

L. HAZAREESINGH  
M. PAVEK

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## Program Review

*Mathematics Department*

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2005 - 2010



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# PURPOSE

## 1.1 Introduction

The purpose of Program Review at Mesabi Range College is to study each program at the College every three years in a manner that will accommodate improvement, change, and recognition of a job well done. Programs that face challenges in respect to enrollment patterns, evolving business and industry practices, and other viability factors may be required to complete program review on an accelerated timeline as determined by Administration.

Program Review provides the opportunity to analytically reflect about what works and what does not work within our programs. The process can be a very productive and a worthwhile learning experience for instructors in the program being reviewed and the entire College. Only by taking the time to look thoughtfully at various aspects of all programs (instructional and non-instructional), can we assess the needs and determine the future direction of the College.

Program Review emphasizes the assessment of student learning at program and course level, and is another facet of assessment that helps Mesabi Range Community & Technical College improve learning. It also helps determine the extent to which a program lives up to the values and mission of the College.

## 1.2 Mission & Vision

The MNSCU Board of Trustees adopted the Vision and Mission for Mesabi Range Community & Technical College in May 2000.

## 1.2.1 Mission

Mesabi Range Community & Technical College provides high quality education resulting in rewarding employment, lifelong learning, and the enriched lives of our students and community.

## 1.2.2 Values

Mesabi Range Community & Technical College values leadership in learning through innovation, excellence, integrity, and accountability.

We are



Learner Focused and Customer Service Oriented



Leaders and Innovators in Technology and Learning Tools



Focused on Integrity through Community and Environmental Stewardship

# THE MATHEMATICS PROGRAM

## 2.1 Description of the Program

The courses of the mathematics department span the range of mathematical concepts from Arithmetic to Calculus IV and include typical Beginning & Intermediate Algebra, Trigonometry and Mathematics for Liberal Arts. The Department also offers Finite Mathematics, Calculus for Business and Introduction to Statistics.

### 2.1.1 Mission

The Mathematics Department's mission is to provide high quality courses to meet the differing needs of a wide variety of students ranging from those needing refresher courses to those seeking transfer to four-year programs requiring a high degree of sophistication in mathematics.

### 2.1.2 Purpose

The Mathematics Department's purpose is to enhance the problem solving and quantitative skills of students and prepare them for graduation from this and/or other colleges by providing courses that

- satisfy the Minnesota State Colleges and Universities system general education requirements
- bridge the gap between their current knowledge and the college level courses needed for their respective programs
- address the mathematical needs of technical programs

### 2.1.3 Philosophy

The Mathematics Department's philosophy is rooted in the belief that all students' math skills can be improved.

## 2.2 Course Offerings

### 2.2.1 MATHEMATICS

**MATH 0091:** Arithmetic with Applications(2 Lec; 2 Cr)

This course is designed for students whose background in mathematics shows marked deficiencies. Emphasis is on operational rules of arithmetic and their applications to solving problems.

**MATH 0093:** Beginning Algebra(3 Lec; 3 Cr)

This course is a review of operations with real numbers, polynomials, and exponents. Solutions of linear equations and applications, factoring, operations with rational expressions, and solution of rational equations are also included in this course.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0091

**MATH 0095:** Intermediate Algebra(3 Lec; 3 Cr)

This course is the study of exponents and radicals, rational expressions and equations, quadratic equations and inequalities, graphing techniques, and functions.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0093

**MATH 0094:** Higher Algebra(4 Lec; 4 Cr)

This course is the study of exponents and radicals, rational expressions and equations, quadratic equations and inequalities, graphing techniques, and functions.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0093

**MATH 1511:** Foundations of Mathematics I (3 Lec; 3 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This course is designed to introduce fundamental math concepts such as sets and logic, develop geometric and quantitative skills and cover applications to probability and statistics.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0094 or MATH 0095

**MATH 1521:** College Algebra(4 Lec; 4 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This study of Algebra includes: real numbers, first degree equations and inequalities with word problem applications and linear graphs, second degree equations and inequalities in one and two variables with the quadratic formula and graphs, relations, functions, absolute value, variation problems, exponential and logarithmic functions with applications, polynomial functions, the theory

of polynomial equations and complex numbers, systems of equations and inequalities, conic sections, and partial fractions.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0094, or instructor's consent

**MATH 1545:** Finite Math(3 Lec; 3 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This course is primarily for students in the social sciences, behavioral sciences, and various business curricula. It provides an excellent background for statistics. Topics include set theory with operations and Venn diagrams; permutations, combinations and binomial theorem, probability; Bayes' theorem, frequency functions, binomial probability; matrices operations, transposes, inverses, solutions of systems of equations, and linear programming with simplex method.

Prerequisite: Placement by CPT score or a grade of **C** or higher in MATH 0094, or instructor's consent; MATH 1521 recommended (offered alternate years)

**MATH 1547:** Trigonometry(2 Lec; 2 Cr)

This course is the study of angles in degree and radian measure, trigonometric functions of angles in a coordinate system and in triangles, and solutions of triangles and applications. Students will examine solutions of trigonometric identities and equations, and graphs of the trigonometric functions and inverses.

Prerequisite: MATH 0094

**MATH 1556:** Survey of Calculus(4 Lec; 4 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This course is offered for those wishing a brief survey of calculus including some integration. This course will include a review of real numbers, graphing, functions, and inequalities. There will be an introduction of limits, continuity, differentiation, and integration, applications of differentiation and integration from physics, business, social and behavioral sciences, logarithmic and exponential functions with applications of growth, decay, interest, and populations. Students planning to enroll in more than one semester of calculus should begin with Calculus I (MATH 1561).

Prerequisite: MATH 1521 or appropriate test score (offered alternate years)

**MATH 1561:** Calculus I(5 Lec; 5 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This course examines limits, continuity, fundamentals of differentiation and integration of functions of one variable, and applications of differentiation and integration.

Prerequisites: MATH 1521 and MATH 1547 or equivalent, or satisfactory math placement scores

**MATH 1562:** Calculus II(5 Lec; 5 Cr)

Meets Goal 4 of the Minnesota Transfer Curriculum

This course is a continuation of the study of calculus including differentiation and integration of the transcendental functions (inverse, logarithmic, exponential, inverse trigonometric and hyperbolic).

This course covers techniques of integration, infinite series, conic sections, parametrized curves, and polar coordinates.

Prerequisite: MATH 1561

**MATH 2563:** Calculus III(5 Lec; 5 Cr)

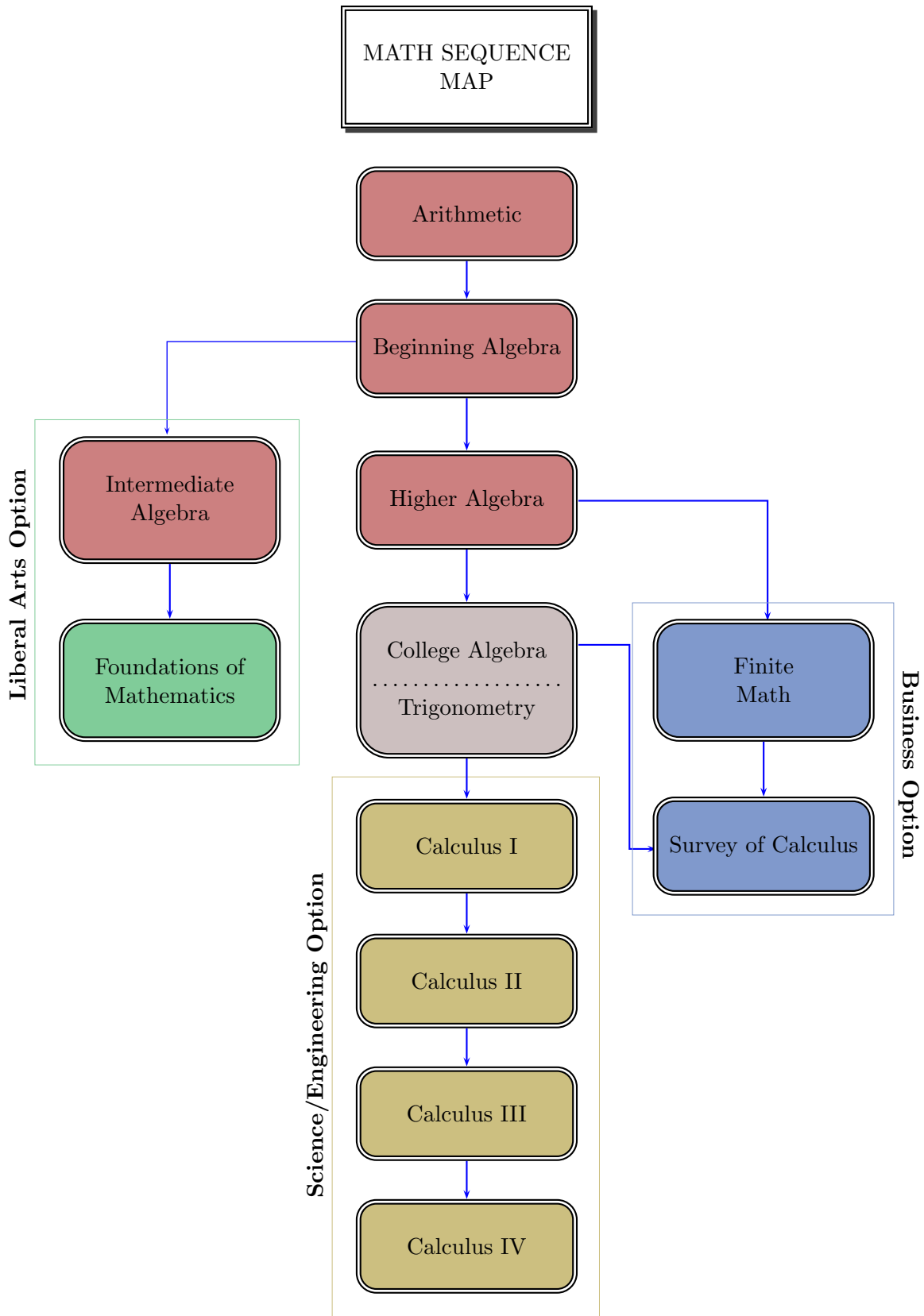
This course covers vectors and analytic geometry in space, vector-valued functions and motion in space, calculus of functions of several variables, multiple integration and applications, and vector analysis including line integrals, surface integrals, Green's theorem, Stokes' theorem, and divergence theorem. We will also study matrices and determinants and their use in solving systems of linear equations.

Prerequisite: MATH 1562

**MATH 2564:** Differential Equations and Linear Algebra(5 Lec; 5 Cr)

This course covers ordinary differential equations with emphasis on solution techniques and applications. It includes first-order equations, linear equations of higher order, Laplace transforms, infinite series methods, and systems of differential equations. In the linear algebra component, it includes matrices and systems of linear algebraic equations, determinants, vector spaces, linear transformations, and Eigenvalue problems.

Prerequisite: MATH 1562



## 2.2.2 STATISTICS

**STAT 2551:** Statistics I (3 Lec; 3 Cr)

Goal 4

This course is an introduction to descriptive and inferential statistics for averages, probability, random variables, interval estimation, and population hypothesis tests. The course includes use of computer programs.

Prerequisite: MATH 0094 (MATH 1521 is recommended, but not required), reading intensive

**STAT 2552:** Statistics II(3 Lec; 3 Cr)

This course is an introduction to design of experiments, two population hypothesis testing, regression and correlation, analysis of variance, time series analysis, and decision theory. The course includes use of computer programs.

Prerequisite: STAT 2551 (MATH 1521 is recommended, but not required.), reading intensive

## 2.3 Faculty

The Department of Mathematics currently consists of 4 full time unlimited faculty. They are:

JURGENS, STACY Mathematics B.S. Bemidji State University M.A. Miami University of Ohio

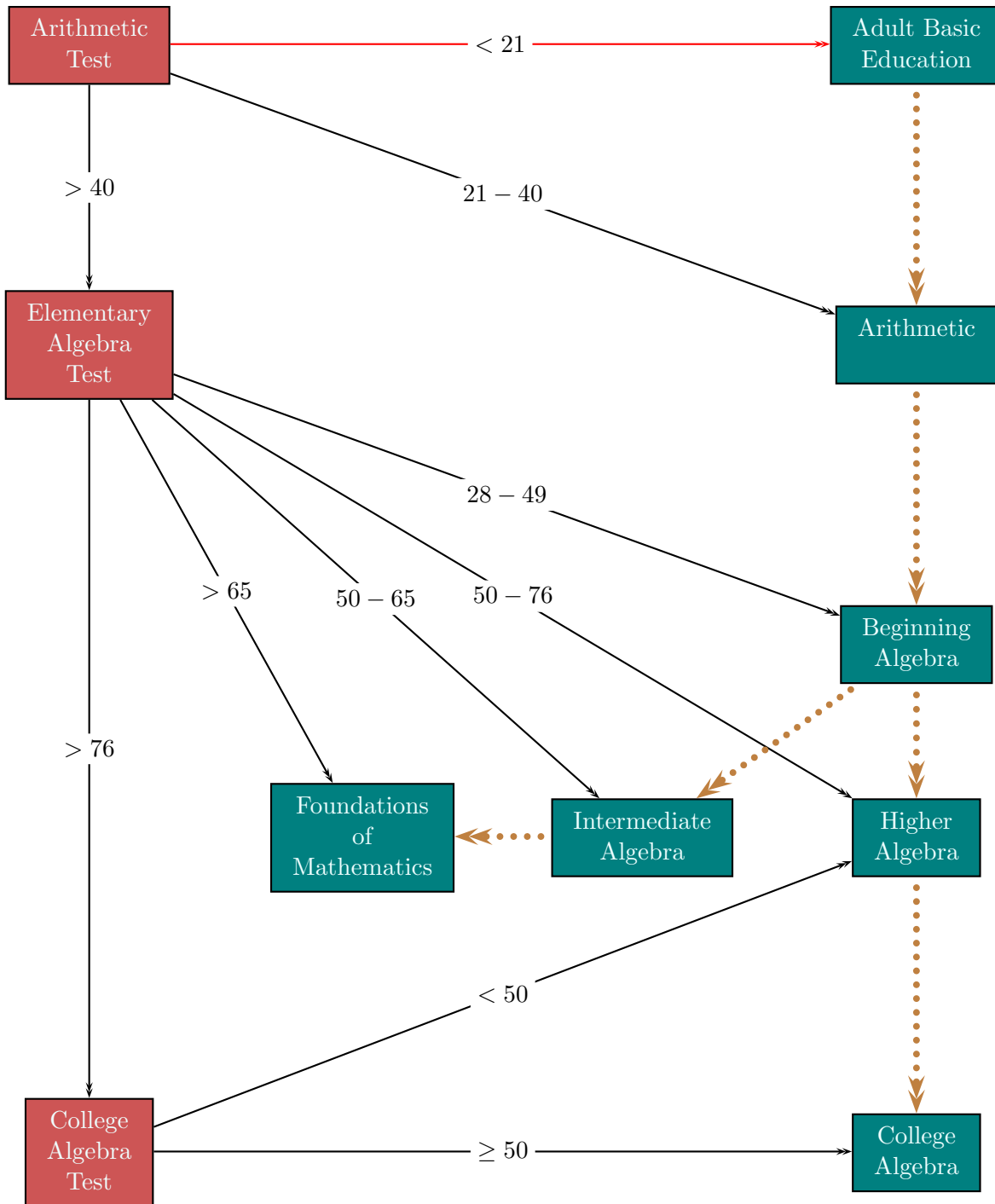
HAZAREESINGH, L., Ph.D. Mathematics, Statistics B.S. University of Colombo (Sri Lanka) M.A. University of Georgia Ph.D. University of Georgia

PAVEK, MONICA Mathematics B.A. University of Minnesota-Morris M.Ed. Southwest State University

PHILLIPS, ROBERT E. Computer Science, Mathematics B.A. St. Cloud State University

## 2.4 Placement Criteria

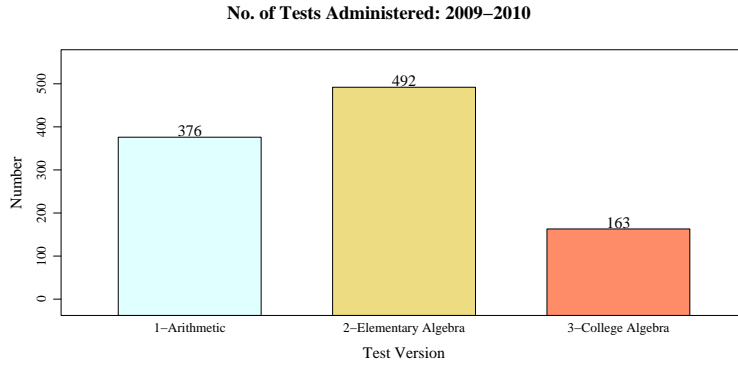
Students entering Mesabi are required to take a placement test in Mathematics. They can choose to take the Arithmetic, the Elementary Algebra, or the College Algebra version depending on their own perception of their readiness in Mathematics. If the scores on one test does not lead to a satisfactory placement, then students can take either the lower or higher test as needed. The following shows the criteria for placement for each of the three tests used at the college, namely, the Arithmetic test, the Elementary Algebra test, and the College Algebra test:



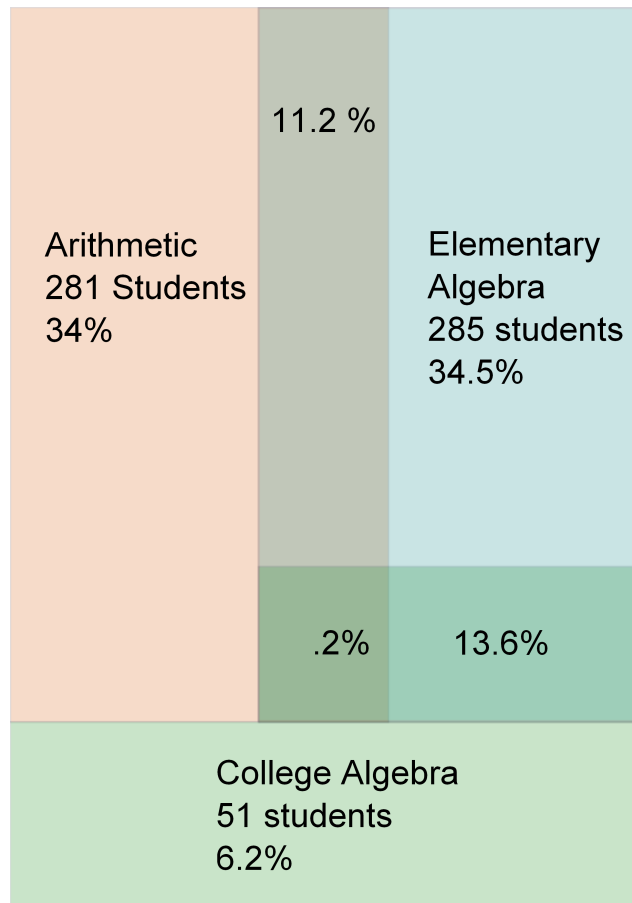
Question: What happens if a student decides to take the College Algebra test and gets a 5?

## 2.5 Analysis of Placement Scores: 2009 - 2010

The following shows the number of students taking each test:

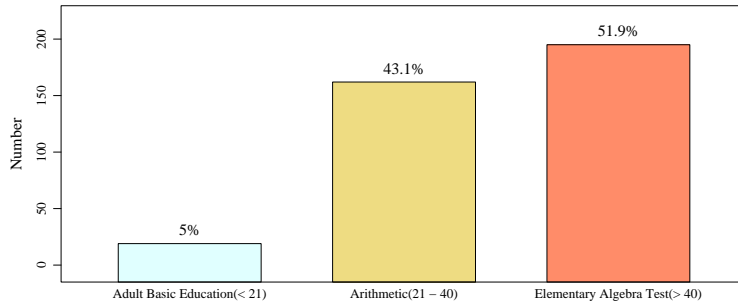


The next visual shows the distribution of students who end up taking one, two, or all three versions of the tests. It is a matter of great concern that only 6.2% of students take just the College Algebra test.



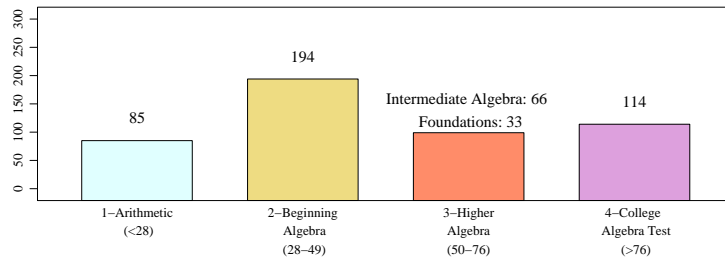
The graph below shows the placement of students according to their scores on the Arithmetic test.

**Placement of Students based on Arithmetic Test**



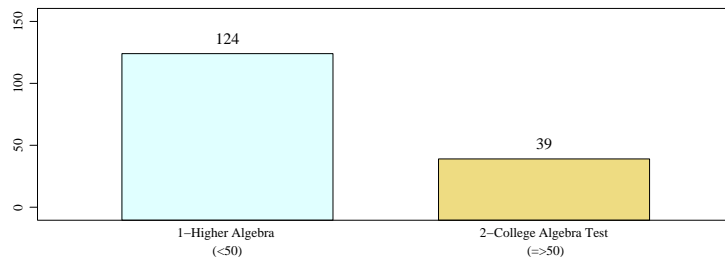
The next graphic shows the eligibility of students for Mathematics classes according to their scores on the Elementary Algebra test.

**Eligibility for Classes based on Elementary Algebra Test**



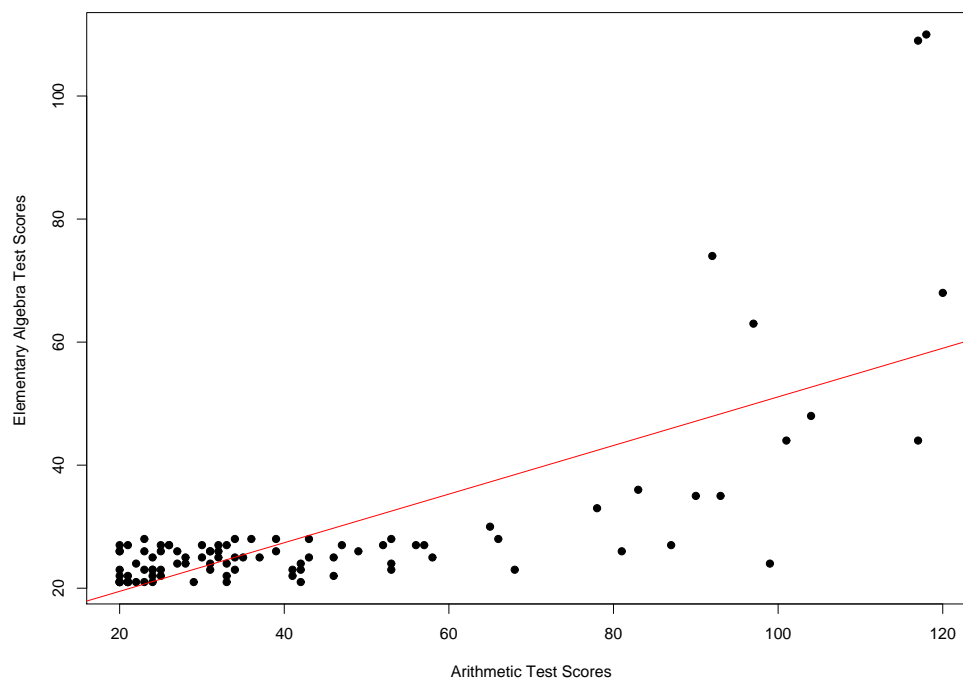
The final chart shows how students who end up taking the College Algebra test fare in their placement:

**Eligibility for Classes based on College Algebra Test**



It is clear from the above data that students have a range of options based on their placement scores. What is not clear is whether the options are being exercised judiciously to produce the best outcome for the students. For example, of the 376 students who took the Arithmetic test, 195 should have taken the Elementary Algebra test. Instead, only 36 did so.

The chart below explores the correlation between scores on the Arithmetic test and the Elementary Algebra test for those applying to admission to Mesabi.



The correlation coefficient at 0.72 is moderately high . In other words, the scores on the Arithmetic test is a fairly reasonable predictor of performance on the Elementary Algebra test. This indicates that there is value for students scoring above 40 on the Arithmetic test to attempt the Elementary Algebra test.

## 2.6 Enrollment for 2008 - 2009

### 2.6.1 Fall 2008-Developmental

The enrollment for all developmental mathematics courses offered in Fall 2009 are given in Table 2.1.

Table 2.1: Fall 2008

Subject	Course Number	Enrolled
MATH	0091	15
MATH	0091	7
MATH	0091	22
MATH	0093	27
MATH	0093	27
MATH	0093	23
MATH	0093	15
MATH	0094	26
MATH	0094	12
<b>Total</b>		<b>174</b>

## 2.6.2 Spring 2009 - Developmental

The enrollment for all developmental mathematics courses offered in Spring 2009 are given in Table 2.2.

Table 2.2: Spring 2009

<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
MATH	0091	8
MATH	0093	19
MATH	0093	24
MATH	0094	13
MATH	0094	15
<b>Total</b>		<b>79</b>

## 2.6.3 Fall 2008 - College

The enrollment for all college level mathematics courses offered in Fall 2008 are given in Table 2.3.

Table 2.3: Fall 2008

<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
GEDM	1165	25
MATH	1511	27
MATH	1511	35
MATH	1511	35
MATH	1521	15
MATH	1521	16
MATH	1547	6
MATH	1547	37
MATH	1561	10
MATH	2563	1
<b>Total</b>		<b>207</b>

## 2.6.4 Spring 2009 - College

The enrollment for all college level mathematics courses offered in Spring 2009 are given in Table 2.4.

Table 2.4: Spring 2009

	<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
	MATH	1511	23
	MATH	1511	32
	MATH	1511	37
	MATH	1521	2
	MATH	1521	30
	MATH	1521	37
	MATH	1547	7
	MATH	1561	7
	MATH	1562	8
	MATH	2563	1
	STAT	2551	19
<b>Total</b>			<b>203</b>

## 2.7 Enrollment for 2009 - 2010

### 2.7.1 Fall 2009 - Developmental

The enrollment for all developmental mathematics courses offered in Fall 2010 are given in Table 2.5.

Table 2.5: Fall 2009

	<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
	MATH	0091	17
	MATH	0091	17
	MATH	0091	10
	MATH	0093	32
	MATH	0093	12
	MATH	0093	28
	MATH	0093	30
	MATH	0094	16
	MATH	0094	26
<b>Total</b>			<b>188</b>

### 2.7.2 Spring 2010 - Developmental

The enrollment for all developmental mathematics courses offered in Spring 2010 are given in Table 2.6.

Table 2.6: Spring 2010

	<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
	MATH	0091	19
	MATH	0093	22
	MATH	0093	28
	MATH	0094	29
	MATH	0094	15
<b>Total</b>			<b>113</b>

### 2.7.3 Fall 2009 - College

The enrollment for all college level mathematics courses offered in Fall 2010 are given in Table ??.

Table 2.7: Fall 2009

	<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
	GEDM	1165	27
	MATH	1511	10
	MATH	1511	26
	MATH	1521	15
	MATH	1521	17
	MATH	1547	24
	MATH	1561	11
	MATH	2564	1
<b>Total</b>			<b>131</b>

### 2.7.4 Spring 2010 - College

The enrollment for all college level mathematics courses offered in Spring 2010 are given in Table 2.8.





Table 2.8: Spring 2010

	<b>Subject</b>	<b>Course Number</b>	<b>Enrolled</b>
	GEDM	1165	1
	MATH	1511	32
	MATH	1511	33
	MATH	1521	12
	MATH	1521	23
	MATH	1521	25
	MATH	1547	12
	MATH	1561	8
	MATH	1562	7
	MATH	2563	1
	STAT	2551	19
<b>Total</b>			<b>173</b>

# GOALS

## 3.1 Introduction

Integration of Mesabi Range Community & Technical College's Learning Outcomes into program and/or discipline. Mesabi Range Community and Technical College works toward the creation of an informed citizenry with the ability to

-  communicate effectively,
-  think critically,
-  develop mathematical skills, and
-  use information technology.

The Mathematics Department has a long history of emphasizing conceptual understanding and procedural fluency rather than rote memorization of steps. All instructors in the department are in agreement on the priorities of teaching mathematics. Except for information technology, the above skills are fully integrated into our teaching. This is demonstrated by continuous assessment that instructors carry out, either formally or informally. All instructors provide regular assignments for grades and this allows for regular evaluation of students' progress. Grading is usually not a matter of right/wrong answer but is dependent on an acceptable show of work.

### **Communicate Effectively**

The Mathematics Department's curriculum develops the student's ability to Communicate Effectively in the following ways:

Emphasize the process of doing mathematics rather than the answers. The Department carried out an analysis of student writing to determine how organized and structured they were. Few students understood the need to

1. write neatly
2. write formally
3. keep their notes together

The Department created a PowerPoint presentation which is currently used to show students models of different types of writing and make them aware of the standards the department expects. In addition, students are required to maintain a portfolio of their work for monitoring and grading. See Appendix II for the PowerPoint.

### **Think Critically**

The Mathematics Department's curriculum develops the student's ability to Think Critically in the following ways:

Analyze problems, synthesize knowledge of mathematical theory and ideas, and evaluate solutions. This is done by emphasizing applications of mathematical concepts. Unfortunately, at this stage, sub-scores on applications are not systematically kept.

### **Demonstrate Mathematical Skills**

The Mathematics Department's curriculum develops the student's ability to Demonstrate Mathematical Skills in the following ways:

Redundant

### **Use Information Technology**

NA

## **3.2 Program Outcomes**

The Mathematics Department's primary program/discipline outcomes and assessment methods are:

**Outcome One** The Mathematics Department will assure that its STEM classes will exceed standards required for transfer to four year colleges.

1. Classes will develop problem-solving skills.
2. Classes will embed appropriate technologies.
3. Classes will develop communication skills.
4. Classes will cover content according to nationally accepted norms.

**Outcome Two** The Mathematics Department will assure that its service courses will meet or exceed the requirements of the Minnesota Transfer Curriculum.

1. Classes will develop communication skills.
2. Classes will develop problem-solving skills.
3. Classes will cover content to ensure transferability to four year colleges.
4. Classes will reflect trends established by the four year colleges.

**Outcome Three** The Mathematics Department will assure that its developmental classes are designated to assist students work towards attaining college level proficiency.

1. Classes will develop problem-solving skills.
2. Classes will develop appropriate arithmetic skills.
3. Classes will develop appropriate algebra skills.
4. Classes will develop communication skills.

### 3.3 Delivery of Department Program and Courses

The Mathematics Department currently deliver courses and programs primarily through lectures. However, faculty is also available outside of classroom for one on one or small group help. Instructors can be seen working with small groups of students on campus. The Department has also ported Foundations of Mathematics and Statistics to an online format, making these classes more accessible and more cost effective.

The Mathematics Department incorporates information technology depending on needs; regular calculators, calculators with algebra systems, software purchases for computers.

Based on an extensive assessment carried out in 2007, the department is currently working on new models of teaching using information technology through a grant from the Fund for the Improvement of Post Secondary Education, secured in collaboration with Pine Tech.

### 3.4 Professional Development Plans

Hazareesingh has done extensive research based assessment of developmental mathematics at the NHED colleges through a grant from the Chancellor's Office under the Initiative to Promote Excellence in Student Learning (IPESL). This exercise required developing expertise in educational and assessment areas, traditionally not within the domain of content specialists. This work was followed by several grant applications, which again broadened his view of teaching and learning mathematics and their evolution. Hazareesingh is currently working to refine the framework for college wide assessment as a result of the work done previously for several agencies and for the college. Hazareesingh chairs the Center for Teaching and Learning (CTL), which is a great forum for professional development.

Pavek has completed her Master's degree since the last program review and participates actively in the departmental improvement initiatives in collaboration with Hazareesingh. She was a member of the IPESL assessment team and is a member of the Serious game project funded by FIPSE. She also worked on using games in teaching mathematics through an Award for Excellence. She is currently participating in the redesign project for developmental mathematics.

Jurgens participates in the annual AP Calculus Reading and participates in the Minnesota Council of Teachers of Mathematics(MCTM) and Minnesota Mathematical Association of Two Year Colleges (MN-MATYC)annual meetings.

## ASSESSMENT & PROGRAM EFFICIENCY

The standard metric used by MnSCU to measure students served is the Full Year Equivalent or FYE. This metric consists of multiplying the number of credits by the number of students in a class summed over all classes and divided by 30.

**In Minnesota, for purposes of state budgeting, the concept of full-year equivalent (FYE) student has been established as the standard means of reporting enrollments for public postsecondary institutions. Minnesota Statute 135A.031, Subd.4. (b) states:**

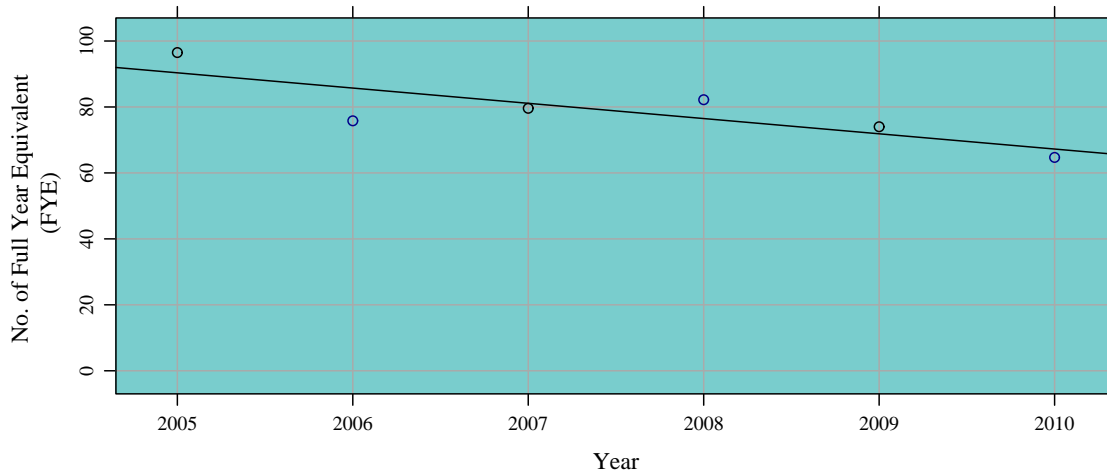
*For all purposes where student enrollment is used for budgeting purposes, student enrollment shall be measured in full-year equivalents and shall include only enrollments in courses that award credit or otherwise satisfy any of the requirements of an academic or vocational program.*

*Public postsecondary institutions calculate FYE students by dividing total student credit hours by the number of credit hours constituting a full load. Under semesters, a full-time load is 30 credit hours for undergraduate and professional courses and 20 credit hours for graduate courses for the academic year.*

Source: <http://www.ohe.state.mn.us/mPg.cfm?pageID=1294>

The chart below shows the number of Full Year Equivalent (FYE) served by the faculty over the past six years:

**Six Year Trend in FYE Served with Trend Line**



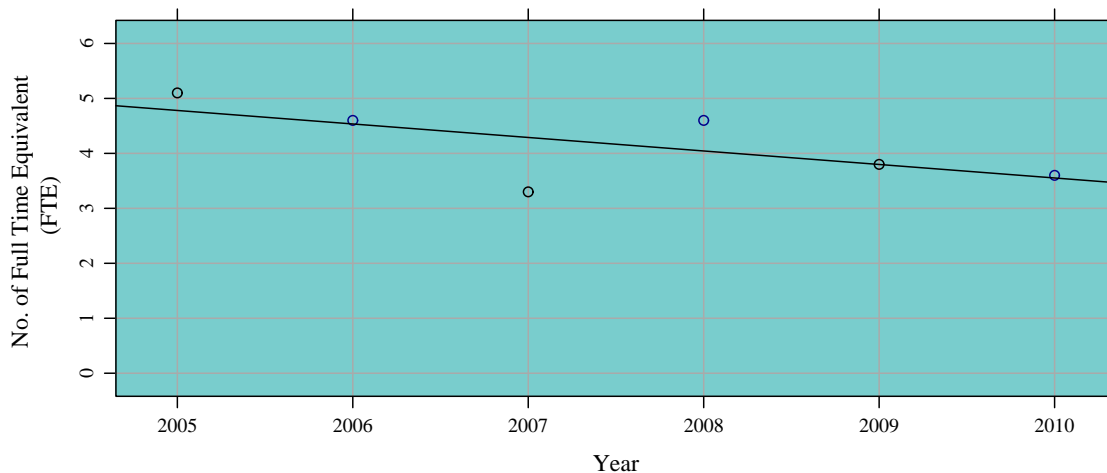
The equation of the regression line is

$$FYE = -0.1454 \times year + 2018.95$$

The Mathematics Department has four full time faculty members. For purposes of determining instructional effort related to teaching, MnSCU uses the concept of Full Time Equivalent or FTE to measure faculty assignment. One FTE equates to 30 credits of instructional load for a regular academic year.

The next chart shows that, as the number of FYE's has decreased, the faculty assigned to mathematics has been adjusted accordingly:

**Six Year Trend in No of Departmental FTE's with Trend Line**

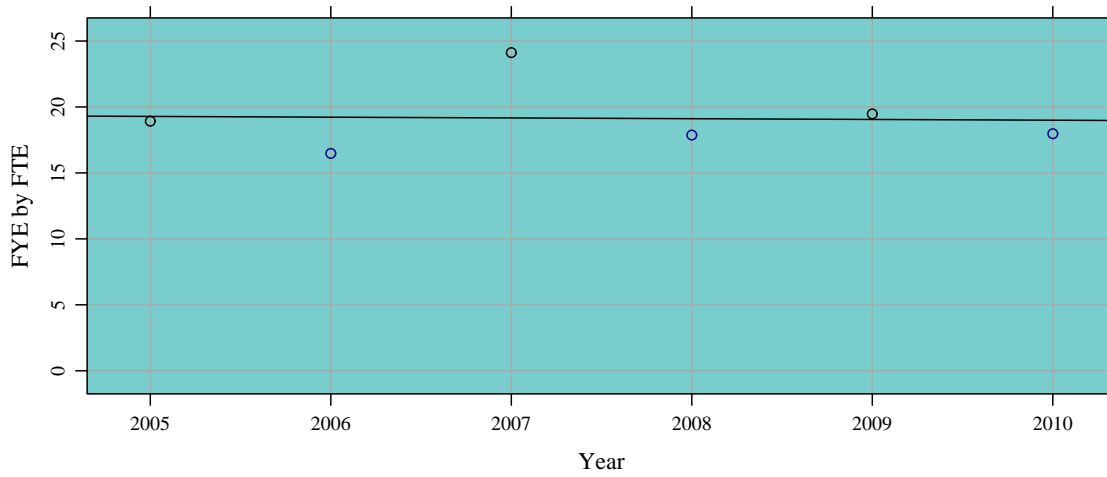


The equation of the regression line is

$$FYE = -0.2457 \times year + 497.43$$

These adjustments have limited the erosion in the number of FYE per FTE, as shown in the next chart:

**Six Year Trend in FYE by FTE with Trend Line**

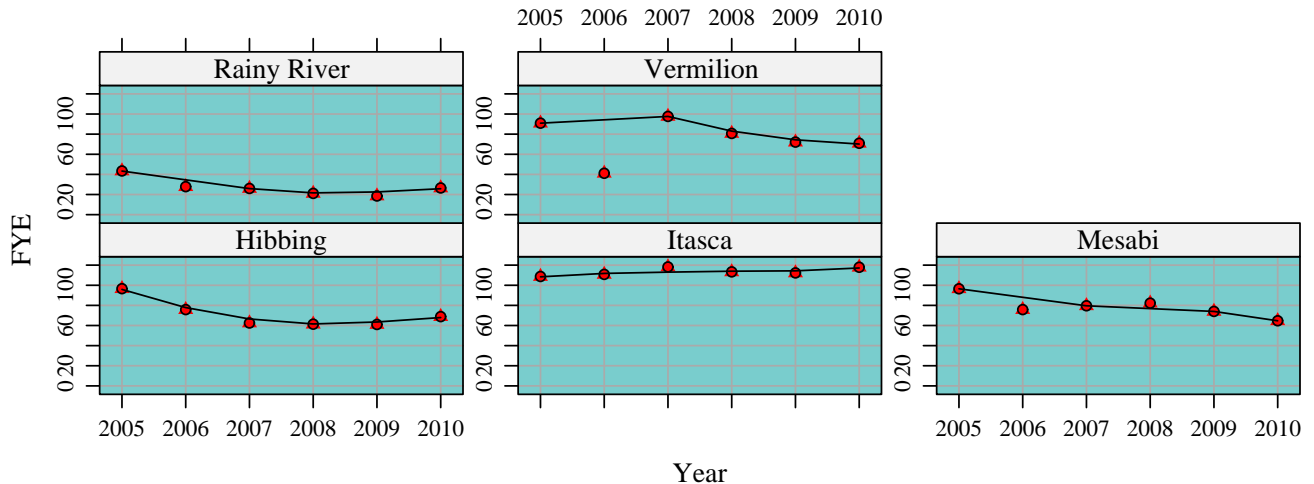


The equation of the regression line is

$$FYE = -0.0575 \times year + 134.55$$

The next figure shows how FYE has changed over time at the NHED colleges. The khaki lines show the cost band within which MnSCU expect all colleges and programs to operate. The trend line shows that while Mesabi is struggling to conform and Itasca and Vermilion are clearly within the band, the outlook for either Hibbing or Rainy River is not as hopeful. **However, it is interesting to note that for fiscal year 2010, the NHED colleges as a whole will be within the band.**

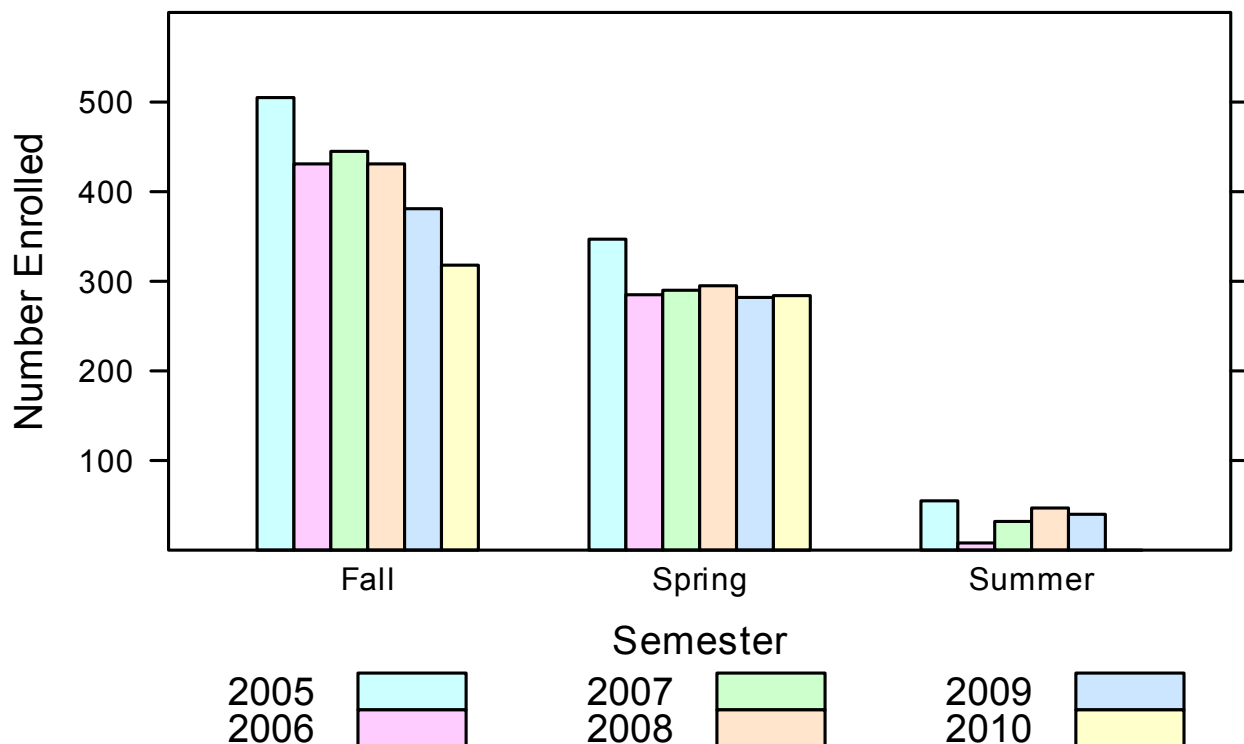
**FYE at NHED Colleges for 2005–2010  
with  
Smoothing Line**



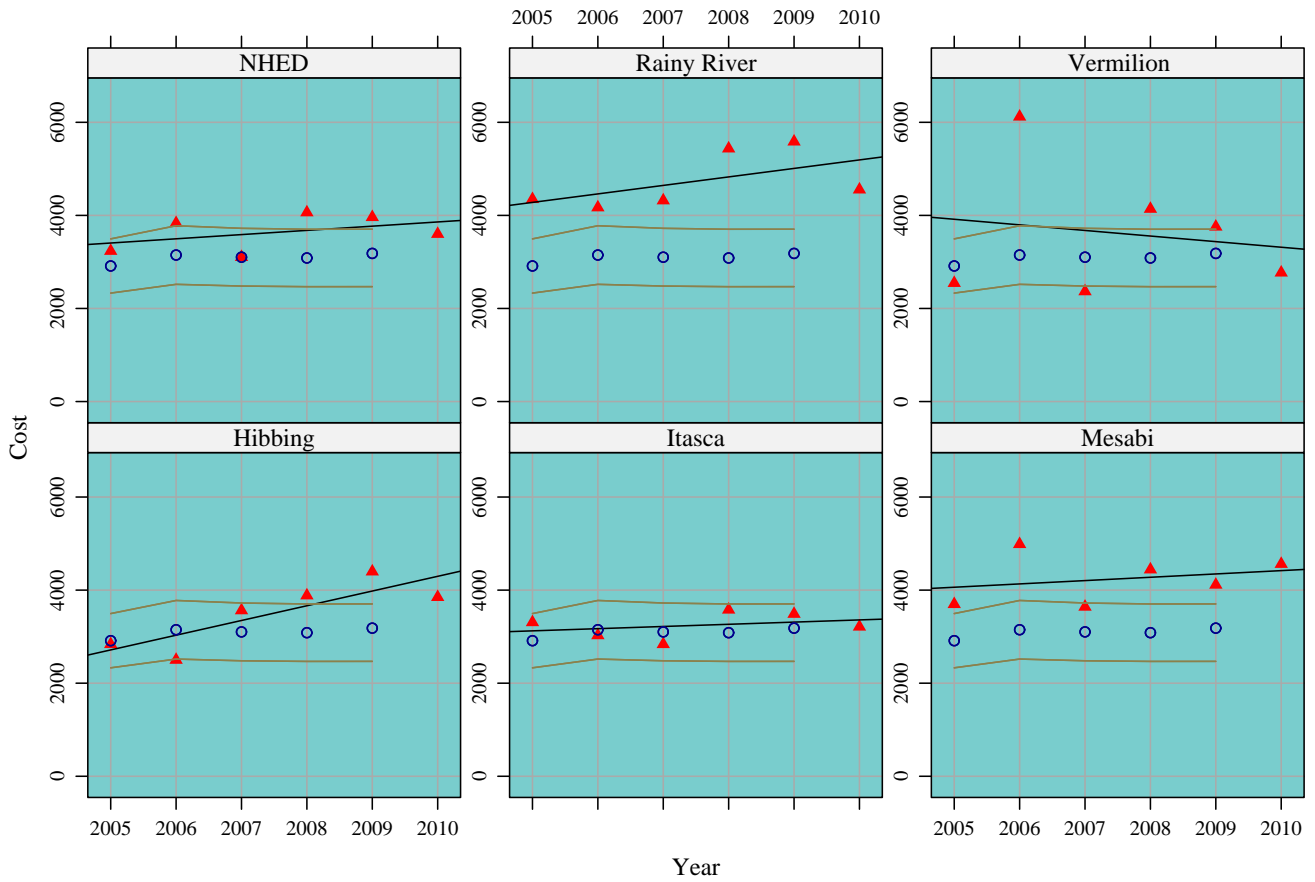
In order for the colleges to remain viable as providers of higher education, the need to retain mathematics classes remains as strong as ever. However, with the declining FYE's, availability of higher level classes and timing of lower level classes will be severely constrained. This is not a Mesabi problem but one for the entire district. While Itasca and Hibbing have so far been operating within MnSCU's program band for cost per FYE, it is clear from the chart below that the trend is towards increasing costs. There is, therefore, an urgent need to consider other delivery options in order to squeeze even more efficiencies.

The following chart and tables show the dramatic changes in enrollment in the past six years:

*Enrollment Pattern for 2005-2010 by Semester*



### Cost per FYE with Trend Line



### Key

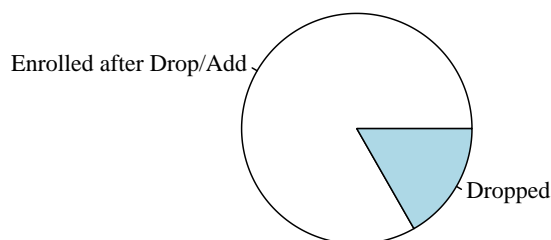
- ▲ represents institutional costs
- represent MnSCU average cost for Mathematics
- Ochre lines represent the 20% band above and below the system average cost

Data for 2010 are not on line as of the time of this report.

### Completion Data

In the period 2004-2010, 2868 students enrolled for a math course. 17% opted to drop out in the first 5 days.

### Enrollment in MATH Courses: 2004–2010



The following describes the 2388 students who remained:

Number of students enrolled in Developmental but no record in College	686	19.4%
Number of students enrolled in College but no record in Developmental	1238	51.8%
Number of students with records in both Developmental and College	464	28.7%

Among those who take a college course without having a developmental class, the pass rate is 83%. For those who enter at the developmental level and go on to college level classes, the pass rate is 73%.

## 4.1 Assessment of Facilities and Equipment

The current campus facilities have been adequate for the the configuration of classes offered and the modes of deliveries. However, with the planned roll out of the technology developed under the FIPSE grant and the possibility of course redesign under a National Center for Academic Transformation (NCAT) grant, the department will require access on a continuous basis of a 40-50 station computer lab. Software is under development. In redesigning classrooms, it will be important to keep in mind the need to promote student to student collaboration, a mode of learning that is not fully integrated into current teaching paradigms but one that will become more embedded under redesign plans.

# STRENGTHS AND CHALLENGES

## 5.1 Strengths

### 5.1.1 Professional Expertise

The department has four professional mathematicians with very complementary skills.

Phillips doubles up as Computer Science instructor.

Jurgens is highly experienced teaching and preparing students for upper level Mathematics courses. She has participated in the annual AP Calculus Reading, attended MCTM and MnMATYC meetings and was chosen as a project ACCCESS fellow. She has also attended the Bemidji State University Articulation conference and participated in the RAMP grant.

Pavek has excelled at developmental and service courses.

Hazareesingh teaches Mathematics and Statistics both on land and online, has worked extensively in program evaluation for external agencies, and is currently developing the college's assessment framework. Hazareesingh has published several articles in technical journals and chaired the state level Center for Teaching and Learning Steering Committee.

The cross expertise allows not only for flexible scheduling but also helps in developing new models for teaching. In 2007, Hazareesingh received a grant from the Chancellor's Office under the Initiative to Promote Excellence in Student Learning (IPESL) to conduct a comprehensive assessment of development mathematics. Pavek participated in the project and designed many of the instruments used in the assessment. Among the notable achievements of the assessment were the following:

- Realization that student writing posed a program wide problem and needed to be addressed as department
- Realization that student attrition was extensive and program wide

- Under-preparedness was similarly program wide

This was a very complex study and required multi-disciplinary skills but the results were convincing and led to development of several new initiatives. As reported earlier, a PowerPoint was developed to raise awareness of good writing among students. Proposals to redesign developmental courses was submitted to the National Science Foundation and the Department of Education. The latter was successful. Under this grant, Hazareesingh and colleagues are developing a serious game based software to help students acquire better conceptual understanding of mathematics. Now, the department is engaged in a proposal to follow the NCAT model for course redesign. In collaboration with Pine Tech, a follow up proposal has also been submitted to the National Science Foundation.

In addition, the faculty play important roles at the college and state levels.

### **5.1.2 Student Engagement Activities**

1. Skills Fair
2. Science and Math Club
3. Pi Day
4. One-on-one working with students

### **5.1.3 External Funding**

1. CAMP
2. FIPSE
3. NCAT(in progress)
4. NSF(in progress)

### **5.1.4 College Governance**

1. Curriculum
2. AASC
3. Personnel
4. Faculty Development
5. Assessment
6. Academic Planning

### **5.1.5 State Level Committees**

- Center for Teaching and Learning

## 5.1.6 Professional Organizations

1. ACTM

The implications of these strengths are:

1. The Department has the ability to respond to continuing and emerging challenges
2. The Department is poised to become a model for course redesign at the college
3. Students will have better options for crossing what is admittedly a huge hurdle for them
4. Students will be better supported as a result of these transformations

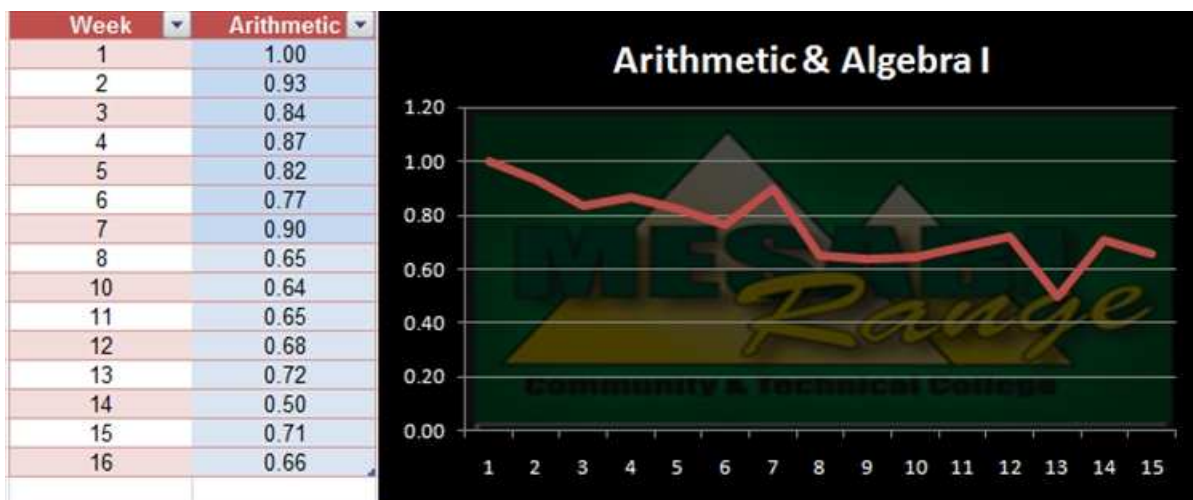
## 5.2 Challenges

### 5.2.1 Low Enrollment in College Level Classes

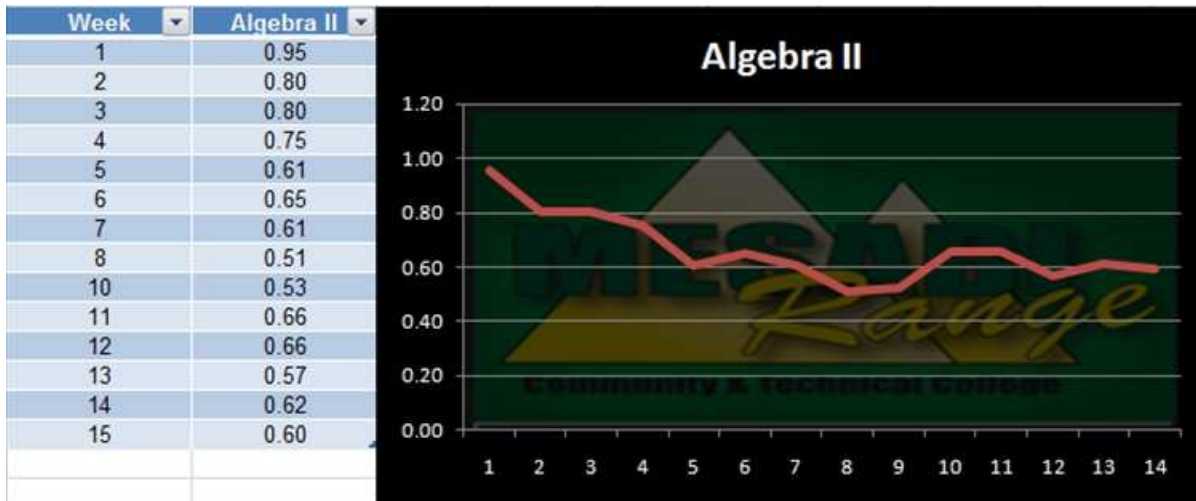
The placement analysis in Chapter 2 indicates that, out of 824 students tested only 72 qualified to take college level classes. Most of these would most likely take Foundations, leaving only a tiny subset on which to build the upper level mathematics classes.

### 5.2.2 Student Attrition

The following are examples of attrition in Math classes. Data was collected for the IPESL project in 2007.



These two courses are held in short term format within a single semester.



The trend is incontrovertible evidence of the difficulties faced by the college in its retention efforts. This phenomenon is not unique to Mesabi. It is repeated in class after class and college after college within NHED.

### 5.2.3 Funding Constraints

At first sight, Mathematics does not appear to be a likely candidate for enhanced funding for redesign purposes. In truth, the degree of effort to carry out successful redesign is quite daunting. This is one of the main reasons for considering external funding.

### 5.2.4 Facilities Constraints

Technology is an essential factor in the proposed redesign efforts. Unfortunately, with the encroachment of Mesabi classroom space by Iron Range Engineering programs, technology integrated classrooms are at a premium, especially since the English program and the Intro to Computers courses rely heavily on the same spaces.

## FUTURE DIRECTION

### 6.1 Short Term( 1-2 years)

The Mathematics Department is undergoing some radical changes in the coming years. It is anticipated that one faculty will retire within two years and another is being being partly reassigned to administrative duties. At the same time, the Department has applied for a grant from the National Center for Academic Transformation to support a new model of delivering developmental mathematics. Under this model, students will work in a lab setting in small groups but in larger numbers. For example, currently developmental classes are capped at 30 or below but this limit will change to 50 over the next 3 years.

Beginning Fall 2011, instead of 14 sections of developmental mathematics taught by different instructors, students will register for developmental math 1, 2, or 3. Each class will be for 3 credits and students will be required to complete their coursework in modules. Each module will require mastery for advancement and each course will require mastery of 4 modules.

Empirical evidence from several colleges point to increased student success with this model while reducing the cost for students and the college alike. It is expected that the savings can be used to grow college level mathematics which can then become a feeder for other programs.

### 6.2 Long Term

The department will continue integration of technology assisted teaching in order to provide greater flexibility to students and reduce operating expenses. The department will work collaboratively with other NHED colleges to provide a stable slate of mathematical classes so that students will continue to have opportunities for completing programs in the STEM areas.

## 6.3 Technology

As integration of technology assisted teaching gains ground, the college will have to invest in creating the type of classrooms that are conducive to collaboration among students and reasonable supervision of their work by faculty. It is expected that the main expenditure will be in appropriate classroom furniture and some management software.

## 6.4 Recommendations

- The department functions best when it has the right mix of staff. Even as its operations are changing, the department needs senior level mathematicians with extensive knowledge of the field, mathematicians with sound knowledge of developmental and educational issues and mathematicians who can serve as bridges between the mathematics department and the myriads of other departments at the college. Hence, as reassignment and retirement affect the current faculty, recruitment of new faculty require a careful balancing of priorities.
- The college should develop a careful strategy to upgrade its computer lab for use as mathematics laboratories.
- The mathematics faculty need to ramp up participation in state and national professional organizations to maintain currency with new technology and methodologies.

## 6.5 Conclusion

While the demographic and economic challenges facing the college are immense, there is no doubt that the mathematics department will live up to its mission and adapt to changing circumstances and will continue to provide high quality learning opportunities to its students.