UW-Stout Math Teaching and Learning Center


submitted by
Dr. Jeanne Foley, Math TLC Director
September 22, 2008

HIGHLIGHTS:

• The Math TLC program has served 2330 students since the Fall of 2004.
• Failure/withdrawal rates have been reduced by 55% in Math 010 and 40% in Math 110.
• An estimated 300 more students passed introductory algebra courses than would have passed without the Math TLC program.
• The fall-to-spring retention rate for first-year students who took remedial math (Math 010) last year exceeded the rate for all first-year students.
• The Math TLC program has cut the minority student achievement gap by more than half.
• The Math TLC director has received four external grant awards, including a 3-year, $450,000 grant from the U.S. Department of Education FIPSE program and over $50,000 in first-year funding from the UW System for a two-year minority achievement gap reduction project.
• Grant-funded course redesign workshops developed by the Math TLC teaching team have been attended by a total of 34 educators from 22 institutions in 8 states.

This work is supported by U.S. Department of Education FIPSE grant number P116B06011.
Math TLC: Combining Technology with Traditional Approaches Improves Student Outcomes in Introductory Algebra Courses at UW-Stout

Four-Year Progress Report
(Fall 2004 through Spring 2008)

Success in first-year math courses is a strong predictor of retention into the second year of college, increasing the incentive for postsecondary schools to invest resources in a program demonstrated to impact a large proportion of incoming students. Created in 2004 via a special allocation from the Chancellor’s office, the UW-Stout Math Teaching and Learning Center uses a comprehensive approach combining online work with required daily classroom sessions and a new tutoring service devoted specifically to our two introductory algebra courses. Beginning Algebra (Math 010, a 2-credit remedial course) and Intermediate Algebra (Math 110, 4 credits) are prerequisites to math courses that satisfy the university’s General Education math requirement and are taken by students whose test scores are too low to qualify them to enroll directly into a Gen. Ed. math course upon matriculation at UW-Stout. Math 010 and 110 typically enroll 40-45% of our first-year students, a figure consistent with the national average for incoming college students.

The cornerstone of our new math program is daily computer-graded homework that counts significantly (~25%) towards the course grade. One major feature distinguishing our curriculum from exclusively online courses is the blending of online homework and tests with required daily classroom sessions in a dedicated, technology-enhanced classroom/tutor lab complex. Another key factor is a new tutoring service dedicated exclusively to supporting students in these two courses. Online work is continually monitored by the student’s classroom instructor who intervenes actively as soon as a student begins to show signs of falling behind.

Over the past four years, this program has reduced the failure/withdrawal rate by 55% in Math 010 and 40% in Math 110 compared to the rates in the four years prior to the Math TLC program. We estimate that over this four-year period, the Math TLC program has resulted in nearly 300 more students passing introductory algebra courses than would have passed without the Math TLC program. This number translates to nearly 4% of the entire Stout undergraduate student population over those four years, many of whom would likely have dropped out if they hadn’t passed these math classes.

Results to date: The Math TLC program has served 2330 students since the Fall of 2004. The combined failure/withdrawal rate for the 528 students who have taken the remedial Beginning Algebra (Math 010) course during the first four years under the new system has decreased by 55%, to 13.1% as compared to 29.0% in the previous four years (see Figure 1.) Results in the Intermediate Algebra (Math 110) course showed a less dramatic 40% reduction in non-pass rates (17.5 % for 1802 students over seven semesters, vs. 29% pre-Math TLC; see Figure 2), but this improvement was achieved despite the elevated passing standards we instituted in Fall 2004.
Figure 1: Percentage of students receiving failure or withdrawal grades in Beginning Algebra, a 2-credit remedial course.

*Left panel:* Cumulative data for the 4 years prior to creation of the Math TLC program vs. 4 years since inception.

*Right panel:* Year-by-year data for same intervals.

Figure 2: Percentage of students receiving failure or withdrawal grades in Intermediate Algebra, a 4-credit prerequisite to General Education math courses.

*Left panel:* Cumulative data for 4 years prior to creation of the Math TLC program vs. the 4 years since inception.

*Right panel:* Year-by-year data for same intervals.
Student Engagement:

Using the tracking features of the software, we found that 95% of students are submitting all homework assignments, with an average score of 92%. Students are now spending an average of 95 minutes on each day’s homework assignment. Attendance rates now average above 90%. We also log about 2500-3000 student visits to the tutor lab each semester, or between 150 and 200 per week, compared to the 75-80 tutoring sessions per semester logged by the campus-wide free tutoring service for students in these two courses before our program began. Over 25% of students enrolled in the two Math TLC courses report using the tutoring service at least once a week.

Students are also registering greater engagement and satisfaction with the learning experience despite the greater demands we are placing on them. On a survey distributed to Math TLC students at the end of each semester, 91% of respondents indicated that they learned as much or more than they expected to learn coming into the course. 84% said they’d be likely to take a course using this structure again. And despite the prominence of online homework and learning tools, students still rated “my teacher” as the top factor influencing their learning, providing strong evidence that the personal interaction this program provides in the classroom and lab is an essential feature distinguishing this approach from strictly online and even most “hybrid” course structures. Written responses to survey questions are typified by the following verbatim selections:

- I learned more in this one course than I learned in all my math classes in high school.
- This class completely changed my views on math. Before this class I hated math and never wanted to do it. I hated math even in grade school! After this course I LOVE math and am considering a math minor. I'm even thinking of being a tutor in the Math TLC next year. I would never have imagined ME teaching and helping others with math.
- I REALLY like the way this class operates,, and let it be known that I can't even remember “not minding” a math class since Jr. high school!
- I've never done as well in a math class as I have this term.

Subsequent Course Performance and Impact on Retention:

Analysis of subsequent course performance has been completed for the first two years of the Math TLC program. Although more students are passing Intermediate Algebra, there has been no reduction in the proportion of these students who go on to take a higher level math class in the subsequent semester compared with students in the two previous years. Consequently more students are now able to choose science, technology, engineering and math (STEM) or business majors. Furthermore, the average grade of students in the subsequent College Algebra course has actually increased slightly compared to the traditionally-taught cohort.

Although retention and graduation impact have not yet been fully assessed, it is noteworthy that in Fall of 2007, 93.6% of the of first-year students who took our lowest level math course (Math 010) returned for the following semester, exceeding the fall-to-spring retention rate for all incoming first-year students last year. We estimate that over the past four years the Math TLC program has resulted in hundreds more students passing introductory algebra courses than would have passed at pre-Math TLC rates. With nearly half of Stout students placing into these courses each year, this increase in success rates benefits a large fraction of the Stout student body and has the potential to significantly increase retention and graduation rates.
Closing the Minority Achievement Gap in Math:

The Math TLC program has also cut the minority student achievement gap by more than half. Minorities represent about 5% of UW-Stout students but comprise 15-20% of the enrollment in the remedial algebra course. The gap in F/W rates between students of color and students in the white majority dropped from 40% in 2003-2004 to less than 20% in 2004-2005 (Figure 3). Analysis of data from subsequent years is still in progress, but anecdotal evidence from Math TLC teachers, tutors and students suggest that this trend is continuing and perhaps even improving on the first-year results.

Figure 3: Comparative results for minority students in Math 010, 2004=2005 vs. 2003-2004.

Left panel: Percentage of students receiving failure or withdrawal grades in Beginning Algebra, a 2-credit remedial course.
Right panel: Year-by-year data for same intervals.

External Grant Funding:

The success of the UW-Stout Math TLC has attracted interest and support from many quarters. In addition to small grants from the NSF-funded Wisconsin Alliance for Minority Participation and from the donor-funded Stout Foundation, the UW-Stout Math TLC team led by Dr. Jeanne Foley has also received a 3-year, $450,000 grant from the U.S. Department of Education via the Fund for the Improvement for Post-Secondary Education (FIPSE) program. Foley and UW-Stout Director of Diversity Programs Richard Tafalla have also been awarded over $50,000 in first-year funding from the UW System for a two-year project to adapt portions of the Math TLC program for a new initiative to reduce the achievement gap between minority and non-minority students. This first installment of this new program will be offered to incoming first-year minority students prior to the Fall 2009 semester to help prepare them for success in college mathematics courses.
Regional and National Impact of The UW-Stout Math TLC Program:

The FIPSE award was the first such grant for UW-Stout and was also the only 2006 FIPSE grant awarded among the states of Wisconsin, Minnesota, Iowa and Michigan. The goals of the FIPSE grant project are to extend and expand the scope of our successes by assessing the long-term project impact on subsequent course outcomes and retention in school, expanding the concept to higher level math courses, adapting the program to a summer pre-college preparatory program, and developing a series of workshops to foster adoption and adaptation of the approach by other universities and colleges.

Elizabeth Burmaster, Wisconsin State Superintendent of Public Instruction, wrote the following in her letter of support for the FIPSE grant project:

The new approach to teaching introductory mathematics being pioneered at UW-Stout effectively addresses a problem of urgent national significance, and I believe that this new program has great potential for adaptation by other schools in the University of Wisconsin System. I first heard of the innovations in math instruction at UW-Stout when I attended a presentation Dr. Foley made to me and the other members of the University of Wisconsin Board of Regents at our May 2005 meeting. In a personal communication to Dr. Foley after her presentation, I expressed my hope that other UW System Schools, Wisconsin Technical College System partners and high schools would learn more from her and others associated with the program. We face many important educational challenges in our state, and improving mathematics education and the aptitude of our students is certainly at the top of the list of important work that awaits our attention. As chair of the Regents’ Committee on Education, I intend to encourage participation by our member schools in the planned workshops. I extend my thanks and appreciation to Dr. Foley and her colleagues for initiating this program and fostering its expansion.

The first two annual FIPSE grant-funded workshops developed by the Math TLC teaching team were attended by a total of 34 educators from 22 institutions in 8 states. Attendees included teaching teams from five UW System universities and six Wisconsin technical colleges, as well as participants from 2-year and 4-year colleges and universities in Michigan, Texas, West Virginia, Missouri, Illinois, North Dakota, and Minnesota.

In her 2007 evaluation report, external grant evaluator Dr. Carol Skay wrote: “The 2007 Course Redesign Workshop conducted by the faculty and staff of the Math TLC at UW-Stout was, especially for a first time workshop, extremely well planned and executed, and had immediate positive impact on the workshop participants.” Dr. Skay concluded her 2008 workshop evaluation report with these words: “I would like to personally recognize the Stout faculty for delivering a phenomenal workshop.” Among the participant comments she cited in her reports were these:

- “I have been involved with zillions of workshops, conferences, courses, conventions, etc.... and rarely is there the outstanding combination of competence, organization, passion and camaraderie that the Stout team displayed.” [2007 workshop participant]
- “I was surprised by how much they covered in 5 days! I never imagined learning that much about one program in such a short time.” [2008 workshop participant]
- “Clearly, the UW-Stout team are committed to excellence and work together well to achieve it.” [2008 workshop participant]

For more information on the Math TLC, go to http://mathtlc.uwstout.edu.