

CHOOSING AN ON-LINE HOMEWORK DELIVERY SYSTEM: IMPROVING PASS RATES THROUGH TECHNOLOGY

Nancy Leveille
University of Houston-Downtown
Computer and Mathematical Sciences Department; S705
One Main Street
Houston, Texas 77002-1001
U. S. A.
leveillen@uhd.edu

Introduction

In an effort to increase the time and effort students spend on homework, learning activities, and studying for tests, a College Algebra textbook along with its on-line homework delivery system was recently adopted at a wireless, diverse, mid-sized, urban, open admissions university. The change was part of a major redesign effort to include best practices from current research literature into the course. This paper describes the selection process and some results from incorporating a publisher's on-line materials into the course at The University, a pseudonym. Due to our College Algebra success, similar processes are being applied to the selection of textbooks and on-line homework delivery systems for other courses.

The College Algebra Course

College Algebra is a core curriculum requirement for many college degrees. The catalog description for this course includes "topics in algebra including variation, systems of equations and inequalities, nonlinear inequalities, functions and their graphs, lines, quadratic equations and functions, the algebra of functions, an introduction to plane analytic geometry and applications" (The University, 2007, p. 142). Very few of the students who start their college work at The University place out of this course. A faculty committee annually revises the department course materials: (a) syllabus, (b) student syllabus, (c) textbook, (d) suggested homework assignments, (e) final exam review sheet, and (f) required, comprehensive, 40 multiple-choice question, final examinations. Grades are assigned for averages: 90 - 100 A, 80 - 89 B, 70 - 79 C, 60 - 69 D, and F for below 60 or when the final exam score is less than 50. A student passes College Algebra with at least a D. However, a C or better is the prerequisite for additional mathematics courses.

Longitudinal Study

Two faculty members, unhappy with the general lack of student success in their College Algebra sections, started to investigate the pass rate problem in 1994. The semester pass rate is calculated by dividing the number of students who pass the course by the number of students on the official 12th day rolls. The pass rates, based on grades of A, B, or C, for the fall semesters of 1998 through 2004 fluctuated from 35% to 39% with approximately

1000 students in 30 sections each year. Spring semester pass rates, from 1999 through 2003, fluctuated from 29% to 37% with enrollments around 800 students (Waller 2005).

After reviewing various college algebra textbooks the two researchers concluded that a simple book change would not be sufficient. The available textbooks in the 1990s seemed similar to using a traditional approach that repeated high school algebra with learning through rote imitation of exercises. They decided to develop non-traditional College Algebra curriculum materials. They focused on a motivational approach to the learning process that included: (a) a conceptual orientation, (b) real world applications, and (c) meaningful use of technology as an integral part of the course. The teaching materials were continuously revised and made available to other interested faculty members. In comparison to those using a traditional approach, statistically significantly higher pass rates were consistently obtained by more and more sections as other faculty began using these new materials. For example, one class with 29 students achieved a 55% pass rate in the spring 2005 semester (Leveille, 2008).

While these efforts were underway, there were other interventions and forces to improve the pass rates. As part of The University's accreditation process, in the spring 2006 semester, College Algebra was identified as one of three high enrolment, high-attrition courses having a significantly negative impact on student success. The University response resulted in a Quality Enhancement Plan (QEP) which offered various initiatives and interventions designed to improve learning outcomes (The University, 2006). As a result, changes in the course were mandated by forces outside the department. A change process for College Algebra was developed over several years in an effort to include all stakeholders in a collaborative effort. Though many aspects of the changes were data driven, choices were decided in the department by the faculty. A major accomplishment of this change process was the selection of a textbook which includes a motivational approach to learning, similar to the experimental materials that had been successful earlier, as well as on-line technology support.

Choosing a Textbook

In 2006, a mathematics faculty committee was formed to select a book that would support the learning objectives listed in the QEP documents, such as: (a) modeling with functions, (b) reasoning appropriately, and (c) interpreting and using function notation (The University, 2006). All mathematics department faculty members were asked for input and 31 different textbooks and/or online homework delivery systems were suggested. The materials came from 8 different publishers. The book committee members attended conferences and reported on various publisher's textbooks and on-line products. Meanwhile, at open meetings throughout the year, several publishers presented their books and on-line products to the faculty. It was decided that pilot testing would be necessary to know which books would be successful with our students. A mix of traditional and motivational approach books were chosen by the volunteer faculty for the pilots. During the fall 2006 semester, there were 9 pilot sections using 4 new books out of 31 sections of College Algebra. In spring 2007, 13 of the 27 sections used 5 new books.

Table 1 shows pass rate data for the pilot study year comparing traditional to on-line homework options. Using grades submitted to the department by the faculty, the pass rate was calculated based on D or better (60 - 100) grades. Passing rates of 56% and 52% indicate an improvement over the previous statistics. More importantly, Table 1 highlights the positive impact of on-line technology usage with differences of 7 - 12% .

There was a statistically significant difference ($\alpha = 0.05$) for one textbook, with its associated on-line technology, in particular. For the spring 2007 semester, the 65% pass rate for students registered in sections using "The book" was 3.9 standard deviations above the mean, while only 48% of the students passed in other sections. Another corroborating result with "The book" was that the Learners Community section "had an outstanding C or better passing rate of 82%, with a final exam average of 85" (Waller, 2007). For details about Learners Communities or Supplemental Instruction, see articles in Gardner, Barefoot, and Swing (2001), Levine (1999), or Martin and Arendale (1994). The textbook committee narrowed the list for final consideration to the pilot-tested books. The Pre-calculus Committee carefully considered input from the department, the QEP Committee, and current research literature (American Mathematical Association of Two-Year Colleges, 2006; Mathematical Association of America, 2005; National Council of Teachers of Mathematics, 2000). They unanimously voted for "The book." The book chosen for the department utilizes a motivational approach and had demonstrated (a) success, (b) adaptability to varying faculty preferences, and (c) openness to a modern approach that promotes active learning.

Table 1

College Algebra Pass Rates During Pilot Study

2006 fall pass rate 56%			2007 spring pass rate 52%		
	Traditional	Online homework		Traditional	Online homework
Fall N =623	51% 194/379	63% 154/244	Spring N=686	50% 232/466	57% 125/220
				Other books 48% 248/518	The book 65% 109/168

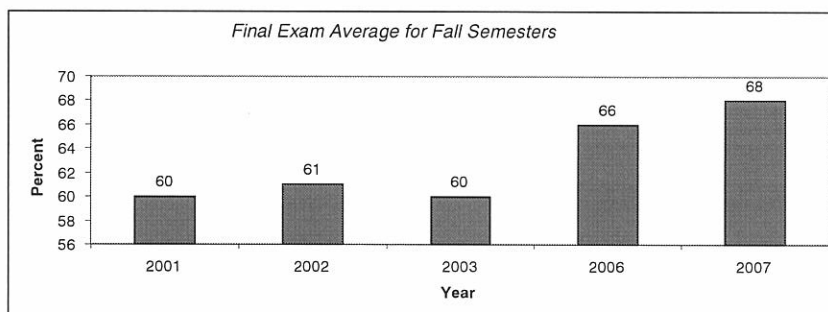
During the pilot year, as many of the books had an online component, the Instructional Technology Department (IT) was consulted. Two main IT concerns were raised. One concern was the potentially large numbers of students who might require IT support if on-line homework were required of all College Algebra students. This was alleviated

when the publishers under final consideration agreed to provide training for mathematics department faculty and staff as well as comprehensive student support. Further, the department agreed to support and update its computer labs as necessary. The second concern was with confidentiality and records retention issues. This was resolved when the publishers under final consideration upgraded their access and security procedures.

Some First Year Results

Before the start of the fall 2007 semester, many faculty, staff, and Supplemental Instruction Leaders attended various training sessions in order to become familiar with the new on-line homework system. The department student syllabus was revised to contain both the textbook homework and the on-line homework directions. A department on-line coordinator course was developed to include chapter quizzes for obtaining individualized study plans, homework, grade book, and other publisher's resources. Faculty copied and made the department on-line course materials available to students in all 26 sections offered that semester. For those faculty who initially did not choose to incorporate the on-line materials, student requests for access proved sufficiently motivating to obtain and provide a Course ID code for the section to the students. As it was the only new course intervention, the on-line materials are assumed to have contributed to the upward trend in the Final Exam Average as seen in Figure 1. A course Final Exam average of 68 in the fall 2007 semester was the latest available and highest.

Figure 1



Individualized training was provided in the spring 2008 semester for faculty new to the chosen publisher's on-line materials. Additional types of homework problems, quizzes, reviews, and tests were incorporated into the on-line materials. Again the department on-line coordinator course was copied and made available to students in all 27 sections. Faculty in 16 of the sections are now counting the on-line homework grade in their course average. With the on-line homework counting for 0-17% of a student's grade, there was a great variability in implementing the on-line homework component of the course. Since various homework assignment and grading philosophies still co-exist in the department, the faculty acceptance of on-line support is not universal. With students embracing the on-line technology, regardless of faculty orientation, the Spring 2008 College Algebra grades (N = 729) are 9% A, 12% B, 20% C, 12% D, 35% F, and 12% W. These result in a 41% A, B, or C pass rate along with a 53% A, B, C, or D pass rate.

These are higher than any previously reported Spring course pass rate. To clarify the details, additional data is currently being sought for a correlation study using individual student on-line homework grades and their course averages.

References

- American Mathematical Association of Two-Year Colleges. (2006). *Beyond crossroads: Implementing mathematics standards in the first two years of college*. Memphis, TN: Author.
- Gardner, J., Barefoot, B., and Swing, R. (2001). *Guidelines for evaluating: The first-year experience at four-year colleges* (2nd ed.). Columbia, SC: University of South Carolina , National Resource Center for the First-Year Experience and Students in Transition.
- Leveille, N. (2008). Choosing a web based homework delivery system. *ACET Journal of Computer Education and Research*, 5(1). Retrieved May 13, 2008, from http://www.texasacet.org/journal/ACETJournal_Vol5/ACETJournalVol5.html
- Levine, J. (Ed.). (1999). *Learning communities: New structures, new partnerships for learning* (Monograph No. 26). Columbia, SC: University of South Carolina, National Resource Center for the First-Year Experience.
- Martin, D., and Arendale, D. (Eds.). (1994). *Supplemental instruction: Increasing achievement and retention*. San Francisco: Jossey-Bass.
- Mathematical Association of America. (2005). *Develop mathematical thinking and communication skills*. Retrieved July 6, 2005, from the MAA-CUPM Web site: http://www.maa.org/cupm/ill_ref/part1/2.html
- National Council of Teachers of Mathematics. (2000). *Principles and standards for school mathematics*. Reston, VA: The Council.
- The University. (2006). *Revised quality enhancement plan: Student engagement through active learning strategies, August 2006*. Houston, TX: Author.
- The University. (2007). *Catalog*. Retrieved May 14, 2008, from <http://global.dt.uh.edu:8080/catalog/>
- Waller, W. (2005). *Results*. Houston, TX: The University, internal memorandum.
- Waller, W. (2007). *Math 1301*. Houston, TX: The University, QEP internal memorandum.