



INNOVATION ABSTRACTS

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KEYSTONE METHOD: A DYNAMIC SYSTEM FOR TEACHING AND LEARNING

The Keystone method is an innovative approach to teaching and learning mathematics. It traces the sources of students' difficulties and failures in mathematics to behavior patterns that negatively affect learning. Short attention spans, limited-time horizons, poor attendance patterns, passivity, failure to learn from errors, inattention to homework assignments, inattention to teacher's statements, and lack of self-esteem are common characteristics of these behavior patterns.

How does the Keystone method address these difficulties? The key is monitoring students' progress and adjusting teaching practices continuously. Students communicate with the instructor through carefully designed quizzes—daily, time-pressured, cumulative, and based on homework. Computer scoring of quizzes provides statistical data—e.g., the mean and standard deviations—for the entire quiz, as well as item analysis of each question. The instructor gets a wide-angle view of overall class performance; obtains valuable information about students' performance on each question; provides immediate feedback; reviews the troublesome questions; and repeats them on the next quiz to encourage attainment of mastery and learning from mistakes. By achieving a higher level of success with each quiz, students become more motivated to do better and become more self-reliant.

Frequent testing improves students' study habits and encourages them to study regularly throughout the term. Time-pressured quizzes focus students' attention and improve their concentration skills by eliminating periods of meandering thought. Cumulative testing consolidates students' learning and helps them integrate their knowledge of the topics covered during the course. The fact that quizzes are based on homework encourages students to complete their assignments regularly. The fact that quizzes are administered at each class meeting improves class attendance and punctuality.

Students in the Keystone classes are graded on an absolute rather than a relative scale. There is no grading curve and no quota for A's and B's. Each student is expected to attain a level of mastery, irrespective of other students' standing in the course. Since achievement of one student is not to the detriment of any other, cooperation and collegiality are encouraged.

The Keystone method is a versatile teaching approach. When the standard deviation of the quiz scores is high (more than 25%)—indicating that the class is splitting—the instructor implements a cooperative learning and peer tutoring approach. In these situations, weaker students learn from the stronger, and the stronger students expand their knowledge of the subject by interacting with the weaker students. The spirit of cooperation and mutual assistance is encouraged once again in these settings. Cooperative learning is an excellent way to combat student passivity.

The Keystone method addresses students' limited time horizons with frequent assignments that must be completed quickly, reducing—if not eliminating—disconnected study spurts and cramming for tests.

Finally, the Keystone approach encourages attentiveness to the instructor's messages. For example, to encourage the study of particular topics (e.g., word problems), the instructor administers dedicated quizzes (e.g., consisting entirely of word problems). Students learn quickly that even "unpopular" topics cannot be placed in the "forgetting bin."

Highlights of Results

Research data compiled over the past 10 years have shown significant outcomes in elementary, intermediate, and college algebra courses using the Keystone method. Results were achieved at no cost to retention across all subjects. A surprising result has been an improvement in students' reading comprehension scores, as demonstrated in standardized, norm-referenced tests. We attribute these improvements to students' improved concentration skills. And, students taking Keystone classes have shown greater persistence in mathematics courses, as well as in the college, compared to students in the control group.



Applicability to Other Disciplines

The principles of the Keystone program are not limited to mathematics. They can be applied to most any discipline; e.g., we have had positive results with students of geography courses, especially in regard to pass rates. The Keystone method is not dependent on the subject matter, rather on the learner being taught. Clearly, this method exemplifies a best practice model designed to improve teaching effectiveness and student learning.

STUDENT-CENTERED COURSE ASSESSMENT

Student assessment is an ongoing process, from the first day placement instrument to the final grade; however, assessment of my work as a teacher tends to be limited to semester's end. The official instrument at Bronx Community College, the Student Evaluation of Faculty Report, is not distributed to faculty until the following semester, after the course is over. So, while I can improve my teaching for subsequent classes, the Report is of no value to the students who generated it.

I developed an instrument to allow students to assess my work and class activities during the middle of the semester, allowing me to initiate a mid-course correction. No matter how carefully crafted my classes, some of which I have taught for 10 years, each group of students has its own personality, and what works for some groups does not work for others. And, even better, students often come up with wonderful suggestions for improving learning outcomes.

Now, halfway through the semester, students—as a class—brainstorm about the various parts of the course. Often, they are surprised at the array of activities that I list for them to discuss—from pair work to class discussions to sessions in the computer lab. They also evaluate the textbook, readings, writing assignments, and videos.

After we finish the general discussion, I divide the class into small groups and ask them to assess how useful each element in the course has been in achieving course (developmental writing) goals. This activity often leads to heated group discussion, as some students find some activities to be extremely useful while others not so. The debate is valuable because students realize that some learning activities are more successful than others and students learn in different ways. In the end, the group must compromise, either by convincing group members or by averaging their individual scores. Finally, each group is asked to consider other activities that would help them to achieve course objectives.

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Each group reports back to the whole class. Discussion begins whenever there is significant disagreement about the value of a particular activity. Suggestions for additional activities are also listed on the board. Many parts of the course are endorsed wholeheartedly, and in some cases students ask for more activities (e.g., more compositions). Other activities that turn out to be flops are discontinued midterm. At times, an activity will become optional or extra credit because students are divided about its usefulness.

Students take their responsibility for giving honest evaluations of each activity seriously, rather than sharing their opinions about the most fun or the easiest. I am amazed that classes consistently give high marks to activities that are the most difficult and time-consuming, and often dismiss others—e.g., watching the movie version of a book they have read—as a waste of time. The mid-semester assessment gives students opportunities to think about how they are learning, and this meta-cognitive leap allows them to take more responsibility for their own learning.

Students are excited about evaluating the course—a role reversal process during which they learn they can effect change. They appear to invest more of themselves in the course once they realize that they have helped to shape it—essentially by approving, eliminating, modifying, and adding elements that will help them improve their writing skills.

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