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TEACHING AND LEARNING IN LARGE CLASSES: A CASE STUDY AT UNIVERSITY OF BOTSWANA

Deepti Garg
University of Botswana., deepti@moipi.ub.bw

Marilyn B. Lee
University of North Alabama, mblee1@una.edu

George Anderson
University of Botswana., george.andy@gmail.com

O.T. Eyotayo
University of Botswana., eyotayo.ot@gmail.com

A. Ayo
University of Botswana., a.ayo@gmail.com

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TEACHING AND LEARNING IN LARGE CLASSES: A CASE STUDY AT UNIVERSITY OF BOTSWANA*

Deepti Garg[1]
Dr. Marilyn Lee[2]
George Anderson[3]
O.T. Eyotayo[4]
A. Ayo[5]

Abstract:

Teaching large classes (>100 students) is a challenge. This study explored various instructional methods to determine which were most effective for large classes and developed guidelines for engaging students in learning in skills courses. A quasi-experimental design study with a control and treatment groups was conducted. The treatment group participated in a teaching learning strategy, which was designed to stimulate engagement of students through active and collaborative learning. These activities were developed based on the anecdotal accounts in the literature and consisted of Written Ground Rules for the course and in-class activities. The data analysis indicated that the teaching strategies used with the treatment group made a difference in the area of student satisfaction, assessment, learning abilities, development and practical application of computer and information skills and use of online tools. The study validated the effectiveness of these instrumental methods in large class. Findings from the student satisfaction element of the study are reported in this paper. The study findings indicate that student engagement and deep learning is achieved through an active and collaborative approach that requires the student to engage with the subject of study.

PROBLEM:

With the massification of education higher education institutions are faced with large increases in enrollment. Furthermore, the Government of Botswana expected that access to the University would be increased annually. These realities resulted in ever-increasing enrolments in mandatory first year courses such as GEC 121 & 122, general education computer and information skills courses. Staff members teaching GEC 121 & 122 were concerned about the quality of learning in their large classes and after performing a literature review in collaboration with the Academic Programme Review Unit (APRU) in the Centre for Academic Development (CAD), agreed that research into effective teaching strategies to increase learning in large classes such as GEC 122, would be useful.

AIM:

The aim of the study was to explore what instructional methods are most effective in engaging students in learning and develop guidelines for skills based courses with large (>100) student enrolments.

LITERATURE REVIEW:

A review of the literature revealed that little experimental research has been performed to explore best practices in teaching and learning in large classrooms. Most literature reviewed was anecdotal in nature and while useful in planning appropriate "treatment" strategies, does not provide scientific evidence of their efficacy.

[1] Lecturer, Computer Science Department, University of Botswana.

[2] Associate Professor, College of Nursing, University of North, Alabama.

[3] Lecturer, Computer Science Department, University of Botswana.

[4] Lecturer, Computer Science Department, University of Botswana.

[5] Research Assistant, University of Botswana.

METHODS:

Sample: The sample was all students and lecturers in GEC122 in Semester II 2005 that were willing to participate in the study.

Design: An experimental design with a control and treatment group was conducted. Students in the WebCT version of GEC122 in Semester II 2004 comprised the Control Group. Members of the research team developed a 'treatment' for selected groups. These students and staff comprised the Treatment Group (see Appendix A - Study Design).

Instruments: Measures of student satisfaction and marks were collected at end of GEC122 2005 to compare the two groups. The research team developed student satisfaction surveys (see Appendix B). Development and testing of the student satisfaction survey took place in Semester II 2004.

FINDINGS:

There were significant differences between treatment and control group scores on the following variables: being a student in GEC122 is challenging, has helped me become more independent in my learning, has helped me find more and better information, was enjoyable, method of instruction helped me to understand the content, had a clear idea of how I would be assessed, and assessments helped me to understand rather than just memorize facts.

CONCLUSION:

These findings validate the effectiveness of instructional methods used in teaching these large classes. It is, therefore, recommended that strategies based on the findings from this study need to be designed for teaching in large classes. Furthermore, this study has shown the impact of active and collaborative learning in large classes.

1. Introduction:

With the massification of higher education, universities are faced with large increases in enrolment. In addition, higher education systems are becoming accessible to a more diverse group of learners. The University of Botswana (UB) is no exception; with the abolishment of one-year government service (Terelo Seshaba) the Government of Botswana expected that the UB would increase enrolment for secondary school leavers as well as those completing their one-year government service. It was expected that access to the UB would increase annually to prevent excessive unemployment in the post secondary sector. In Botswana, these realities resulted in increasing enrolments in first year courses in the tertiary education programmes. This is particularly true in General Education Courses (GECs) such as GEC121 & GEC122, which are mandatory courses to assist learners in development of computer and information skills; skills required for higher education and lifelong learning.

These mandatory GECs are designed for first year students, resulting in enrolments for these courses of above 4,000 students. The courses (GEC121 & GEC122) are comprised of both theory and practical components. While the department responsible for teaching these courses has a number of lecturers and laboratory demonstrators assigned responsibility for these courses, and in spite of using the strategy of breaking the course into theory and laboratory sections, the resulting size of individual theory sections of the courses are enrolments of between 100 and 300 students per section.

2. Problem:

The above enrolments create a number of problems within the system. The physical resource constraints, i.e., classroom size, the potential constraints on learning in these large classes and the subsequent negative influence on quality created by resource constraints, were a concern for the Computer Science Department

(CSD) and Academic Programme Review Unit (APRU) at the UB. Additionally, staff members teaching in these sections were not equipped for teaching the large class sizes described above. In addition to increasing enrollment there was increased pressure on lecturers to improve efficiency in the use of available resources in order to cope with the increased number of students. In large classes more time was spent on classroom management than creating new ways of teaching to cope with such large classes. Classes of large size led to difficulties in interaction between students and teachers and getting and giving feedback on students' progress. Bigger lecture rooms increased the problem of acoustics, visibility and attention. Resources like overhead projectors, laptops and digital projectors and sound systems were not conveniently available. Photocopying handouts for class was, due to the large enrolment, very problematic.

Papo's [26] findings suggests that the majority of South African higher education institutions have the common opinion that class size plays a determining role in teaching and learning effectiveness among students and lecturers. Furthermore, studies have concluded that there is a substantial relationship between class size and teacher and student attitudes [33] and that attitudes influence performance [22]. Therefore, the impact of class size on the quality of an educational experience is of paramount importance in quality discussions. Consequently, the CSD, along with the APRU in the CAD, designed a study to address this concern.

3. What is a large class?:

The definition of a large class varies from educator to educator. What is important is not the definition itself but the basis on which the definition is made. What constitutes a large class differs according to a variety of factors such as the type of class and the discipline. Papo [26] acknowledges that teaching and learning success may depend in part on what is being taught, for example, courses such

as the sciences, require learning of concepts as well as laboratory skills and problem solving; each of these has an optimum student teacher ratio. Moreover, assessment of student learning varies with the discipline, for example, languages and political science require answering complex essay questions while mathematics may require understanding and use of formulae, which may be tested through multiple choice questions or calculations.

In spite of the difficulties in defining a large class, some literature has suggested useful ideas on what might constitute a large class. There are a number of resources that support the idea that a class of over 50 students is large. The basis for designation is that in a class of 50 minutes the teacher can engage or at least make a connection with each student for one minute [6]. One could conclude on this basis, therefore, that to define a large class one would have to know the length of a class and the number of students that could be engaged and therefore the 'threshold' number for defining a large class would be a number equal to the number of minutes in the class. This formula, however, is problematic since regardless of how many minutes in a class there is an optimum number of students that a teacher can assess and for whom they can provide timely feedback and these factors influence the quality of the experience.

Buchanan and Rogers [7] suggest that large classes are when traditional teaching techniques are no longer workable and new ones must be tried. Another view of large classes is based on the capacity of the teacher to remember the names of class members (Botha et al. 2005). Based on this view, a large class would therefore be a class consisting of as many individuals whose names the teacher/lecturer could comfortably learn and recall. This definition is problematic as memory capacity varies from one individual to another.

Some authors classify numbers for a large class without any basis for doing so. For example, a class of 200 students is considered large by some

authors [39] and others define a large class as a class of 100 students[13]. Cuseo (n.d.) concludes that large class size is a contextual variable that has a generally adverse effect on student learning, mediated primarily by lowering students' level of engagement with the course instructor, with classmates and with the subject matter.

Some authors have indicated that large classes are not necessarily less effective than smaller ones, but they require more conscious effort and planning [13]. But both lecturers and students were, and still are, not adequately prepared for this change in higher education environment, [6].

Some studies have compared small classes of seven (7) students with 'large' classes of 40 students [35]; other authors have compared small classes of 40 students with a large class of 300 [4]. Apparently, authors consider 150 to 600+ [6], 300 to 1000 [16], 100 [13], 80+ [7] large class sizes. Based on the suggestions in the literature and personal experience of the authors, in this study all theory classes, which had enrolments of 100 or more students, are considered large classes.

General problems with large classes:

Apart from these factors, quality of a large class is also dependent on the facilities available for teaching and the experience and perceptions of individual teachers and students. To 'design out' problems in a class related to the size of the class is even more difficult, as problems present in a large class can often be present in small classes but are magnified by the excessive number of learners. Gibbs and Jenkins [16] identified lack of clarity of purpose, knowledge about progress, advice on improvement, opportunity for discussion; inability to support wide reading, independent study, and motivation of students, as factors that contribute to both student and teacher dissatisfaction with large classes.

Although the same problems are present in small classes, some problems are peculiar to large classes and/or their effects are exacerbated in large classes [35]. In any class, irrespective of size, "good teaching is good teaching" [24] and includes enthusiasm for the subject, motivating students, being systematic and organized, getting and giving feedback, providing quality learning experiences and management of the class. These activities are, however, more difficult to accomplish in large classes.

Problems in large classes are managed differently by people; both students and teachers, for example, Feigenbaum and Friend [14] found that more experienced students express stronger preferences for large classes than do first year students who often prefer small classes because of the greater opportunity for teacher-student and student-student interaction. One would also expect that a more experienced teacher would prefer to teach a large class rather than teach the same material in smaller groups a large number of times.

If a teacher is able to manage a class of 200 Master's degree students s/he should not expect to do the same at undergraduate level, especially if the students are in first year. Indeed, teaching a class of 200 freshman students is likely to present a challenge in classroom management for even an experienced educator. Maturity of students and teachers of large classes is therefore a prominent factor in determining optimum size of a class [11].

The problems encountered in large classes by students and teachers could be discussed separately [37], however, since the problems are shared, some problems may not be separated into teacher problems or student problems, more so as the success of the teacher is a function of the problems of the student and vice-versa. Generally, some of the problems encountered in large classes include disruptive behaviour and classroom management, academic workload, particularly

related to student assessment and feedback, academic dishonesty, absenteeism, and facility problems.

Strategies for Managing Problems in Large Classes:

Since the aim of this study was to determine teaching strategies that are most effective in facilitating learning in classes considered large, the literature review that follows primarily examines accounts of what has worked for educators in a variety of educational settings but primarily in large classes. Some of these strategies were incorporated into the 'treatment' for the experimental group.

Class disruptions:

Classroom disruption is a common feature in all classes; however, it is more problematic in large classes because it is more difficult to identify the person or group of persons disrupting the class, making the problem more difficult to solve. In small classes where students are aware of the teachers' presence, they are more likely to 'behave' so that the teacher does not isolate their behaviour from the rest of the class, unlike in large classes [11].

Classroom disruptions involve activities such as talking, reading newspaper, packing belongings before the end of the class, eating, students coming in late, non-class members coming in or other visitors asking for a class member, cell phones and sleeping. To handle these problems of class disruption ground rules are useful and need be established on the basis of foreseen sources of class disruptions.

Ground rules:

The use of ground rules is a classroom management strategy used to inform students of acceptable and unacceptable behaviour as well as provide information about the course in context [29]. Ground rules are rules/laws/ principles stipulated at the beginning of a course. Ground rules provide guidelines throughout the course that direct the activities of students and teachers. It is not enough to make these ground rules; however, they must be consistently enforced.

Attendance:

Students often feel invisible in large classes and therefore feel that they are not going to be noticed by the teacher if they do not come to the class. If class attendance is expected, this should be stated clearly in the ground rules along with the conditions under which a student can be absent, the consequences for non-attendance and the number of absences that are permissible. Having an attendance policy requires that the teacher take attendance. There are several ways of taking attendance but these are time consuming and fraught with difficulties in terms of reliability and validity. One strategy suggested in the literature suggests that the teacher use the class list from which the names of class members are called at random to answer some questions. Marks are awarded on the basis of the students' presence in the class and not on the basis of the correctness of the answer. This strategy not only facilitates class attendance but also encourages preparedness on the part of students [40].

Another way of managing absenteeism is to conduct short tests, which could be called attendance tests. Such tests do not focus so much on the content of the test but rather the presence of the writer. At Indiana University in the USA, attendance is taken using entry or exit tickets. The tickets are made up of questions or comments on the course material written by students before they enter or leave the classroom, this allows attendance to be taken simply by tallying the slips. A further benefit is that the instructor receives student feedback regarding the course [8].

Another alternative for taking attendance is calling names on the class list at random during the class and the person called is awarded a mark if he/ she is present. Finally, there is disagreement on

the value of taking attendance in classes in higher education. Some educators believe that if the class is conducted in such a way that students' feel that attending the class is worthwhile there is no need to have punishment or reward for attendance. This is particularly true in an environment where students are held responsible for their learning.

Syllabus:

The syllabus is a useful strategy for communicating the content of the course by specifying the core concepts, learning experiences and learning outcomes students will experience during the course. In some cases hints on how to succeed in the class are also included as part of the syllabus to help lower level students understand the teacher's expectations for students. Furthermore, the modes of assessment are also clearly described with the time frame to help the teacher and students prepare ahead of time. The syllabus is therefore a very effective means of restating ground rules and preparing students for a course [8].

Feedback in large classes:

Feedback is a way of assessing quality of learning. To obtain feedback on learning it is necessary to perform student assessment. Obtaining feedback on learning and providing feedback to students on their learning is a more difficult process in large classes than in small classes because of the number of assessments to review. Moreover, in large groups it is more difficult to detect academic dishonesty, in particular, plagiarism. Challenges of assessment have been grouped as follows:

- Avoiding assessment that encourages shallow learning

- Providing high quality, individual feedback

- Fairly assessing a diverse mix of students

- Managing the volume of marking and coordinating the staff involved in marking

- Avoiding plagiarism [36].

To manage the volume of work involved in assessment of large groups it is possible and common to resort to group work, which has problems, as some students may "freeload" or hide under the shadow of the hard working students, without detection. On-line assessment is another means of managing large group assessment but this method can encourage academic dishonesty if not handled properly.

The problem of assessment in large classes often results in shallow learning as teachers tend to prefer giving assessment tasks that test lower levels of knowledge leaving out the more demanding tasks, which consequently reduces the quality of assessment and potentially, learning. One of the ways whereby large classes disadvantage students is that when teachers give assignments, they give limits that could put the students at a disadvantage. The students are disadvantaged because they are not given enough chance to express their ideas (as with multiple choice questions) or they lack experience or language skills required for writing essay type questions. Either of these factors could have a negative influence on the student assessment [11]. These points must be considered when teaching large classes.

In order to improve the quality of feedback of students, teachers should set out early in the semester to assess students in order to create time for improvement. This helps students to have enough time to adjust their learning strategies, where necessary. Allowing students to be able to discuss their areas of weakness with the teacher is helpful in preparation for the final summative assessment in the course. In large classes, however, this is frequently not possible, unless assistance is provided.

Academic Dishonesty:

In large classes, especially where resources are limited and spacing during examinations is limited, the problem of students copying occurs. One strategy to reduce this is to set different versions of the test using a set of questions that are mixed for each version. For example, if there are 5 essay

type questions, students may have the same questions but question number 1 on Test A would be question number two on Test B and so on, such that the students would be unable to use copying as a method of cheating in examinations. This method can also be used with objective (multiple choice) tests as long as marking schemes are produced for each version of the test [30].

Another strategy to limit academic dishonesty during examinations is to mix two (or more) groups of students at the same time who are taking different examinations. In this way students would not be sitting next to someone taking the same examination. The problem of plagiarism is much more difficult to handle with large classes. Many universities have opted to purchase plagiarism prevention and identification software, especially if teaching staff members are inexperienced in 'spotting' plagiarism or have little experience in marking essay type questions.

Student Engagement-Active and Collaborative Learning:

Researchers have formed a strong consensus on the importance of active and collaborative learning and describe strategies to promote active learning in large classes. This section reviews literature on active and collaborative learning interventions and their influence on student engagement and quality of learning.

Active learning is about getting *students* involved in *doing* things and *thinking* about what they are doing [5]. Amerom [3] analyses the above definition and concludes that students should be involved in the learning process and the only way the students can construct meaning out of his/her encounters with different types of knowledge and experiences, is by digging into these him/herself. To do things students must be active, there must be movement and students must think about what they are doing and exercise their minds. This means active learning strategies create a classroom environment in which students actively participate and engage in the learning experience rather than sit as passive learners.

Active learning can increase student attention and concept retention [12]; [34]; [9]; [28], motivate students towards further learning, assist in the development of students' higher order thinking skills and require students to assess their own degree of understanding and skill at handling concepts or problems in a particular subject [5]; [38]; [3].

Allers and Vrekern [2] evaluated two different teaching learning approaches during pulmonary practical laboratory learning in physiology using an experimental group approach where the experiment was designed to stimulate active learning in students. The findings of the study revealed that when students are actively involved in the teaching learning process, their ability to use cognitive skills such as interpretation, judgment and problem-solving skills is enhanced. These results underline the importance of an active approach towards practical/laboratory work and emphasize ideas such as group work, cooperation, full participation, small group discussion and the scientific work method.

The results of a study by Lubbers [21] support the notion that alternate learning techniques and technology can increase student performance on examinations in a large lecture introductory public relations course. Riffell and Sibley [28] report that a hybrid course format (part online, part face-to-face) can substantially improve the amount of active learning in and effectiveness of high enrollment lecture courses, where face-to-face sessions featured active learning exercises. Varying the *instructional strategies* used during a class period, making use of *visuals* during class to focus students' attention and to reinforce the material presented and allowing students to provide their own opinion and interpretation of the material are three basic assumptions for promoting active learning successfully in the classroom [3].

According to Smith & MacGregor [32] "collaborative learning" is an umbrella term for a variety of educational approaches involving joint intellectual effort by students, or students and

teachers together. Collaborative learning activities vary widely, but most center on students' exploration or application of the course material, not simply the teacher's presentation or explication of it. Collaborative learning is similar to those developed by constructionist learning environment, as identified by Grabinger [17] and Sherry, and Billing and Tavalin [31] where students engage in a continuous collaborative process of knowledge construction in an environment that reflects the context in which that knowledge is created [18]. Some authors report their experiences with collaborative learning. Adam and Slate (not on reference list) experimented with collaborative learning in a class of about 200 students per section. They reported data on students' reaction to collaborative groups and argued that the increased degree of enthusiasm and participation indicated greater engagement with learning. However, these authors could not demonstrate improvement in student learning due to the continuous evolution of learning goals, forms of assessment and student population over the course of the study. Nonetheless, these authors consider this approach worth considering for other faculty.

Computer based technologies expand capabilities for teaching and learning in ways hardly imagined a few years ago. Computer supported learning has increased significantly with the introduction and expansion of distance learning. Software systems, including Internet/World Wide Web, are becoming available that enable greater collaboration in learning, however, models of collaboration and their management to achieve particular objectives need careful research [20]. Francescato, Porcelli, Mebane, Cuddetta, Klobas and Renzi [15] support the claim that computers can be an effective enabler, not only of independent learning, but also of collaborative learning. Furthermore, computer supported collaborative learning environments have been found to be as effective as collaborative learning in face-to-face seminars in developing social presence and increasing professional competencies and self-efficacy.

Various researchers have presented learning models for collaborative learning. However, Nomodo [23] warns that those involved in the collaborative learning process should look deeply into why the need for collaboration developed, the nature of the need, how this need ties in with existing curricula and the level of integration that has to occur to accommodate the new need. Costin [10] reviewed research that compared the effectiveness of lecture with that of other techniques. Both concluded that a complete reliance on one or the other is unwarranted and that some combination is probably best, and is dependent on learning objectives. The empirical evidence, as reported in the above literature review, suggests that active and collaborative learning strategies can be helpful.

Study Aim:

Pressure to increase enrollment and expand the curriculum to meet the needs of the country, without adding faculty, contributes to the necessity for large classes [4]. The aim of this study was to explore what instructional methods, such as e-Learning and other active learning strategies, are most effective in facilitating learning and to develop guidelines for engaging students in learning in a skills based course such as the GEC122.

Research Question:

This study is designed to answer the following question. Do specific teaching strategies improve student satisfaction with teaching and learning in large skills based classes?

Significance of the study:

This study will help academic staff members who teach in large classes to improve the teaching and learning experience for both their students and for themselves. Since there is a dearth of empirical evidence on what strategies are effective, this study will add to this knowledge.

Research Design:

The literature review revealed that there is little experimental research on effectiveness of collaborative/active learning in large classes. To assess the effectiveness of active/collaborative learning strategies, this quasi-experimental study was conducted. Researchers developed a 'treatment' for a selected group and compared students' responses on a satisfaction survey to that of a control group. Because a convenience sample was used, the study can only be considered quasi-experimental (see Figure 1).

Study Design:

GEC122
MAY 2005

MEASUREMENT

Groups

Control Group

Measures

Student satisfaction
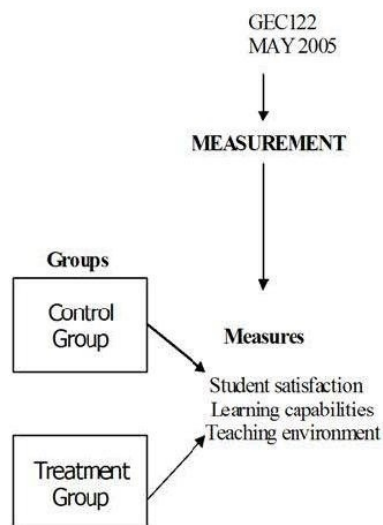Learning capabilities
Teaching environment

Treatment Group

Figure 1: Schematic layout of research design

Control group:

The control group participated in face to face sessions where lectures were done using conventional methods used in the past, that is, more lecture oriented and students were more passive in the teaching learning environment. Because lab sessions had been introduced for GEC 122 in the previous semester the control group also used WebCT as a learning strategy.

Treatment group:

The treatment group participated in a teaching learning strategy that was designed to stimulate student engagement through active and collaborative learning strategies. These activities were developed based on the anecdotal accounts in the literature and consisted of:

1. Written Ground Rules for the course (Appendix A) and class activities (Appendix B)

2. Teaching strategies that included: questions reviewed/discussed (5 minutes), student generated multiple choice questions (5 minutes), lecture on specific topic (15 minutes), In-class activity (10 minutes) and final wrap up for 5 minutes. The details of the 'treatment' are given in Appendix B.

Population:

Since GEC122 is a mandatory Level I course, the study population consisted of 2,900 undergraduate students (first year of study in UB) registered for GEC122. All GEC122 course sections were randomly divided into two groups; treatment and control. Students registered in GEC122 sections were automatically entered into the designated treatment or control group.

Sample:

The sample consisted of students and lecturers in GEC122 in Second Semester 2005 (January to May 2005), that were willing to participate in the study. The purpose of the study was explained to the students as well as assurance given that there would be no negative consequences if they chose not to participate. Five hundred forty valid responses from students in the treatment group and 351 from the control group were obtained. The overall response rate was 891 (31%).

Measurement instrument:

A researcher designed student satisfaction questionnaire was used to capture the responses of the students in the experimental and control groups on a variety of variables. Variables measured included the following. Table 1 provides a list of variables and instrument items that measured these variables.

Tables
Table-1: Items measuring variables of interest in the study.

Measure	Variables	Indicators
Students satisfaction	Outlook of students	1. The course is rewarding (X_1)
		2. The course is frustrating (X_2)
		3. The course is challenging (X_3)
		4. The course is enjoyable (X_4)
	Assessment	5. I had clear idea of how I will be assessed (X_5)
		6. The assignments and tests reflect what is taught in the course. (X_6)
		7. The assessment helped me to understand rather than just memorize facts. (X_7)
		8. I am happy with feedback I have received in GEC122 (X_8)
Learning capabilities	Practical application	9. Being a student in the course has helped me in other courses I am taking at UB (X_9)
	Learning abilities	10. Being a student in the course has helped me to become more independent in my learning (X_{10})
		11. Being a student in the course has helped me to improved my overall learning abilities (X_{11})
	Developing CS and IS skills	12. Being a student in the course has helped me to develop computer skills (X_{12})
		13. Being a student in the course has helped me to find more and better information (X_{13})
	Online tool	14. Using WebCT enhanced my understanding of course contents. (X_{14})
		15. Having a WebCT quiz at the end of each topic helped me to understand better the course content. (X_{15})
Teaching environment	Course delivery	16. The method of instruction helped me to understand the content (X_{16})
		17. I have a clear understanding of the goals of the course (X_{17})
	Setting tone	18. Having ground rules encouraged students to take this course more seriously. (X_{18})
	In class activity	19. Writing multiple choice questions made me learn more (X_{19})
		20. In class questions/activities/discussions were an improvement on GEC121 (X_{20})

a) Outlook of student: Outlook refers to attitude of the students towards the course. Three indicators, i.e., rewarding, challenging and frustrating were used in the study.

b) Assessment – It has long been recognized that assessment influences the student's approach to learning [7]. Indicators of assessment determined how clear students were in their understanding of how they would be assessed.

c) Practical application – The students were asked to comment on their ability to apply the skills they had learned in GEC122 in other courses.

d) Learning ability – Learning ability was measured by asking students to comment on several aspects of their learning.

e) Developing Computer and Information Skills - One of the important objectives of the course was to equip students with computer and information skills that will enable students to effectively utilize computer technology in their work as student and in their future work as professionals. Students were asked to comment on their ability to use these skills.

f) Online tool – Technology enhancements not only can make large lecture courses more cost effective, but also can alleviate student stress by making more study options available and by sustaining student engagement with scholarly material. It also has the potential to reduce the time that educators spend on routine and repetitive tasks [19]. The instrument specifically asked students about their skills with the Learning Management System WebCT.

g) Course delivery – An increase in class size requires lecturers to radically reconsider how they deliver their course [3]. This variable was measured by asking students to indicate their opinion on course delivery.

h) Setting the tone – Excellent teaching in large classes is not only about communicating clearly, but also about managing the class. Literature particularly suggests establishment of ground rules stating policies regarding attendance, missed exams, academic integrity and classroom disruptions. By setting the tone, the instructor gives student cues for expectations, attitudes, motivation, behaviors and learning [25].

Data Analysis:

The views of the students in the two groups were tested for statistical significance (*t* test) and findings are reported in Table 2. Variable means that were significantly different between control and treatment groups included:

Table-2

Differences in mean scores between treatment and control group on each variable (*n* =?) really need to put in the n for each control and treatment.

Measure	Variables	Indicators	Mean values		T values		P
			Control Group	Treatment Group	Control Group	Treatment Group	
Students satisfaction	Outlook of students	(X_1)	4.33	4.31	0.277	0.269	0.782
		(X_2)	2.42	2.27	2.001	1.930	0.046*
		(X_3)	3.99	4.03	-0.659	-0.667	0.510
		(X_4)	3.94	4.04	-1.716	-1.657	0.087
	Assessment	(X_5)	3.63	3.76	-2.143	-2.093	0.032*
		(X_6)	4.00	4.18	-3.334	-3.234	.001**
		(X_7)	3.97	4.00	-0.586	-0.570	0.558
		(X_8)					
Learning capabilities	Practical application	(X_9)	3.98	4.14	-2.844	-2.806	.005**
	Learning abilities	(X_{10})	3.95	4.00	-0.954	-0.950	0.340
		(X_{11})	3.83	3.97	-2.503	-2.459	.012**
	Developing CS and IS skills	(X_{12})	4.54	4.44	2.083	2.130	0.038*
		(X_{13})	4.18	4.25	-1.350	-1.352	0.177
	Online tool	(X_{14})	3.99	4.11	-2.315	-2.172	0.021*
		(X_{15})					
Teaching environment	Course delivery	(X_{16})	3.85	3.87	-0.411	-0.393	0.682
		(X_{17})	3.76	3.87	-1.946	-1.885	0.052
	Setting tone	(X_{18})	Not done				
	In class activity	(X_{19})	Not done				
		(X_{20})	Not done				

*   Significant at 0.05 level
**   Significant at 0.01 level
X_2 Being a student in GEC122 is challenging ($p = 0.046$)
X_5 Being a student in GEC122 has helped me become more independent in my learning ($p = 0.032$)
X_6 Being a student in GEC122 has helped me find more and better information ($p = 0.001$)
X_9 I really enjoyed GEC122 ($p = 0.005$)
X_{11} The method of instruction helped me to understand the content ($p = 0.012$)
X_{12} I had a clear idea of how I would be assessed ($p = 0.038$)
X_{14} The assessments helped me to understand rather than just memorize facts ($p = 0.021$)

Discussion:

In any class, irrespective of size, "good teaching is good teaching" [24] and includes enthusiasm for the subject, motivating students, being systematic and organized, getting and giving feedback, providing quality learning experiences and management of the class. These activities are, however, more difficult to accomplish in large classes. Problems associated with large class are unique and require intervention to achieve the best results. As indicated earlier, to assess the effectiveness of active/collaborative learning strategies, this study developed a 'treatment' for selected groups and the design of the study was quasi experimental with one treatment and one control group. The result of the intervention was measured using parameters indicated in the above section. The data indicated that the teaching strategies used with the treatment group did make a difference in the areas of student satisfaction, assessment, development and practical application of computer and information skills, learning abilities and use of online tool such as those available through the learning management system WebCT.

Since the treatment group received a teaching learning approach that included more active and collaborative student learning strategies the findings from this study support the literature that indicates that student engagement and deep learning is achieved through active and collaborative approaches that require the student to engage with the concepts of interest. The findings are in line with authors like Ebert-May, Brewer, & Allerd [12]; Springer, Stanne, & Donovan, [34]; Cooper and Robinson, [9]; Riffell and Sibley [28] etc.

The teaching staff who participated in this research who are teaching in the GEC 122 course also found the experience to be more rewarding than in previous semesters as students, not all but a larger percentage than in previous years, seemed more engaged in the material.

Limitations:

The findings in this study must be used with caution, as the context in which it was conducted is that of a small country university in a developing country. Students who enter the UB are usually post secondary or one year after their graduation from secondary school. These students may be vastly different from those in universities where adult learners make up the greatest percentage of the first year student population. In addition, universities that have well developed resources for online learning may find the findings of this research to be less useful as the researchers planned strategies that were feasible for them to implement within the course at the UB.

Conclusion:

Managing large classes is a challenge to the institution, faculty and students. This study validates the effectiveness of instructional methods used in teaching large classes and studied the impact of active and collaborative learning in large classes. The study contributes to existing knowledge by providing effective alternative strategies to educators who teach in large classes. Since accessibility in higher education is a major thrust for universities globally, it is likely that these strategies will be useful to academic staff throughout the world.

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Appendix A
GROUND RULES FOR GEC122

The following ground rules are set to ensure that the teaching and learning experience is beneficial for both lecturer and student. These Ground Rules outline what lecturers expect of you and what you can expect from the lecturer.

1. Class will begin and end on time. Be on time and don't start packing up before the end of class, the class will end on time so you have time to pack your things and get to your next class.

2. If you know that you will have to leave early, sit in a seat close to the door so that your departure will be less disruptive. In such a large class it is disruptive for anyone to enter late or leave early so PLEASE be considerate and respectful of you fellow learners.

3. Be prepared. Read items assigned before coming to class and prepare questions that you have about readings, bringing any equipment that may be required, etc. From the lecturer you can expect that s/he is a sound academic and therefore up to date on the topics/concepts being discussed.

4. Your participation in class will influence your mark. In class activities are meant to give you opportunities to get feedback on how well you understand the material and help you to develop skills needed in using computers and accessing information.

5. Contribute to in-class or WebCT discussions.

6. Take responsibility for your learning. Part of being an adult is accepting responsibility and consequences of one's action. We will treat you as adults and expect you to behave as such. This also means that all class members are responsible for the learning environment of the class. If a classmate is disrupting the class it is every member of the class's responsibility to discipline the offender!

7. Demonstrate respect by listening to each other (lecturer and students) and contributing to group activities. Lecturers will try to learn your name so when answering questions or making comments please give your name.

8. Due dates for assignments are listed in the assessment section of the course outline. Earthquakes, flood, fire and catastrophic illness are the only reasonable excuses for late submission. It is expected that assignments will be completed and submitted by the due date and that's why dates are provided. The consequence of late submission will be reduction of marks for each day the assignment is late. The lecturer will provide you timely feedback on your assignment.

9. Give your full attention to the class. Don't read unrelated papers or work on homework assignments while in class unless the lecturer has requested you to.

10. Don't have conversations with the person(s) next to you unless you have been asked to do so by the lecturer.

11. Cell phones off or on vibrate only. Do not answer calls while in class.

12. If you don't want to be in the class please don't interfere with other student's opportunity to learn from the class session.

13. If disruptions occur and the lecturer is unable to continue then s/he will leave the class but you are responsible for knowing the material planned for that day.

14. If you feel like sleeping, don't come to class. Laying your head down to take a nap is rude and distracting to lecturer and other students. We will try to make the class interesting but remember our primary goal is to help you learn not to entertain you.

15. If emergencies arise and you must miss a class please be sure to get notes from your classmates. It is not possible for the lecturer to go over the material for individuals that were unable to go to class. Be a responsible student.

16. Get in the habit of carrying your ID cards with you to all your classes.

17. Academic dishonesty hurts everyone. It undermines the value of UB qualifications and potentially decreases your learning. If you are caught cheating or plagiarizing on an assessment the consequences will be as per the Academic Honesty Policy.

18. Keep in mind that for every credit hour you are taking you should expect to spend 2-3 hours/week outside class or lab in learning about the subject.

19. In classrooms where there are inadequate numbers of chairs, please come early enough and bring an extra chair.

If we all meet the expectations that are outlined in these ground rules we can become learning community and all be winners!!

Appendix B

Treatment for Experimental Group 2
(Treatment and WebCT)

Week 1 or 2 (depending on attendance in Week 1):

- Ground Rules were distributed in writing on first day of class and extra copies available thereafter. Reference was made to specific items on the ground rules as needed by the individual lecturer, throughout the semester.

- Students were told that the class/section is part of a study. (5 minutes)

- Short quiz to help students review GEC121 content (5 minutes).

Format for All classes:

1. Read out loud the best 2-3 multiple-choice questions (MCQ) produced by students. Share answers – can have students answer first and put up a piece of paper with the number selected before giving correct answer. (5 minutes)

2. Lecture on specific topics (15 minutes)

3. In-class activity: (10 minutes)

    Activities used the overall format of either:

    - Think-Pair-Share or

    - One Minute Paper

Actual topic of these specific learner centred activities will vary for example, the lecturer may use concept mapping, "list five main points", "muddiest" point,

student demonstration, problem solving, example of application of concepts, etc.

4. Lecture on specific topics (15 minutes)

5. Wrap-Up: (5 minutes)

    - Get students to write an MCQ for today's class.

    - Explain that you will be using some of these questions in the final examination.

    - You will be answering the 2-3 best questions at the beginning of the next class.

Week before semester break: administer the mid semester student evaluation questionnaire. Request that they complete and return to the lecturer before leaving.

Final week - students should be asked to complete the final evaluation and the SECAT form.

Lecturer will keep weekly field notes of activities (agreed on format to be used).

Student Study Participation Information:

This is a study being funding by the Research and Publications Committee of the Faculty of Science. The purpose of the study is to determine best practices in teaching large classes. Students will be asked to participate in the study by completing an evaluation of the course at mid semester as well as at the end of the course. Completion of the questionnaire will indicate their informed consent.