in favor of smaller classes[3-5].

It is easy to understand why instructors might prefer smaller classes. Being confronted with two or three hundred students simultaneously, particularly when one can hardly make out the faces of those seated at the rear, can be daunting. Classroom management skills become more important. For example, dealing with paper darts can become problematical if one cannot identify the students responsible for them. Course management skills also become critical. Everything must be planned very carefully and well in advance. Tests cannot be written and reproduced at the last minute when hundreds of copies are required. Marking also becomes a major undertaking. Teaching a large class has been likened to steering an ocean liner with a paddle[6]. Mistakes may have severe consequences and be hard to correct.

Students are not so clearly against large classes. One survey found that 41% of students reported preferring classes with enrollments of 100 or more[7]. Large classes were liked for several reasons. First, there were more people to get to know, to study with, to talk to, and to have fun with. Second, large classes provided a low-pressure environment and a sense of security. Students could hide in the class and the chance of being singled out was very low. Third, students felt a sense of independence in large classes: they liked the feeling of having to rely on themselves for study and learning. Fourth, some students also liked the way that they could choose to arrive late, leave early, or even miss lectures altogether.

Students also saw problems with large classes. First, there was less individual responsibility. They saw the passive context as hindering learning, making it easier to not pay attention, or even not attend. Second, large classes were seen as impersonal, leading to decreased motivation. Third, students found that large classes tended to be noisier and offer more distractions: students arrived late, left early, and talked to others during the lecture. Students also mentioned overcrowding, microphone difficulties, and projected images that were hard to see. Significantly, however, when asked to compare their best large classes with their best small classes, the class size did not appear to affect perception of the amount learned, nor the usefulness and relevance of course content. Students reported that the quality of instruction, not class size, determined the success of a class. Others have also concluded that large classes can be just as effective as small classes[8, 9]. Perhaps it is simply that a high degree of effectiveness is harder to achieve in larger classes. Some factors determining the educational effectiveness of large classes are now discussed.

Emphasis on content

In medieval times lecturing was essentially reading, with possibly some commentary on what was being read. This probably made reasonable sense when the lecturer had the only copy of the

book being read and when the pool of knowledge was relatively small and growing slowly. These days the situation is quite different. Students have ready access to a vast range of texts and electronic resources. Often the course will be based on a text or a set of notes previously prepared by the lecturer and available to the student. There is little value in the lecturer simply reading the text or the set of notes. There is even less value in regarding the dissemination of knowledge as being the primary purpose of lectures: what is now regarded as leading-edge knowledge will soon become out of date, irrelevant, and perhaps even incorrect. This is particularly true in technical fields. Even the entire current body of knowledge will not, in itself, be sufficient to see the students of today through careers that may span the next 40 years.

Clearly, students will need to keep learning throughout their professional lives. They will also need to be able to solve problems that do not currently exist and may be beyond current imagination. For these reasons, universities should move towards an emphasis on problem-solving, understanding of fundamental principles, flexibility, adaptability, and lifelong learning and away from an emphasis on content[10]. Unfortunately, there is a danger of just the opposite. Attempts by instructors to keep their courses up to date in the face of rapid technological change can lead to overburdened curricula[11]. Faced with such curricula, students may adopt a surface learning approach and rely on techniques such as memorization. Some lecturers also prefer to present large amounts of content: content is easy to obtain, and the sight of students writing furiously as they try to keep up can be a reassuring one. Lecturers often focus on the material rather than the process and try to deliver too much information too fast.

Attention span

A traditional lecture consists of 50 minutes of instructor presentation during which students only listen and take notes. Unfortunately, many students are likely to stop paying attention after about 15 or 20 minutes. Figure 1 has been proposed to show how student performance varies with time during a traditional lecture[12].

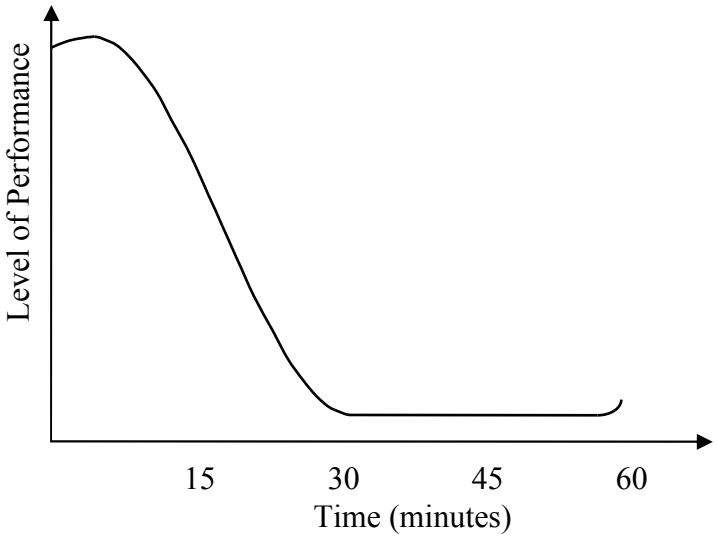

Figure 1: Student performance versus time for a traditional lecture

After 15 minutes students will be recording fewer notes, these notes will be less accurate, and they will contain a smaller percentage of the key ideas presented in the lecture at that point. One survey found that students could recall 70% of material covered in the first ten minutes of lectures but only 20% of material covered in the last ten minutes[13]. This performance drop-off renders a traditional lecture extremely inefficient. Fortunately there are various antidotes. Perhaps the most radical of these is to replace traditional-length lectures with 20-minute mini-lectures[14]. These could be combined with 30 minutes of structured discussion, reading, or problem-solving. They could be given at the start of practical sessions, with the traditional lecture slot being abandoned. Some critics would argue that a 20-minute lecture can only cover one third as much as a one-hour lecture. The truth is that while the lecturer can cover three times as much in the one-hour lecture, the students cannot. At best, they can simply copy down three times the notes, notes that could well be given as a handout.

Less-radical proposals use a change in activity to raise student levels of attention close to their original values. Variety is the spice of life and of lectures too. Figure 2 shows the outcome of having a change in activity after 30 minutes in an otherwise traditional lecture[12]. The simplest change in activity is a short break. Breaks that involve some movement, social chat, a change of seat, or a breath of fresh air are more effective. One study[15] investigated the use of 3 two-minute breaks in 45 minute lectures. During the breaks students were asked to clarify their notes with a partner. Compared to students in traditional lectures, these students scored 10% higher in the final examination. Breaks can benefit the lecturer too, providing a chance to get organized for the next part of the lecture. In fact, lecturers are also subject to the performance decline illustrated in figure 1!

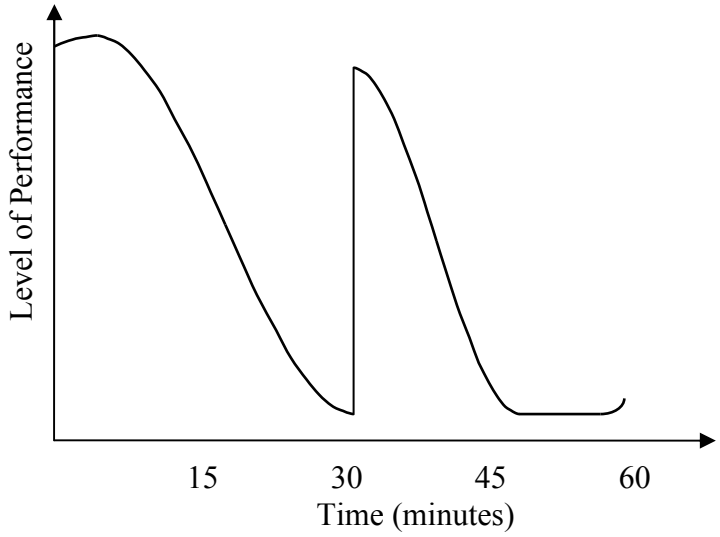

Figure 2: Student performance versus time for an otherwise traditional lecture that includes a change of activity after thirty minutes.

A demonstration can provide a break, as well as being of educational value. A video-camera can help all students see the demonstration. The demonstration may in fact be a video-clip of

something, such as soldering, carried out previously. Students should be involved in demonstrations if possible. For example, a student can be asked to turn a hand-powered generator and she or he can then report to the class that it became harder to turn when a load was attached. Such demonstrations enable lectures, often overly theoretical, to be related more closely to practice. A change from talking to showing has a further benefit beyond simple variety. Different students learn in different ways: the use of multiple approaches makes it more likely that students meet approaches suited to their learning styles.

A short quiz given during a lecture can also provide variety. Lecturers may also ask the class for feedback: "am I going too fast?", "can you hear me at the back?", "can you read this overhead?" or "did that explanation make sense?" Carefully selected jokes and stories, particularly those related to the presentation, also make excellent breaks. The following section contains more suggestions for adding variety to lectures.

Active and passive learning

Lectures have been criticized for relegating students to passivity when they need to construct their own knowledge. They are criticized for involving one-way communication, spoon-feeding, and for being poor replacements for textbooks[16]. There is a danger that note-taking and memorization will become equated with learning. Mass lectures are particularly susceptible to such problems, since it is more difficult to actively involve students in their learning when they are present in their hundreds. However, it is possible, and it is important to do so[17, 18].

Brainstorming provides one way to start a lecture in an interactive manner. The class can be asked, for example, to state all they know about a certain topic. The lecturer should write down all the points offered by the students before any discussion of them is begun.

The lecturer can also question the students to promote active learning. Either particular students can be targeted or the questions can be general. Multiple-choice questions can be answered by asking for a show of hands for each option in turn, or by asking students to hold up a flash-card to display the letter of the answer[19]. Questions should be genuine, not rhetorical, and the lecturer should give students sufficient time to formulate answers rather than answer his or her own questions. Questions can be posed at the end of one lecture with a view to starting the following lecture with some student answers. Students should also be encouraged to ask their own questions. These questions should be repeated to confirm that the lecturer has properly understood the question and also for the benefit of students who may not have been able to hear the question the first time. Some lecturers always start their lectures by asking if there are any questions. This is better than asking for questions at the end: usually this is simply taken as a signal that the lecture is over. Questions that the lecturer has previously received, by email perhaps, can also be answered during the lecture as appropriate. It is important to note that student questions can be answered by other students. This redirection of the question enables more students to become actively involved.

The flash-card technique has been used to deliver interactive lectures in physics at South-eastern Louisiana University and Iowa State University. The great majority of students appreciated the technique[20]. Furthermore, when students were tested using questions from the Conceptual

Survey in Electricity and Magnetism[21], average pre-test scores of 28% and post-test scores of 78% were gained. This compared extremely favourably with national figures of 27% and 43% respectively, indicating that the course had produced learning gains high above the national average. As another validation of the technique, common questions were used in the final examinations for the interactive-lecture algebra-based physics courses and some traditionally-taught calculus-based physics courses. The students taking the interactive-lecture algebra-based physics course gained significantly higher mean scores (78% versus 59%) even though, as a rule, 'better' students take calculus-based courses[21].

Variations on the above approach may involve purpose-built electronic systems[22] or even cell phones[23]. At Eindhoven University of Technology, audience paced feedback (APF) has been implemented: each student uses an electronic handset that has a single button, only pressed to indicate a 'yes' response to a lecturer's question. A typical lecture consists of 20 minutes of APF functions interspersed between 25 minutes of conventional lecturing. Surveys indicate that students felt this approach improved their understanding more than traditional lectures[24]. A study over four years in subjects including engineering and applied physics showed that APF-based courses had a mean examination pass rate of 85% while for traditionally-lectured courses the figure was 56%. Independent supervisors ensured consistent examination standards.

Breaking a large class into small groups can also promote active learning, providing more students with an opportunity to speak, think and generate ideas. Speaking up in small groups may help students develop enough confidence to speak up later in large classes. Group-work helps students get to know each other, and also gives the lecturer a chance to move around the room, make personal contact with some students, and get a feeling for where the class is at. Some lecturers typically lecture for about 15 minutes and then set a problem. The students work on the problem for 5 or 10 minutes, after which the solution is presented and further lecturing ensues. While the students work on the problem, usually in small groups, the lecturer moves around the room, answering questions, offering suggestions, and gauging how well the students are handling the problem. Both lecturer and students derive rapid feedback from this exercise: sometimes what is found may well modify the remainder of the lecture.

Practical demonstrations and activities can also actively involve students. Very simple activities have the advantage that all students can undertake them during a lecture: for example, bringing two pencils together so that their points touch while using both eyes and then just one eye to indicate the importance of binocular vision and triangulation in range-finding. Other active learning activities include large-class debates, simulations, role-playing and the 'minute paper' in which students have one minute to summarize the major points in the lecture, to answer a question, or similar[25]. For very large classes the lecturer may only review, comment on, and return a sample. Alternatively, students can review each other's papers in a small group format.

Student anonymity

In large classes students feel, and usually are, anonymous. Such students feel less personal responsibility. This has negative consequences for morale, order, motivation and learning. Even though it is not possible to get to know everyone in a large class, it is worth making the effort and it will be appreciated by almost all students, including many of those who do remain

anonymous. Lecturers can encourage personal contact with students in many ways: arriving to lectures early and staying afterwards to chat and to give students a chance to ask questions; visiting or teaching laboratory, discussion or tutorial groups; interacting with students during group-work or problem-solving sessions held in lectures; making eye contact with students; wandering around the lecture theatre while lecturing using a cordless microphone; setting regular office hours and/or encouraging office visits; encouraging and replying promptly to emails; calling for volunteers to be interviewed about certain stated aspects of the course; asking students to write a short autobiographical note; and inviting students to meet for coffee after a lecture. Even though group-work during lectures does not enable every student to interact directly with the lecturer, at least it does enable each student to interact with other students.

Personal student-lecturer interaction can also be facilitated by the lecturers presenting themselves in a more personal way. Stories and jokes have already been mentioned. Lecturers can talk about their days as a student, or their current research interests. Even asking the class if they understood a concept, or explaining the educational reasons for a two-minute break, or outlining a good study technique for the up-coming examination, presents the lecturer in a different light.

Assessment

Large classes entail correspondingly large assessment loads. For large classes assessment can become the most time-consuming activity. For example, in DECE, for the year-one class of 560, the number of staff hours allocated to assessment is 3.5 times the number of hours allocated to lecture preparation and delivery. For a year-two class of 210, the corresponding number is 1.8. When assessment dominates workload, staff feeling overworked may see reducing assessment as the way forward. Fewer assessments could be given and questions that are easier to mark, such as multiple-choice, could be used. However, assessment is the dominant influence on student learning, affecting both the amount of effort and its focus[26, 27]. One researcher[28] found that, by year four, only 5% of out-of-class student time was spent on learning unrelated to assessment. A landmark meta-analysis of hundreds of studies concluded: "formative assessment is an essential component of classroom work... We know of no other way of raising standards for which such a strong prima facie case can be made"[29]. Prompt feedback informs instructors and is essential for student learning[30, 31]. One survey[32] found that 94% of students rated quick feedback more important than class size. It is clearly critical to maintain effective formative and summative assessment together with prompt feedback. In large groups this is not easy. For formal tests, invigilation and marking may involve teams of individuals. When hundreds of students are involved, mistakes made in booking test rooms, setting test questions, or printing test scripts can have dire consequences. Software packages are increasingly being used to manage academic workload and to maintain or enhance student performance through regular assessment and prompt feedback[33-35]. In some cases instructor time has been reduced to one third of its previous value with no reduction of student satisfaction or achievement[36].

Peer marking offers a creative way to provide effective formative assessment for relatively small instructor effort. Gibbs[31] describes a compulsory year-two engineering course. Each week, students worked on problem sheets in tutorials which were marked by lecturers and returned. The average examination mark was 55%. When student numbers increased the lecturers no longer had time to mark the problems and the average mark dropped to 45%. In an effort to

restore standards, peer assessment was implemented. Six times during the course, students met and handed in their problem sheets. These were then redistributed randomly with a mark scheme. Students then marked the work they were given and the papers were returned immediately. Marks were not recorded and teachers were not involved at all in this process. To complete the course, students were required to complete three quarters of the problem sheets. Everything else about the course remained the same. Amazingly, the average examination mark increased to 75%. Peer marking proved much more successful than instructor marking. By examining and following a mark scheme, students gained a fuller perspective than they had from just doing the problems. While marking, students were actively engaged with the material: noticing other ways to do the problems, errors which they made themselves, and errors which they were alerted to avoid. They also saw the care some students took and others did not. They developed a good idea of the standard of work and the effort required to achieve at various levels.

Classroom management

Some large-class management problems can result from a lack of personal lecturer-student contact and the fact that the students feel anonymous. Passive learning and a lack of variety in lectures and resultant student boredom can also produce classroom management problems. Some ways to address these problems have already been mentioned.

Good student behavior should be established from the outset. Ground-rules should be laid down and explained in the first lecture. For example, a rule requiring students not to talk while the lecturer is talking would be explained in terms of respecting the rights of the majority of students who may not be able to follow the lecture if other students are talking. Ground-rules can be presented in terms of rights and responsibilities for both students and lecturer. Some lecturers produce a first-day handout with two headings such as ‘my commitment to you’ and ‘my expectations of you’. Once the ground-rules have been established, even minor contraventions of them should be dealt with promptly and never tolerated. The vast majority of students do want to learn and they will appreciate a lecturer who maintains a good learning environment. A number of lecturers have even had the unexpected experience of reprimanding a misbehaving student and then, at the end of the course, receiving complimentary feedback from the student! Effective lecturers explain to their students why they do things in a certain way and they continuously review their own actions. Should disruptions occur, they ask themselves if any of their actions are promoting disruption. All the usual cautions such as ‘be firm and fair’ and ‘don’t over-react’ should be borne in mind.

Students are not like tape recorders, simply storing lectures. Rather, what students learn becomes part of their framework of knowledge and skills. The process of learning may well involve considerable modification of the lecture material and/or the framework. This process can be assisted by lecturers who start each lecture by outlining what will happen in the lecture and why, and explaining how it fits into the course. The overview or ‘big picture’ can be restated during the lecture or at its conclusion. The course guide, provided at or prior to the first lecture, should enable students to gain a good understanding of what the course is about. To this end it may include items such as: aims and objectives, a list of lectures, perhaps with a summary of each, a reading list, a problem list, an assessment schedule, assessment criteria, advice on how to write up laboratory activities, and past examination papers.

Facing the class and maintaining eye contact is important. Turning one's back to write on a blackboard at length can encourage disruptive behavior. A document camera or overhead projector is preferable in this regard. There are a number of things for the lecturer to check. Can the students see what is being written or displayed? Can the students hear what is being said? Is the lecture proceeding too fast or too slow? Did the class follow that explanation? These checks should be made with the students themselves.

Lectures should start promptly and finish on time to reinforce good habits and also out of consideration to those who are punctual. If there is too much material to cover properly in one lecture, some should simply be left for the next lecture. This is preferable to rushing at the end of a lecture when students will be absorbing material very poorly. Lectures should end with bang rather than a whimper. It is better to finish 5 minutes early than to ramble on with little left to say. Students will appreciate the occasional early finish!

Conclusions

As more students pursue a tertiary education, and as governments squeeze per-student funding, it is clear that large classes are here to stay. Large classes are often regarded by instructors as difficult to manage and disadvantageous to student learning. They also tend to restrict the mode of instruction: almost invariably it is the lecture. However, in spite of the above, there is sufficient evidence to suggest that student learning need not be disadvantaged in large classes. Large classes should not be seen as an opportunity to save money or as an excuse to reduce assessment. Although large classes do need more financial, temporal and human resources, the higher student numbers should enable their provision.

Potential problems, such as short attention spans, can be countered through a variety of activities, particularly those that stress active learning. To reduce student anonymity, the lecturer will need to proactively initiate personal interactions with students before, during and after lectures, and though email exchanges and office hours. A personal as well as a 'business' side should be seen during lectures. Large-class lectures can produce classroom management problems: the lecturer should explain the ground-rules at the first lecture and stick with them in a fair, firm and friendly way. Activities need to be carefully planned well in advance, explained clearly to students, and monitored closely. Lecturers should continuously reflect on what they are doing during lectures and be prepared to modify it if necessary. To help lecturers reflect, one 'golden rule' has been suggested: "do not do anything in the class, to the class or for the class that you would not wish to have done if you were taking the course yourself"[37]. This rule may well prove useful when making difficult decisions.

One experienced lecturer has remarked to those who lecture large classes: "you will notice that your colleagues will treat you with great care, admiration and respect. Why? Because they want you to keep teaching the course. They all harbour the fear that should you decide to move on to something else, they will be next. So enjoy the experience and wear the position well"[38]. Lecturing to large classes may be more difficult and certainly carries more responsibility. When done well it is also more rewarding: the lecturer has the satisfaction of knowing that she or he has influenced positively a great number of lives and minds.

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