

Mathematics Competency Assessment: Summary Report for 2009-2014

In the Competency Area of Mathematics, Middle Tennessee State University (MTSU) assesses annually the following student learning outcomes:

1. Students are able to use mathematics to solve problems and determine if results are reasonable.
2. Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.
3. Students are able to make meaningful connections between mathematics and other disciplines.
4. Students are able to use technology for mathematical reasoning and problem solving.
5. Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.

MTSU uses multiple measures to evaluate the extent to which its students have attained the mathematics competency outcomes and to determine if the level of attainment is acceptable.

Course-Embedded Assessment of Mathematics Competency

In compliance with Tennessee Board of Regents (TBR) requirements, the General Education Mathematics Outcomes are assessed annually in one of the MTSU courses approved for the General Education Mathematics subject area. MATH 1710, College Algebra, was selected for the assessment because it is the most highly enrolled General Education Mathematics course.

All students in MATH 1710 complete a common comprehensive final examination with specific questions mapped to each General Education Mathematics Outcome. Each of the five learning outcomes for mathematics is associated with a specific set of questions on the final examination—40 questions for the first learning outcome and 16 questions for each of the four additional learning outcomes. The same set of questions is used to assess both Learning Outcome 2 (real-life problems) and Learning Outcome 3 (meaningful connections) because the distinction between these two learning outcomes is too subtle to measure with a single examination. All MATH 1710 students are included in the assessment results. In academic year 2013-14, for example, a total of 1,966 students were assessed (1,335 in fall 2013 and 631 in spring 2014).

Results of the Mathematics outcomes assessment for the past five years are represented in the table below, which indicates the percentage of students performing at the Superior level (correct response rate of at least 85% on questions mapped to the outcome), Satisfactory level (correct response rate between 60% and 84% on questions mapped to the outcome), and Unsatisfactory level (correct response rate of less than 60% on questions mapped to the outcome).

The MTSU Department of Mathematical Sciences has set a goal that no more than 25% of students will perform at the Unsatisfactory level on each of the mathematics competency outcomes. MTSU students' attainment of the outcomes is also benchmarked against information provided by the TBR identifying the statewide average for all TBR universities. On three of the five outcomes (Outcomes 1, 4, and 5) MTSU students' attainment of the outcomes is above the statewide average and is at or near the goal of no more than 25% performing at the Unsatisfactory level. On two of the five outcomes (Outcomes 2 and 3), MTSU students have not yet reached the goal of 75% performing at the satisfactory or higher level.

Mathematics Outcomes	Superior	Satisfactory	Unsatisfactory	Statewide TBR University Average Rate of "Unsatisfactory"
2009-2014 Summary				
1. Students are able to use mathematics to solve problems and determine if results are reasonable.	2009-10: 13.0% 2010-11: 15.2% 2011-12: 17.8% 2012-13: 13.0% 2013-14: 13.6%	2009-10: 62.0% 2010-11: 56.7% 2011-12: 62.4% 2012-13: 59.5% 2013-14: 60.9%	2009-10: 26.0% 2010-11: 28.1% 2011-12: 19.8% 2012-13: 27.5% 2013-14: 25.5%	30%
2. Students are able to use mathematics to model real-world behaviors and apply mathematical concepts to the solution of real life problems.	2009-10: 10.0% 2010-11: 9.0% 2011-12: 13.4% 2012-13: 10.8% 2013-14: 10.1%	2009-10: 53.0% 2010-11: 55.6% 2011-12: 60.4% 2012-13: 51.5% 2013-14: 54.8%	2009-10: 37.9% 2010-11: 35.4% 2011-12: 26.2% 2012-13: 37.7% 2013-14: 35.1%	32%
3. Students are able to make meaningful connections between mathematics and other disciplines.	2009-10: 10.0% 2010-11: 9.0% 2011-12: 13.4% 2012-13: 10.8% 2013-14: 10.1%	2009-10: 53.0% 2010-11: 55.6% 2011-12: 60.4% 2012-13: 51.5% 2013-14: 54.8%	2009-10: 37.9% 2010-11: 35.4% 2011-12: 26.2% 2012-13: 37.7% 2013-14: 35.1%	26%
4. Students are able to use technology for mathematical reasoning and problem solving.	2009-10: 10.0% 2010-11: 12.6% 2011-12: 14.8% 2012-13: 12.7% 2013-14: 13.2%	2009-10: 55.0% 2010-11: 56.6% 2011-12: 58.6% 2012-13: 58.9% 2013-14: 60.2%	2009-10: 36.0% 2010-11: 30.8% 2011-12: 26.5% 2012-13: 28.4% 2013-14: 26.6%	34%

5. Students are able to apply mathematical and/or basic statistical reasoning to analyze data and graphs.	2009-10: 19.0%	2009-10: 57.0%	2009-10: 25.0%	32%
	2010-11: 18.5%	2010-11: 54.0%	2010-11: 27.5%	
	2011-12: 26.5%	2011-12: 55.2%	2011-12: 18.3%	
	2012-13: 27.6%	2012-13: 52.9%	2012-13: 19.5%	
	2013-14: 28.7%	2013-14: 54.5%	2013-14: 16.8%	

Indirect Assessment of Mathematics Outcomes

Indirect assessment of the Mathematics outcomes includes survey data from the Alumni Survey, Graduating Senior Survey, and the National Survey of Student Engagement (NSSE).

Alumni Survey: Alumni are asked to rate the impact of their MTSU education on their skills in “analyzing quantitative problems.” Students rate this impact using the following scale:
1 = Very little, 2 = Some, 3 = Quite a bit, 4 = Very much.

The score from the 2010 Alumni Survey was 2.74, and the score from the 2012 survey was 2.81. The Alumni Survey was not administered in 2013 or 2014.

Graduating Senior Survey: A question related to the development of mathematical skills asks students to rate how much their MTSU experience contributed to their skills in “using mathematical concepts.” The percentage of seniors who responded positively was 63% in both 2011-12 and 2012-13, and 68% in 2013-14.

NSSE: A question related to the development of mathematical skills asks students to rate how much their MTSU experience contributed to their knowledge and skills in “analyzing numerical and statistical information.” MTSU seniors rate this impact using the following scale:
1=Very little 2=Some 3=Quite a bit 4=Very much.

The score from the 2011 NSSE survey was 2.95, and the score from the 2014 survey was 2.76 (compared to the 2014 national NSSE average score of 2.82).

Evidence of Improvement Based on Analysis of the Results

Between academic years 2009-10 and 2013-14, there was improvement in student attainment of all mathematics outcomes, and particularly noteworthy are the improvements in Outcomes 4 and 5. These improvements are also significant because fewer than one-quarter of MATH 1710 students present an ACT Math score as high as 22, the ACT College Readiness Benchmark for a 75% chance of passing College Algebra with a C or better. Students’ perceptions of their mathematical skills showed improvement on the Alumni Survey and Graduating Senior Survey, but a slight decline on the NSSE.

The Department of Mathematical Sciences has initiated a number of interventions to improve student attainment of the mathematics competencies. Below is a summary of some of these interventions:

1. The Department of Mathematical Sciences appointed a General Education Coordinator, Dr. Nancy McCormick, who chairs the Department's General Education Committee. Several strategies have been implemented to provide a more consistent program for general education courses.
2. In order to insure greater uniformity in syllabi, grading, and learning expectations, all instructors are now required to have common information on syllabi and to use the same grading scale ranges. The Department's General Education Committee created common departmental syllabi and common course schedules listing topics to cover for all instructors of MATH 1710 (also for the General Education Mathematics courses MATH 1010, MATH 1530, MATH 1630, and MATH 1810).
3. All faculty members are instructed to keep accurate attendance records on each student to document D-F-W grades and to encourage students to attend classes.
4. Faculty members are instructed to utilize the University's Academic Alert System early and throughout the semester to notify students who are in academic jeopardy.
5. Students are encouraged to use all available resources to receive tutoring and help with classwork. The Department of Mathematical Sciences and the Department of University Studies provide free tutoring to students in all General Education Mathematics courses. In support of the University's Quest for Student Success, in spring 2014, the General Education tutoring operation for MATH 1010, 1410, 1420, 1530, 1630, and 1710 was relocated to the Walker Library, extending tutoring services into the evening and weekend hours. The Department continues to offer tutoring in Calculus and Precalculus. The University Studies Department offers tutoring for prescribed/enhanced math sections MATH 1010-K, 1710-K, and 1530-K. Several tenured/tenure-track faculty have been given one-hour workload assignments to support the Department's tutoring labs.
6. University Studies developed a program called Academic Intervention in Mathematics (AIM) to promote success for those highly at-risk students who are repeating prescribed General Education mathematics courses. AIM targets students who have failed the course in which they are enrolled. These at-risk students are identified for each instructor at the beginning of the semester. The instructor meets with each student periodically to advise, to encourage, to teach study skills, and to individualize other interventions. Interventions may include assignments of time to be spent in the Math Lab, notebook checks, or written assignments. Simply meeting with students to show concern for them and to build relationships with them is a proven

retention tool. Students are encouraged to meet with instructors during office hours. Instructors also use phone calls, emails, and Advisor Alerts to contact students who are not attending class. It is obvious that this type of intervention would be helpful to other students, so instructors intervene when any student is not progressing well. Any intervention that is designed for repeating students is also available to non-repeaters.

7. The department's master's level GTAs are currently supervised by Dr. Rebecca Calahan. Supervision of GTAs in the Ph.D. program is assigned to Dr. Angie Murdock. In supervising the teaching assistants, these faculty members provide teaching mentoring, help with instructional practices, scheduling of workloads, and oversight of University and Departmental requirements in these graduate programs.

8. The Department's General Education Committee developed and administered a survey of faculty teaching the general education courses MATH 1010, MATH 1710, MATH 1810, MATH 1530, and MATH 1630. A summary of responses for MATH 1710 (College Algebra) indicated an appropriate curriculum, use of technology, and textbook for the course. However, in response to faculty feedback, the committee recommended an improvement in the sophistication and breadth of assessments for the course, including examinations that consist of different types of questions, not solely multiple-choice items.

9. Currently, the overwhelming majority of College Algebra sections are taught either by full-time temporary, graduate teaching assistants, or adjunct faculty. Some semesters have had as many as 34 different instructors teaching College Algebra. Consequently, the Department has requested administrative support for more tenure-track lines to provide greater consistency in instruction for all general education courses.

10. In order to identify actions and strategies to improve student achievement, annual assessment results are always shared with faculty in Mathematical Sciences, faculty in University Studies, and members of the Mathematics General Education Committee.

Summary

Along with other Tennessee Board of Regents schools, MTSU has identified college-level general education competencies, one of which is mathematics. Development of the competencies is supported in MTSU's General Education courses. To ensure that MTSU's General Education courses are college-level, the courses are approved at multiple levels and undergo periodic review. Course-embedded assessment of the mathematics outcomes indicates improvement on all of the outcomes over the past five years, and MTSU students are now meeting benchmarks on three of the five outcomes. Indirect assessments also indicate improvements, with students' responses to survey questions related to the mathematics competency showing improvement over the past five years. In response to less than

satisfactory results, the MTSU Department of Mathematical Sciences has implemented a number of changes to improve students' attainment of the mathematics competency.