Active Learning Classes

Important Note
The description and assessment materials presented below pertain to active learning classes. They have been designed by some our best instructors in this format and therefore characterize the "best practices" for the format and give assessment criteria appropriate for an instructor teaching this format. Experienced instructors who have taught in multiple formats often adopt a mixture of styles, and so the criteria here may not apply at all times. In such cases, the *overall effectiveness of instruction* represents the bottom line when assessing good teaching.

Overview. An active learning class is taught using a combination of intensive reading assignments, small group learning methods, mastery testing, and graphing calculators. A detailed sample syllabus of an active learning class is included here as Appendix A. The typical format for an active learning course consists of three components. The first is a mini-lecture in each class period on material assigned for reading in advance. The second is a group work session in each class period in which students learn the material through group problem solving. The final component is a two-hour weekly lab that focuses on group work and problem solving.

Class Sessions

Mini-Lecture. Students are given a reading assignment from the text for almost every class. The students are expected to read the material on their own in preparation for class. This is absolutely essential in order for the group work to be effective. The teacher should, one way or another, ensure that this happens (e.g. motivation through quizzes over the readings, question and answer sessions, etc.). The mini-lecture should be brief (15 min). It should serve as a vehicle to a) answer questions about the readings, b) clarify specific details of the readings, and c) provide an overview or context for the readings in relation to itself and to previous material.

Group Work. Students spend the remainder of each class working on problems and worksheets in small groups (3 or 4 students each). During this time the instructor circulates around to see how the groups are working and to provide some guidance when necessary. In this way the students should be actively doing mathematics instead of passively listening to a lecture. It is important that the instructor establish control of the classroom during this time. This is evident if students are generally remaining on task. Over time, as students familiarize themselves with each other and the instructor, the level of off-math discussion will inevitably rise; the instructor should still maintain an efficient level of focusing on task. A good teacher circulates among the students, not feverishly but regularly, and helps just a little, encouraging group interaction by using the group-mates as tutors for one another.

Mastery Exams. In each active learning class, one of the hourly exams is a mastery exam. This exam must be passed at the 85% level (without the use of a calculator) but can be taken multiple times (with penalty). This exam tests the student's abilities at basic conceptual understanding and algebraic skills in the calculus. It is important that the instructor prepare students well for the rigors of this exam and to encourage them in preparing for any re-takes that must be attempted.

Weekly Labs. Each active learning class has a two-hour weekly lab. This is a session designed for more intensive group work with problems that are challenging but related to

previous class work. The students are generally assessed on group performance in these lab assignments. Essay type answers with full explanations should be encouraged.

Calculators. Graphing calculators are to serve as a significant learning aid in an active learning class. Instructors should encourage the use of calculators in making initial graphical and numerical assessments of a problem. However, the instructor must also emphasize the limitations of calculator information and encourage written solutions to justify calculations.

APPENDIX A – Sample Course Description

Math 120 Course Information

Please Keep This Handout for Reference

REQUIRED TEXT: Calculus, from Graphical, Numerical, and Symbolic Points of View, Volume I by A. Ostebee & P. Zorn, Sanders College Publ., 1997
REQUIRED EQUIPMENT: A graphing calculator. The TI-82 is recommended for the course but others may be used. Calculators such as the TI-85 and higher are not permitted.

YOU SHOULD BRING YOUR TEXT BOOK AND CALCULATOR TO EVERY CLASS AND LAB

1. COURSE DESCRIPTION: This course will be taught using intensive reading assignments, small group learning methods, mastery testing, and graphing calculators.
   (a) INTENSIVE READING ASSIGNMENTS: The text by Ostebee & Zorn has been designed to be read. It is very well crafted in terms of how it conveys information and in the choice of information for each topic. For almost every class you will have a reading assignment of from 5 to 15 pages. It is essential that you complete the readings in preparation for each class since the small group work (see below) will depend upon this being done. You should make notes for yourself of the main ideas and examples in the reading assignment so that you can identify issues that are puzzling and also so that you will have notes to use when studying for exams. To help in understanding the material, it is useful to attempt some of the "basic" problems. These problems will test your understanding of the material and raise questions that can be answered at the start of class. I will ask you questions about the reading material at the start of class, so make sure you have done the reading assignment and have your notes ready.
   (b) SMALL GROUP LEARNING METHODS: You will spend a large amount of each class and the weekly lab working on problems and worksheets in a group with three or four other classmates. The lecture will take at most 15 minutes of each class. The purpose of the lecture is to introduce the material of the day or to clarify some point that is bothering the class. During the rest of the class I will circulate around to see how the working groups are doing and to provide some guidance when necessary. In other words, you will be actively doing mathematics instead of passively listening to a lecture. Participation in this group work is very important and it will play a part in your grade.
   Please pay careful attention to the detailed syllabus included with this course description; it is expected that you will have read each section of the text before the class in which it is to be discussed. Effective participation in the class will be possible only if you have read the assigned textbook material in advance.

(c) MASTERY TESTING: The second hour exam will be different from the others. It is called the Mastery Exam. It will examine your mastery of some very basic skills that are essential for success in this and other courses which depend on this material. You must demonstrate mastery of these skills at the 85% level or better in order to pass this exam; if you do not reach 85% the first time, then you are to take repeat exams until the 85% level is reached. These repeat exams will be given four more times during the semester, roughly a week apart. The following penalty applies for repeats: your recorded grade for this exam will be reduced by 10 points (out of 100) for each retake that is needed to reach the 85% level. Anyone who does not ultimately achieve a score of at least 85% (before the penalty is applied) will have his/her highest mastery exam score recorded and his/her term grade reduced by one letter grade.

(d) GRAPHING CALCULATOR: The graphing calculator will be a significant learning aid and will be (ultimately!) a time saver. You will make much use of it in class, for your homework, and while studying. Your calculator will become a close friend and you will be permitted to use it in all classes and on all tests and the final exam, with the single exception of the mastery exam.

2. HOMEWORK, GROUP WORK, EXAMS: The grades for the course will be constructed from a variety of group and individual activities. These are described as follows:

(a) GROUP WORK: During the weekly lab you will be divided into groups and given a set of problems to work on as a group. Each member of the group must hand in at the end of the lab solutions of the problems. Then one set of solutions for each group will be selected at random and graded. All members of a group will get the grade recorded for the one paper graded. Therefore you must work as a group and make sure that each member of the group knows how to solve the problems.

(b) HOMEWORK: Each day the small group work in class will consist of a selection of problems from the text. In addition, two or three problems similar to the in-class problems may be assigned for homework. Note: it is therefore important in the group work on in-class problems that you at least discuss each question as an aid to working out the solutions of the additional problems after class.

(c) EXAMS: There will be four one hour exams during the semester as well as a comprehensive final exam at the end of the semester. One of the hour exams will be the mastery exam as described above.