

# Quality Enhancement Plan

Path2Math Success

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August 15, 2010



TRIDENT TECHNICAL COLLEGE



# path math

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Trident Technical College

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## Table of Contents

<b>Executive Summary</b> .....	<b>1</b>
<b>Introduction to Trident Technical College</b> .....	<b>3</b>
<b>Process Used to Develop the QEP</b> .....	<b>4</b>
<b>Identification of the QEP Topic</b> .....	<b>5</b>
<b>Refining the Focus of the QEP Topic</b> .....	<b>11</b>
<b>Path2Math Success Goals and Outcomes</b> .....	<b>32</b>
<b>Path2Math Success Workplan</b> .....	<b>34</b>
<b>Path2Math Success Timeline</b> .....	<b>46</b>
<b>Path2Math Success Organizational Structure</b> .....	<b>48</b>
<b>Path2Math Success Resources and Budget</b> .....	<b>52</b>
<b>Path2Math Success Assessment Plan</b> .....	<b>54</b>
<b>References</b> .....	<b>63</b>
<b>Appendices</b>	
Appendix A: QEP Development Team Membership.....	67
Appendix B: Path2Math Success Implementation Team Membership .....	68
Appendix C: Path2Math Success Assessment Team Membership .....	69
Appendix D: Achieving the Dream Data Team Membership.....	70
Appendix E: Achieving the Dream Core Team Membership.....	71
Appendix F: Math Course Descriptions .....	72
Appendix G: Math Student Survey .....	73
Appendix H: Application for Path2Math Success Faculty Development .....	75
Appendix I: Achieving the Dream Presentations and Subcommittees .....	77
Appendix J: OnCourse Path2Math Success Article.....	78



**Executive Summary**

In support of its mission to empower individuals through education and its institutional value of student success, Trident Technical College (TTC) has developed a quality enhancement plan, **Path2Math Success**, that is clearly focused on student success, learning and engagement in the study of math.

The college has a history of using data for decision making and in recent years has participated in two major student learning and success studies, the national Achieving the Dream initiative and the National Community College Benchmark Project. Based on the results of these studies, the college community identified math as the central topic for the QEP. In the summer of 2009, President Mary Thornley convened a cross-divisional QEP Development Team with faculty representation from multiple academic disciplines and representatives from key Student Services offices. She charged this team with refining the focus of and developing strategies for the QEP.

The QEP Development Team identified three goals for the QEP. To address these goals, the team has identified three initiatives with six strategies. Together, these initiatives and strategies comprise **Path2Math Success**, an integrated, comprehensive approach to improving student success, learning and engagement in math.

QEP Goals, Initiatives and Strategies		
Goal	Initiative	Strategy
Improve <b>student success</b> in developmental and algebra coursework	Student Preparation	Adjust Placement in Math Courses
		Implement a New Developmental Math Course
Improve <b>student learning</b> and math skills attainment in developmental and algebra courses	Instructional Improvement	Adopt Computer-Assisted Instruction
		Enhance Faculty Development
Increase <b>student engagement</b> in and comfort with the study of math	Student Support	Expand Tutoring Services
		Create Designated Student Study Spaces

In support of **Path2Math Success**, the college has developed a budget that allocates sufficient resources, has identified the key personnel responsible for carrying out the components of the project, and has developed a comprehensive assessment plan that will provide both formative and summative data on the project’s progress toward achieving stated goals.



## Introduction to Trident Technical College

Trident Technical College (TTC) is a public, two-year, multi-campus institution that provides quality education and promotes economic development in Berkeley, Charleston and Dorchester counties. Located in coastal South Carolina, TTC is one of 16 two-year colleges that make up the South Carolina Technical Education System. An open-door institution, the college serves approximately 15,000 traditional and nontraditional curriculum students who have a wide variety of educational goals, from personal enrichment to career development to university transfer. The college maintains campuses in suburban North Charleston (Main Campus), downtown Charleston (Palmer Campus) and rural Berkeley County (Berkeley Campus) and offers a variety of coursework at additional sites.

TTC has a long history of fostering both accessibility and student success and is committed to being responsive to community needs. TTC provides developmental education and comprehensive student services. TTC faculty members have designed a curriculum that develops the communication and critical thinking skills that are fundamental to lifelong learning.

The ethnic diversity of TTC's student body is largely representative of the population in the college's service area. In Fall 2009, 62% of the student population was Caucasian, 29% African-American and 9% other minorities, including American Indian, Asian-Pacific Islander and Hispanic. In Fall 2009, 63% of students were female and 37% male; the average age was 27.

Like the rest of the country, TTC's service area was struck hard by the economic downturn in 2008-2009, and this downturn had a powerful positive effect on the college's enrollment. The impact of the recession is especially visible in the unemployment rate for the Charleston/North Charleston/Summerville region. According to the U.S. Bureau of Labor Statistics, the regional unemployment rate in August 2007 was 4.7%; the college's headcount enrollment for the Fall 2007 term was 12,076. By Fall 2009, the regional unemployment rate increased to 9.7%, and the college's enrollment increased to 14,834. This robust growth is both a challenge and an opportunity for the college.

TTC's focus on helping all of its students succeed has informed both the process for developing the college's Quality Enhancement Plan (QEP), **Path2Math Success**, and the design of the plan's initiatives.

## Process Used to Develop the QEP

TTC's mission is to serve "as a catalyst for personal, community and economic development by empowering individuals through education and training." Inherent in this mission is the obligation to assist students in achieving their education goals. TTC's 2005-2010 Strategic Plan presents the college's specific improvement goals, including a strategic initiative focused on student success: "Student Success and Retention - Improve student progress toward completion of academic programs."

The identified institutional values of student success and continuous improvement guide the college community as it works to achieve its mission and implement its strategic initiatives.

Since 1992, President Mary Thornley has promoted a culture of action for continuous improvement. Through Trident's Quality Management (TQM), the college follows a data-based problem-solving model to assess and improve its programs, services and strategic initiatives. In the early years of TQM, the college applied this methodology primarily to the improvement of administrative procedures. In recent years, the college has applied its quality improvement model to student success initiatives. TTC's emphasis on data-based decision making and continuous improvement permeated the QEP development process.

### Broad-Based Process

As described in the next two sections, the process for developing the QEP involved the participation and input of all of TTC's major constituencies: students, faculty, staff, administrators and the Area Commission. Student input was solicited through focus groups and surveys, which garnered responses from over 2,300 students on issues affecting their college success. A total of 126 TTC faculty and staff served on twelve key committees involved in the development of the QEP. Additionally, 341 faculty and staff participated in surveys and focus groups, and approximately 170 faculty and staff attended data review sessions designed to solicit input to determine priorities and strategies for student success. This participation represents more than 70% of TTC's full-time faculty and staff. Senior administrators provided oversight to the QEP development process and served on decision-making teams. TTC's Area Commissioners have remained abreast of the college's QEP development process through five presentations at regular Board meetings. In all, more than 2,800 TTC students, faculty, staff, administrators and Commissioners have participated in this process. Their work has culminated in a comprehensive, unified plan to address student success, student learning and student engagement in math, **Path2Math Success**.

## Identification of the QEP Topic

Over the past six years, dialogue and data analysis from three separate yet interconnected assessment and quality improvement initiatives provided evidence that clearly pointed to math, specifically developmental math and the college's algebra sequence, as a discipline area desperately needing a college-wide focus on student learning and success. These three initiatives are:

- student learning outcomes assessments,
- the National Community College Benchmark Project, and
- the Achieving the Dream initiative.

### **Student Learning Outcomes Assessments (2004 to present)**

TTC launched a new program evaluation process during the 2004–2005 academic year to include comprehensive assessments of student learning outcomes across the curriculum, completed on a two-year cycle. As part of this process, TTC faculty identified key student learning outcomes at the institution, program and course levels:

**Institution Level.** TTC identified two essential, college-level general education competencies that all associate degree graduates should be able to demonstrate: critical thinking and effective communication. The General Education Committee uses a Curriculum Assessment Plan (CAP) to identify the extent to which graduates have attained these core competencies. One source of data the committee uses in the CAP is student artifacts in upper-level courses. The committee's review of six measures of critical thinking showed slight decreases in scores from the 2006-2008 assessment cycle to the 2008-2010 cycle.

**Program Level.** Every two years, the faculty complete assessments of student learning for each associate degree program. Program managers identify the broad, discipline-specific student learning outcomes that graduates should master as well as strategies for collecting evidence of this learning. The Associate in Science program includes in its CAP an assessment of students' ability to apply mathematical principles to solve problems. Faculty found that the percentage of College Algebra students who were successful declined from the 2006-2008 assessment to the 2008-2010 cycle.

**Course Level.** The TTC curriculum is competency based, and all TTC courses identify learning objectives in the course syllabus. However, because the grade a student earns in a course reflects only the student's overall performance, a course grade does not provide an appropriate assessment of student learning on specific competencies. In order to accurately assess student learning, TTC

evaluates student performance on individual course objectives. Assessment methods vary by discipline, but many rely on departmental finals to ensure uniformity in course content and instructor expectations.

In the Mathematics Department, the department head and curriculum coordinators examine student performance on the departmental final exams to assess the extent to which students are mastering key concepts in the three courses that comprise the algebra sequence: Beginning Algebra (MAT 101), Intermediate Algebra (MAT 102), and College Algebra (MAT 110). Additionally, The Learning Center math faculty review student work on the departmental final for Developmental Mathematics (MAT 032). (Course Descriptions, Appendix F) The data in the following table reveal that ***an alarming percentage of students taking the final exams in these courses do not demonstrate mastery of the key learning objectives for the course.***

Assessment of Student Learning Outcomes in the Algebra Sequence Percent of Students Demonstrating Mastery on the Departmental Final Exam		
Course	Learning Outcome	Percent
MAT 032	Rank whole numbers, fractions, or decimals using the symbols $<$ , $>$ and $=$	74.8%
	Perform computations with whole numbers or fractions	55.6%
	Simplify expressions using order of operations	88.0%
	Convert any given fraction, decimal, or percent to its equivalent other two forms	86.4%
	Round whole numbers or decimals to a specific place value	77.7%
	Solve applied problems involving whole numbers, decimals, or fractions	86.6%
	Perform computations with decimals or percents	<b>40.1%</b>
	Solve a proportion for an unknown term	<b>38.0%</b>
	Find the perimeter of geometric figures with given decimal and integer dimensions	79.5%
	Find the area of various geometric figures with given decimal and integer dimensions	88.6%
	Solve single step equations involving integers and fractions	81.0%
MAT 101	Solve a linear equation	62.5%
	Solve a linear inequality	<b>39.4%</b>
	Graph a linear equation	<b>26.0%</b>
	Factor a quadratic equation	50.4%
	Solve a quadratic equation by factoring	<b>30.8%</b>
	Apply rules of integer exponents to simplify an expression	52.8%
MAT 102	Solve a quadratic equation	62.1%
	Solve an absolute value equation in one variable	70.8%
	Simplify an algebraic expression involving exponents	<b>44.6%</b>
	Simplify algebraic expressions involving radicals	50.4%
	Solve a radical equation	65.0%
	Find the x- and y-intercepts of a quadratic function	53.8%
MAT 110	Solve an exponential equation	69.6%
	Solve a logarithmic equation	<b>20.4%</b>
	Solve a system of equations	60.0%
	Graph a rational function	56.3%
	Find the zeros of a polynomial function	<b>31.1%</b>
	Graph the solution to a system of linear inequalities	82.2%
	Solve an application problem involving an exponential function	<b>41.1%</b>

**National Community College Benchmark Project (2007 to present)**

In 2007, the college began its participation in the National Community College Benchmark Project (NCCBP) to secure comparative data on student success and persistence. The NCCBP compares a wide range of data fields among self-selected colleges, including success rates in key developmental and college-level courses. The 2009 NCCBP results yielded comparisons between TTC and 210 peer colleges.

TTC’s Leadership Cabinet, composed of 115 administrators and faculty leaders from across the college, reviewed the NCCBP results. NCCBP results for math courses revealed patterns that heightened the college’s concern about students’ success in math, particularly College Algebra. ***The success rates for TTC’s math courses consistently placed the college in the lowest quartile:***

<b>NCCBP Math Course Success Rate Comparisons</b>				
<b>NCCBP Cohort</b>	<b>Developmental Math</b>		<b>College Algebra</b>	
	<b>Success Rate</b>	<b>NCCBP Percentile</b>	<b>Success Rate</b>	<b>NCCBP Percentile</b>
Fall 2005	47.59%	20 <sup>th</sup>	42.54%	8 <sup>th</sup>
Fall 2006	38.87%	3 <sup>rd</sup>	30.06%	0 <sup>th</sup>
Fall 2007	41.96%	6 <sup>th</sup>	38.11%	2 <sup>nd</sup>

**Achieving the Dream (2007-Present)**

In 2007, TTC applied to participate in the Achieving the Dream initiative developed by the Lumina Foundation. Founded in 2004, Achieving the Dream (ATD) has a multi-year mission to improve student success at two-year colleges, focusing particularly on students of color and low income students. The goals and methodology of ATD align with the college’s values of student success and continuous improvement. ATD focuses on five inter-related measures of student success. Two of these measures relate specifically to the college’s QEP emphasis:

- Completing developmental courses and advancing to curriculum-level courses
- Enrolling in and completing “gatekeeper” courses (credit courses that experience high enrollment and low success rates and are required for graduation by one or more programs)

To manage its ATD efforts, the college designated two co-chairs from the faculty, Darren Felty from the English and Journalism Department and David Flenner from the Mathematics Department. The college also formed two teams with college-wide representation, the Data Team (Appendix D) and the Core Team (Appendix E). The members of the Data Team worked with TTC’s Institutional

Research staff to collect and interpret quantitative and qualitative data, to research practices at other institutions, and to communicate the results of these studies to the Core Team and the college community. The Core Team determined the priority focuses for the initiative based on data results and input from faculty, staff, students and the community. The Core Team also directed the implementation of the ATD initiatives by defining work plans, establishing a budget and developing assessment plans. In addition to these two teams, the college created 11 subcommittees tasked with investigating potential strategies and conducting strategy-specific research. These subcommittees consisted of an additional 63 faculty and staff members from multiple divisions.

Intrinsic to the ATD model for improvement is the requirement to collect both qualitative and quantitative data for decision making. As part of its ATD investigations, 20 faculty and staff members conducted more than 30 student focus groups to determine key issues influencing student success both in and out of the classroom. These focus groups solicited input from more than 400 student participants whose insights helped to frame the college's approach to improving student success. Additional quantitative results are presented below.

The coordinated and mutually-reinforcing work of the ATD teams created the most comprehensive college-wide effort in TTC's history to explore, understand and address the college's pressing issues with student success. The college conducted research in two key areas, course success rates and student progression, and produced data confirming the need for an institutional focus on student success in math courses.

**Course Success Rates.** The Data Team began by analyzing success rates for all TTC's courses from Fall 2006 and determining which of these courses should be designated as "gatekeeper" courses. Course success was defined as a grade of A, B or C; grades of W, D or F were considered unsuccessful. The "gatekeeper" courses exhibited the following characteristics:

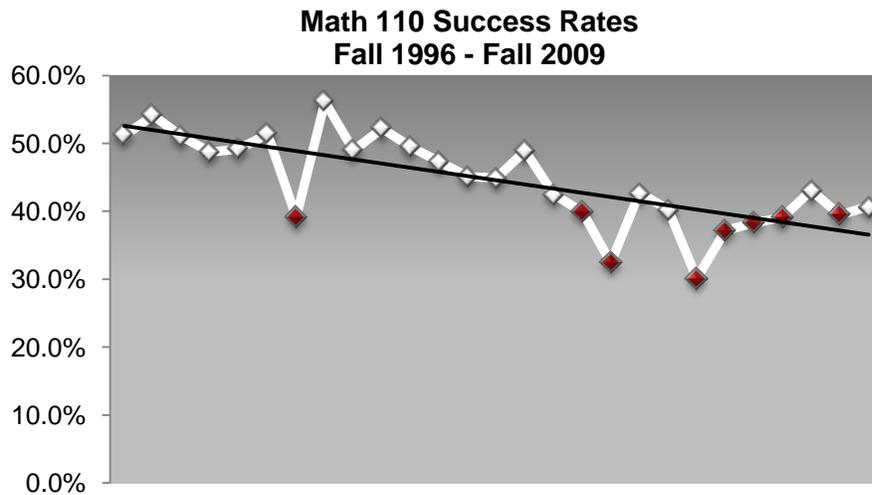
- high student enrollments
- required for associate degree completion
- fell below the college's median success rate of 65% (with the exception of MAT 155)

In essence, these are courses that have the potential to impede students' progress toward their degrees. The tables below detail success rate results for both developmental courses and the college's designated gatekeeper courses. While these results revealed substantial problems with success rates in many courses, ***MAT 032, MAT 101, MAT 102 and MAT 110 exhibited markedly low success rates.***

Non-degree Credit Course Success Rates (Fall 2006)	
Course	Success Rate
ENG 032	51.4%
ENG 100	57.5%
<b>MAT 032</b>	<b>38.5%</b>
<b>MAT 101</b>	<b>33.2%</b>
<b>MAT 102</b>	<b>36.5%</b>
RDG 032	60.1%
RDG 100	54.3%

Gatekeeper Course Success Rates (Fall 2006)	
Course	Success Rate
ACC 101	55.1%
BIO 210	57.6%
ECO 210	56.1%
ENG 101	55.8%
HIS 101	57.8%
<b>MAT 110</b>	<b>26.3%</b>
MAT 120	55.2%
MAT 155	72.0%
PSY 201	59.0%
SPC 205	63.1%

MAT 110 in particular fell well below the success rates of other gatekeeper courses. For the Fall 2006 semester, the ten gatekeeper courses had an average success rate of 57.6%, while the MAT 110 success rate for the same term was 26.3%. These results focused additional attention on the college's algebra sequence, as did a review of MAT 110 success rate trends from Fall 1996 through Fall 2007. ***This review demonstrated a significant overall decline in MAT 110 success rates:***



The red diamonds indicate success rates below 40%. Prior to Fall 2004, only one semester experienced success rates this low; in seven of the last eleven semesters, however, success rate levels fell below 40% and no term had a success rate above 43%.

**Student Progression.** An additional measure of student success is the students' rates of progression through curriculum-level math courses. The following chart details the progression rate of 2,886 entering students from Fall 2004. The college tracked this cohort to determine how many of the original 2,886 had completed MAT 110, MAT 120 or MAT 155 each year. Results of this study are displayed in the following chart.

Fall 2004 First Time Student Cohort Progression through Curriculum Math Courses				
Number in Cohort	Year	Number Completing Curriculum Math	Cumulative Total	Percent of Cohort
2,886	2004-05	481	481	16.7%
	2005-06	209	690	23.9%
	2006-07	98	788	27.3%

As these results indicate, ***a substantial percentage of students do not successfully complete the curriculum-level classes required for their degrees.***

### Selection of the QEP Topic (Spring 2009)

During the development of the Achieving the Dream initiative, the ATD teams and Dr. Mary Thornley, TTC's president, shared all or portions of the above data results with members of the college community. The ATD team members requested input from all faculty and staff members and hosted presentations and discussions at Leadership Cabinet, Faculty Council, Deans and Department Heads' meetings, Professional Development Day sessions, Faculty Colloquia, and open-invitation ATD discussion sessions (Appendix I). Through these sessions, TTC's faculty and staff developed an understanding of students' primary areas of need and participated in the selection of the initiatives the college was developing to help students succeed, particularly first-year students and those in math courses.

Presentations to	Data Shared			
	Student Learning Outcomes	Course Success Rates	Student Progression Rates	NCCBP Data
Student Cabinet/Student Focus Groups		X	X	
Math Faculty – Developmental Studies	X	X	X	X
Math Faculty – Curriculum Math	X	X	X	X
Faculty and Staff		X	X	X
Leadership Cabinet		X	X	X
Area Commission		X	X	X

The selection of the QEP topic grew out of these investigations and discussions. The ATD Core Team, with its substantial knowledge of the ATD priorities, initiatives and data, was the logical choice to select the QEP topic. The team determined three findings to be the most compelling in their deliberations: the challenges math poses for students, the significant discrepancies in student success rates between math courses and other developmental and curriculum-level courses, and the importance of success in math courses for students to complete degrees. The team unanimously agreed that student learning and success in math should be the focus of the QEP.

## Refining the Focus of the QEP Topic

### QEP Development Team Selection and Initial Meetings

Upon selection of the QEP focus, TTC's Vice President for Academic Affairs, Dr. Pat Robertson, consulted with the President, members of the ATD Core Team, and division deans to select the members of the QEP Development Team. Linda Collie, a faculty member and coordinator in the Mathematics Department, was selected to lead the QEP Development Team. The team membership includes representatives from multiple academic disciplines, key Student Services offices and Institutional Research (Appendix A). Dr. Robertson served as a resource for the team.

The QEP Development Team's July 31, 2009 organizational meeting was attended by Dr. Thornley and Suzy Barr, TTC's SACS Institutional Liaison. The team reviewed the QEP focus, requirements, objectives, and completion timeline. The meeting included a brief review of the Achieving the Dream data in preparation for further explorations the team would undertake. The team met weekly during the Fall 2009 and Spring 2010 terms. Early meetings were devoted to review of additional data from both Achieving the Dream and NCCBP, as well as new data requested by the team. The team also developed and administered a student survey in order to acquire a better understanding of student attitudes toward math (Appendix G). As the team narrowed its focus and identified potential strategies, members conducted literature reviews and research on best practices at other institutions.

### Narrowing the QEP Focus

In order to determine the courses or course clusters that pose the greatest challenges for students, the QEP Development Team examined the success rates of courses from Fall 2006 through Spring 2009. The success rates were notably and consistently lowest in MAT 032, MAT 101, MAT 102, MAT 110 and MAT 112. Of these, developmental math and the algebra sequence maintain the largest student enrollments, reflecting their necessary roles in the college's degree programs. The following table displays these data.

<b>Math Course Success Rates Fall 2006 – Spring 2009</b>			
<b>Course</b>	<b>Title</b>	<b>Enrollment</b>	<b>Success Rate</b>
MAT 032	Developmental Mathematics	4,252	39%
MAT 101	Beginning Algebra	6,020	33%
MAT 152*	Elementary Algebra	235	40%
MAT 102	Intermediate Algebra	3,220	39%
MAT 110	College Algebra	3,510	38%
MAT 111	College Trigonometry	832	51%
MAT 112	Precalculus	403	33%
MAT 120	Probability and Statistics	5,643	55%
MAT 123	Contemporary College Mathematics	228	61%
MAT 130	Elementary Calculus	281	50%
MAT 132	Discrete Mathematics	71	58%
MAT 140	Analytic Geometry and Calculus I	591	63%
MAT 141	Analytic Geometry and Calculus II	297	46%
MAT 155	Contemporary Mathematics	1,244	61%
MAT 170	Algebra, Geometry and Trigonometry I	84	63%
MAT 240	Analytic Geometry and Calculus III	104	63%
MAT 242	Differential Equations	87	62%

\*MAT 152, a five-credit alternative to MAT 101, was introduced in Spring 2008.

In addition to these findings, results from the 2009 NCCBP report confirmed for the team that student success in TTC's Developmental Mathematics (MAT 032) and College Algebra (MAT 110) courses fall well below desired levels. Institutional Research staff used the NCCBP's Peer Analysis Tool to conduct a comparative study of TTC and ten peer institutions. This tool allows the selection of a set of peer institutions and provides comparative data without disclosing the performance of individual peers. Two peer groups were selected: (1) five multi-campus colleges with over 12,000 students and similar minority student representation and (2) five single-campus colleges of over 12,000 students and similar minority student representation. The chart below details the results of this study.

<b>2009 NCCBP Peer Analysis Key Math Indicators</b>				
<b>Indicator</b>	<b>Multi-campus Peers</b>		<b>Single-campus Peers</b>	
	<b>Institution</b>	<b>Value</b>	<b>Institution</b>	<b>Value</b>
Developmental Math Success Rate	College 1	56%	College 1	54%
	College 2	55%	College 2	52%
	College 3	52%	College 3	52%
	College 4	49%	College 4	49%
	College 5	49%	TTC	42%
	TTC	42%	College 5	40%
College Algebra Success Rate	College 1	64%	College 1	64%
	College 2	57%	College 2	54%
	College 3	55%	College 3	53%
	College 4	50%	College 4	44%
	College 5	49%	College 5	40%
	TTC	38%	TTC	38%

As a result of these findings, the QEP Development Team decided to concentrate its research on MAT 032 and the algebra sequence courses, MAT 101, MAT 102 and MAT 110, due to their disproportionate impact on students and the consistently low success rates for students in these courses.

The team identified three goals for the QEP:

1. Improve **student success** in developmental and algebra coursework.
2. Improve **student learning** and math skills attainment in developmental and algebra courses.
3. Increase **student engagement** in and comfort with the study of math.

For each of these goals, the team identified an initiative with two corresponding strategies.

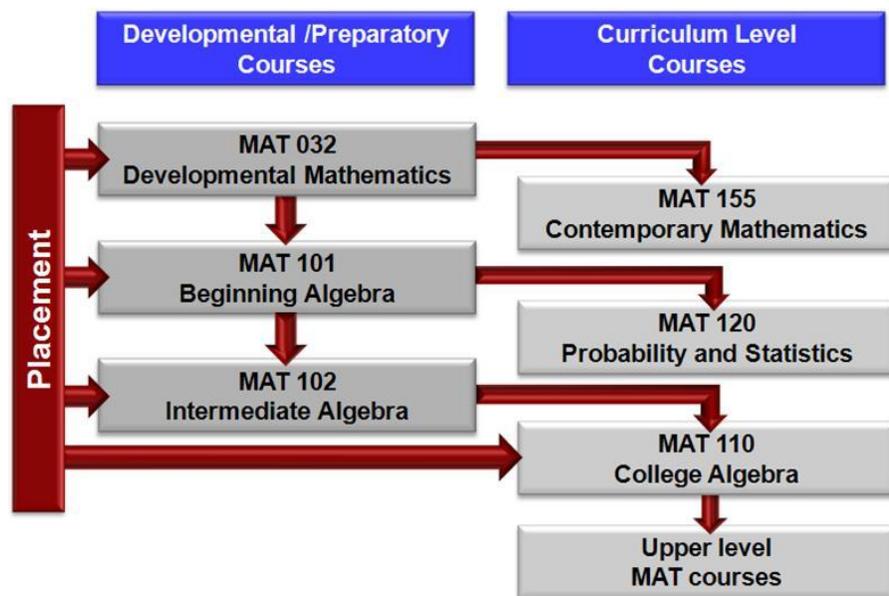
QEP Goals, Initiatives and Strategies		
Goal	Initiative	Strategy
Improve <b>student success</b> in developmental and algebra coursework	Student Preparation	Adjust Placement in Math Courses
		Implement a New Developmental Math Course
Improve <b>student learning</b> and math skills attainment in developmental and algebra courses	Instructional Improvement	Adopt Computer-Assisted Instruction
		Enhance Faculty Development
Increase <b>student engagement</b> in and comfort with the study of math	Student Support	Expand Tutoring Services
		Create Designated Student Study Spaces

### QEP Initiative 1 - Student Preparation

In order to ensure that all of its students have the opportunity to succeed in the math courses required for degree completion, TTC offers a full battery of developmental and non-degree math courses designed to prepare students for college-level math courses.

TTC uses the ACT COMPASS<sup>®</sup> computer-adaptive college placement test for determining student placement into English, reading and math courses. TTC uses four sub-tests for math placement: Pre-algebra, Algebra, College Algebra and Trigonometry. The TTC Testing Center administers the COMPASS<sup>®</sup> and also assists students who need to test away from campus (e.g. distance learning students).

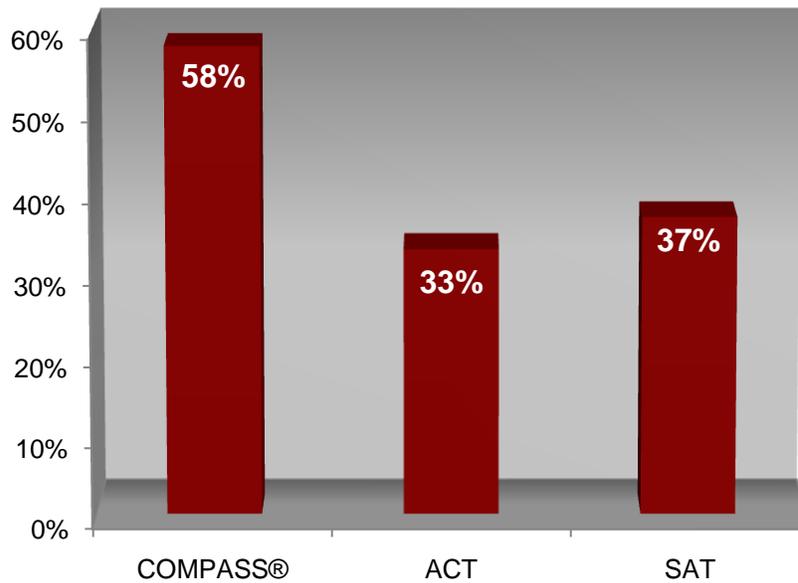
The following diagram provides an overview of the key preparatory and curriculum math courses and course sequences at TTC:



### Strategy 1 – Adjust Placement in Math Courses

**MAT 110.** As part of its Achieving the Dream work, the college convened three “Math Summits,” day-long meetings during which math faculty members discussed issues that potentially affect student success in math courses. One universal concern expressed by members of the math faculty was that students in key math courses – MAT 101, MAT 102 and MAT 110 – were underprepared to be in the course. Faculty reported that these students were often overwhelmed and lost within the first week of classes. As one faculty member stated, “It is frustrating and embarrassing for students in a MAT 110 class who don’t have the basic algebra skills of factoring, finding LCD’s of fractions, working with exponents, and simplifying radicals. [. . .] We need to do a better job of preparing our students for college-level mathematics, and we need to do a better job of placing them in the appropriate math course.”

The college investigated math faculty concerns about student preparation by examining student success in MAT 110, College Algebra, disaggregated by the method used to place the student in the course. At the time of the study, students could be placed into MAT 110 with an SAT Math score of 480, an ACT Math score of 19, or a COMPASS® Algebra score of 66. Of these, only the COMPASS® is certified as a placement test. The following graph provides an overview of the results of this study.

**MAT 110 Success Rates by Placement Method**

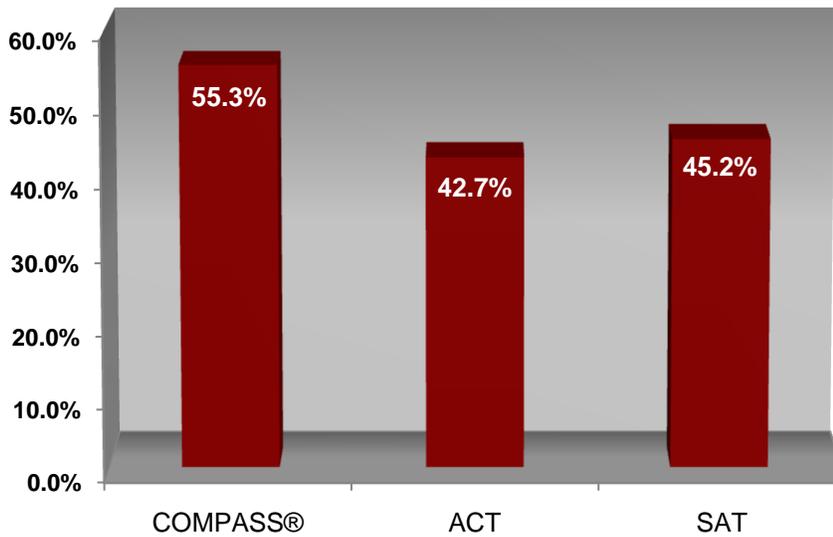
These results clearly demonstrate that the COMPASS® placement test provided the best and most reliable predictor of student success in MAT 110. However, the COMPASS® was the least used placement method, representing only 6.9 percent of the students who placed into MAT 110 based on their test scores. Additional studies showed that students with SAT scores below 580 and ACT scores below 22 had particularly poor success rates. Based on these findings, the college implemented a new policy for placement into MAT 110. Students must now either:

1. Have an SAT Math score of 580, or
2. Have an ACT Math score of 22, or
3. Take the COMPASS® placement test and enroll in the course the test prescribes.

Building on this foundational work, the QEP Development Team determined that similar studies should be conducted for MAT 101 and MAT 102 in order to fully investigate the effect of placement on student success across the algebra sequence.

**MAT 102.** The team examined the success rates of MAT 102 students based on their placement methods for the Fall 2007, Spring 2008, Fall 2008 and Spring 2009 terms. Students in the data pool who qualified by more than one placement method were included in the results for each method by which they placed in the course. The following chart compares the outcomes for students placed by COMPASS® Algebra, ACT and SAT:

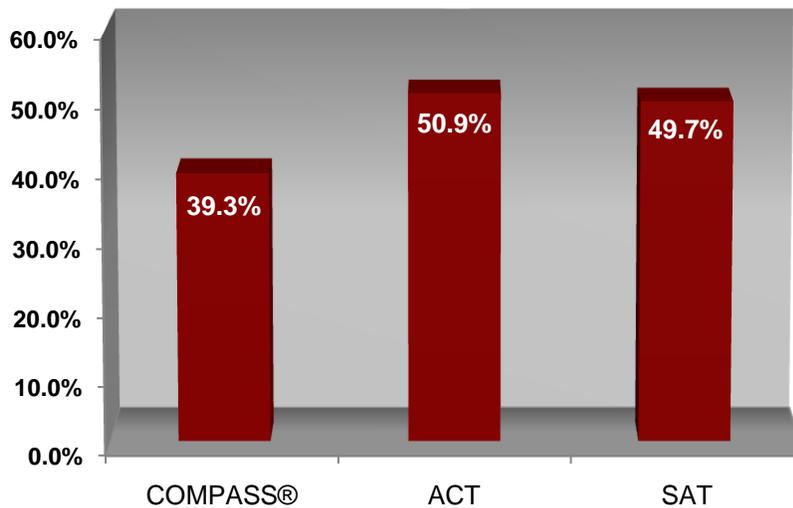
**MAT 102 Success Rates by Placement Method**



The team was encouraged to see that the best predictor of student success is again the COMPASS® test. The adjustments made to the college's placement process (effective for the Fall 2010 term) as a result of the Achieving the Dream work will remove SAT and ACT as placement methods for MAT 102.

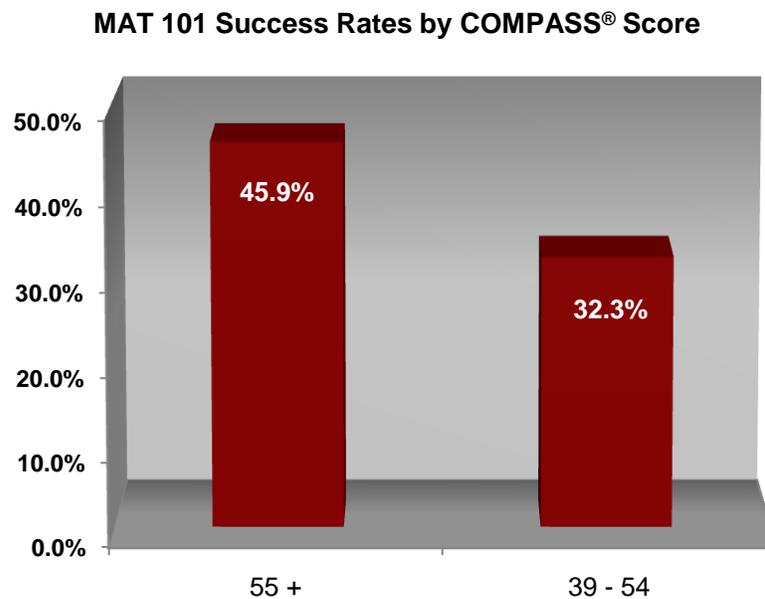
**MAT 101.** The team next examined the success rates of MAT 101 students based on their placement methods using the same methodology and same term data as described above for the MAT 102 analysis. The following chart compares the outcomes for students placed by COMPASS® Pre-algebra, ACT and SAT:

**MAT 101 Success Rates by Placement Method**



The team was concerned with the low success rates of students placed by the COMPASS® test for this course. The data show an 11.2 percentage point difference between the success rates of students placed via the COMPASS® test and those placed by other tests. The results of this study are of particular concern because the overwhelming majority of students, 60.1%, qualify to take MAT 101 through the COMPASS® test. In addition, the effect of the changes in placement policy described above will result in more students being placed in MAT 101 as a result of the COMPASS® (in essence, removing placement based on ACT and SAT, which currently account for placement of 15.3% of MAT 101 students).

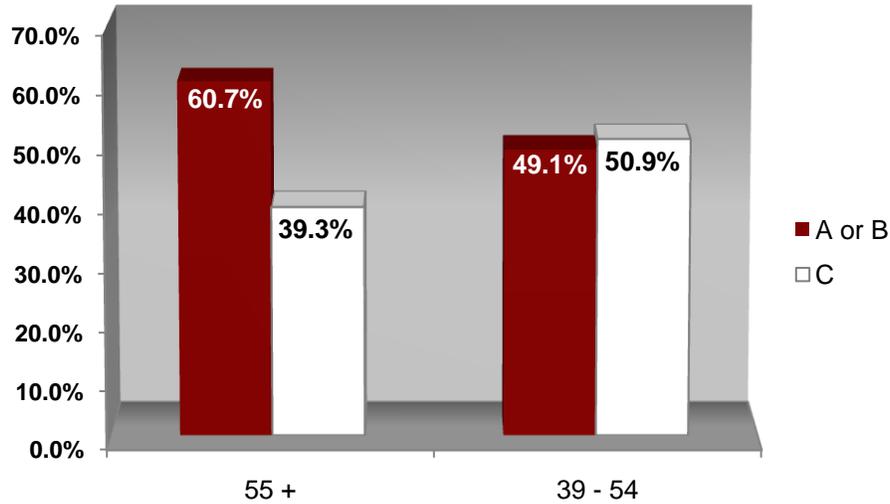
The team further examined student performance in MAT 101 by disaggregating success rates by COMPASS® Pre-algebra test scores, placing students into two groups: those with Pre-algebra scores of 55 or higher and those with Pre-algebra scores of 54 or lower. The following chart displays the results:



Chi-square tests reveal a statistically significant difference ( $p = 0.000$ ) between the two groups. The statistical validity is maintained even when term data are examined independently rather than in aggregate.

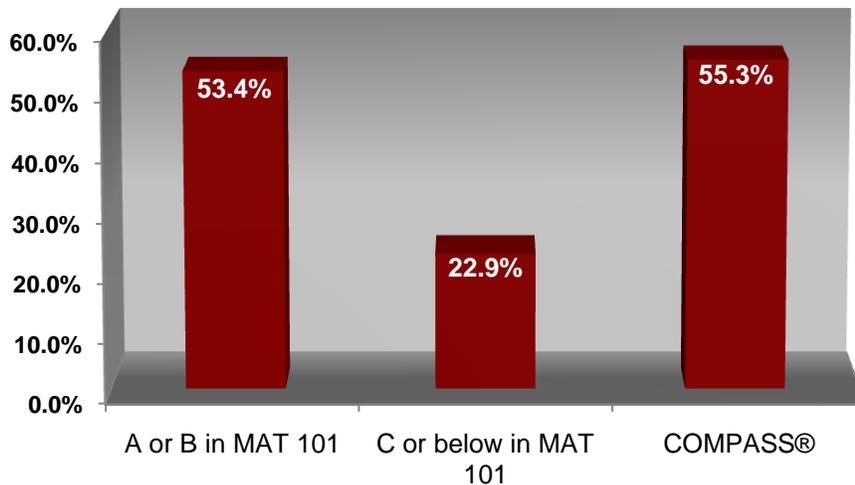
The team also examined the distribution of grades in MAT 101 disaggregated by score on the COMPASS® test. Not only do students with COMPASS® Pre-algebra scores above 54 demonstrate greater success in the course, the data demonstrate a strong correlation between improved student performance and placement score.

**MAT 101 Grade Distribution by COMPASS® Score**



The team analyzed success rates of students in the next course in the algebra sequence and disaggregated the results by the grade earned in MAT 101. These data, displayed in the chart below, demonstrate that students who perform at the A or B level in MAT 101 have success rates in MAT 102 at or above students who qualified to take MAT 102 based on test scores. There is no statistically significant difference in the two populations ( $p = 0.24$ ). Students who completed MAT 101 with a grade of C had the lowest success rate in MAT 102 of any student population. Students with a grade of A or B in MAT 101 significantly outperformed students with a MAT 101 grade of C ( $p = 0.000$ ).

**MAT 102 Success Rates by MAT 101 Grade or Placement**



The team also investigated the placement test practices among the other 15 technical colleges in the South Carolina Technical College System. The system uses a common Catalog of Approved Courses; therefore, most of the technical colleges offer the same math curriculum. Of the 15 colleges that offer MAT 101, eleven place students based on the COMPASS® Pre-algebra test. The team found that the average COMPASS® Pre-algebra cutoff score for TTC peer institutions was 49.8 – more than ten points higher than TTC’s cutoff score. Of particular note, Florence Darlington Technical College, which is in the fifth year of its math QEP implementation, uses a cutoff score of 60. The results of this investigation are displayed in the following table.

<b>Minimum COMPASS® Scores for MAT 101 Placement South Carolina Technical Colleges</b>	
<b>College</b>	<b>Pre-Algebra</b>
Florence-Darlington Technical College	60
Horry-Georgetown Technical College	60
York Technical College	54
Greenville Technical College	50
Orangeburg-Calhoun Technical College	49
Aiken Technical College	47
Central Carolina Technical College	47
Midlands Technical College	44
Spartanburg Community College	44
Denmark Technical College	43
Trident Technical College	39

***It was evident to the QEP Development Team that adjusting the placement criteria for MAT 101 will accomplish four objectives: 1) align TTC placement practices with those of its peers, 2) more accurately place students in the course appropriate to their skill level, 3) dramatically improve student success rates in MAT 101, and 4) improve the student success rate in MAT 102 of those students progressing from MAT 101.***

Based on current enrollment and placement data, the QEP Development Team completed projections for the potential effects of adjusting the MAT 101 Pre-algebra cutoff score from its current 39 to 55. These projections are summarized in the table below.

<b>Effects of Adjusting MAT 101 Placement Scores on MAT Course Enrollments</b>			
<b>Course</b>	<b>Fall 2009 Enrollment</b>	<b>Projected Change</b>	<b>Projected Percent Change</b>
MAT 032	1,125	+350	31.1%
MAT 101	1,561	-350	-22.4%
MAT 155	404	-47	-11.6%

Through its investigations, the team discovered that the college has no process in place to ensure that placement test cutoff scores are reviewed for appropriateness. ***The team has included a regular, systematic, college-wide review of placement procedures in this strategy.***

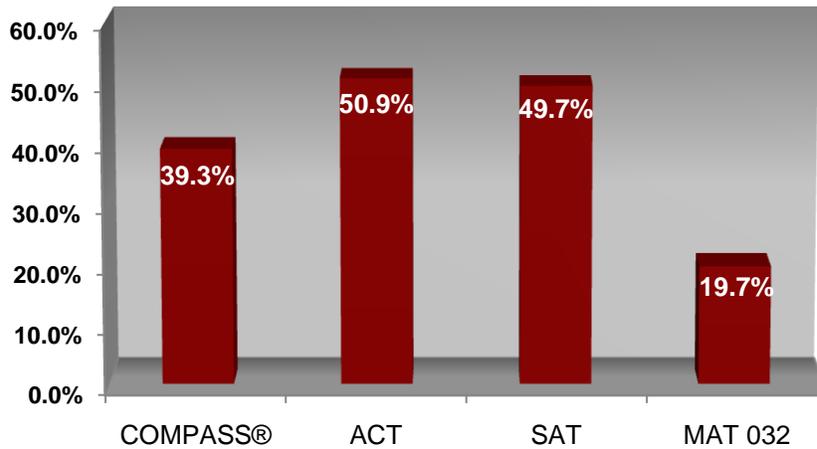
### **Strategy 2 – Implement a New Developmental Math Course**

The QEP Development Team turned its attention to the success rates of students in the MAT 032 course. Instructors in this course have expressed concerns about the range of abilities of the students placed into MAT 032. Because the college does not have a minimum math skill level, the students entering MAT 032 range in ability from those who are ready to begin pre-algebra work to those who have not mastered basic arithmetic functions. In order to prepare these students for elementary algebra, MAT 032 has nearly twice the number of essential competencies of the algebra courses. Faculty have expressed concerns that this is simply too much, too fast for many students.

In spite of the ambitious scope of the MAT 032 course, math faculty have agreed that the course does not go far enough to adequately prepare students for MAT 101. Specifically, MAT 101 instructors have noticed that students who progress to the course from MAT 032 have not mastered the critical competencies of collecting like terms in an expression or solving multi-step equations involving integers and fractions.

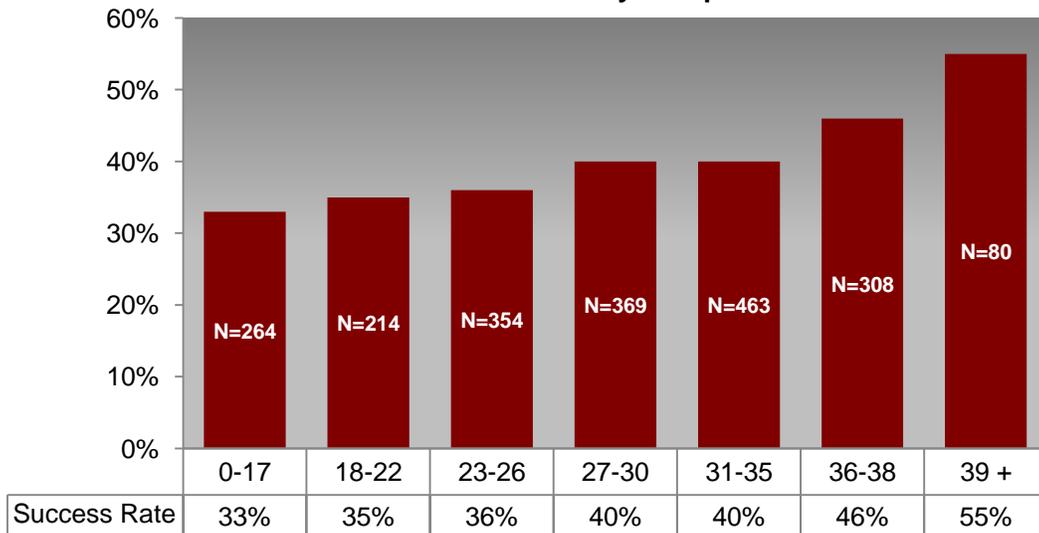
The team first addressed these concerns by examining the success of MAT 032 completers in MAT 101 from the 2007-08 and 2008-09 academic years. The team was concerned about the significantly lower success rates for students progressing from MAT 032 compared to students who placed into the course. To quote from the Institutional Research report, “Although students qualifying for MAT 101 certainly have higher test scores than students enrolling in MAT 032, students completing MAT 032 should have gained adequate skills to be at least as successful in MAT 101 as students that qualify for immediate enrollment into MAT 101. Evidence that MAT 032 students are not prepared for MAT 101 is overwhelming.”

**MAT 101 Success Rates by Placement Method**



The team next examined MAT 032 success rates disaggregated by the students' COMPASS® placement scores for the Fall 2006, 2007 and 2008 terms. The team was concerned that, regardless of placement score range, no group of students that placed into MAT 032 had a success rate above 50%. The sole group that exceeded this benchmark, students with a score above 39, had qualified to take MAT 101 but enrolled in MAT 032. These students were either self-referred or advised to take the lower level course.

**MAT 032 Success Rates by Compass Score**

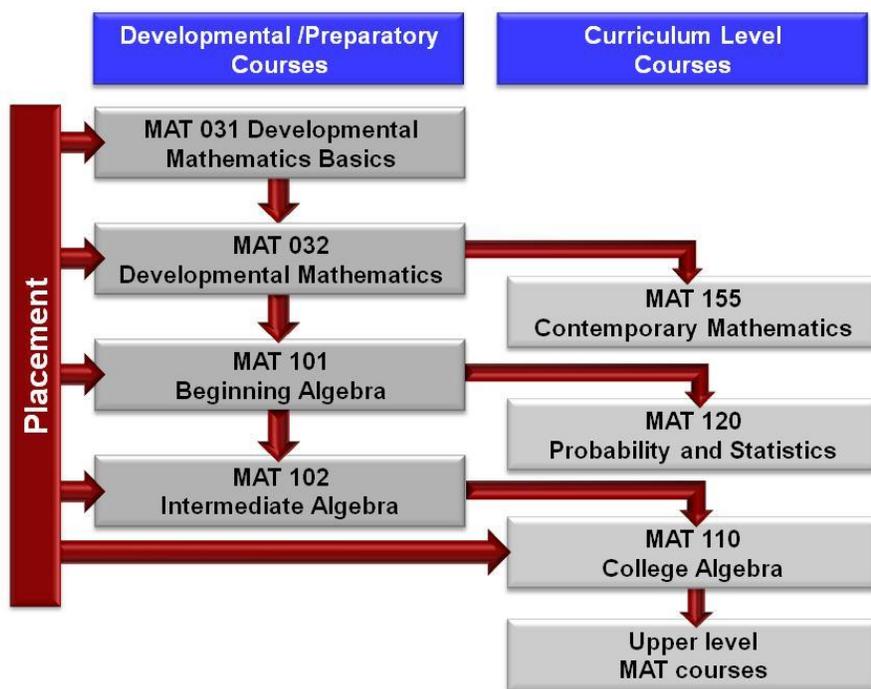


The team was well aware that the recommended changes to the placement procedures for MAT 101 would increase the number of students in MAT 032 with COMPASS scores in the 39-55 range. This shift will undoubtedly increase the overall success rates in MAT 032 but will not improve the success of those students with test scores in the lower ranges.

As part of its investigations in developmental math, the team interviewed math faculty and administrators from the other technical colleges. Through these conversations, the team discovered that 12 of the 16 technical colleges offer MAT 031, Developmental Mathematics Basics, as a prerequisite course for MAT 032 for those students who need remediation in basic arithmetic. Colleges across the state reported success with this course. Of particular interest to the team were the practices and results from Aiken Technical College (ATC), another Achieving the Dream institution. ATC has implemented a self-paced, computer-based MAT 031. The course provides students the option of an accelerated path that allows them to complete both MAT 031 and MAT 032 in a single term.

***The QEP Development Team determined that the current MAT 032 curriculum does not adequately address the needs of those students with the lowest placement test scores. The college will benefit from the implementation of a flexible, self-paced MAT 031 course focusing on basic arithmetic skills for these students.***

The following diagram is a representation of the proposed math progression, which includes a MAT 031 course.



## QEP Initiative 2 – Instructional Improvement

The QEP Development Team investigated strategies that would provide students with hands-on experience with course material and create greater interaction among students and between students and faculty during the learning process. The critical aspects of an effective strategy were perhaps most clearly expressed by Chickering and Gamson in their “Seven Principles for Good Practice in Undergraduate Education” (1987) in which they assert that good practice:

1. Encourages student-faculty contact
2. Encourages cooperation among students
3. Encourages active learning
4. Gives prompt feedback
5. Emphasizes time on task
6. Communicates high expectations
7. Respects diverse talents and ways of learning (p. 3)

These principles have long been accepted as key means of fostering student engagement, and they directly align with the team’s goals for math intervention strategies.

In keeping with these principles, the second area the team investigated is instructional effectiveness. The team believes that a comprehensive strategy to improve instructional effectiveness in the algebra sequence must incorporate methods that increase students’ opportunities for direct problem solving, enhance students’ concentration on homework assignments, employ more frequent assessments of students’ work, provide additional and faster feedback to students on the quality of their work, and allow additional time for discussions of challenging concepts. TTC math instructors individually have used a variety of methods to reach some or all of these objectives, but the Mathematics Department does not currently employ a uniform methodology.

### Strategy 3 – Adopt Computer-Assisted Instruction (CAI)

The team researched the impacts of computer-assisted instruction by focusing on broad-based studies of CAI, learning outcomes reports, case studies, and consultations with other colleges. Large-scale studies and literature reviews such as Jenks and Springer (2002), Lowe (2001), Timmerman and Kruepke (2006) and Twigg (2005) discuss multiple methods of using CAI, from fully computer-guided courses to CAI supplemental resources. These studies support the continued use, refinement and analysis of CAI to enhance student learning. In their review of over two decades of CAI studies on all educational levels, Jenks and Springer (2002) agree with Lowe

(2001) that CAI works best as a supplement to conventional instruction. They close their analysis with this statement:

In answering the question, 'Is CAI an effective teaching tool?' the answer should be, 'Yes. But don't throw out conventional instruction for CAI.' [ . . . ] the literature further suggests CAI is best delivered as a supplement to conventional instruction and effective instruction appears to be more a matter of quality of design rather than a matter of medium (see Lowe, 2001). (p. 55)

Learning outcomes studies of math initiatives using CAI at the K-12 and post-secondary levels are plentiful and elicit a range of conclusions. A few studies report that CAI delivers mixed results, creates no discernible impact on student performance or even falls short of conventional instruction (Klein, 2005; Wynegar and Fenster, 2009); however, most studies report increases in students' test scores, course success rates or skills development when using CAI, usually as a supplement to conventional instruction (Barrow et. al., 2008; Bassoppo-Moyo, 2010; Kodippili and Senaratne, 2008; Schoppek and Tulis, 2010; Twigg, 2005). In addition to these studies, the team consulted Intervention Reports from Achieving the Dream colleges that employ CAI in math initiatives. Most of these reports provide access to data from pilot programs and scaled-up intervention strategies. Several institutions, including the Alamo Community College District, Wayne Community College and Sinclair Community College, reported gains in student performance when using CAI.

Pearson, the publisher of the popular CAI system MyMathLab, produced a report entitled *Making the Grade* (2007) that details colleges' experiences with the system and offers advice on best practices. On the MyMathLab internet site, Pearson also features individual case studies. While these studies contain data and are composed by college representatives rather than Pearson employees, the team desired further consultations with colleges before accepting the claims in the reports. Team members contacted one of the featured colleges, Hillsborough Community College (HCC), and verified that College Algebra students using MathXL (a MyMathLab variant) demonstrated improved test grades and course completion rates. Brooke Quinlan, the HCC math instructor who prepared the report, also asserted that her students using MathXL "just learn so much doing the homework that it 'sticks' when it comes time to take the test" (personal communication, June 21, 2010).

Team members also contacted Florence-Darlington Technical College (FDTC) in South Carolina for a telephone conference and followed up with a site visit. FDTC concluded in its MyMathLab case study that "students learn more with MyMathLab when it is required than when it is optional." The

students in classes that required MyMathLab produced higher final exam scores and higher course completion rates in both their initial math courses and subsequent math courses. In developmental math, FDTC also requires that students repeat homework assignments until they achieve 100% mastery before testing on those skills. During the site visit, FDTC demonstrated the use of their Math Hub, a dedicated lab that students are required to use to access their MyMathLab assignments, and further discussed best practices and the successful results of their CAI initiatives.

Additional site visits to the College of Charleston and Charleston Southern University reinforced the team's conclusions. Math professor Katherine Johnston-Thom at College of Charleston has required MyMathLab for College Algebra homework for two semesters. Professor Johnston-Thom reported that MyMathLab students produced significantly higher final exam scores than students in previous terms, and she believes that using CAI better prepares students for subsequent math courses. Math professor Elizabeth Valentine at Charleston Southern University detailed the college's four-year use of MyMathLab in developmental mathematics and asserted that developmental math students have been successful in completing the course because of using MyMathLab.

While many of TTC's algebra sequence students choose online courses, which already use MyMathLab, or have taken MAT 032 in a computer lab environment, students' attitudes toward a required technology-based instructional component in math courses also factored into the team's investigation of this intervention. One report by Klein (2005) discusses students' dissatisfaction with the MyMathLab program functionality. Other studies show that the use of CAI improves student attitudes toward both CAI and their course subject (Bassoppo-Moyo, 2010; Collins et. al., 2008; Deaney, et. al., 2003; Nguyen et. al., 2006; Taylor, 2008). In order to better discern TTC's students' views on adding a CAI supplement to their math courses, the team included this question on its survey of math students: "I believe that a computerized math application that provides homework assistance, immediate feedback, and tutoring would help me to learn math." Of the 235 respondents, 123 (52%) strongly agreed and 62 (26%) agreed with this assertion, providing evidence of students' willingness to embrace this method of providing additional assistance in their math courses.

***Based on the strong results at other colleges, including peer institutions within South Carolina, and the positive response of TTC students to the CAI concept, the QEP Development Team determined that TTC will benefit from the adoption of a CAI system as a supplement to instruction in MAT 101, MAT 102 and MAT 110.***

#### **Strategy 4 – Enhance Faculty Development**

TTC's faculty development activities have led to many initiatives designed to assist math students. For instance, an Achieving the Dream sponsored faculty site visit to Housatonic Community College provided information that helped the college refine changes to MAT 032 designed to increase student success. Students who do not successfully complete the course may now begin their studies the next term at the furthest point at which they demonstrated competency in their prior attempt. The additions of MAT 152 (Elementary Algebra) and MAT 153 (Intermediate Algebra), alternative 5-credit courses for MAT 101 and MAT 102 that provide math study skills instruction, both derived from an on-campus faculty workshop with Dr. Paul Nolting. Consultations with the state Math Workgroup, which includes participants from all sixteen South Carolina technical colleges, led to TTC's development of MAT 109 (College Algebra with Modeling), which was offered in Fall 2009. As part of the college's Title III project, math faculty members received on-campus training to produce student "Learning Objects," computer modules on a variety of math topics available to all students at TTC's Library web site. Since 2005, the Mathematics Department has received on-campus training from Pearson in using MyMathLab. The comfort level with technology that this training has generated helped create widespread support for the expansion of CAI in math courses.

Research strongly supports the need to maintain a rigorous faculty development program for instructors. Studies of K-12, adult basic education and college-level education show that the most effective programs depend on faculty "ownership" of the training to ensure purposeful participation. Successful programs also employ coordinated activities that are maintained over a long duration rather than communicated in one brief session. It is ideal if the faculty members who participate in training receive institutional support to implement their ideas in classes, and if they evaluate the results of their course work and communicate the results to their colleagues. Faculty development programs that include these elements have generated stronger faculty participation, greater participant satisfaction and improved student outcomes (Baniflower et. al., 2006; Garet et. al., 2001; Huffman et. al., 2003; Knapp, 2003; Smith and Gillespie, 2007; Watts and Hammons, 2002; Whitehurst, 2002). Watts and Hammons (2002) have articulated a philosophical approach to faculty development that corresponds to TTC's goal of maintaining and expanding upon innovative approaches to teaching mathematics:

[. . .] professional development should be considered a means rather than an end. When taken as an end, too much emphasis is placed solely on the number of programmatic activities generated in a year and the number of people involved in those activities. [. . .]

Instead of professional development justifying its existence with numbers, it can more appropriately focus on the linkage between programmatic activities and the accomplishment of organizational goals. (p. 8)

Such an approach to faculty development will involve a sequential program that could support continued experimentation and assessment designed to enhance student learning in mathematics courses. This type of program would maintain faculty ownership of the professional development strategies by instituting a process whereby instructors apply for funds to engage in long-term professional development activities that they will use to improve classroom practices or other services focused on student learning. After receiving the requested training, the instructors will implement their ideas in pilot projects, which the college will monitor and assess. The faculty members will report results from their pilots to colleagues, and the department will evaluate the next steps for the project. The faculty development funding and pilot projects will rotate among faculty members, fostering a wider range of ideas and experimentation. This system aligns with a philosophy articulated by Epper and Baker (2009): “there is a consensus that rigorous and thoughtful professional development is critical in the adoption of any proposed innovation, whether content-based, classroom-based, or technology-based. As noted by Myra Snell, ‘Whatever your approach, it is guaranteed to fail if not wrapped in intense professional development’” (p. 18).

***Based on TTC’s experiences with effective faculty development and research on best practices, the QEP Development Team concludes that implementing an organized, focused approach to faculty development in mathematics will foster continuous innovation while maintaining rigorous professional standards and assessment.***

### **QEP Initiative 3 – Student Support**

The QEP Development Team also targeted support strategies that would work toward meeting the objective, as expressed by Kuh et. al. (2008), that “institutions should seek ways to channel student energy toward educationally effective activities, especially for those who start college with two or more ‘risk’ factors—being academically underprepared or first in their families to go to college or from low income backgrounds” (p. 540). These “risk” descriptors apply to a large proportion of TTC students in developmental mathematics and the algebra sequence. To help students overcome these disadvantages, the college focused its research on methods of increasing student-faculty contact, encouraging cooperative learning among students and accommodating diverse learning methods. The college’s two primary avenues for accomplishing these goals will be expanding tutoring services and creating designated study spaces for math students.

## Strategy 5 – Expand Tutoring Services

Currently, The Learning Center provides both by-appointment and drop-in math tutoring services for students on TTC’s three campuses. These services are limited, however, by funding for tutoring personnel. As a result, students who desire tutoring often cannot schedule tutoring sessions. The team’s survey of math students indicated that most students do not take advantage of the available services, whether due to choice or a lack of available tutors. To the assertion “I use the college’s on-campus tutoring services when I have problems with math assignments,” 64% indicated that they rarely or never seek tutoring services. The high percentage of TTC students who do not use these support services exceeds the national averages of the 2009 Community College Survey of Student Engagement (CCSSE), in which 46% of respondents indicated that they “Rarely/never” use tutoring services and 37% indicated that they “Rarely/never” use skill labs (*Making Connections*, 2010, p. 15).

Despite the limited number of students who use tutoring services, the team’s research on the efficacy of tutoring reinforced the value of tutoring as a mechanism to enhance students’ learning. Many studies indicate that professional and peer tutoring interventions that include tutor training can have positive impacts on students, including increasing students’ course grades and retention rates (Bailey and Alfonso, 2005; Boylan and Saxon, 2005; Hendriksen et. al., 2005; Pan et. al., 2008; Perin, 2004; Robinson et. al., 2005). The team researched nine colleges from five states that instituted or expanded math tutoring services as part of their participation in Achieving the Dream. Of particular interest to the team were the results from three colleges that had demonstrated increases in student success by increasing student participation in tutoring. Alvin Community College, Patrick Henry Community College and Wharton County Junior College saw such increases. Patrick Henry Community College’s data from Fall 2005 to Summer 2006 showed that the more frequently students used the lab the greater their retention rate over three terms. Wharton County Junior College reported strong outcomes from tutoring, as well: “Final course grades for fall 08 show a significantly higher course completion rate for students attending the Learning Assistance Centers (84.8% versus 79.5% for students who did not receive tutoring) and a positive relationship between the number of visits and the final grade.”

TTC’s Institutional Research explored the impact of tutoring on students’ performance in classes through a comparative review of success rates in the Fall 2006 and Spring 2007 terms. The courses were grouped by developmental/preparatory classes, which include MAT 032, MAT 101, MAT 102 and BIO 100, and curriculum courses. The following table shows the results of this study.

Success Rates of Tutored Math and Science Students				
Student Group	Fall 2006		Spring 2007	
	Students	Success Rate	Students	Success Rate
General Population	6,989	48%	6,345	48%
Tutored Students	275	62%	296	66%

The results indicate that students who received math and science tutoring in The Learning Center succeeded at statistically significant higher rates than students who did not. While it is impossible to determine if the students who sought tutoring would have succeeded without the tutoring services, the success rates of these students are encouraging. Additionally, the study highlights the enormous discrepancy between the numbers of students who seek tutoring and those who do not.

During the last six years, the staffing of the college's tutoring services has fluctuated. Data from the Writing Center show that the average number of student appointments per tutor has remained relatively constant, regardless of the staffing level. In short, when the college has had a larger tutoring staff, more students received tutoring services. These data suggest that increasing the number of available math tutors will likely result in a proportional increase in the number of students seeking and receiving tutoring.

***The QEP Development Team found that the local results, results at peer institutions and best practices documented in the literature clearly demonstrate the need for expanded tutoring services at TTC.*** This strategy will include the additional manpower necessary to expand tutoring hours on nights and weekends as well as provide additional appointment-based tutoring. It also will involve the development and certification of a comprehensive tutor training program.

### **Strategy 6 – Create Designated Student Study Spaces**

Creating opportunities for out-of-class interactions among students and between students and instructors has been a long-standing college goal. Faculty members stress their availability to students and encourage students to visit them in their offices for assistance. According to a survey of math students, respondents indicated a high comfort level with seeking instructor assistance. A large majority either strongly agreed (41%) or agreed (40%) with the assertion, "I feel comfortable seeking assistance from my instructor outside of class when I am having problems in a math class." This was an encouraging result, but college faculty believe more students need this assistance and that the college should emphasize the value of faculty-student interaction outside of class. In addition, despite attempts to encourage students to form study groups, evidence strongly indicates that they do not. For instance, when asked how frequently they "study math with other students

outside of class,” 24% of the math student survey respondents answered “Rarely” and 45% answered “Never.”

Research studies of student engagement are extensive and consistently emphasize the importance of faculty-student interaction outside of class (Lampert, 1993; *Making Connections: Dimensions of Student Engagement*, 2009; Schuetz, 2005; Thomas and Higbee, 1999; Thompson, 2001; Tinto, 1993). In his review of literature concerning informal student-faculty engagement, Lampert (1993) concludes that “Research supports the view of the faculty member as a socializing agent in the college experience. To varying degrees, faculty can aid in student academic achievement, college satisfaction, intellectual and personal development, persistence in college, and career and educational aspirations.” The 2009 report of the Community College Survey of Student Engagement (CCSSE) documents the challenges two-year colleges face in facilitating faculty-student interaction. The report reveals that “Nearly half of all students (47%) report that they never discussed ideas from their readings or classes with instructors outside of class” (*Making Connections*, 2010, p. 13). This problem is compounded by the large number of adjunct faculty members who do not hold office hours or who have neither the time nor the salary incentive to meet with students outside of class (see Schuetz, 2005).

QEP Development Team members and math faculty are also concerned that TTC students lack student-to-student interaction outside of class. According to the CCSSE report, “41% of students report that they never worked with other classmates outside of class to prepare class assignments” (p. 13), a percentage that corresponds to the 45% of TTC’s math survey respondents who never study with other students. The benefits to students of participating in study groups have long been clear, and TTC has explored initiatives by other Achieving the Dream colleges to promote these activities, including strategies aimed at assisting developmental math students at Henry Ford Community College, Seattle Central Community College and Technical College of the Lowcountry.

The CCSSE study strongly endorses expanding engagement opportunities for students while also recognizing the difficulties of implementing consistently effective strategies:

*Personal connections are the unanticipated success factor — a critical variable that improves the odds of persistence. But students’ typical patterns of college attendance, including part-time enrollment and juggling classes with work and family commitments, create challenges. Establishing personal connections may not happen easily, much less automatically. This discrepancy raises an important question for colleges and their approach to engaging students: Since strong personal connections are key to keeping more students in college, how can*

*institutions foster stronger and more diverse connections with (and among) students? (Making Connections, 2010, p. 3; italics in original)*

The team raised similar concerns and questions while exploring means of increasing outreach opportunities for math students at the college, and these questions shaped the college's response to this issue.

The team concludes that the college needs to stress the significance of math success in ways that it previously has not. One method of emphasizing to students the benefits of engaging with their peers and instructors outside of class is to provide spaces that support these interactions. The college maintains excellent tutoring facilities on all three campuses but offers no other designated spaces for math students to work together or with an instructor. Based on the principle that "Campus values or concerns can [. . .] be transmitted to students through the physical interface of campus environment" (Schuetz, 2005, p. 67), ***the team concludes that creating designated math study spaces will not only provide students with easily accessible places in which to meet but also will help to emphasize the college's commitment to students' math success.***

### **Path2Math Success**

In summary, the QEP Development Team has identified three initiatives and six corresponding strategies that address the three goals for the QEP. Together, the six strategies comprise **Path2Math Success**, a five-year quality enhancement plan designed to improve student success in math courses, increase student math skills attainment and increase student engagement and comfort with math. The following sections detail the goals and objectives, workplan, timeline, organization, resource requirements and assessment plan for **Path2Math Success**.

## Path2Math Success Goals and Outcomes

### Goals

TTC has identified three goals for the QEP:

1. Improve student success in developmental and algebra coursework.
2. Improve student learning and math skills attainment in developmental and algebra courses.
3. Increase student engagement in and comfort with the study of math.

For each of these goals, the college has identified the specific, measurable outcomes expected to result from the QEP initiatives. The narrative that follows details these outcomes.

### Student Success Outcomes

Student success is the central focus of the QEP. As described earlier, the purpose of TTC's developmental and preparatory math courses is to ensure that students have the appropriate foundational skills to progress to and complete curriculum level math courses required for degrees. The most direct measures of student success include successful course completion, progression, and success at the next level. Indirect measures of student success such as student retention rates and persistence rates contribute to a more complete understanding of student progress. The following table identifies the key measures of student success for the QEP.

Key Measures of Student Success	
Measure	Description
Course Success Rate	The percentage of enrollees who complete the course with a grade that allows progression to the next level math course.
Retention Rate	Percentage of students who enroll the subsequent term.
Progression Rate	Percentage of successful students in a math course who enroll in the next level math course the following term.
Persistence Rate	Percentage of unsuccessful students in a math course who re-enroll in the same math course the following term.
Success at the Next Course Level	Percentage of those students who have progressed from one level of math to the next who are successful in the next level course.

### Student Learning Outcomes

Each course at TTC identifies the student learning outcomes in the course syllabus. Math faculty members have reviewed the learning outcomes for the courses targeted for QEP intervention and have identified the outcomes that are the most fundamental to competency and most critical to student success at the next level. The following table identifies these key student learning outcomes for each of the five courses the QEP addresses.

Key Student Learning Outcomes	
Course	Learning Objective
MAT 031	Rank whole numbers, fractions or decimals using the symbols $<$ , $>$ and $=$
	Perform computations with whole numbers or fractions
	Simplify expressions using order of operations
	Convert any given fraction, decimal or percent to its equivalent other two forms
	Round whole numbers and decimals to a specific place value
	Solve applied problems involving whole numbers, decimals or fractions
	Perform computations with decimals or percents
MAT 032	Solve a proportion for an unknown term
	Find the perimeter of geometric figures with given decimal and integer dimensions
	Find the area of geometric figures with given decimal and integer dimensions
	Collect like terms in an expression
	Solve single-step equations involving integers and fractions
	Solve multi-step equations involving integers and fractions
MAT 101	Solve a linear equation
	Solve a linear inequality
	Graph a linear equation
	Factor a quadratic equation
	Solve a quadratic equation by factoring
	Apply rules of integer exponents to simplify an expression
MAT 102	Solve a quadratic equation
	Solve an absolute value equation in one variable
	Simplify an algebraic expression involving exponents
	Simplify algebraic expressions involving radicals
	Solve a radical equation
	Find the x- and y-intercepts of a quadratic function
MAT 110	Solve an exponential equation
	Solve a logarithmic equation
	Solve a system of equations
	Graph a rational function
	Find the zeros of a polynomial function
	Graph the solution to a system of linear inequalities
	Solve an application problem involving an exponential function

### Student Engagement Outcomes

Student learning and student success are clearly the most important goals of **Path2Math Success**. However, many of the strategies are designed with student engagement in mind. While the direct measures of student learning and success cannot be supplanted by measures of student engagement, the QEP will be more successful with an observed increase in these measures:

- Increased student use of on-campus tutoring services
- Increased student use of on-campus study spaces
- Increased frequency of student study groups outside of class
- Increased student confidence levels in the ability to do well in math

**Path2Math Success Workplan  
Student Preparation:  
Adjust Placement in Math Courses**

**Strategy**

Raise the COMPASS® Pre-Algebra placement score from 39 to 55 for placement into MAT 101 (Beginning Algebra).

**Implementation Process**

The Mathematics Department will present this proposal to TTC's Curriculum Committee in Fall 2010. The policy change will impact all new TTC students enrolling in Fall 2011. The college will communicate the new policies to all academic advisors and Student Services personnel.

**Impact of Implementation**

The proposed changes will align TTC's placement practices with its peers, more accurately place students in the course appropriate to their skill level, improve student success rates in MAT 101 and improve the student success rate in MAT 102 of those students progressing from MAT 101.

As more students are shifted from MAT 101 to MAT 032, the MAT 032 courses will need additional course sections and instructors. Based on Fall 2009 enrollments, changing the COMPASS® Pre-Algebra placement score from 39 to 55 would have increased enrollment in MAT 032 by 350 students. Using Spring 2009 enrollments, the change in the pre-algebra score would have increased enrollment in MAT 032 by 160 students. These enrollment shifts will necessitate the addition of one computer lab to accommodate expanded course offerings in The Learning Center.

The change also would impact MAT 155 (Contemporary Mathematics). In order to maintain consistent placement criteria, the COMPASS® Pre-Algebra entrance requirement for MAT 155 will be set at 55. This change will shift approximately 50 students per term from MAT 155 to MAT 032.

**Path2Math Success Workplan**  
**Student Preparation:**  
**Adjust Placement in Math Courses**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Procedure Approval	Prepare proposal for Curriculum Committee	Department Head, Math	1	Fall	2010
	Review curriculum proposal	QEP Development Team	1	Fall	2010
	Present proposal to Curriculum Committee	Dean, Math and Sciences Department Head, Math	1	Fall	2010
	Review Curriculum Committee recommendations	VP, Academic Affairs	1	Fall	2010
System Implementations	Implement changes in the COMPASS <sup>®</sup> testing software	Director, Testing Services	1	Spring	2011
	Implement placement equivalency changes in the Datatel Colleague administrative database	Registrar	1	Summer	2011
Advising	Communicate changes in placement procedures to the Advising Committee	QEP Implementation Team	1	Spring	2011
	Update the advising section of the Faculty Handbook	Advising Committee AVP, Instruction	1	Spring	2011
	Communicate changes in placement procedures to academic advisors, counselors and Student Services staff	Advising Committee AVP, Instruction	1	Summer	2011
Scheduling and Manpower Adjustments	Designate an additional computer lab for developmental studies use (available Fall 2011)	VP, Academic Affairs	1	Spring	2011
	Shift scheduling of developmental reading courses to the new lab	Dean, The Learning Center	1	Spring	2011
	Add additional MAT 032 sections in The Learning Center for the Fall 2011 term.	Dean, The Learning Center	1	Spring	2011
	Adjust MAT 101 and MAT 155 section offerings to accommodate enrollment shifts	Department Head, Math	1	Spring	2011
	Recruit and employ additional MAT 032 instructors as needed	Dean, The Learning Center	1	Summer	2011
	Recruit, employ and schedule additional MAT 032 instructional assistants as needed	Dean, The Learning Center	1	Summer	2011
Review of Math Placement Procedures	Identify additional members of the Math Placement Review Team	VP, Academic Affairs	4	Fall	2013
	Convene the Math Placement Review Team	QEP Director	4	Fall	2013
	Disseminate review results to academic deans and math faculty	Math Placement Review Team	4	Spring	2014
	Implement changes to placement (if warranted)	Department Head, Math	5	Fall	2015

**Path2Math Success Workplan**  
**Student Preparation:**  
**Implement a New Developmental Math Course**

**Strategy**

Implement a flexible, self-paced MAT 031 (Developmental Mathematics Basics) course for students who score below a 39 on the COMPASS® Pre-Algebra placement test. Restrict MAT 032 (Developmental Mathematics) to students who score in the 39-54 range on the COMPASS® Pre-Algebra placement test.

**Implementation Process**

The Learning Center will present this proposal to TTC's Curriculum Committee in Fall 2010. The policy change will impact all new TTC students enrolling in Fall 2011. The college will communicate the new policies to all academic advisors and Student Services personnel.

**Impact of Implementation**

Adding MAT 031 will divide the necessary Developmental Mathematics competencies between two courses, allowing students needing basic remediation to progress through the competencies at a more feasible rate. This revised system will allow students to experience success in their initial MAT 031 course rather than fail their first term MAT 032 class and, if they re-enroll, repeat it in their second term. Students who can progress through both MAT 031 and MAT 032 in one term will be allowed to do so through the scheduling of Fast-Forward I MAT 031 and Fast-Forward II MAT 032 sections. Students with acute math struggles who need multiple terms to master the MAT 031 and MAT 032 course competencies will receive financial aid assistance to take each course twice; this system will double the number of terms in which they can receive financial aid assistance for Developmental Mathematics.

**Path2Math Success Workplan**  
**Student Preparation:**  
**Implement a New Developmental Math Course**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Course Development and Approval	Prepare proposal for Curriculum Committee	Department Head, Dev Math	1	Fall	2010
	Review curriculum proposal	QEP Development Team	1	Fall	2010
	Present proposal to Curriculum Committee	Department Head, Dev Math	1	Fall	2010
	Review Curriculum Committee recommendations	VP, Academic Affairs	1	Fall	2010
System Implementations	Set up new course in Datatel Colleague administrative database	Director, Instructional Services	1	Spring	2011
	Implement changes in the COMPASS <sup>®</sup> testing software	Director, Testing Services	1	Spring	2011
	Implement placement equivalency changes in the Datatel Colleague administrative database	Registrar	1	Summer	2011
Advising	Communicate changes in placement procedures to the Advising Committee	QEP Implementation Team	1	Spring	2011
	Update the advising section of the Faculty Handbook	Advising Committee AVP, Instruction	1	Spring	2011
	Communicate changes in placement procedures to academic advisors, counselors and Testing Services staff	Advising Committee AVP, Instruction	1	Summer	2011
	Update the 2011-2012 TTC Catalog	AVP, Curriculum	1	Spring	2011
Scheduling and Manpower	Add MAT 031 sections in The Learning Center for the Fall 2011 term.	Dean, The Learning Center	1	Spring	2011
	Recruit and employ MAT 031 instructors as needed	Dean, The Learning Center	1	Summer	2011
	Recruit, employ and schedule MAT 031 instructional assistants as needed	Department Head, Dev Math	1	Summer	2011

**Path2Math Success Workplan  
Instructional Improvement:  
Adopt Computer-Assisted Instruction**

**Strategy**

Adopt a computer-assisted instruction (CAI) system to supplement instruction in MAT 101, MAT 102 and MAT 110.

**Implementation Process**

TTC will employ CAI in five sections of MAT 101 in Fall 2010. The college then plans to scale up the CAI MAT 101 courses by five courses per term until at least 20 sections of MAT 101 employ CAI. In order for students to progress through a CAI supplemented algebra sequence, MAT 102 and MAT 110 will follow the same pattern beginning in Spring 2011 and Fall 2011, respectively. The Path2Math Success Assessment Team will evaluate the effectiveness of the pilot plan through data-based assessments and recommend adjustments as necessary.

To facilitate a smooth implementation, the first round of CAI pilot sections for each course will be taught by full-time faculty members. Adjunct faculty will be assigned CAI sections in the second semester of the pilot sequence. This plan will allow ample time for training adjunct faculty members before they implement a new teaching methodology.

The college will designate a CAI Lead Instructor to design materials for all sections of CAI courses, coordinate the CAI sections and provide CAI training for both full-time and adjunct faculty members. In Fall 2011, the college will open a designated CAI computer lab for math courses; in this lab students will be able to complete assignments and receive help from the CAI Lead Instructor and part-time assistants.

**Impact of Implementation**

The addition of CAI to the algebra sequence courses will provide students the additional assistance and skills practice they need in order to succeed in these courses. The CAI supplement to course instruction will help students to master course competencies and retain essential information through emphases on homework completion, continuous skills practice, immediate feedback, skills mastery and directed assistance.

**Path2Math Success Workplan  
Instructional Improvement:  
Adopt Computer-Assisted Instruction**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Plan for CAI Implementation	Select a CAI system	Faculty, Math Department	P	Fall	2009
	Pilot 5 sections of MAT 101 and MAT 152 to determine “best practices” for use of CAI at TTC	Faculty, Math Department	P	Spring	2010
	Develop guidelines for CAI use	Faculty, Math Department	P	Summer	2010
	Develop a pilot plan	QEP Development Team	P	Summer	2010
	Advertise CAI to students	QEP Development Team Marketing Department	P	Summer	2010
	Select a CAI Lead Instructor	Department Head, Math QEP Director	1	Fall	2010
Provide Resources for CAI	Designate and fund a computer lab for CAI	VP, Academic Affairs	1	Spring	2011
	Furnish CAI lab	QEP Director	1	Summer	2011
	Interview and hire student assistants for the CAI lab	CAI Lead Instructor	1	Summer	2011
	Develop a Student Assistant schedule	CAI Lead Instructor	2	Fall	2011
	Open the CAI lab	CAI Lead Instructor	2	Fall	2011
Implement CAI in MAT 101	Offer 5 CAI MAT 101 sections	Math Department	1	Fall	2010
	Offer 10 CAI MAT 101 sections	Math Department	1	Spring	2011
	Offer 15 CAI MAT 101 sections	Math Department	2	Fall	2011
	Offer 20 CAI MAT 101 sections	Math Department	2	Spring	2012
	Institutionalize CAI in MAT 101	Math Department	3	Fall	2012
Implement CAI in MAT 102	Offer 5 CAI MAT 102 sections	Math Department	1	Spring	2011
	Offer 10 CAI MAT 102 sections	Math Department	2	Fall	2011
	Offer 15 CAI MAT 102 sections	Math Department	2	Spring	2012
	Offer 20 CAI MAT 102 sections	Math Department	3	Fall	2012
	Institutionalize CAI in MAT 102	Math Department	3	Spring	2013
Implement CAI in MAT 110	Offer 5 CAI MAT 110 sections	Math Department	2	Fall	2011
	Offer 10 CAI MAT 110 sections	Math Department	2	Spring	2012
	Offer 15 CAI MAT 110 sections	Math Department	3	Fall	2012
	Offer 20 CAI MAT 110 sections	Math Department	3	Spring	2013
	Institutionalize CAI in MAT 110	Math Department	4	Fall	2013

## Path2Math Success Workplan Instructional Improvement: Enhance Faculty Development

### Strategy

Implement an organized, sustained approach to faculty development in mathematics that encourages continuous innovation while maintaining rigorous professional standards and assessment.

### Implementation Process

Beginning in Fall 2010, **Path2Math Success** will institute a faculty development program that includes a number of defined steps. Faculty members will participate in an application process for travel, faculty support funds and release time (Appendix H). The applicants will concentrate on a defined focus targeting improved classroom practices or student support. If selected for faculty development support, they will receive up to a year of funding and release time to explore a project in detail through research, workshop attendance, site visits or other activities. After completing research, the faculty member(s) will pilot the project over at least two semesters. Working with Institutional Research, the faculty member will assess the effectiveness of the pilot and communicate the results to colleagues in the department. The **Path2Math Success** budget allocates \$7,000 each year for these activities.

In addition to these individual faculty development projects, **Path2Math Success** will provide several on-site professional workshops available to all full-time and adjunct math faculty. Annually, the Path2Math Success Director will schedule an American Mathematical Association of Two-Year Colleges (AMATYC) Traveling Workshop to be held in the Spring term.

### Impact of Implementation

A systematic program for sponsoring and maintaining faculty development will create an atmosphere of continuous experimentation and improvement in the Mathematics Department, reward creative approaches to math instruction and student learning, integrate project assessments as fundamental elements of course initiatives, and create a faculty development model for other departments at the college.

**Path2Math Success Workplan  
Instructional Improvement:  
Enhance Faculty Development**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Planning	Develop a 5-year Faculty Development plan	QEP Development Team	P	Spring	2010
Year 1 Faculty Development	Select first year PD participants	Department Head, Math	1	Fall	2010
	Sponsor 1-2 instructors to the ATD Spring 2011 Strategies Institute	QEP Director	2	Spring	2012
	Hold an on-site AMATYC traveling workshop Spring 2011	QEP Director	1	Spring	2011
Year 2 Faculty Development	Select second year PD participants	Department Head, Math	2	Fall	2011
	Sponsor 1-2 instructors to the ATD Spring 2012 Strategies Institute	QEP Director	2	Spring	2012
	Hold an on-site AMATYC traveling workshop Spring 2012	QEP Director	2	Spring	2012
Year 3 Faculty Development	Select third year PD participants	Department Head, Math	3	Fall	2012
	Sponsor 1-2 instructors to the ATD Spring 2013 Strategies Institute	Co-Chairs, Achieving the Dream	3	Spring	2013
	Hold an on-site AMATYC traveling workshop Spring 2013	QEP Director	3	Spring	2013
Year 4 Faculty Development	Select fourth year PD participants	Department Head, Math	4	Fall	2013
	Sponsor 1-2 instructors to the ATD Spring 2014 Strategies Institute	Co-Chairs, Achieving the Dream	4	Spring	2014
	Hold an on-site AMATYC traveling workshop Spring 2014	QEP Director	4	Spring	2014
Year 5 Faculty Development	Select fifth year PD participants	Department Head, Math	5	Fall	2014
	Sponsor 1-2 instructors to the ATD Spring 2015 Strategies Institute	Co-Chairs, Achieving the Dream	5	Spring	2015
	Hold an on-site AMATYC traveling workshop Spring 2015	QEP Director	5	Spring	2015

Path2Math Success Workplan  
Student Support:  
Expand Tutoring Services

**Strategy**

Expand math tutoring services and develop a tutor training program to meet the tutoring needs of students.

**Implementation Process**

The college will progressively hire additional math tutors and assess students' use of these tutors in order to provide adequate tutoring services for math. The college also will increase advertising for tutoring services and stress the need for additional assistance in this challenging subject.

Concurrently, The Learning Center (TLC) will develop a tutor training program and apply for program certification. A TLC faculty member will devise a ten-hour training program during the 2010-2011 academic year; the tutor training will begin in Fall 2011 and continue in Fall 2012. The college will apply for certification in Spring 2013. The faculty member who designs the program and leads the certification process will receive course releases for this work.

**Impact of Implementation**

Students who need tutoring assistance in math will be able to depend on the availability of trained tutoring personnel. The increase in the numbers of students who receive tutoring will allow more students to succeed in their mathematics courses.

**Path2Math Success Workplan  
Student Support:  
Expand Tutoring Services**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Tutor Scheduling and Manpower	Develop an expanded tutoring schedule that includes evening and weekend hours	Dean, The Learning Center	P	Summer	2010
	Interview and hire two additional part-time tutors (1 FTE)	Dean, The Learning Center	1	Fall	2010
	Interview and hire two additional part-time tutors (1 FTE)	Dean, The Learning Center	2	Fall	2011
	Interview and hire two additional part-time tutors (1 FTE)	Dean, The Learning Center	3	Fall	2012
	Interview and hire two additional part-time tutors (1 FTE)	Dean, The Learning Center	4	Fall	2013
Tutor Training Development	Investigate tutor training systems and best practices	Faculty Member, Dev Math	1	Fall	2010
	Customize tutor training program for TTC needs and produce tutor training materials	Faculty Member, Dev Math	1	Spring	2011
	Conduct first pilot tutor training program	Faculty Member, Dev Math	2	Fall	2011
	Conduct second pilot tutor training program	Faculty Member, Dev Math	2	Fall	2012
	Apply for International Tutor Program Certification (Level I)	Dean, The Learning Center Faculty Member, Dev Math	2	Spring	2013
	Conduct ITPC certified tutor training	Faculty Member, Dev Math	3	Fall	2013

Path2Math Success Workplan  
Student Support:  
Create Designated Student Study Spaces

**Strategy**

Create designated math study spaces to provide students with easily accessible rooms in which to meet and work together or with instructors.

**Implementation Process**

TTC has designated a space on each of its three campuses to serve as a Math<sup>3</sup> (Math Cube), a work area set aside for math students. These rooms will be renovated to create welcoming environments and will be heavily advertised to students. Full-time math faculty members will hold some office hours in the Math<sup>3</sup> and adjunct faculty will have the opportunity to use the space to meet with students. The rooms will remain open even without a faculty presence for student group work. The college will assess the use of the Math<sup>3</sup> and, if needed, will pay adjunct instructors to provide additional support for students in the study areas. The budget reflects additional funds for adjunct faculty beginning in Year 2.

**Impact of Implementation**

The Math<sup>3</sup> will provide students with a means to establish and maintain contacts with other students and with their math instructors. They also will convey the college's commitment to math assistance and to a culture of support for math students.

**Path2Math Success Workplan  
Student Support:  
Create Designated Student Study Spaces**

Action	Detailed Actions	Responsible Unit/Person	Timeline		
			QEP Year	Term	Calendar Year
Main Campus Study Space	Designate a room for the Math <sup>3</sup>	VP, Academic Affairs	P	Spring	2010
	Develop budget estimates for furnishings for Math <sup>3</sup>	Purchasing Department	P	Spring	2010
	Develop budget estimates for renovations for Math <sup>3</sup>	Physical Facilities	P	Spring	2010
	Complete renovations for Math <sup>3</sup>	Physical Facilities	P	Summer	2010
	Purchase furnishings for Math <sup>3</sup>	VP, Academic Affairs	P	Summer	2010
	Install furnishings for the Math <sup>3</sup>	Physical Facilities	P	Summer	2010
	Develop a schedule for Math Faculty assistance in the Math <sup>3</sup>	QEP Director	1	Fall	2010
	Open Math <sup>3</sup>	QEP Director	1	Fall	2010
	Advertise Math <sup>3</sup> to math classes	Faculty, Math Department	1	Fall	2010
	Hold Opening Ceremony for the Math <sup>3</sup>	Faculty, Math Department	1	Fall	2010
Palmer Campus Study Space	Designate a room for the Math <sup>3</sup>	Dean, Palmer Campus	1	Fall	2010
	Open Math <sup>3</sup>	Dean, Palmer Campus	1	Fall	2010
	Develop budget estimates for furnishings for Math <sup>3</sup>	Purchasing Department	1	Spring	2011
	Develop budget estimates for renovations for Math <sup>3</sup>	Physical Facilities	1	Spring	2011
	Complete renovations for Math <sup>3</sup>	Physical Facilities	1	Summer	2011
	Purchase furnishings for Math <sup>3</sup>	VP, Academic Affairs	1	Summer	2011
	Install furnishings for the Math <sup>3</sup>	Physical Facilities	1	Summer	2011
	Develop a schedule for Math Faculty assistance in the Math <sup>3</sup>	QEP Director	2	Fall	2011
	Advertise Math <sup>3</sup> to math classes	Faculty, Math Department	2	Fall	2011
Hold Opening Ceremony for the Math <sup>3</sup>	Dean, Palmer Campus	2	Fall	2011	
Berkeley Campus Study Space	Designate rooms for the Math <sup>3</sup>	Dean, Berkeley Campus	2	Fall	2011
	Open Math <sup>3</sup>	Dean, Berkeley Campus	2	Fall	2011
	Develop budget estimates for furnishings for Math <sup>3</sup>	Purchasing Department	2	Spring	2012
	Develop budget estimates for renovations for Math <sup>3</sup>	Physical Facilities	2	Spring	2012
	Complete renovations for Math <sup>3</sup>	Physical Facilities	2	Summer	2011
	Purchase furnishings for Math <sup>3</sup>	VP, Academic Affairs	2	Spring	2012
	Install furnishings for the Math <sup>3</sup>	Physical Facilities	2	Summer	2012
	Develop a schedule for Math Faculty assistance in the Math <sup>3</sup>	QEP Director	3	Fall	2012
	Advertise Math <sup>3</sup> to math classes	Faculty, Math Department	3	Fall	2012
Hold Opening Ceremony for the Math <sup>3</sup>	Dean, Berkeley Campus	3	Fall	2012	

## Path2Math Success Timeline

	Year 1			Year 2			
	Fall	Spring	Summer	Fall	Spring	Summer	
Adjust Placement in Math Courses	Approval	System implementation		First term for new procedure			
		Advising					
		Scheduling and manpower adjustments					
Implement a New Developmental Math Course	Course developed and approved	System implementation		First term MAT 031 offered	MAT 031 offered		
		Advising					
		Scheduling and manpower					
Adopt Computer-Assisted Instruction	Planning						
		CAI Lab development		CAI Lab in operation			
	Implement CAI in MAT 101						
	Implement CAI in MAT 102						
	Implement CAI in MAT 110						
Enhance Faculty Development	Year 1 PD activities			Year 2 PD activities			
Expand Tutoring Services	Year 1 tutoring expansion			Year 2 tutoring expansion			
	Tutor training development			Tutor training pilot 1	Tutor training development		
Create Designated Student Study Spaces	Main Campus Math <sup>3</sup> opening	Main Campus Math <sup>3</sup> open					
		Planning – Palmer Campus		Palmer Campus Math <sup>3</sup> opening	Palmer Campus Math <sup>3</sup> open		
		Planning – Berkeley Campus					

# Path2Math Success Timeline

Year 3			Year 4			Year 5		
Fall	Spring	Summer	Fall	Spring	Summer	Fall	Spring	Summer

Review of math placement procedures

MAT 031 offered

CAI Lab in operation

<b>MAT 101 Scale up</b>	Institutionalize CAI in MAT 101
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<b>MAT 102 Scale up</b>	Institutionalize CAI in MAT 102
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<b>MAT 110 Scale up</b>	Institutionalize CAI in MAT 110
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Year 3 PD activities

Year 4 PD activities

Year 5 PD activities

Year 3 tutoring expansion

Year 4 tutoring expansion

Institutionalize expanded tutoring schedule

<b>Tutor training Pilot 2</b>	Application for ITPC Level I tutor training certification
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ITPC Level I tutor training
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ITPC Level I tutor training
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Main Campus Math<sup>3</sup> open

Palmer Campus Math<sup>3</sup> open

<b>Berkeley Campus Math<sup>3</sup> opening</b>	Berkeley Campus Math <sup>3</sup> open
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## Path2Math Success Organizational Structure

The responsibility for the implementation and success of the QEP belongs to the President. She has assigned oversight of the initiative to the Vice President for Academic Affairs. The vice president in turn has authorized substantial release time for two faculty positions that will provide direct management and administrative coordination for the project. These two positions, the Path2Math Success Director and the CAI Lead Instructor, will each have at least 40% release time for the duration of the project.

The Path2Math Success Director will be responsible for the coordination of the project as a whole, will manage the project budget, will direct the activities of the various departments and personnel involved in the initiative and will provide regular reports on project progress to the Vice President for Academic Affairs. The CAI Lead Instructor will coordinate the CAI activities, as well as provide supervision to the CAI Student Assistants and Math<sup>3</sup> Assistants.

Detailed position descriptions for **Path2Math Success** personnel are included in the following table. An organizational chart highlighting project personnel is located on page 51.

Path2Math Success Key Positions	
Path2Math Success Director	
Responsibilities	<ul style="list-style-type: none"> <li>▪ Provides direct management and administrative coordination for the QEP</li> <li>▪ Chairs the Path2Math Success Implementation Team</li> <li>▪ Co-chairs the Path2Math Success Assessment Team</li> <li>▪ Manages the project budget</li> <li>▪ Schedules meetings with Curriculum Committee for changes in placement scores and the introduction of new course</li> <li>▪ Communicates changes in placement scores to the Advising Committee</li> <li>▪ Convenes the Math Placement Review Teams</li> <li>▪ Supervises the pilot plan for CAI in selected math courses/sections</li> <li>▪ Assists in selecting the Lead Instructor for CAI</li> <li>▪ Coordinates furnishing for and renovations to CAI lab</li> <li>▪ Oversees faculty projects selected for the Faculty Development strategy</li> <li>▪ Arranges AMATYC Traveling Workshops at TTC</li> <li>▪ Prepares the annual progress report</li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ Masters degree, two years of experience teaching mathematics at TTC</li> <li>▪ Computer, management and communication skills</li> <li>▪ Commitment to the continuous improvement and evaluation of successful teaching strategies to increase student success</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ Five years of experience teaching mathematics</li> <li>▪ Knowledge and experience working with college students and familiarity with college and CAI resources</li> <li>▪ Skills in public relations and supervision</li> <li>▪ Management experience</li> </ul>

## Path2Math Success Key Positions

### CAI Lead Instructor

Responsibilities	<ul style="list-style-type: none"> <li>▪ Sets up MyMathLab each semester (spring, summer and fall) for instructors</li> <li>▪ Conducts training for both full-time and adjunct instructors</li> <li>▪ Serves as a resource for individual instructors and assistants in the dedicated lab</li> <li>▪ Communicates as needed with individual instructors and lab assistants</li> <li>▪ Ensures upkeep of software and hardware in dedicated lab</li> <li>▪ Hires and manages lab assistants during spring, summer and fall semesters</li> <li>▪ Serves as the secondary source of communication among students using CAI</li> <li>▪ Reports to the Mathematics Department Head</li> <li>▪ Works with the course coordinators to maintain course objectives within the CAI system</li> <li>▪ Interviews, hires and develops schedules for Math<sup>3</sup> assistants</li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ Masters degree, two years of experience teaching mathematics at TTC</li> <li>▪ Computer, management and communication skills</li> <li>▪ Commitment to student success in mathematics</li> <li>▪ One year of experience in using MyMathLab</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ Five years of experience teaching mathematics</li> <li>▪ Knowledge and experience working with college students and familiarity with college and CAI resources</li> <li>▪ Skills in public relations and supervision</li> <li>▪ Management experience</li> </ul>

### The Learning Center Math Tutor (Full-time)

Responsibilities	<ul style="list-style-type: none"> <li>▪ Assists with The Learning Center Tutor training</li> <li>▪ Supervises The Learning Center Math Tutors</li> <li>▪ Provides math tutorial assistance and skills development to students either by appointment or on a walk-in basis</li> <li>▪ Assists students in developing the study skills that lead to independent learning</li> <li>▪ Encourages students to use supplementary resources such as computer instructional resources and directs students to and demonstrates use of appropriate media</li> <li>▪ Monitors accuracy of appointments, maintains visit records and schedules follow-up appointments using TutorTrac software</li> <li>▪ Invites students to complete voluntary evaluation forms</li> <li>▪ Is familiar with all components of The Learning Center and the services of offices in Student Services and understands the limits of the tutoring role</li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ Bachelor's degree with at least 18 credit hours of mathematics</li> <li>▪ As verified by transcripts, grade of A or B in all mathematics courses</li> <li>▪ Excellent customer service, computer and communication skills</li> <li>▪ Commitment to the continuous improvement and evaluation of successful tutoring strategies to increase student success</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ Bachelor's degree in mathematics or mathematics education</li> <li>▪ At least one college-level statistics course</li> <li>▪ Knowledge of and experience working within a college environment</li> <li>▪ Minimum three years of tutoring experience</li> </ul>

## Path2Math Success Key Positions

### The Learning Center Math Tutors (Part-time)

Responsibilities	<ul style="list-style-type: none"> <li>▪ Provides walk-in and appointment tutoring to students enrolled in math courses</li> <li>▪ Assists students in developing the study skills that lead to independent learning</li> <li>▪ Encourages students to use supplementary resources such as computer instructional resources and directs students to and demonstrates use of appropriate media</li> <li>▪ Uses the TutorTrac software to maintain visit records and schedule appointments</li> <li>▪ Invites students to complete voluntary evaluation forms</li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ 12 credit hours of college-level mathematics</li> <li>▪ Excellent customer service, computer and communication skills</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ 15 credit hours of college-level mathematics, including a statistics course</li> <li>▪ Knowledge of and experience working within a college environment</li> <li>▪ Tutoring experience</li> </ul>
Tutor Selection Criteria	<ul style="list-style-type: none"> <li>▪ Interview plus written approval of a content instructor or endorsement of a tutor</li> <li>▪ At least one of the following:                             <ul style="list-style-type: none"> <li>▪ Grade of A or B in the subject/content being tutored</li> <li>▪ Documented experience equivalent to an A or a B</li> </ul> </li> </ul>

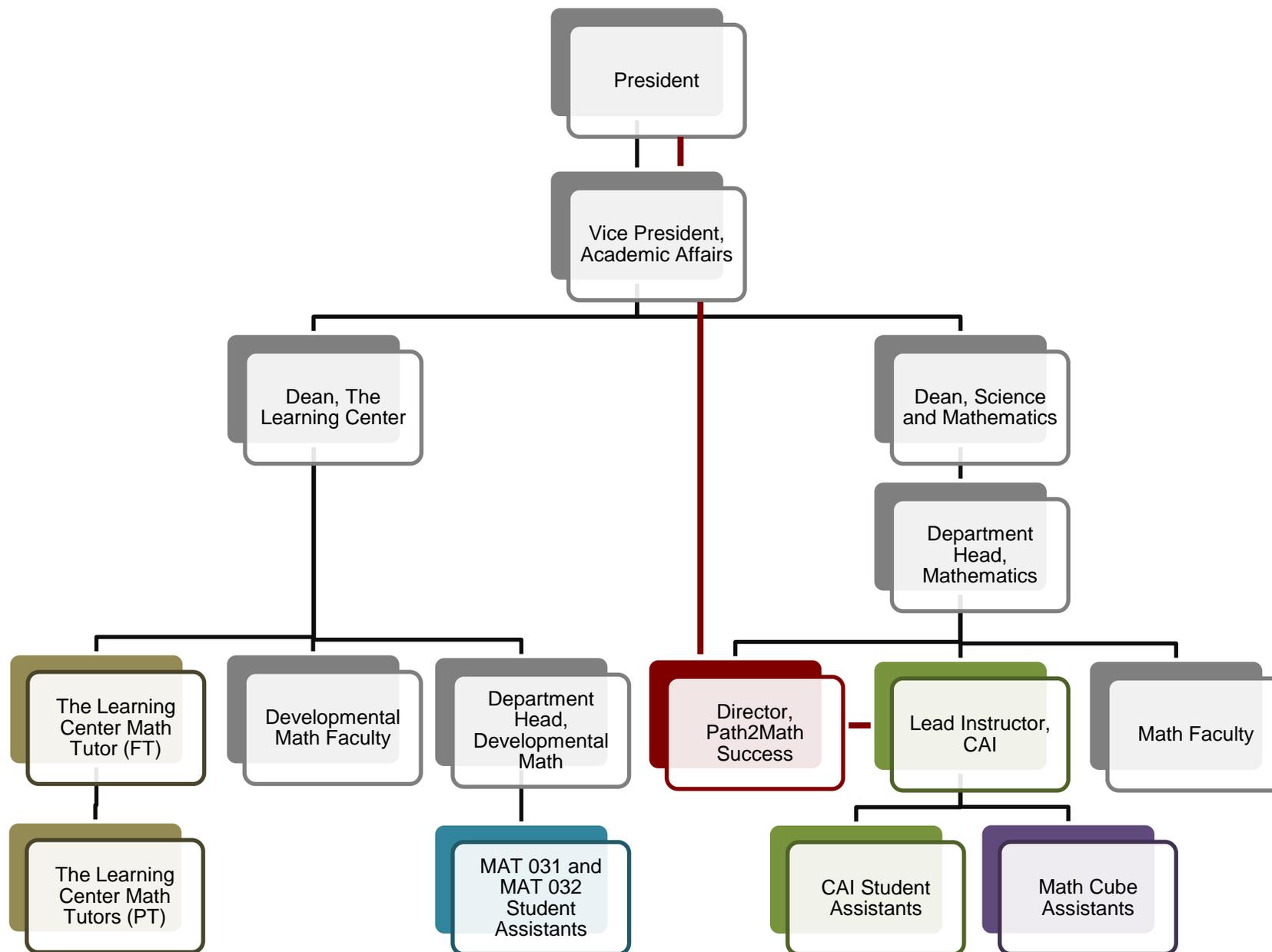
### MAT 031 and 032 Student Assistants

Responsibilities	<ul style="list-style-type: none"> <li>▪ Assists MAT 031/032 students in the computer labs during and between classes</li> <li>▪ Communicates with instructors concerning the procedures and practices of the sections he/she is assigned</li> <li>▪ Builds confidence in ability to do mathematics by encouraging the student</li> <li>▪ Circulates through the ongoing sections helping as he/she sees the need</li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ Six credit hours of college-level mathematics</li> <li>▪ Excellent customer service, computer and communication skills</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ Knowledge of and experience working within a college environment</li> <li>▪ Tutoring experience</li> </ul>
Tutor Selection Criteria	<ul style="list-style-type: none"> <li>▪ Interview plus written approval of a content instructor or endorsement of a tutor</li> <li>▪ At least one of the following:                             <ul style="list-style-type: none"> <li>▪ Grade of A or B in the subject/content being tutored</li> <li>▪ Documented experience equivalent to an A or a B</li> </ul> </li> </ul>

### Math<sup>3</sup> Assistants

Functions	<ul style="list-style-type: none"> <li>▪ Assists students in the Math<sup>3</sup> with mathematics questions</li> <li>▪ Directs students to The Learning Center for formal tutoring sessions</li> <li>▪ Maintains a studious atmosphere in the Math<sup>3</sup></li> </ul>
Minimum Qualifications	<ul style="list-style-type: none"> <li>▪ Current or previous math instructor at TTC</li> <li>▪ Demonstrated enthusiasm for mathematics</li> <li>▪ Excellent customer service skills</li> <li>▪ Management and communication skills</li> <li>▪ Commitment to the continuous improvement and evaluation of successful teaching strategies to increase student success</li> </ul>
Preferred Qualifications	<ul style="list-style-type: none"> <li>▪ College mathematics courses including Calculus and Probability and Statistics</li> <li>▪ Knowledge and experience working with students and familiarity with the college</li> <li>▪ Tutoring experience</li> </ul>

### Path2Math Success Organizational Chart



## Path2Math Success Resources and Budget

TTC has both the financial resources and the administrative capacity to implement, assess and institutionalize the **Path2Math Success** initiative.

TTC's recent financial history demonstrates the stability necessary to support the mission of the college and the scope of its programs and services. The college's strong financial position is the result of sound planning and budgeting processes, diverse revenue sources, careful and conservative expenditure of funds, highly qualified and experienced team members, and a culture of continuous improvement. The college has a strong history of providing financial and administrative support for major self-funded initiatives, such as Achieving the Dream, another initiative aimed at improving student success.

TTC recognizes that improved student success in math courses will result in higher student retention. Because of the large enrollments in the targeted math courses, even small gains in student success have the potential to produce strong results. Institutional Research has projected the potential tuition revenues of increased student success and subsequent retention; even a modest increase of 2% per year in pilot sections during the first three years of the project would result in an additional \$240,000 in tuition revenue. Although the college is aware of this potential return on investment for **Path2Math Success**, it will not rely on these increases to fund the project.

TTC has developed a comprehensive budget for the **Path2Math Success** initiative that allocates adequate resources for the personnel, supplies, permanent improvements, equipment, contractual services and travel expenses of the project. The President, the Vice President for Finance and Administration and the Vice President for Academic Affairs have reviewed and approved this budget, which is displayed on page 53.

TTC has in place the administrative structure to support this project. The Path2Math Success Implementation Team (Appendix B) includes in its membership those individuals who hold responsibility for implementation of the project's initiatives, which are clearly defined in the project workplan. In addition to members of this team, the project is supported by staff in Financial Services, Procurement and Risk Management, Physical Facilities and Institutional Research. In August, the Director of Institutional Research and Assessment convened a project start-up meeting to discuss administrative roles and responsibilities associated with **Path2Math Success**. This meeting was attended by the Path2Math Success Director, the Assistant Director of Finance, the Director of Procurement and Risk Management, and the Director of Physical Facilities.

### Path2Math Success Budget

	2009-2010 (Plan Yr)	2010-2011 (Year 1)	2011-2012 (Year 2)	2012-2013 (Year 3)	2013-2014 (Year 4)	2014-2015 (Year 5)	Total Years 1 - 5
<b>Personnel</b>							
QEP Development Team Member Release Time	\$25,500						\$0
QEP Director Salary and Benefits Offset (40%)		\$34,775	\$34,775	\$34,775	\$34,775	\$34,775	\$173,875
CAI Lead Instructor Salary and Benefits Offset (40%)		\$25,619	\$25,619	\$25,619	\$25,619	\$25,619	\$128,095
Full-time Math Tutor Salary and Benefits (100%)			\$48,640	\$48,640	\$48,640	\$48,640	\$194,560
Tutor Training Development Release Time		\$1,500	\$1,500	\$1,500			\$4,500
Instructional Assistants - MAT 032 (\$9/hr)	\$12,000	\$12,000	\$15,000	\$15,000	\$15,000	\$15,000	\$72,000
Instructional Assistants - MAT 031 (\$9/hr)			\$12,000	\$12,000	\$12,000	\$12,000	\$48,000
Math Tutors (\$12/hr)		\$19,200	\$19,200	\$38,400	\$57,600	\$57,600	\$192,000
Faculty Tutors - Math <sup>3</sup> (20 hr/wk @ \$15/hr)			\$12,000	\$12,000	\$12,000	\$12,000	\$48,000
Faculty Release for Faculty Development		\$1,500	\$3,000	\$3,000	\$3,000	\$3,000	\$13,500
Student Assistants - CAI lab (20 hrs/wk @ \$8.00/hr)			\$6,400	\$6,400	\$6,400	\$6,400	\$25,600
<b>Supplies and Materials</b>							
Tutor training materials		\$500	\$500	\$500	\$500	\$500	\$2,500
Promotional materials		\$4,000					\$4,000
Office supplies, misc.		\$500	\$500	\$500	\$500	\$500	\$2,500
<b>Permanent Improvements</b>							
Furnishings - Main Campus Math <sup>3</sup>	\$14,000						\$0
Renovations - Main Campus Math <sup>3</sup>	\$4,000						\$0
Furnishings - Palmer Campus Math <sup>3</sup>		\$12,000					\$12,000
Renovations - Palmer Campus Math <sup>3</sup>		\$4,000					\$4,000
Furnishings - Berkeley Campus Math <sup>3</sup>			\$7,000				\$7,000
Renovations - Berkeley Campus Math <sup>3</sup>			\$4,000				\$4,000
Renovations - CAI lab		\$6,000					\$6,000
<b>Equipment</b>							
Computers and peripherals - New DS Lab		\$43,200					\$43,200
Computers and peripherals - CAI Lab		\$43,200					\$43,200
<b>Contractual Expenses</b>							
NCCBP	\$1,250	\$1,250	\$1,250	\$1,250	\$1,250	\$1,250	\$6,250
AMATYC Traveling Workshops		\$1,800	\$1,800	\$1,800	\$1,800	\$1,800	\$9,000
ITPC Certification				\$250	\$250	\$250	\$750
<b>Travel</b>							
QEP Development Team (Conferences and Site Visits)	\$1,451						\$0
Faculty travel for Faculty Development		\$4,000	\$4,000	\$4,000	\$4,000	\$4,000	\$20,000
<b>Total</b>	<b>\$58,201</b>	<b>\$215,044</b>	<b>\$197,184</b>	<b>\$205,634</b>	<b>\$223,334</b>	<b>\$223,334</b>	<b>\$1,064,530</b>

## Path2Math Success Assessment Plan

The Path2Math Success Assessment Team (Appendix C), co-chaired by the project director and the Director of Institutional Research and Assessment, has developed a comprehensive assessment plan for **Path2Math Success**. The team understands the importance of reviewing formative and summative data in the assessment of large-scale initiatives and has included both of these in the Path2Math Success Assessment Plan (pages 55 - 62).

The assessment team will convene at appropriate intervals to review and analyze assessment data for the strategies as it comes available throughout the project period. The team recognizes that new ideas and initiatives frequently need time to produce meaningful results. Therefore, the plan specifies a review of a minimum of two cycles of data before the team determines whether the strategies are on track or need adjustment.

The assessment plan includes detailed descriptions of the evaluations for five of the six project strategies. For each assessment method, the plan provides a data definition, the data collection frequency, the baseline performance and a timeline for two rounds of data collection. In order to effectively evaluate the sixth strategy, Enhance Faculty Development, Institutional Research staff will work with individual faculty members to design assessments and determine timelines for data collection for the faculty development projects. The Application for Path2Math Success Faculty Development (Appendix H) makes clear to faculty the expectation that they will both assess the activity and share results with their colleagues.

TTC has the human and technical resources necessary to provide performance data and analysis for project assessment. The college has an Institutional Research (IR) department staffed by a director and four research analysts. The IR staff has extensive experience in the evaluation of major student success and learning projects including the Achieving the Dream initiative and the college's Title III projects. Research analysts are skilled in developing data queries and conducting statistical analyses.

Annually, the Path2Math Success Director will prepare a progress report. This report will include not only the assessment results but also financial and personnel updates. The Path2Math Success Director will submit this report to the Vice President for Academic Affairs who will, in turn, share it with the President's Cabinet. These annual reports will be an important tool in the preparation of the college's QEP Impact Report as part of its fifth-year review.

**Path2Math Success Assessment Plan  
QEP Initiative 1 – Student Preparation  
Strategy 1 – Adjust Placement in Math Courses**

Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy increased student success in MAT 101?	F	D	Course Success Rate	Fall terms	Fall 2009 Success Rate = 33.8%	Fall 2011	Fall 2012
To what extent has the strategy increased measures of student progress for MAT 101 students?	F	I	Retention Rates for MAT 101 students (Percentage of Fall MAT 101 students who enroll in the subsequent Spring term)	Spring terms	Spring 2010 Fall to Spring Retention Rate = 71.8%	Spring 2012	Spring 2013
	F	I	Progression Rates for students who successfully complete MAT 101 (Percentage of successful Fall MAT 101 students who enroll in a math course in the subsequent Spring term)	Spring terms	Spring 2010 Successful Completer Progression Rate = 68.7%	Spring 2012	Spring 2013
	F	I	Persistence Rates for students who do not successfully complete MAT 101 (Percentage of unsuccessful Fall MAT 101 students who re-enroll in MAT 101)	Spring terms	Spring 2010 Unsuccessful Student Persistence Rate = 29.3%	Spring 2012	Spring 2013
To what extent has the strategy increased student success in the next level math course?	S	D	Course Success Rate in MAT 102 for students who successfully complete MAT 101	Spring terms	Spring 2010 MAT 102 Success Rate for Fall 2009 MAT 101 Students = 34.1%	Spring 2012	Spring 2013
	S	D	Course Success Rate in MAT 120 for students who successfully complete MAT 101	Spring terms	Spring 2010 MAT 120 Success Rate for Fall 2009 MAT 101 Students = 59.2%	Spring 2012	Spring 2013

Path2Math Success Assessment Plan QEP Initiative 1 – Student Preparation Strategy 2 – Implement a New Developmental Math Course							
Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy improved student learning in developmental math?	F	D	Percentage of students demonstrating competency on key student learning outcomes for MAT 031	Fall and Spring terms	Spring 2010 MAT 032 Competency Assessments: Competency 1 = 74.8% Competency 2 = 55.6% Competency 3 = 88.0% Competency 4 = 86.4% Competency 5 = 77.7% Competency 6 = 86.6% Competency 7 = 40.1%	Fall 2011	Spring 2012
	F	D	Percentage of students demonstrating competency on key student learning outcomes for MAT 032	Fall and Spring terms	Spring 2010 MAT 032 Competency Assessments: Competency 1 = 38.0% Competency 2 = 79.5% Competency 3 = 88.6% Competency 4 = n/a Competency 5 = 81.0% Competency 6 = n/a	Fall 2011	Spring 2012
To what extent has the strategy increased student success in MAT 032?	F	D	MAT 032 Course Success Rate	Fall terms	Fall 2009 Success Rate = 39.7%	Fall 2011	Fall 2012

**Path2Math Success Assessment Plan  
QEP Initiative 1 – Student Preparation  
Strategy 2 – Implement a New Developmental Math Course**

Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy increased measures of student progress for MAT 032 and MAT 031 students?	F	D	Retention Rates for MAT 031 students (Percentage of Fall MAT 031 students who enroll in the subsequent term)	Spring terms	Spring 2010 Fall to Spring Retention Rate of MAT 032 students = 72.0%	Spring 2012	Spring 2013
	F	D	Retention Rates for MAT 032 students (Percentage of Fall MAT 032 students who enroll in the subsequent term)	Spring terms		Spring 2012	Spring 2013
	F	D	Progression Rates for students who successfully complete MAT 031 (Percentage of successful Fall MAT 031 students who enroll in MAT 032 in the subsequent term)	Spring terms	Spring 2010 Successful Completer Progression Rate of MAT 032 students = 71.0%	Spring 2012	Spring 2013
	F	D	Progression Rates for students who successfully complete MAT 032 (Percentage of successful Fall MAT 032 students who enroll in a math course in the subsequent term)	Spring terms		Spring 2012	Spring 2013
	F	D	Persistence Rates for MAT 031 (Percentage of unsuccessful Fall MAT 031 students who re-enroll in MAT 031)	Spring terms	Spring 2010 Unsuccessful Student Persistence Rate for MAT 032 students = 39.1%	Spring 2012	Spring 2013
	F	D	Persistence Rates for MAT 032 (Percentage of unsuccessful Fall MAT 032 students who re-enroll in MAT 032)	Spring terms		Spring 2012	Spring 2013

Path2Math Success Assessment Plan QEP Initiative 1 – Student Preparation Strategy 2 – Implement a New Developmental Math Course							
Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy increased student success in the next level math course?	F	D	MAT 032 Course Success Rate for students progressing from MAT 031	Spring terms	N/A	Spring 2012	Spring 2013
	S	D	Course Success Rate in MAT 101 for students who successfully complete MAT 032	Spring terms	Spring 2010 MAT 101 Success Rate for Fall 2009 MAT 032 Students = 21.9%	Spring 2012	Spring 2013
	S	D	Course Success Rate in MAT 155 for students who successfully complete MAT 032	Spring terms	Spring 2010 MAT 155 Success Rate for Fall 2009 MAT 032 Students = 54.3%	Spring 2012	Spring 2013

**Path2Math Success Assessment Plan**  
**QEP Initiative 2 – Improved Math Instruction**  
**Strategy 3 – Adopt Computer-Assisted Instruction (CAI)**

Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy improved student learning in MAT 101?	F	D	Percentage of students demonstrating competency on MAT 101 key student learning outcomes on the final exam	Fall and Spring terms	Spring 2010 MAT 101 Competency Assessments: Competency 1 = 62.5% Competency 2 = 39.4% Competency 3 = 26.0% Competency 4 = 50.4% Competency 5 = 30.8% Competency 6 = 52.8%	Fall 2010 (1st Pilot Group)	Spring 2011 (2nd Pilot Group)
To what extent has the strategy improved student learning in MAT 102?	F	D	Percentage of students demonstrating competency on MAT 102 key student learning outcomes on the final exam	Fall and Spring terms	Spring 2010 MAT 102 Competency Assessments: Competency 1 = 62.1% Competency 2 = 70.8% Competency 3 = 44.6% Competency 4 = 50.4% Competency 5 = 65.0% Competency 6 = 53.8%	Spring 2011 (1st Pilot Group)	Fall 2011 (2nd Pilot Group)
To what extent has the strategy improved student learning in MAT 110?	F	D	Percentage of students demonstrating competency on MAT 110 key student learning outcomes on the final exam	Fall and Spring terms	Spring 2010 MAT 110 Competency Assessments: Competency 1 = 69.6% Competency 2 = 20.4% Competency 3 = 60.0% Competency 4 = 56.3% Competency 5 = 31.1% Competency 6 = 82.2% Competency 7 = 41.1%	Fall 2011 (1st Pilot Group)	Spring 2012 (2nd Pilot Group)

**Path2Math Success Assessment Plan**  
**QEP Initiative 2 – Improved Math Instruction**  
**Strategy 3 – Adopt Computer-Assisted Instruction (CAI)**

Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
To what extent has the strategy increased student success in the courses?	S	D	MAT 101 Course Success Rate	Fall terms	Fall 2009 Success Rate = 33.8%	Fall 2010 (1st Pilot Group)	Spring 2011 (2nd Pilot Group)
	S	D	MAT 102 Course Success Rate	Fall terms	Fall 2009 Success Rate = 36.1%	Spring 2011 (1st Pilot Group)	Fall 2011 (2nd Pilot Group)
	S	D	MAT 110 Course Success Rate	Fall terms	Fall 2009 Success Rate = 40.7%	Fall 2011 (1st Pilot Group)	Spring 2012 (2nd Pilot Group)
To what extent has the strategy increased student success in the next level math course?	F	D	Course Success Rate in MAT 102 for students who successfully complete MAT 101	Spring terms	Spring 2010 MAT 102 Success Rate for Fall 2009 MAT 101 Students = 40.6%	Spring 2011 (1st Pilot Group)	Fall 2011 (2nd Pilot Group)
	F	D	Course Success Rate in MAT 110 for students who successfully complete MAT 102	Spring terms	Spring 2010 MAT 110 Success Rate for Fall 2009 MAT 102 Students = 50.3%	Fall 2011 (1st Pilot Group)	Spring 2012 (2nd Pilot Group)
	F	D	Course Success Rate in MAT 111 for students who successfully complete MAT 110	Spring terms	Spring 2010 MAT 111 Success Rate for Fall 2009 MAT 110 Students = 45.5%	Spring 2012 (1st Pilot Group)	Fall 2012 (2nd Pilot Group)

**Path2Math Success Assessment Plan  
QEP Initiative 3 – Student Support  
Strategy 5 – Expand Tutoring Services**

Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
Has providing expanded tutoring services resulted in an increase in the number of students being tutored?	F	D	Number of unique students recorded in TutorTrac during the term	Fall terms	Fall 2009 Unique Tutored Students = 338	Fall 2010	Fall 2011
	F	I	Number of student visits recorded in TutorTrac during the term	Fall terms	Fall 2009 Number of tutoring sessions = 1999	Fall 2010	Fall 2011
Do students indicate an increased level of use of the college's tutoring services?	S	I	Percentage of student survey respondents answering "Always" or "Sometimes" to "I use the college's on-campus tutoring services when I have problems with math assignments."	Spring terms	Spring 2010 Math Student Survey = 34%	Spring 2011	Spring 2012
Have tutored students continued to show a higher level of performance than non-tutored students?	F	D	Course success rates in math courses for tutored students compared to the general population	Fall terms	Fall 2006 Tutored Student Success Rate = 62% General Population Success Rate = 48%	Fall 2010	Fall 2011
Do students express an improved confidence in their ability to do math?	F	I	Percentage of student survey respondents answering "Agree" or "Strongly Agree" to "I feel confident in my ability to do well in math classes."	Spring terms	Spring 2010 Math Student Survey = 81%	Spring 2011	Spring 2012

Path2Math Success Assessment Plan QEP Initiative 3 – Student Support Strategy 6 – Create Designated Student Study Spaces							
Assessment Questions	Type of Assessment		Assessment Methods	Frequency	Base Line Performance	First Assessment Results	Second Assessment Results
	Form / Sum	Direct / Indirect					
Are the new designated student study spaces popular with students?	F	I	Number of students using the study space during the term	Fall terms	N/A	Fall 2010	Fall 2011
Do students express an improved confidence in their ability to do math?	S	I	Percentage of student survey respondents answering "Agree" or "Strongly Agree" to "I feel confident in my ability to do well in math classes."	Spring terms	Spring 2010 Math Student Survey = 81%	Spring 2011	Spring 2012
Do students indicate they are more likely to study in groups outside of class?	S	I	Percentage of student survey respondents answering "Always" or "Sometimes" to "I study math with other students outside of class."	Spring terms	Spring 2010 Math Student Survey = 31%	Spring 2011	Spring 2012

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Henry Ford Community College (MI). *Developmental Math.*

National Park Community College (AR). *Evening Tutoring.*

Patrick Henry Community College (VA). *Math Lab.*

Patrick Henry Community College (VA). *Update 1 - Math Lab.*

Paul D. Camp Community College (VA). *Tutoring.*

Seattle Central Community College (WA). *Developmental Math Study Sessions.*

Sinclair Community College (OH). *Math 191 Series Standardization.*

South Texas College (TX). *Student Success Centers – Update Fall 2006.*

Technical College of the Lowcountry (SC). *Walk-in Mathematics Lab for Students.*

Wayne Community College (NC). *MyMathLab.*

Wharton County Junior College (TX). *Open Computer-Enhanced Learning Assistance Centers on Main Campuses.*

## Appendix A: QEP Development Team Membership

Laurie Boeding	Department Head, Network Systems Management
Brandon Branham	Director, Orientation Services
Linda Collie	Chair, QEP Development Team Coordinator, Mathematics
Darren Felty	Department Head, English and Journalism Co-Chair, Achieving the Dream
David Flenner	Instructor, Mathematics Co-Chair, Achieving the Dream
Krista Gentry	Coordinator, Radiologic Technology
James Green	Research Analyst, Institutional Research
David Harris	Instructor, Mathematics
Robbie Johnson	Coordinator, Mechanical Engineering Technology
Sharon Kearns	Director, Testing Services
Ann Long	Department Head, Developmental Mathematics
David Mellor	Instructor, Mathematics
Pamela Middleton	Director, Counseling and Career Development Services
Beth White	Department Head, Mathematics
Team Resources:	
Cathy Almquist	Director, Institutional Research and Assessment
Pam Leonard-Ray	Dean, The Learning Center
Pat Robertson	Vice President, Academic Affairs
Louester Robinson	Dean, Palmer Campus
Bob Walker	Dean, Berkeley Campus

## Appendix B: Path2Math Success Implementation Team Membership

Linda Collie	Director, Path2Math Success Coordinator, Mathematics
Pamela Droste	Registrar
Eric Hamilton	Director, Physical Facilities
David Harris	CAI Lead Instructor, Mathematics
Sharon Kearns	Director, Testing Services
Pamela Leonard-Ray	Dean, The Learning Center
Ann Long	Department Head, Developmental Mathematics
M.G. Mitchum	Director, Information Technology
Louester Robinson	Dean, Palmer Campus
Eddie Simmons	Assistant Vice President, Instruction
Robert Walker	Dean, Berkeley Campus
Beth White	Department Head, Mathematics
TBA	Math Tutor, The Learning Center

## Appendix C: Path2Math Success Assessment Team Membership

Cathy Almquist	Director, Institutional Research and Assessment
Linda Collie	Director, Path2Math Success Coordinator, Mathematics
Darren Felty	Department Head, English and Journalism Co-Chair, Achieving the Dream
James Green	Research Analyst, Institutional Research
David Harris	CAI Lead Instructor, Mathematics
Sharon Kearns	Director, Testing Services
Pamela Leonard-Ray	Dean, The Learning Center
Ann Long	Department Head, Developmental Mathematics
Robert Walker	Dean, Berkeley Campus
Beth White	Department Head, Mathematics
TBA	CAI Instructor, Mathematics
TBA	Adjunct Instructor, Mathematics
TBA	Instructor, Developmental Studies Mathematics

## Appendix D: Achieving the Dream Data Team Membership

Cathy Almquist	Director, Institutional Research and Assessment
Suzy Barr	Associate Vice President, Planning and Accreditation
Tom Brady	Instructor, Information Systems
Darren Felty	Instructor, English and Journalism
David Flenner	Instructor, Mathematics
Joe Gibson	Director, Information Technology Training Center
Barbara Gordon	Instructor, The Learning Center
Ellen Green	Director, Financial Aid
Alva Hamilton	Director, Student Support Services, TRIO Programs
David Hansen	Director, Public Information
Pamela Middleton	Director, Counseling and Disability Services
Susan Norton	Assistant Vice President, Academic Programs
Lester Pittman	Department Head, History, Humanities, and Political Science
Eddie Simmons	Assistant Vice President, Instruction
Kim Sturgeon	Assistant Vice President, Advancement
John Ungaro	Dean, Law-Related Studies

## Appendix E: Achieving the Dream Core Team Membership

Cathy Almquist	Director, Institutional Research and Assessment
Elise Davis-McFarland	Vice President, Student Services
Darren Felty	Instructor, English and Journalism
David Flenner	Instructor, Mathematics
David Hansen	Director, Public Information
Daphne Holland	Assistant Registrar, Student Services
Vikki Lane	Assistant Director, Berkeley Campus
Pamela Leonard-Ray	Dean, The Learning Center
Pamela Middleton	Director, Counseling and Disability Services
Susan Norton	Assistant Vice President, Academic Programs
Pat Robertson	Vice President, Academic Affairs
Louester Robinson	Dean, Palmer Campus
Kim Sturgeon	Assistant Vice President, Advancement
Mary Thornley	President

## Appendix F: Math Course Descriptions

### **MAT 031: Developmental Mathematics Basics (Draft)**

Developmental Mathematics Basics is intended for students who need assistance in basic arithmetic skills. Based on assessment of student needs, instruction includes performing the four arithmetic operations with whole numbers, fractions, decimals and percents. Application skills are emphasized.

### **MAT 032: Developmental Mathematics**

This course includes a review of arithmetic skills and focuses on the study of measurement and geometry, basic algebra concepts and data analysis. Application skills are emphasized.

### **MAT 101: Beginning Algebra**

This course includes the study of rational numbers and their applications, operations with algebraic expressions, linear equations and applications, linear inequalities, graphs of linear equations, operations with exponents and polynomials, and factoring.

### **MAT 102: Intermediate Algebra**

This course includes the study of linear systems and applications; quadratic expressions, equations, functions, and graphs; and rational and radical expressions and functions.

### **MAT 110: College Algebra**

This course includes the following topics: polynomial, rational, logarithmic, and exponential functions; inequalities; systems of equations and inequalities; matrices; determinants; and solutions of higher degree polynomials. Students who receive credit for MAT 110 may not receive credit for MAT 109 or MAT 112.

## Appendix G: Math Student Survey

Garnering information on students' attitudes toward math and the resources they use in order to succeed in their courses was another important research goal of the QEP Development Team. The team developed a survey of mathematics students that focused on these topics. On February 2, 2010, IR distributed the survey to 919 math students, 235 (26%) of whom responded. The following chart details the survey items and the students' responses:

Question		Strongly Agree	%	Agree	%	Disagree	%	Strongly Disagree	%
1.	I need a good understanding of mathematics to achieve my career goals.	149	63%	70	30%	14	6%	2	1%
2.	I feel confident in my ability to do well in math classes.	75	32%	116	49%	36	15%	8	3%
3.	I feel comfortable asking questions in math classes.	95	40%	96	41%	35	15%	9	4%
4.	I feel comfortable seeking assistance from my instructor outside of class when I am having problems in a math class.	97	41%	94	40%	32	14%	12	5%
5.	I believe that a computerized math application that provides homework assistance, immediate feedback, and tutoring, would help me to learn math.	123	52%	80	34%	23	10%	9	4%
Question		Always	%	Sometimes	%	Rarely	%	Never	%
6.	I complete the assigned homework for my math classes.	168	71%	62	26%	3	1%	2	1%
7.	I learn math well from lectures during class.	110	47%	94	40%	28	12%	3	1%
8.	I use the college's on-campus tutoring services when I have problems with math assignments.	36	15%	44	19%	67	29%	88	37%
9.	I study math with other students outside of class.	18	8%	54	23%	57	24%	106	45%

IR also disaggregated the responses by the math courses in which students were enrolled, from MAT 032 through MAT 110.

The survey yielded many informative responses and helped shape the QEP Development Team's math initiative proposals. The fact that 93% of respondents strongly agreed or agreed that they need to understand math to achieve their career goals supported the contention that students recognize the importance of their math classes, lending further credence to the college's focus on improving math courses, placement, and support systems. A smaller percentage (81%) expressed confidence in their ability to do well in math courses, and more students agreed rather than strongly agreed with this item. The overall percentage was still quite high, though, indicating that a majority of respondents feel confident in their ability to complete math courses.

Respondents also expressed a willingness to ask questions in class and seek help from instructors outside of class. The large majority of respondents (86%) who strongly agreed and agreed that a computerized math application would help them to learn math provided support for exploring this option in math courses. While 71% of respondents asserted that they always complete assigned homework for math classes and only 5% said they rarely or never complete homework assignments, a number of instructors indicated that these percentages did not correspond to their experiences in their classes. Most students also indicated that course lectures prove helpful to their understanding of the course material.

Of particular interest to the QEP Development Team were the responses to the students' use of tutoring services and the frequency with which they study with other students. In both of these categories, the largest percentages of students indicated they never take advantage of these resources (37% and 45%, respectively), and the second largest percentage of responses were in the category of rarely using these resources (29% and 24%). The college faculty and staff believe that such assistance can be of great value to students, and the low numbers of students who embrace these opportunities created additional incentive for the QEP Development Team to examine ways to enhance both the visibility and availability of these resources.

## APPLICATION FOR Path2Math Success FACULTY DEVELOPMENT



Name \_\_\_\_\_

Division/Department \_\_\_\_\_

What is the focus of your faculty development project? (a brief narrative description)

What activities will be involved in this faculty development project? [check all that apply]

- Independent research
- Travel (Provide location, title and dates)
  - Conference \_\_\_\_\_
  - Workshop \_\_\_\_\_
  - Site Visit \_\_\_\_\_
- Classroom pilot
- Other

Which of the **Path2Math Success** goals will your project address? [check all that apply]

- Increased Student Success (e.g. course success rates, student retention rates)
- Improved Student Learning (e.g. student performance on course objectives)
- Increased Student Engagement in and Comfort with the Study of Math

What indicators will be used to measure the success of this activity? (If your proposal is approved, please contact Institutional Research as soon as possible to coordinate the assessment of your activities.)

- Course success rate
- Student retention rate
- Student progression rate
- Student learning outcomes assessments (please specify learning outcome, use separate sheet if necessary)

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

- Math student survey (please specify questions, use separate sheet if necessary)

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

How will you present this information to the department?

How will you cover any missed classes?

Supervisor Approval \_\_\_\_\_ Date \_\_\_\_\_

## Appendix I: Achieving the Dream Presentations and Subcommittees

### **ATD Presentation and Discussion Events:**

- Leadership Cabinet (October 15, 2007)
- Faculty Council (October 19, 2007; April 18, 2008)
- Faculty Colloquia (October 23, 2007; May 1, 2008)
- Area Commission (November 27, 2007; September 23, 2008)
- Student Cabinet (January 29, 2008)
- Achieving the Dream Data Review and Input Sessions (February 25, 26, and 27, 2008)
- Professional Development Day (March 3, 2008; March 9, 2009)
- Deans and Department Heads (March 17, 2009)

### **ATD Subcommittees:**

- Advising and Orientation Practices
- Current Practices
- Developmental Studies Practices
- First-Year Student Experience
- Institutional Policies
- Instructional Strategies
- Mathematics
- Placement Policies
- Student Attendance
- Student Success Courses
- Student Support Services

# Adding up to success:

## TTC increasing math assistance opportunities for students

Have you struggled with math? Have you even avoided taking math classes? If so, you are certainly not alone. Of all the courses that make students nervous, math ranks right at the top. Some students even choose their program of study based on how much math is required. However, many in-demand technology careers require math skills, and students should not give up an opportunity at a great career because of uncertainty or fear of failure in math. TTC has developed a focused Quality Enhancement Plan (QEP) designed to increase student success in math courses. This plan, called Path2Math Success, will provide additional assistance to math students both in and out of the classroom.

“TTC has always offered academic help to students,” said Linda Collie, TTC math instructor and QEP chairperson. “However, we want to find new ways that we can help our students be successful. The Path2Math Success plan offers several options that students can utilize to enable greater understanding of math skills.”

Several of these options for help include computer-assisted math courses, tutoring and community gathering places for math students.

### Computer-assisted math courses

“Research has shown that many students understand math concepts better when they can use computers to reinforce what they’ve been taught in the classroom,” said Collie.

To provide these tools to students, TTC is offering five sections of computer-assisted MAT 101 this fall. This format offers several advantages, including increasing communication between the student and the instructor between class meetings. Students in these sections also receive immediate feedback on tests, quizzes and homework assignments, identifying any problems or misunderstandings early so they can take measures to grasp the material. One other benefit is getting online help with homework. “The instructor is not available 24 hours a day,” said Collie. “Having access to online help means that the student who is struggling can receive guidance and help from another resource.”

## **The Math<sup>3</sup>**

For students wanting a place to study math in a community setting, math lounges will soon be available on each campus. Called the Math<sup>3</sup> (Math Cube), these locations will provide math students of all levels with a place to discuss math assignments and hold group study sessions. The Math<sup>3</sup> will give students the opportunity to be part of a community of math students. These lounges will be open whenever the college is open, so students can gather outside of class, early in the morning, late into the evening and on weekends.

“We hope that students will utilize the Math<sup>3</sup> lounges to deepen their understanding of math concepts as they discuss with other students,” said Collie. “For students who need help outside of the classroom, dropping by the Math<sup>3</sup> would be a great opportunity to make connections with other math students.”

Look for more information in student e-mail specifying the locations and hours of the Math<sup>3</sup> on each campus.

## **Tutoring**

Students who need one-to-one time to master math skills can make an appointment with a tutor in The Learning Center.

“The Learning Center offers a great service to students,” said Pamela Leonard-Ray, dean of The Learning Center. “For many students, the individual time spent with a tutor is invaluable. The popularity of the tutors means that the waiting time can often be long, and a student usually has a specific deadline to meet for a test or assignment. We hope to increase our tutoring service to students.”

To make a tutoring appointment, students can call or visit The Learning Center reception desk. Each appointment lasts 30 minutes, and students may schedule up to two appointments each week for two weeks in advance.

Additionally, The Learning Center holds group math tutoring sessions throughout each semester. For a schedule of group sessions, students can drop by The Learning Center on Main Campus in Bldg. 920/Room 211 or on Palmer Campus in Room 226. Students needing help on Berkeley Campus can visit Room 141B.

On Main Campus, students can visit The Learning Center (Bldg. 920/Room 211C) for homework assistance any time a facilitator is on duty. Schedules are posted on the door and online at [www.tridenttech.edu/664.htm](http://www.tridenttech.edu/664.htm).

For more information about The Learning Center, call 843.574.6409.

Students who are fearful or anxious about taking math courses have many opportunities at TTC to get the help they need to be successful. With ongoing initiatives like Path2Math Success, students will have more and more options to absorb and master math skills, including taking computer-assisted courses, getting one-on-one tutoring and studying with other math students in a learning community. By achieving success in mathematics, students at TTC will be prepared for in-demand jobs, especially in technology fields that require understanding and mastery of math concepts.