Millikin University
Student Learning in the Mathematics and Computer Science Major

By Daniel Miller
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Executive Summary

The Department of Mathematics supports Millikin's Mission in that the Department works:

1. To prepare students for professional success.
    a. Applied mathematics – we provide core mathematical experiences and a range of application areas to prepare students for work or graduate study.
    b. Mathematics education – we prepare students for the Illinois State Certification Exam, give them experience in teaching, and keep them current on the use of technology in mathematics education.

2. To prepare students for democratic citizenship in a diverse and dynamic global environment.
    a. Applied mathematics- we provide fundamental tools to analyze dynamic events that will inform public policy.
    b. Mathematics education- in a world where political leaders are becoming increasingly numbers driven, we provide the teachers the skills to empower children by enhancing their ability to reason quantitatively.

3. To prepare students for a personal life of meaning and value we help our students develop the intellectual framework, and instill in them the mindset, that will enable them to remain life-long learners. Our students are taught to think rigorously and rationally, and to revel in the sheer pleasure of thinking.

Additionally, the department has specific goals for two of its majors Applied Mathematics, and Mathematics Education. These goals clarify and document the department's desire to produce highly qualified and successful majors.

assessment data necessary for the mathematics education major beyond what is collected for the yearly NCATE report.

Report

Goals

The Department of Mathematics supports the mission of the university in preparing students for professional success, democratic citizenship in a global community, and a personal life of meaning and value. The mission of the department is to produce graduates who achieve the following learning outcome goals:

1. Applied Mathematics

An applied mathematics major will

a.

b. Mathematics education- in a world where political leaders are becoming increasingly numbers driven, we provide the teachers the skills to empower children by enhancing their ability to reason quantitatively.
c. Computer science- we provide the skills necessary for students to succeed in an increasingly technological world

3. To prepare students for a personal life of meaning and value we help our students develop the intellectual framework, and instill in them the mindset, that will enable them to remain life-long learners. Our students are taught to think rigorously and rationally, and to revel in the sheer pleasure of thinking.

Snapshot

The Department of Mathematics guides students in the completion of three different majors: mathematics education, applied mathematics and actuarial science. Currently, 25 students are following one of our major programs of study. The Department also serves elementary education students with mathematics concentrations, currently 5.

General Description. The Department of Mathematics includes the disciplines of mathematics and statistics. The department offers mathematic majors with options in Applied Mathematics, Mathematics- Secondary Teaching, and Actuarial Science. Additionally, a minor in Applied Mathematics is offered. Elementary Education majors may take a concentration in mathematics. The curriculum is structured to meet the overlapping needs of students who fall in one or more of the following categories:

those who plan to become high school mathematics teachers;
those who intend to pursue graduate work in applied mathematics, computer science, or other related fields; and
those who will apply mathematics and/or computer science in the natural sciences, social sciences, business or other areas of quantitative studies such as actuarial science.

Additional Comments.

The three majors offered in the Department share courses and faculty. The applied mathematics and mathematics secondary education majors are particularly entwined with students taking common courses and interacting with the same faculty members. In many respects these two majors cannot be disentangled for analysis.
Students can earn either the Bachelor of Arts or Bachelor of Science. The choice of B.A. or B.S. depends entirely on the student's interest in studying a foreign language. There is no distinction in Departmental coursework between the B.A. and B.S. degrees. Therefore, this report will not separate the B.A. from the B.S.

All fulltime tenure-track members of the Department have doctorate degrees. (See Table 1.) The department continues to **rely heavily** on adjunct faculty for most of our developmental offerings (12 of 22).

Description Applied Mathematics**.** The applied mathematics major is for students interested in immediate employment or further study in applied mathematics or in actuarial sciences. Applied mathematics majors take a minimum of 33 credit hours in mathematics. The core courses and required advanced courses are those specified in *Undergraduate Programs and Courses in the Mathematical Sciences: CUPM Curriculum Guide 2004* by the Committee on the Undergraduate Program in Mathematics of The Mathematical Association of Ameripr7 sted

Assessment Methods

All students are required to pass the Millikin mathematics placement exam prior to taking a QR course or receive an equivalent math ACT score. The Department expects our majors to score an ACT math sub score of 28 or higher or a placement score of 5 (the suggested score for placement into Calculus I) The Department will be reviewing the entrance requirements for Calculus I during the 2011-2011 academic year. Students are assessed within our programs in numerous ways: course exams, problem sets, and written and oral demonstrations. Additionally, the Department requires every student in Mathematics Education to complete an internship. Written evaluations from these experiences including e

passed the state certification exam prior to student teaching. Additionally, the chair will note and analyze the subject area sub scores on an ongoing basis to determine the need for curricular change.

a. All students passed the state secondary content exam (4 of 4)! Note the state wide passing rate was below 50%.

Assessing the Actuarial Science Major Goals.
An assessment program for the new actuarial science is also under development. Currently the number of students in the program is too small to accurately access.

Analysis of Assessment Results

The assessment data collected for 2009-2010 constitutes the department's second systemic attempt to quantify student achievement within the department. The results suggest that for students in both Mathematics and Mathematics Education program goals are being met. Assessment of the Actuarial Science program will be delayed until enrollment increases.

Improvement Plan

Assign a permanent faculty member to oversee MA 471 as part of load
Redesign the developmental and QR sequence to better match the current student body and faculty lines
Develop a new method for calculus placement
Obtain a fulltime faculty line for developmental mathematics at the instructor level
Obtain a funding line within the department for undergraduate research
Develop an intradepartmental marketing program

Again the department anticipates having at least TEN uncovered classes for the Fall 2011 semester in the traditional program if no staffing changes are made. Additionally, PACE will request at least eight more (see fall request below) in the 2011-2012 academic year. If this is not enough justification for on additional faculty line there need to be a move, from the administration, to reduce university requirements in mathematics! Believing this will not occur, the department will submit a Fall 2011 course schedule that contains no more than two uncovered courses.

PACE Fall 2012 University Studies Course Needs
Mathematics

1 section MA 100
1 section MA 106
1 section MA 112
1 section MA 125

Student Publications and Presentations
Department of Mathematics
2010-2011

Lee, E., Lee, S., Elliot, D., Mathy, K., and **Walker, D.** Interval Estimation for Extreme Value Parameter with Censored Data, ISRN Applied Mathematics (2011), Article ID 687343, 1-12.

Weber, D. Zero-Divisor Graphs and Lattices of Finite Commutative Rings, Rose-Hullman Undergraduate Math Journal, 12 (2011), no. 1, 58-70.

Coté, B., Ewing, C., Huhn, M. and Plaut, C., **Weber, D.** Cut-sets in Zero-Divisor Graphs of Finite Commutative Rings, Communications in Algebra, 39 (2011), no. 8, 2849-2864

Stickles, P. and **Morin, M.** Conference Presenation. Undergraduate Fellows Program AKA Getting an Undergraduate to Do Your work and Enjoy it! Annual Meeting of the Illinois Council of Teachers of Mathematics. Springfield, IL, sixty minutes (October 2011)

Stickles, J., **Helding, C., and Morin, M.** Conference Presentation. Undergraduate Teaching Internship Program at Millikin University, Annual Meeting of the Illinois Council of Teachers of Mathematics. Springfield, IL, sixty minutes (October 2011)

Weber, D. James Millikin Scholar Project. Zero-Divisor Graphs and Zero-Divisor Lattices of Finite Commutative Rings. Received Outstanding JMS Project Award. (May 2011)

Stickles, P., **Helding, C., and Smith, B.** Conference Presenation. Authentic Teaching Experiences in Secondary Mathematics Methods Courses. Annual Meeting of the National Council of Teachers of Mathematics. Indianapolis, IN, sixty minutes (April 2011)

Bloome, L. Conference Presentation. Compressed Zero-divisor Graphs of Finite Commutative Rings, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes (March 2011)

Luciano, G. Conference Presentation. Using Data Mining to Determine Academic Success in College, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes (March 2011)

Weber, D., Conference Presentation. A Preliminary Look at Compressed Zero-Divisor Graphs and Zero-Divisor Lattices, Rose-Hulman Undergraduate Mathematics Conference, Terre Haute, IN, twenty minutes (March 2011)

Bloome, L. and Weber, D. Poster Presentation. Compressed Zero-Divisor Graphs and Zero-Divisor Lattices of Finite Commutative Rings, Joint Mathematics Meetings, New Orleans, LA. (One of twenty $100 prize winners out of over 250 posters. (January 2011)

[redacted], B., Ewing, C., Huhn, M. and Plaut, C., **Weber, D.** Cut-sets in Cut-Vertices in the Zero-Divisor Graph of , Rose-Hulman Undergraduate Math Journal, 11 (2010), no. 1, 1-8.

Bloome, L. Conference Presentation. Compressed Zero-divisor Graphs of Finite Commutative Rings, Millikin Undergraduate Mathematics Research Conference, Decatur, IL, twenty minutes (November 2010)

Luciano, G. Conference Presentation. Using Da9

Table 1. Full time faculty: Mathematics

Faculty	Highest Degree	Rank	Tenure Status	Year Hired	Specialty Field	Courses taught
James Rauff	Ph.D.	Professor	Tenured	1988	Formal Languages, Computational Linguistics, Ethnomathematics.	Discrete Math, Computing Theory, History of Math, Linear Algebra, Calculus, Remedial Algebra.
Randal Beck	Ph.D.	Associate Professor	Tenured	1979	Partial Differential Equations, Statistics.	Calculus, Statistics, Differential Equations.
Daniel Miller	Ph.D.	Professor	Tenured	1997	Mathematics Education, Geometry, Educational Technology.	Teaching Methods, Precalculus, Geometry, Remedial Algebra
Joe Stickles	Ph.D.	Professor	Tenured	2006	Ring Theory.	Calculus, Liberal Arts Mathematics, Abstract Algebra.
Eun-Joo Lee	Ph.D.	Assistant Professor	Tenure-track	2006	Mathematical Statistics.	Statistics, Calculus.
Paula Stickles	Ph.D.	Associate Professor	Tenured	2011	Problem Solving/Posing, Mathematical Modeling	Secondary Methods, Calculus, Mathematics Content for Elementary

Assessment of MA 140-01 Final Exam for Fall 2010

***Goal*: An applied mathematics major will be able to integrate and differentiate functions.**

***Assessment of goal*:**

Differentiation: Of the 12 problems on this final exam, problems 2, 3, 4, and 5 on the calculator part, and problems 1a, 4, and 5 on the non-calculator part either explicitly or implicitly required the students to take a derivative of some function in order to be able to solve the problem. Problem 1(a) on the non-calculator part required the students to understand the definition of the derivative. Problem 5 on the non-calculator part required the students to connect the first derivative of a function with the function increasing or decreasing and to connect the second derivative with the concavity of the function. Problem 2 on the calculator part required the students to apply differentiation techniques without having an explicitly stated function. Problem 3 on the calculator part required students to connect the derivative to optimizing a quantity given certain restrictions. Problem 4 on the calculator part required students to

Assessment of MA 140-01 Final Exam for Spring 2011

***Goal*: An applied mathematics major will be able to integrate and differentiate functions.**

***Assessment of goal*:**

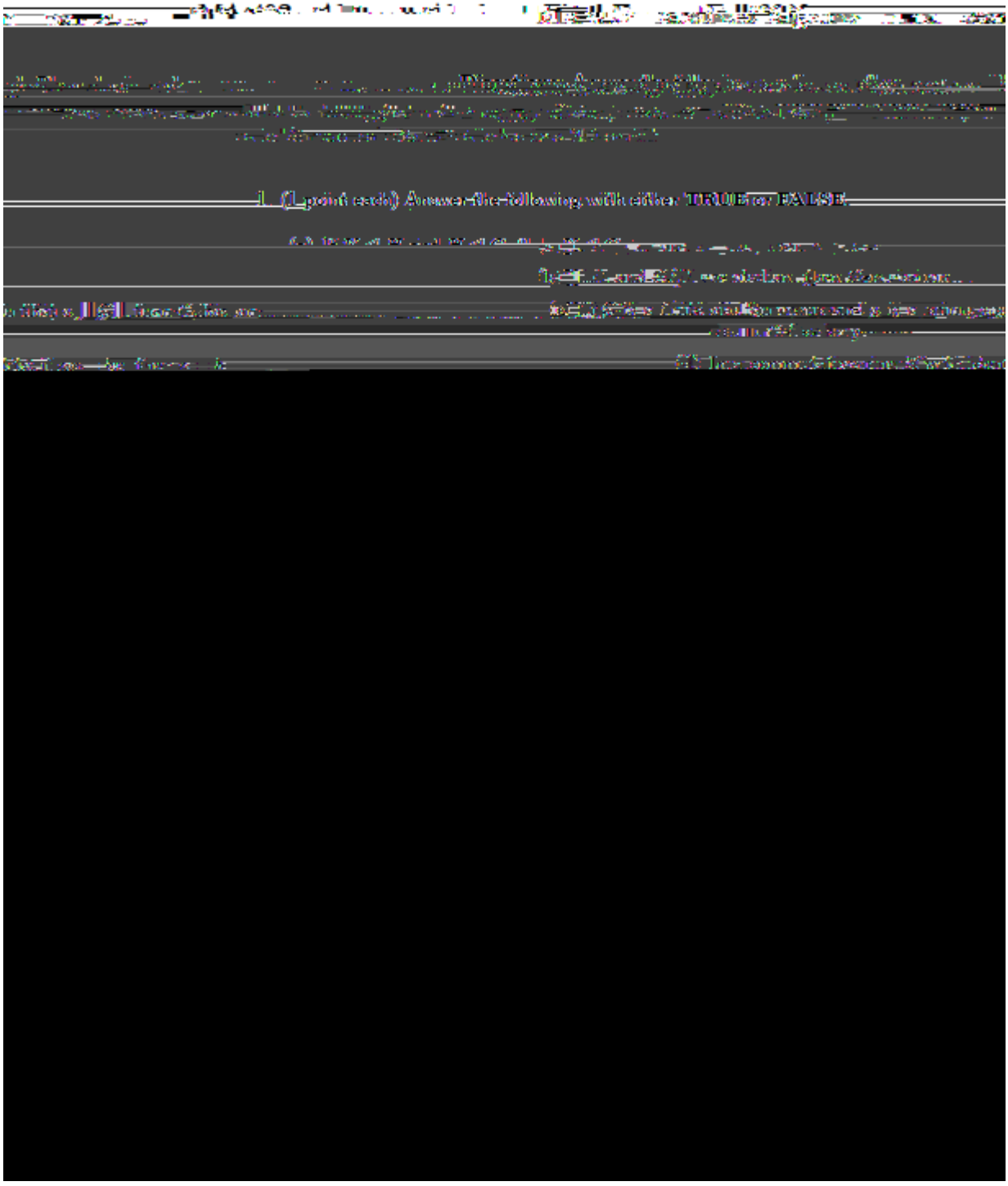
Differentiation: Of the 18 problems on this final exam, problems 2, 4, 5, and 6 on the calculator part, and problems 1, 5, 6, and 7 on the non-calculator part either explicitly or implicitly required the students to take a derivative of some function in order to be able to solve the problem. Problem 1 on the non-calculator part required the students to understand the definition of the derivative. Problem 7 on the non-calculator part required the students to connect the first derivative of a function with the function increasing or decreasing and to connect the second derivative with the concavity of the function. Problem 2 on the calculator part required the students to apply differentiation techniques without having an explicitly stated function. Problem 4 on the calculator part required students to connect the derivative to optimizing a quantity given certain restrictions. Problem 5 on the calculator part required students to connect the derivative to a change in quantities with respect to time (related rates).

Integration: Of the 12 problems on this final exam, problems 2, 8, and 9 on the non-calculator part, and problem 7 on the calculator part either explicitly or implicitly required students to integrate some function in order to be able to solve the problem. Problem 2 on the non-calculator part required the students to understand the definition of the definite integral to obtain the exact value of the definite integral. The remain problems either explicitly or implicitly required students to integrate some function in order to be able to solve the problem.

As nearly every problem on this final exam involved either differentiation or integration (or both), it would be impossible for a student to pass this exam without knowing how to differentiate or integrate functions.

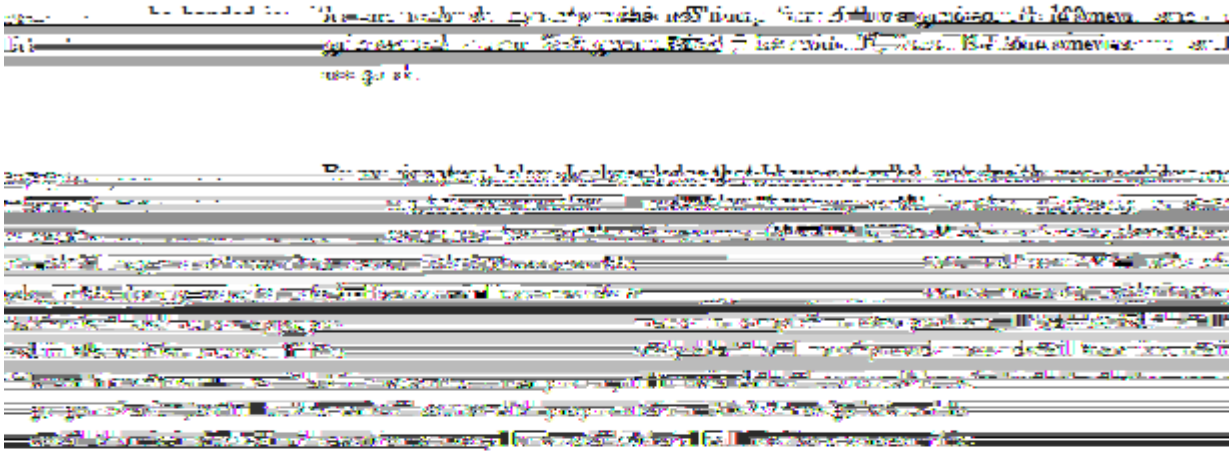
***Goal*: An applied mathematics major will be able to apply mathematics to at least two areas taken from biology, physics, chemistry, economics, or computer science.**

***Assessment of Goal*: Problem 7 on the calculator part dealt with estimating integrals from a table of values; in particular. Since science students will be making inferences using experimental data, the ability to estimate derivatives and integrals from a table of values will be extremely useful. Problem 4 on the calculator part required students to determine the minimum value of some physical quantity. Though this particular problem did not explicitly bring in physics or chemistry per se, the technique required to solve this problem *does* occur in solving problems in physics and chemistry, and therefore, students who successfully completed this problem have learned a(TBT1 0 0 118-3(5 h)-3>Bw**



MATH 403 - Take-Home Final Exam - Fall 2010

Please read the statement below and sign your name on the line provided. This form should



Signature

Name (printed)