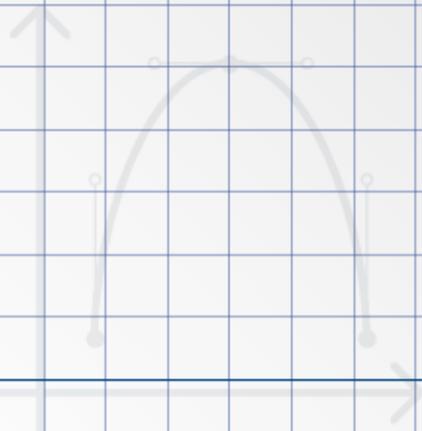
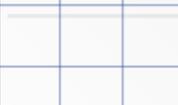


QEP TEAM

QUALITY ENHANCEMENT PLAN
TOWARD ENHANCED ACHIEVEMENT
IN MATHEMATICS



**NORTH CAROLINA
AGRICULTURAL AND TECHNICAL
STATE UNIVERSITY**



CONTACT INFORMATION

Harold L. Martin Sr., Ph.D.

Chancellor

336-334-7940

hmartin@ncat.edu

Beryl C. McEwen, Ph.D.

Provost and Executive Vice Chancellor for Academic Affairs

336-334-7595

mcewenb@ncat.edu

Regina Williams Davis, Ph.D.

SACSCOC Liaison

336-285-4086

rmwilli1@ncat.edu

Stephanie Kelly, Ph.D.

Interim QEP Director

336-285-4903

sekelly@ncat.edu

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LETTER FROM THE CHANCELLOR

Perhaps no topic in higher education today receives the volume of discussion, examination and focus that student success does. From campus to campus across the country, colleges and universities are preoccupied with ensuring that the talented students they admit and enroll are retained after their first year, persist throughout their lower- and upper-division work and graduate in a timely fashion, ready for success in the workplace.

At historically black colleges and universities, such as North Carolina Agricultural and Technical State University, that focus takes on heightened meaning, as we seek to overcome the challenges of inequity from which so many of our undergraduates emerge. Even though they come from increasingly impressive scholastic backgrounds and enter our institution with glowing academic profiles, how we academically engage and prepare them for success in the classroom and in the workplace can make the difference between failure and success.

These challenges have been front and center for North Carolina A&T in recent years. We have poured significant thought and energy into initiatives aimed at moving the needles upward in the key measures of retention and graduation rates. As we have done so, parsing the data, examining obstacles and learning from both setback and progress, we have zeroed in on mathematics as an area of particular challenge for our students needs in this area and the ingredients necessary from successful mathematics instruction and performance has been a challenge that has required input of our faculty and academic administrators, careful examination of research and best practices and careful assessment of our efforts.

From all of that has emerged the Quality Enhancement Plan (QEP) that follows this introductory message. Colleagues across our university have contributed significantly to this document, and I believe that the care and thought that each put forward is reflected fairly in this thoughtful plan. As North Carolina A&T continues to grow, with strategic aspirations to enroll 14,000 students by 2023, the opportunities for that work to affect the learning and education of an even greater number of individuals, looms large. That is where the value of this QEP squarely lies—in an enhanced education for the students of our future and a stronger university, better prepared to meet the educational needs of tomorrow through the careful examination of the challenges of today.

I thank our colleagues participating in the SACSCOC accreditation reaffirmation process in advance for the attention and focus they will give to these efforts and for the many ways, both expected and unforeseen that your work will benefit North Carolina A&T for many to come.

Harold L. Martin, Sr.
Chancellor

INTRODUCTION

Established in 1891, “North Carolina Agricultural and Technical State University advances knowledge through scholarly exchange and transforms society with exceptional teaching, learning, discovery and community engagement. An 1890 land-grant doctoral research institution with a distinction in STEM and commitment to excellence in all disciplines. North Carolina A&T creates innovative solutions that address the challenges and economic needs of North Carolina, the nation and the world.”¹

N.C. A&T is also committed to and has a culture of continuous improvement through assessment and evaluation. Assessment begins with the institution’s educational values and is tied to its educational mission, strategic plan and vision for the future.

Part of the SACSCOC² accreditation reaffirmation process requires institutions to provide a Quality Enhancement Plan, which focuses on improving specific learning outcomes and/or student successes.

As a STEM-focused institution, mathematics is a critical competency for all N.C. A&T students, in all academic disciplines. However, with approximately one-third of its students earning grades of D, F or W (withdrawal) in undergraduate general education mathematics, the university identified the need for improvement of and student success in the mathematics curriculum. This QEP: Toward Enhanced Achievement in Mathematics (QEP: TEAM) focuses on those needs, strategies to improve student and instructor performance, the commitment of resources and timelines for implementation and assessment.

¹ Mission Statement (approved by the UNC Board of Governors, (March 23, 2018)

² Southern Association of Colleges and Schools Commission on Colleges

EXECUTIVE SUMMARY

The purpose of the Quality Enhancement Plan for North Carolina Agricultural and Technical State University is to improve student success, specifically student performance in general education mathematics courses. This will be evidenced by improved student goal orientation toward mathematics; improved attendance in general education math courses, decreased DFW rates and improved four-year graduation rates.

To determine the focus of the QEP, members of the SACSCOC Steering Committee visited each college faculty meeting during the fall 2018 semester to learn about perceived areas of need for improvement in undergraduate education. General education mathematics emerged as the most critical area of focus for improving undergraduate education. This was validated with the university data, student focus groups and math faculty interviews. The Quality Enhancement Plan idea that emerged was titled QEP: TEAM (Toward Enhanced Achievement in Mathematics).

The process began with an analysis of institutional data to identify student variables that predict success in general education mathematics. No persuasive findings emerged from this exploration. A series of focus groups, held in each college, during the fall 2018, found that performance in mathematics was a major impediment to overall student success at the university. Next, the team reviewed the academic literature to provide the grounding for developing a survey of student experiences and performance influences in Mathematics courses. Students were assessed for influences on math success during the spring 2019 semester. The results showed that regardless of major, students' primary goal was to get through their math courses, not to truly learn the material, an issue the literature refers to as low goal orientation. Attendance was also found to be problematic in math courses.

QEP forums were held across the university to gain campus input from students and faculty to learn how to increase attendance and improve goal orientation in general education mathematics. A website was also created with a QEP overview and links through which both students and faculty could give input on the QEP development 24/7. With this community input, a student success QEP was framed.

QEP: TEAM has 12 strategies, which were developed to effect a cultural change on campus, leading to more students valuing learning mathematics for career and life success and therefore performing better in math courses and enhancing their likelihood of graduating in four years. The strategies fall into one of five categories: Faculty/Advisor Enhancement, Student Support, Curricula and Campus Education.

Six of the strategies will constitute one-time changes to the institution that will be implemented in Year 1. Four of the strategies will involve providing resources and training beginning in Year 1 and then recurring each semester or academic year. Three strategies, which involve policy changes and faculty development, will require more nuanced rollouts throughout the QEP cycle; initial steps of implementation will begin during Year 1.

This student success QEP will involve (a) attendance rates in general education mathematics courses, (b) goal orientation toward mathematics, (c) assessment of DFW rates (students earning D's or F's or withdrawing from a course) in general education mathematics, (d) four-year graduation rates. Assessments will be both formative and summative.

TOPIC IDENTIFICATION PROCESS

In the fall 2018 the university began a conversation about its Quality Enhancement Plan (QEP). Members of the SACSCOC Steering Committee visited N.C. A&T's eight colleges to ask faculty and students to brainstorm ways in which learning could be improved at N.C. A&T. The list of potential foci emerged during these listening sessions. The most common themes were mathematics and communication. Institutional data supported the mathematics concerns. It was clear that performance in mathematics was a major impediment to overall student success at the university.

Improving mathematics skills was one of the topics that emerged from the eight listening sessions held in each college. Institutional data showed that 33% of the students who enrolled in a general education mathematics course earned a D, an F or a W (they withdrew from the course). Appendix A provides an overview of these courses. This means that the university's DFW rate for general education mathematics was approximately 33%, making it the biggest bottleneck of all general education courses for students. This is particularly concerning when placed against the university's mission, which states:

North Carolina Agricultural and Technical State University advances knowledge through scholarly exchange and transforms society with exceptional teaching, learning, discovery and community engagement. An 1890 land-grant doctoral research institution with a distinction in STEM and commitment to excellence in all disciplines, North Carolina A&T creates innovative solutions that address the challenges and economic needs of North Carolina, the nation and the world.

As a STEM- (science, technology, engineering, and mathematics) focused institution, mathematics is a foundational competence for most of the majors offered on campus. Thus, the steering committee recognized that the university's commitment to distinction in STEM and excellence in all disciplines makes mathematics a critical competency for all N.C. A&T students. Thus, with 33% of its students failing or withdrawing from mathematics, the institution decided to focus its QEP on mathematics, with a goal of **decreasing the DFW rates in general education mathematics courses and decreasing overall delays in students' graduation rates due to repeating math courses.**

In the spring of 2019, QEP Co-Directors were appointed with a charge to consult relevant academic literature, institutional data and the university community to develop strategies for improving the DFW rates in general education mathematics courses.

The process for determining the QEP included:

1. Using Institutional Data to Refine the Topic

- a. MATH 101, 102, 103, and 104 DFW rates were analyzed to determine the relatedness to student retention. These four classes were chosen because they have the highest student enrollment among general education math courses, designed specifically for students who are either in non-STEM-focused majors or have low standardized test scores in math. The data indicated that approximately 12% of students failed MATH 102 or 104, the second courses in the math sequence. Most students who passed the first course also passed the second course regardless of instructor, course delivery, or student demographic. The students who failed MATH 101 and 103 did so with no

patterns in their major. Appendix A provides the breakdown of general education mathematics courses at N.C. A&T. Each course is part of a two-course sequence, e.g., 101 and 103; 102 and 104.

- b. Next, math prerequisite data were examined across the university. These data showed student performance in all courses that require a general education math course as a prerequisite compared to their performance in that prerequisite math course. The data showed a correlation of $r = .51$ between performance in the general education math prerequisite course and the requisite course. Approximately 25% (r^2) of the variance in students' grades in classes within their major that require math as a prerequisite is accounted for by their performance in that math prerequisite.
- c. Data on course-taking patterns were then reviewed. Reviewing the prerequisite data uncovered the fact that students often skipped semesters between course sequences. Reviewing the number of semesters between students enrolling in the first and second course of a general education math sequence (e.g., How many semesters after taking MATH 101 did students enroll in MATH 103—the next course in the sequence?). Unsurprisingly, the larger the gap between courses, the less likely students would pass the second course. Thus, not taking the first and second course in back-to-back semesters increased the probability of failing the second course regardless of major or course sequence.
- d. The final dataset provided insight on freshman performance in general education mathematics based on the orientation session they attended. N.C. A&T offers five freshmen orientation sessions across the summer. Data indicated that students who attend the last session, shortly before school starts, was the only orientation cohort with statistically significant higher DFW rates than those in the other cohorts. However, this was not surprising given that the last orientation cohort must build a schedule based on the course sections that are left, which often means a combination of early morning and late afternoon courses. These courses tend to have more attendance issues than the courses offered during more desirable times blocks.

2. Focus Group with Math Faculty Data

During the 2018–2019 academic year the Center for Academic Excellence gathered focus group data from the mathematics faculty. Math faculty were asked to share their observations of student learning, particularly areas in which students struggle. Three recurring themes emerged from these data:

- a. Students who attend their general education math courses regularly almost always pass the course on the first attempt.
- b. Students struggle to retain math skills between courses.
- c. To optimize the learning experience, the classroom environment needs to be comfortable.

Renovating spaces was determined to be outside the scope of the QEP, but the feedback resulted in recommendations to the Physical Plant. The first and second themes, however, provided directions to explore in determining the direction of the QEP.

The QEP Co-Directors compared class attendance records with grades in the classes to verify the belief that students who regularly attend classes usually pass and those who did not tended to fail the course. Data from MATH 101, 102, 103, 104 and 131 were analyzed. The results showed that, on average, students who fail these courses missed far more class meetings than students who passed. Attendance data indicated that students who failed MATH 101 (n=921; Figure 1 below) had an average of 19 unexcused absences each semester, 22 unexcused absences in MATH 102 (n=110), 15 unexcused absences in MATH 102 (n = 339), 10 unexcused absences in MATH 104 (n=166), and 15 unexcused absences in MATH 131 (n=284). The data covered 2011 to 2019.

Having considered these data, the QEP Co-Directors then turned to the academic literature to gain a better understanding of the findings. Literature was specifically sought that could help explain issues with attendance or information related to retention in mathematics courses.

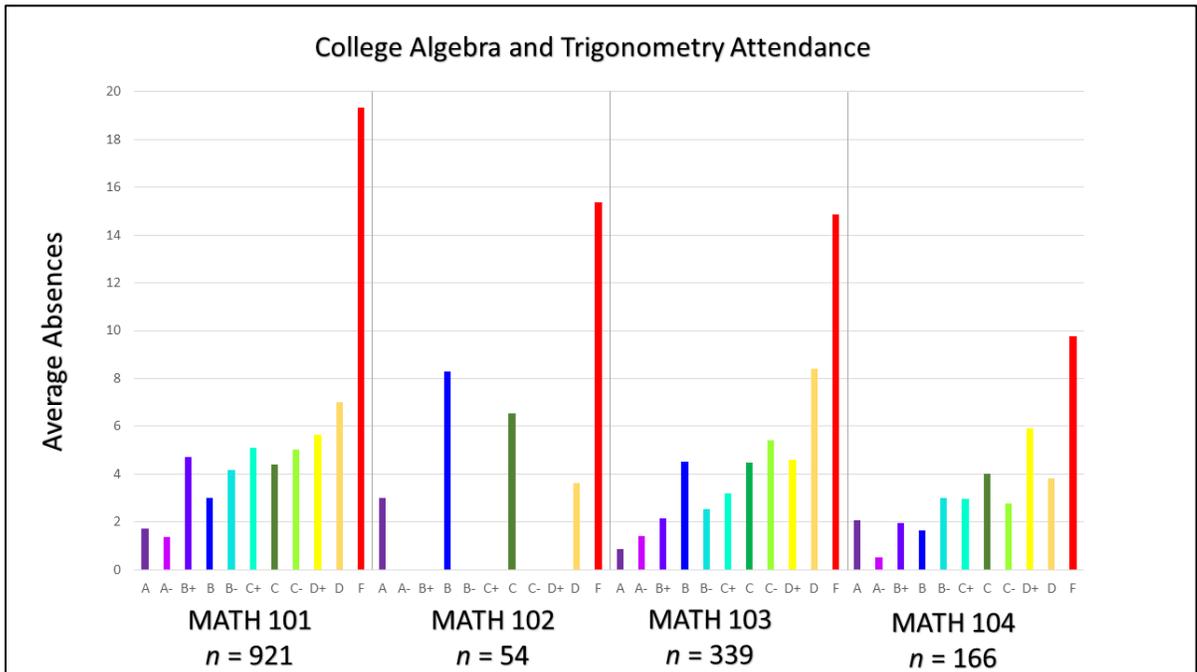


Figure 1: Absences and Grades Earned for MATH 101,102,103 and104

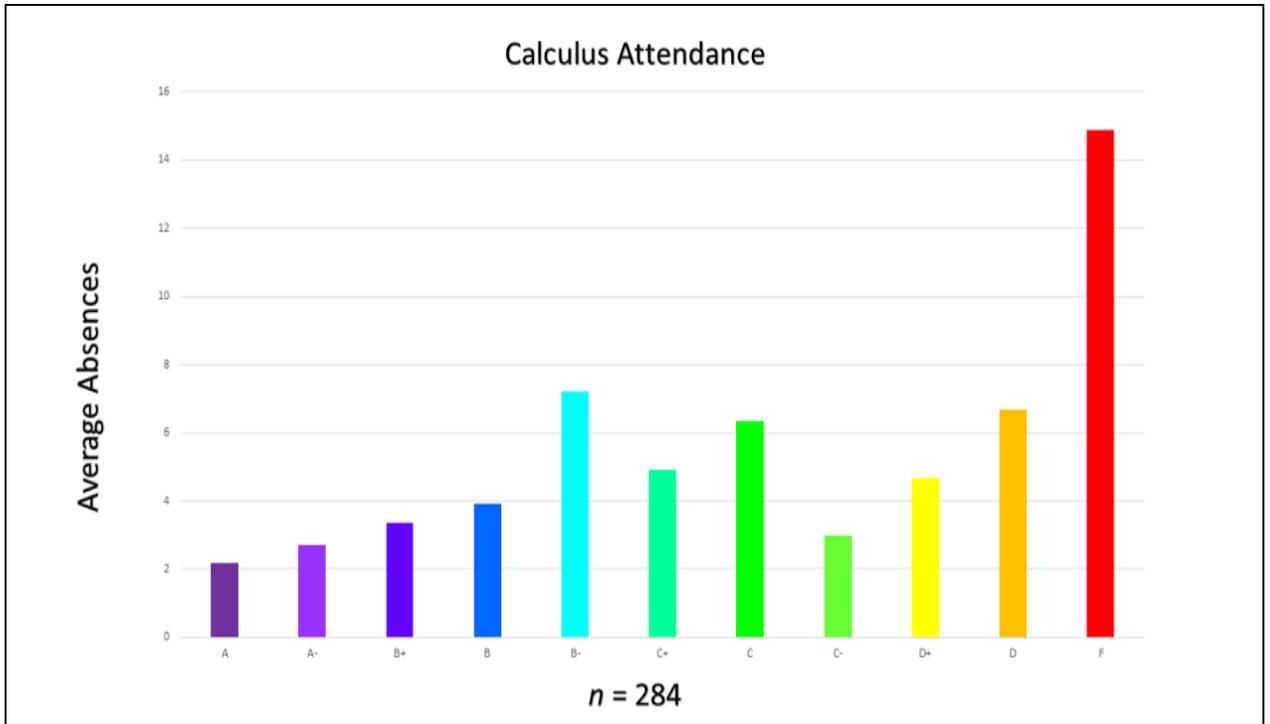


Figure 2: Absences and Grades Awarded for MATH 131—Calculus

Literature Review

The *Instructional Beliefs Model* (Weber, Martin, & Myers, 2011) explains that student learning is influenced by three typologies of variables: student characteristics, teacher behaviors, and classroom characteristics. Student characteristics include variables like motivations, knowledge, or skills. Teacher behaviors include the ways in which an educator communicates to students both while teaching and during more interpersonal interactions. Classroom characteristics involve those course attributes that are outlined on the syllabus such as grading procedures, class policies, or format of course delivery. Each of these variables has a direct influence on the mediating variable in the *Instructional Beliefs Model*: student beliefs. These are beliefs relevant to students' ability to be successful in the classroom such as their beliefs about their own ability to learn the material, whether the material is valuable to learn, or what they believe about their relationship with their instructor. It is then these learning beliefs that directly influence students' learning. The *Instructional Beliefs Model* assumes that learning can take place cognitively, affectively, and/or behaviorally (LaBelle, Martin, & Weber, 2013).

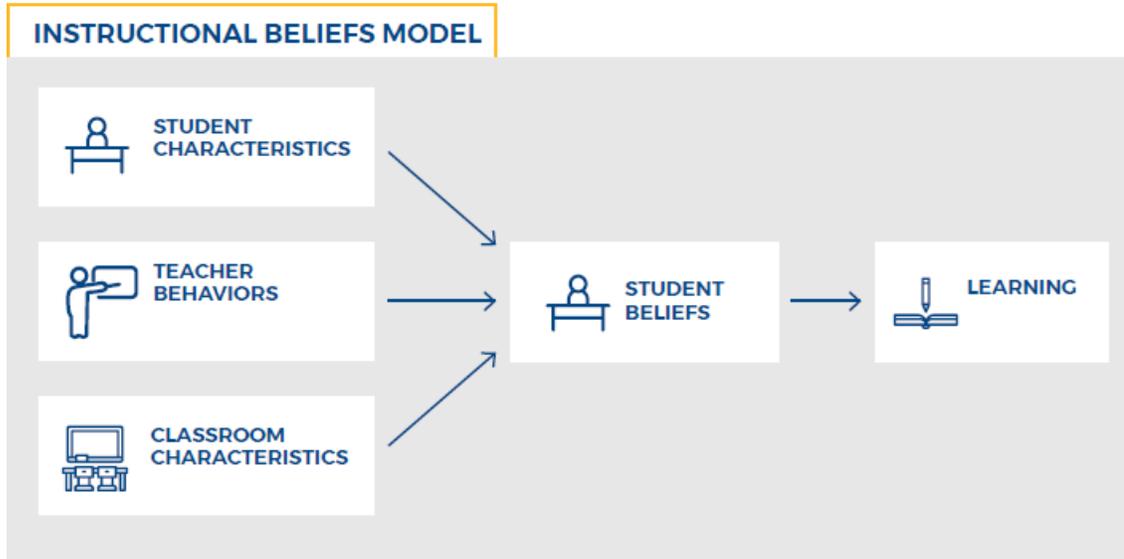


Figure 3: *Instructional Beliefs Model*

The *Instructional Beliefs Model* has been used to explain several recent studies in the math classroom, identifying both teacher behaviors and student characteristics that ultimately affect learning. Therefore, this literature would be used to construct a questionnaire to be disseminated to students enrolled in general education math courses to identify variables that could be negatively affecting their retention of material (i.e., cognitive learning) and attendance (i.e., behavioral learning).

Instructor Behaviors. Instructor behaviors can both enhance and detract from the student learning experience. Two of our professors, Kelly and Gaytan (2020) found that instructors' immediate behaviors help to free students' working memory so that they have better resources to concentrate on learning. Immediate behaviors (i.e., teacher behavior) are any instructional communicative behavior that reduces the psychological distance students believe exists between themselves and their instructor (Zhang & Whitt, 2016). This perceived psychological distance is *perceived immediacy* (i.e., student belief). Most research on instructor immediate behaviors has focused on the face-to-face classroom environment. From this literature, the following nonverbal behaviors have been recognized as immediate behaviors in the U.S. classroom (Zhang & Witt, 2016):

1. Making eye contact with students
2. Using vocal inflection when speaking
3. Addressing students by name
4. Having a relaxed posture
5. Smiling

In the online classroom, the same immediate behaviors can be adopted for synchronous learning using a videoconferencing technology. In text-based, asynchronous learning environments, using emoji in messages, addressing students by name, including casual conversation such as comments about events on campus, and signing one's name to class messages are also immediate behaviors (Kelly & Westerman, 2016; Vareberg & Westerman, 2020).

When STEM teachers use immediate behaviors, students tend to like the course material better (Mottet et al., 2008). Student engagement and instructors' use of immediate behaviors are positively correlated in the traditional (Mazer, 2013) and online classroom (Dixon et al., 2017). Student attendance is also positively related to instructors' use of immediate behaviors in the face-to-face classroom (Rocca, 2007).

Not all instructional communicative behaviors have a positive influence on students in the math classroom though. Instructors who are either antagonistic or deliver poor lectures (i.e., teacher behaviors) actually decrease the perceived immediacy that students have with them, worsening the learning experience (Kelly et al., 2020). Instructor antagonism involves aggressive behaviors such as belittling students, yelling, arguing with students in front of their peers, telling students they are definitely wrong for their opinions or logic, and criticizing students for their opinions or beliefs (Goodboy & Myers, 2015). Poor lecturing as an instructor misbehavior includes content delivery that is dry, too fast, boring, or confusing.

Students who perceive that their instructor is antagonistic will not ask questions to seek clarity on course material (Goodboy & Bolkan, 2010) or seek help in improving performance (Mansson et al., 2018). Students with antagonistic professors lose affect for the course, and as a result withdraw from it by not attending or not studying (Goodboy et al., 2018).

Student Characteristics. Students begin to cluster in groups based on motivation and achievement in math as early as middle school (Cleary & Chen, 2009). Motivation (i.e., a student characteristic) to learn math has been found to be the strongest predictor of mathematical learning (Mata et al., 2012). Motivation has a direct influence on whether students decide that they wish to learn math (León et al., 2015). Even when students are enrolled in a math course that they wish to pass, they may not be motivated to truly learn the math, but rather to just get through the class and put it behind them.

A student's decision to get through a class without necessarily learning the material is their *goal orientation* (Pintrich, 2000). Students whose goal orientation is set to master content in a mathematics course typically have high achievement in math, while those who do not wish to master the material typically do not (Keys et al., 2012). *Goal orientation* is not a simple matter of students who decide they want to master math trying harder and therefore doing better. Instead, if students do not have *goal orientation* to learn math, then their working memory will be consumed with making themselves concentrate on the material, leaving very little left over to learn and perform math tasks in the moment (Lee et al., 2014). Therefore, motivation to learn math dictates whether a student's *goal orientation* is to get through math either with or without learning the material.

There are many ways in which a student can be motivated (or not be motivated) in any subject. Pintrich et al. (1993) provides the following typology of motivations:

- **Intrinsic:** motivation to learn based on the desire to learn, for no external gain
- **Extrinsic:** motivation to learn for external reward such as praise from others
- **Control of Learning Beliefs:** motivation to learn because one believes they have the skills to master the material
- **Task Value:** motivation to learn based on perceived value of the material for success later in life
- **Self-Efficacy:** motivation to learn because learning is part of one's self-concept
- **Test Anxiety:** demotivation to learn because of the psychological angst that a student anticipates will be felt when eventually assessed for competency through examination

Each of these has been found to predict students' classroom performance (Garcia & Pintrich, 1996).

Classroom Characteristics. No literature was found to suggest that particular classroom characteristic (i.e., course design elements laid out in the syllabus) are influential in mathematics courses beyond to suggest that different learning styles work best with different delivery. The general education math courses are already offered with six modes of delivery (i.e., Hybrid, Flipped, Scale-Up, Emporium, Online, and Traditional Lecture), which provide options for students to select courses that best match their learning styles.

Student Survey

Following the literature review, a survey was constructed and disseminated to N.C. A&T students enrolled in general education mathematics courses during the spring 2019 semester. The instrument includes measures of motivation (intrinsic, extrinsic, control of learning beliefs, task value, self-efficacy, and test anxiety; Pintrich et al., 1993), instructor immediate behaviors (McCroskey et al., 1995), perceived immediacy (Kelly et al., 2015), instructor misbehaviors (antagonism and poor lecturing; Goodboy & Myers, 2015), and *goal orientation*. A suitable *goal orientation* measure could not be found in the literature, so one of the QEP Directors, who has a background in measurement development, constructed one. This measure demonstrated excellent fit, by the *Goodness of Fit Index* greater than .95, *Comparative Fit Index* greater than .95, *Root Mean Square Error Approximation* less than .06, and *Standard Root Mean Residual* less than .08, as recommended by Bryne (2016).

The measures were loaded into an online Qualtrics questionnaire. All students enrolled in a general education math course during the spring 2019 semester received an email from a QEP Co-Director asking them to complete the questionnaire. Academic advisors from the Center for Academic Excellence also announced the questionnaire's availability during freshman studies courses to encourage participation. In addition, 500 business cards were printed with both a URL and QR code that would direct students to the questionnaire (see Appendix B). The QEP Co-Directors handed these cards to students between classes in Marteena Hall, where the majority of math courses meet, as well as in the student union. The email invitation indicated that students who wished to be considered for a drawing for one of five \$10 campus bookstore gift cards would have an opportunity to leave their phone number in a separate questionnaire, that their browser would be redirected to following the survey. The Co-Directors orally explained the gift card drawing to students as they passed out the business cards. This recruitment resulted in $n = 396$ students fully completing the questionnaire.

Three notable findings emerged from the survey that spoke to the themes that emerged from the math faculty focus groups:

1. Student motivation for math was slightly above average across the board, but by far the highest motivation was extrinsic motivation: to learn for external reward such as praise from others. As such, students are most motivated to succeed in math based on the reaction others have to their success rather than because of a perceived need to learn the material.
2. Across majors, students had low *goal orientation*, where high *goal orientation* represents an intention to learn math and a low *goal orientation* represents intention to rush through the work and move on. As such, the data indicate that the majority of students are not setting out to learn math when enrolled in these courses.
3. The correlation between perceived immediacy (psychological distance based on instructor communication) and *goal orientation* was $r = -.02$ ($p > .05$). This means that there was no

relationship between students' psychological responses to teacher behaviors and students' goal orientation. In other words, no matter what teachers said or did, it neither increased nor decreased students' goal orientation.

The combination of these findings made it clear that to enhance success in general education mathematics at N.C. A&T, the solution must focus on a cultural change that would instill the value of mathematics in students of all majors.

Table 1. Descriptive Statistics of Measures

DESCRIPTIVE STATISTICS OF MEASURES					
	Range	Mean	SD	Skewness	Kurtosis
Intrinsic	1.00-7.00	4.93	1.17	-.44	.05
Extrinsic	2.00-7.00	5.82	1.08	-.69	-.33
Control of Learning Beliefs	1.00-7.00	5.08	1.29	-.47	-.11
Task Value	1.00-7.00	4.87	1.48	-.54	-.27
Self-Efficacy	1.00-7.00	5.07	1.32	-.56	-.02
Test Anxiety	1.00-7.00	4.53	1.49	.22	-.62
Goal Orientation	1.00-7.00	3.55	1.91	.29	-.101
Immediate Behaviors	1.67-7.00	5.01	1.05	-.35	-.09
Antagonism	1.00-7.00	2.06	1.44	1.51	1.75
Poor Lectures	1.00-7.00	2.96	1.70	.54	-.64
Perceived Immediacy	1.00-7.00	5.36	5.36	-.77	-.14

Topic Identification

On June 10, 2019, the QEP Co-Directors presented findings and conclusions from the QEP Development to the Chancellor's Cabinet. The QEP Co-Directors recommended that the campus community be engaged in soliciting input on how to effect a cultural change that would instill in students the value of learning general education mathematics content as well as the importance of attending classes regularly. The proposed direction received approval from the Cabinet.

Soon after the presentation to the Cabinet the QEP Co-Director model was changed. One of the Co-Directors assumed responsibility for a closely related initiative in collaboration with other UNC System institutions—the *Math Pathways* project. To ensure that the *Math Pathways* initiative, responsible for creating new general education math courses, did not bleed into the QEP, the QEP Co-Directors separated, with one becoming Director of the *Math Pathways* and the other continuing as the Director of the QEP.

BROAD-BASED SUPPORT

The QEP topic and the QEP Director were introduced to the university community on August 16, 2019, during the annual *Faculty and Staff Institute*, an event for faculty and staff on their first day back to campus each fall. Later that afternoon, the Provost visited each College-level faculty meeting, held by individual colleges to welcome faculty back, introduced the QEP Director and give her a chance to announce upcoming QEP Forums. It was also announced at these forums that a preview of the QEP was posted on the university website and that the page contained active links for faculty and students to give input into the QEP at any point throughout the semester (see Appendix C).

Between August and November 2019, a series of QEP Forums were held across campus to gain support from the entire campus regarding how best to implement the desired cultural change. Various units across campus hosted forums, including:

- The Department of Mathematics and Statistics
- Math Faculty in the Center for Academic Excellence
- Student Government Association
- The General Education Council
- College of Agriculture and Environmental Sciences
- The Graduate College
- College of Science and Technology
- College of Arts, Humanities, and Social Sciences
- College of Engineering
- College of Business and Economics
- Bluford Library
- College of Health and Human Sciences
- College of Education
- Faculty Senate

From the insights provided by the campus community, several pieces of information were discovered that informed the design of the QEP interventions. This feedback was used to strengthen the design of the QEP TEAM: Toward Enhanced Achievement in Mathematics.

IMPROVEMENTS TO STUDENT SUCCESS OUTCOMES

Given the DFW rate in general education mathematics, the findings of the survey, and input from the campus community, the outcomes of the QEP were determined to be as follows:

1. Improve student *goal orientation* toward mathematics by .25 points per year, beyond the baseline mean score of 3.55 on a 7-point scale.
2. Improve attendance in general education math courses, with target to be established in fall 2021 or the first semester post-COVID-19.
3. Improve performance in mathematics, which will be demonstrated by decreasing DFWs in general education mathematics courses by an average of at least 5% each academic year.
4. Increase four-year graduation rates at least 5% over the life of the QEP.

Initiatives

Although the long-term goal of the QEP is to improve students' performance in general education mathematics courses and therefore their four-year graduation rates, the short-term goals are to improve attendance and goal orientation. Achieving the short-term goals is anticipated to then lead to better overall performance in general education mathematics courses and improvement in graduation rates as students spend less time repeating general education mathematics courses. The following QEP initiatives were designed to address students' attitudes toward attending class and/or their goal orientation. The initiatives focus on five areas across the institution.

A. Faculty/Advisor Enhancement Initiatives

The first cluster of initiatives, which are based on feedback gathered on campus, focus on faculty and advisors. These initiatives are aimed to develop innovative pedagogy in the general education math courses and provide a system to share and train faculty in those practices that work well among our student population. These initiatives also aim to promote better advising so that faculty communicate about math in such a way that students are encouraged to learn mathematics, and faculty are able to advise students with adequate information.

1. **Create CTE Math Faculty Fellows.** Each semester, the Center for Teaching Excellence (CTE) hosts one faculty member from each College as a fellow. These fellows receive a stipend and one-class reduction to provide the time and resources necessary to focus on pedagogical research. As part of their fellowship responsibilities, fellows are also required to provide training for their colleagues on effective pedagogical practices. For the QEP, four faculty fellow positions will be created for the Department of Mathematics and Statistics, specific to each general education math sequence: 101 & 102, 103 & 104, 110 & 131, and 111 & 112. The CTE Director will train or arrange training to prepare fellows to conduct effective peer teaching observations and serve as a coaches for their peers. Tenure-track and non-tenure track faculty will be eligible to apply to serve as Fellows. CTE Math Faculty Fellows will be charged to do the following:
 - a. Share pedagogical best practices that are likely to increase the *goal orientation* of our students to result in a desire to learn math.
 - b. Use their sections of general education mathematics courses to pilot their interventions.
 - c. Compare the general education math data collected during their pilot courses to data from other sections and train other faculty who teach the same classes on interventions that have resulted in higher learning outcomes.
 - d. Conduct peer teaching observations for math faculty who teach the same general education math courses and provide guidance where possible for infusing pedagogical insights gleaned while working with the CTE.

2. **Faculty Workshops.** The CTE Director will conduct 30-minute workshops on growth mindset and math messaging to be delivered at mandatory college meetings during the fall of 2021 and thereafter during new faculty orientation. It is important to involve all faculty throughout the campus as most faculty serve as academic advisors and often influence students' *goal-orientation*. More specifically, these workshops will focus on how faculty can empathize when students confess that they are struggling with their math courses, without accidentally demotivating students to try to learn mathematics. For example, faculty will learn to replace messages such as, "Remember, you

only need to earn a D," with messages such as, "I struggled with this class when I was in college too, but I passed, and I know you can also."

3. **Monitoring Unexcused Absences.** The N.C. A&T student information system, *Aggie Access*, will be enhanced to display the percentage of unexcused absences so advisors can see whether students regularly attended the classes that they failed and advise accordingly.

B. Student Support Initiatives

Another set of initiatives focuses on the support students receive to be successful outside of the math classrooms. During the forum with the Library Services, it was discovered that many students go to the library to do their math homework but give up when they cannot navigate the textbook software that they need to use to complete the homework. It was also discovered, during the Student Government Association Forum, that peer-tutoring, especially peer-tutoring sessions led by upper-division students in one's major can point to future uses of math skills as they progress through their curriculum, are especially helpful for our students. Therefore, two student support initiatives are proposed.

1. **Graduate Assistants (GAs) in the Library.** Two GAs, who are well-versed in general education mathematics content as well as *My Math Lab* (or future textbook software), and SPSS will be stationed in the library 20 hours per week, including evenings, for each graduate assistant. These GAs will be available during peak computer use times so that students who struggle with the software will have assistance.
2. **Peer-Tutors.** The Department of Mathematics and Statistics will embed peer-tutors in general education mathematics courses to (a) tutor in general education math and (b) identify where content will be used in upper division courses. This will require about 57 tutors per semester.

C. Curricula Initiatives

Across several forums, suggestions were made to enrich freshman studies (FRST) courses with math relevancy lessons to enhance *goal orientation* so that students want to learn math. Further, many forums, including the one with the Student Government Association (SGA), ascribed withdrawals in freshman-level mathematics courses to students transitioning into college. Most high schools in North Carolina, and many across the nation, follow a no-fail system such that students who are present when an assignment is due automatically receive 50% of the assignment points, even if they do not submit an assignment. Because of this, many freshmen have never seen the impact of a zero on their course average. Many students do not understand how completing daily homework provides practice and reinforcement of math skills. This positions students who choose to not submit assignments early in the semester to dig their course average into a hole, from which they are not able to earn an A without retaking the course. Therefore, three curricular strategies are proposed.

1. **Update the Freshman Studies Course (FRST).** Infuse into the FRST courses the importance of mathematics for all majors. This will need to be a collaborative effort with academic departments, to make sure each student recognizes how mathematics is connected to their fields of study.
2. **Math Relevancy Videos.** Create a series of mathematics-relevance videos, with stories from successful students, alumni, and mathematics faculty to help to inspire students.
3. **Offer Short Courses.** Offer some half-semester courses to provide opportunities for students who need to withdraw from the math course and retake it during the same semester. The number of general education math courses offered during summer school will also be increased. This initiative

will minimize the negative impact of withdrawing from a course and having to wait until the next semester to retake it.

D. Policy Initiatives

An issue addressed in forums across the campus, but more so during the Student Government Association forum, was the issue of extra-curricular professional development activities scheduled during class time. This forces students to choose between attending an event that would be helpful for their professional development or the class they have paid tuition to attend. Further, some professional development activities are so helpful for career preparation that faculty make attending these events an assignment, which can force students to skip another course so that they can complete that assignment. Students think they should not have to choose between attending class or a valued extra-curricular event, nor should they be forced to choose between attending one course or earning credit for another. This led to two suggested policy initiatives.

1. **New Extra-curricular Activity Policy.** To end the constant scheduling conflicts in which students have to choose between attending class and professional development opportunities, a policy should prohibit faculty from requiring students to attend extra-curricular events outside of their scheduled class period—attendance should be optional, and therefore not graded. This issue most affects math courses, which meet more hours per week on average than courses in other subjects.
2. **Extra-curricular Grid.** Colleges should be encouraged to schedule extra-curricular events after 5 p.m., Monday–Friday or on the weekend.

E. Campus Education Initiatives

Finally, the need for campus-wide education was reiterated at many of the forums. Faculty and students think many students skip class without ever thinking about the academic loss or the financial loss. This underscores the need to educate the entire undergraduate student body on the importance of attending math courses and the losses that result when a class is skipped. Therefore, two initiatives are proposed.

1. **Online Financial Success Module:** To enhance student's *goal orientation* toward mathematics, academic advisors will recommend that students who skip an unreasonable percent of their mathematics classes (>10%) and fail the course, complete an online financial success module, such as iGRAD. This module will explain the financial and intellectual costs of missing class.
2. **QEP Promotion:** The QEP Coordinator will work with the University Relations team to design a series of activities, including town hall meetings for faculty and students, to provide a thorough QEP education to the campus. The QEP Coordinator will convey not only what the initiatives are, but also why they have been implemented.

COMMITMENT OF RESOURCES TO COMPLETE THE QEP

The financial and other resources to support the implementation of the QEP are presented here, and this section has the approval and commitment of the Office of the Provost and Executive Vice Chancellor for Academic Affairs.

Budget Narrative

These are the projected fiscal resources committed to effectively implementing the QEP. The total budget is **\$1,206,554** over five years.

Personnel (\$1,137,054)

The QEP Coordinator is responsible for implementation, enhancement, assessment, and general oversight of the QEP, working closely with the Director of Assessment. The coordinator reports to the Office of Strategic Planning and Institutional Effectiveness (OSPIE).

The QEP Support Staff, an administrative secretary, provides clerical support to the QEP Coordinator and to the effort.

The Department of Mathematics and Statistics will need adjuncts to cover the course reductions for the CTE Math Fellows, who are given course reductions.

Two GAs will be required to provide assistance in the library at peak hours.

One peer-tutor will be provided for every 49 students, consistent with the staffing model for learning assistants. It is estimated that 57 peer-tutors will be needed per semester.

Video (\$10,000)

The filming and production of the math relevancy videos will have labor and equipment costs.

Travel/Professional Development (\$30,000)

The travel budget will support the QEP Coordinators and others on the team to attend conferences, workshops and other professional development activities.

Equipment/Operating Costs (\$29,500)

Basic equipment will be needed to support the office operation.

Non-Financial Resources

Non-financial resources will include such things as space and utilities.

Table 2: Budget Summary

Budget Summary (July 1–June 30 each year)						
	Year 1 2021-22	Year 2 2022-23	Year 3 2023-24	Year 4 2024-25	Year 5 2025-26	Total
Personnel						
QEP Coordinator (full time); Estimated at \$75,000 salary, with benefits 30%	84,500	86,190	87,914	89,672	91,466	439,741
Support Staff (1); \$31,200 salary with benefits 47%	39,779	40,575	41,386	42,214	43,058	207,013
CTE Fellows Professional Support	8,000	32,000	32,000	32,000	32,000	136,000
Part-Time Math Faculty	9,000	36,000	36,000	36,000	36,000	153,000
Graduate Teaching Assistants	22,020	22,020	22,020	22,020	22,020	110,100
57 Peer Tutors	18,240	18,240	18,240	18,240	18,240	91,200
Personnel Subtotal						1,137,054
Director Travel	6,000	6,000	6,000	6,000	6,000	30,000
Equipment and Operating Costs						
Physical Space	-	-	-	-	-	-
Telephone (2)	3,000	3,000	3,500	3,500	3,500	16,500
Computers (2)	3,000					3,000
Office Supplies	2,000	2,000	2,000	2,000	2,000	10,000
Equipment Subtotal						29,500
Video Production	10,000					10,000
TOTAL						1,206,554

IMPLEMENTATION TIMELINE

Some of the initiatives proposed involve one-time changes to the campus. By the end of Fall 2021, the following initiatives will be implemented:

- 1. Recording Unexcused Absences.** The coding will be modified in Aggie Access so that faculty must input the number/percentage of unexcused absences that accompany a failing final grades before they can submit final course grades.
- 2. Mathematics Relevancy Videos.** A series of math relevancy videos will be produced and made available to faculty and academic advisors to use at their discretion.
- 3. Half-semester Courses.** Adjustments will be made to the Banner system to allow students to register for half-semester general education math courses. The design of these half-semester courses will be similar to that of math courses offered in summer sessions.

4. **More Math Courses.** Additional math courses will be offered each summer session to meet student demand.
5. **Extra-curricular Grid.** An academic policy will limit mandatory attendance at extra-curricular activities to those that are offered after 5:00 p.m. on weekdays or on the weekend. Attendance at other similar event must be optional (See Figure 4, below).
6. **Online Success Module.** An online success module, such as iGRAD, will be available to advisors so that they may share with their advisees as needed.
7. **QEP Promotion.** The QEP Coordinator will work with University Relations to promote the QEP on campus and hold town hall meetings for faculty and students to educate the campus about the QEP.

Other strategies will be implemented Fall 2021 include:

1. **CTE Director Workshops.** The CTE Director will present the 30-minute growth mindset and math messaging workshop to each college during the Fall 2021 semester. Thereafter, the workshop will be presented during the orientation sessions for new faculty.
2. **Math Module in University Studies Courses (FRST).** A math relevancy lesson tailored to the target group of majors within each FRST course will be added to the curriculum and be included each semester thereafter.
3. **Graduate Assistants.** Graduate Assistants (GAs) will be placed in the library, beginning Fall 2021 to assist students with learning mathematics.
4. **Peer-Tutors.** The Department of Mathematics and Statistics and the Center for Academic Excellence will begin interviewing peer-tutors in Fall 2021 and will have them embedded within sections of general education math courses beginning in Spring 2022.

Other strategies will be integrated throughout the five-year cycle. The following figures (4 and 5) outline the proposed timeline for implementation of additional QEP: TEAM initiatives.

Policy Initiatives

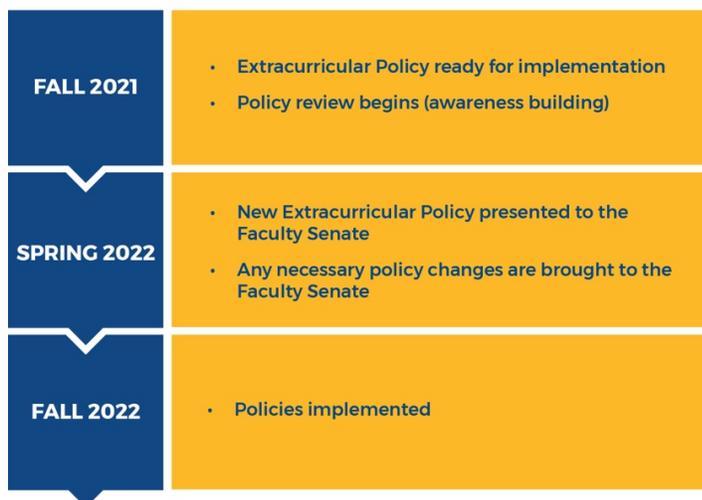


Figure 4: Timeline for the Implementation of Policy Initiatives

CTE Math Fellows

CTE Math Fellows program will be launched in two phases. During Fall 2021, one CTE Math Fellow will be selected from MATH 101/102 faculty. That Fellow will spend Spring 2022 researching potential interventions with the guidance of the CTE Director. In Fall 2022, the Fellow will pilot the initiatives in his or her courses. In Spring 2023, the CTE Fellow will train other MATH 101/102 faculty on the implementation of successful initiatives. This experience with the first fellow will be used as a pilot for the CTE Math Fellows program so that any needed changes to the program can be made before selecting fellows in all general education math courses.

In Fall 2023, CTE Math Fellows will be selected for all general education math courses. They will spend Spring 2024 researching interventions with the guidance of the CTE Director and Fall 2024 piloting selected interventions in their courses. In Spring 2025 all CTE Math Fellows will train their colleagues on the implementation of successful interventions. Figure 5, presents a graphic of the CTE Math Fellows program.

CTE Math Fellows

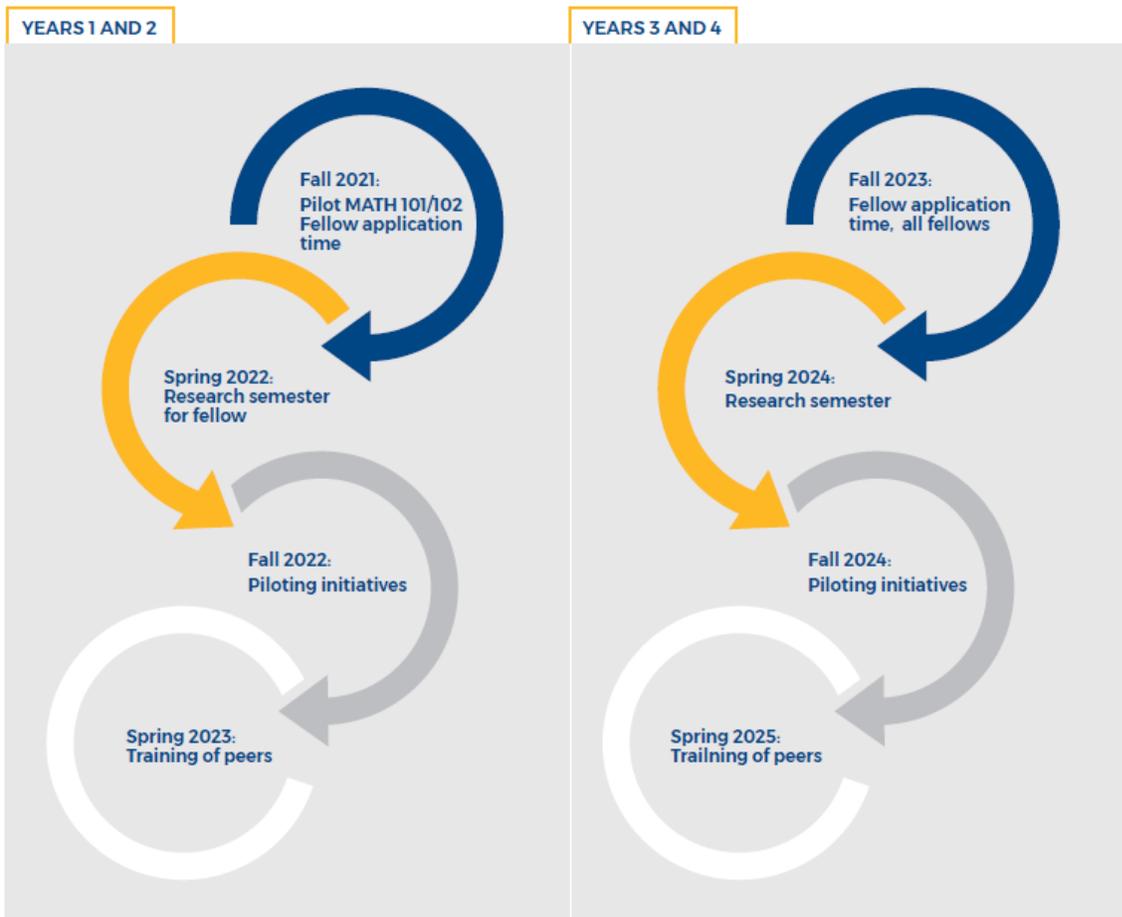


Figure 5: Timeline for the Implementation of the CTE Math Fellows Program

PLAN TO ASSESS ACHIEVEMENT

This QEP focuses on student success. Therefore, all assessments will focus on improvement in the stated student metrics, as follows:

- 1. Goal orientation** will be assessed every spring during FRST courses. The four-item assessment will require less than one minute for students to complete (See Appendix D for the assessment). With the goal to increase students' *goal orientation* in mathematics from the baseline of 3.55 on a 7-point scale by .25 points per year, this assessment will determine whether the proposed QEP initiatives are increasing students' *goal orientation*, shifting their focus from completing math courses to learning mathematics. If the data indicate that goal orientation is not improving, this will alert the QEP Coordinator of the need to alter the interventions. Focus groups and short surveys will be used to determine which interventions students believe are most effective.
- 2. Attendance in general education math courses** will be monitored each semester, using data that will be mined from Blackboard (each faculty has a Blackboard site for each course taught and attendance is recorded). The goal is to decrease the number of absences, and determine whether attendance correlates positively with performance in the courses, i.e., decline in DFW rates.
- 3. Performance in general education mathematics courses** will be compared every spring, beginning with Year 2 (2022-2023). The goal is to decrease the DFW rates. The baseline will be established as the rate at the beginning of year 1—Fall 2021. The target will be to decrease DFW rates by an average of at least 5% per year. Decreasing DFW rates in general education math courses will mean fewer courses repeated by students. Overall, decreasing the DFW rate in mathematics should allow many N.C. A&T students to matriculate through their major more quickly.
- 4. Graduation rates** and time to degree will be assessed in the spring of Years 4 and 5. The baseline will be Year 1 graduation rates (2021-2022). This metric will provide insight into whether the QEP initiatives have been successful in decreasing time to degree, which is the long-term result of decreasing the DFW rate in general education math courses. As DFW rates decline, there should be modest increases in four-year graduation rates, the target being a 5% growth in graduation rates over the life of the QEP.

The formative assessment will take place in Year 2 (2022-2023). At that time all of the data will be requested from the Office of Institutional Research and reviewed by the QEP Advisory Board to determine progress for each goal and will be used to determine if the implementation strategies need to be refined or if additional metrics need to be identified. Summative assessment be done in Year 5.

Table 3: Assessment Timeline

	Year 1 2021-2022		Year 2 2022-23 (Formative)		Year 3 2023-24		Year 4 2024-25		Year 5 2025-26 (Summative)	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Goal Orientation		X		X		X		X		X
Attendance		X		X		X		X		X
DFW Rates		X		X		X		X		X
4-year Graduation Rates		X		X		X		X		X
Time to Degree Students								X		X

KEY QEP ROLES AND RESPONSIBILITIES

The key roles and responsibilities of those who will work directly with the QEP are presented in Table 4, below.

Table 4: Key QEP Roles and Responsibilities

Positions	Core Responsibilities	Supervisor	Notes
QEP Coordinator	Lead the implementation, enhancement, assessments and general oversight of the QEP and report to the Advisory Board and Provost annually	Vice Provost for Strategic Planning and Institutional Effectiveness (OSPIE)	Will have a dotted line to the Student Success Office
QEP Advisory Board	Provides advice and assistance to the QEP Coordinator and support the QEP process		Advisory Group appointed by the Provost
QEP Administrative Assistant	Provides clerical support to the QEP Coordinator, including the maintenance of all records and data related to the implementation and assessment of the QEP	QEP Coordinator	
CTE Fellows (4)	Assist with implementation of the QEP	QEP Coordinator	
Graduate Assistants (2)	Provide tutoring for the QEP—in the library (after-hours)	QEP Coordinator	
Peer Tutors (appx. 57)	Provide tutoring to support the QEP	QEP Coordinator	These will be undergraduate students.

Besides the positions listed above, the QEP will be part of a broader organizational team as shown in Figure 6, below.

QEP Organization Chart



Figure 6: QEP Organization Chart

Promotional Plan

Once the QEP is approved the team will work with University Relations to develop and implement a promotional plan, to be completed and ready to launch by August 1, 2021. The goal of the plan will be to build awareness of the QEP and to foster commitment to achieving its goals. And, the plan will include forums that will all faculty and students to be heard.

QEP SUMMARY

In summary, the Quality Enhancement Plan was developed and refined through broad involvement by university constituents—faculty, students, staff and administrators. Broad-based support has been garnered, so far, through QEP campus forums. Efforts will continue to build awareness and commitment to the QEP as we move toward a Fall 2021 implementation date.

By adopting the proposed QEP and its initiatives, it is expected that in five years:

- 1. Students' goal orientation towards mathematics will be improved.**
- 2. Attendance in general education mathematics courses will improve.**
- 3. Performance in mathematics will improve—lower DFW rates.**
- 4. Time to degree will decrease and four-year graduation rates will see improvements.**

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Appendix A

The following table provides the breakdown of general education mathematics courses at N.C. A&T. Each course is part of a two-course sequence.

COURSE 1	COURSE 2
MATH 101: Fundamentals of Algebra and Trigonometry I (3 hours)	MATH 102: Fundamentals of Algebra and Trigonometry II (3 hours)
MATH 103: College Algebra and Trigonometry for Engineering and Science I (3 hours)	MATH 104: College Algebra and Trigonometry for Engineering and Science II (3 hours)
MATH 110: Pre-Calculus for Engineering and Science (3 hours) (4-hour fast-paced course that replaces MATH 103 and 104 for advanced students)	MATH 131: Calculus I (4 hours)
MATH 111: College Algebra and Trigonometry (4-hour fast-paced course that replaces MATH 103 and 104 for advanced students)	MATH 112: Calculus for Business and Technology (4 hours)

Notably, students who do not test well in math on the SAT or the math placement exam may still take MATH 112 or MATH 131 by taking MATH 103 and 104 in lieu of MATH 111 or MATH 131 respectively. There are also special sections of MATH 101 labeled *MATH 101E* that are 4-hour courses and begin with more fundamental arithmetic and algebra concepts than regular sections of MATH 101. MATH 101E is designed for students who require additional training on fundamental math skills before beginning college math. MATH 101E is taught in the Center for Academic Excellence while all other sections of general education math are taught in the Department of Mathematics and Statistics.

General education math courses are delivered in a variety of modes to meet the various learning needs of students:

- **Traditional lecture:** in this face-to-face mode of delivery, the professor delivers the course content in class and students have opportunities to ask questions throughout the class
- **Lecture lab:** this delivery mode replicates a traditional lecture, but also includes a 1-hour, no credit lab session in small groups with a TA to provide students with extra practice time and more opportunities to ask questions about the material
- **Flipped:** in this face-to-face mode, faculty have carefully recorded their lectures and provided them to students in advance of class so that students may view the lectures before class, leaving class time entirely dedicated to practice and answering questions
- **Emporium:** this face-to-face delivery takes place in a computer lab where students work through self-paced learning modules on the computer with an instructor and with at least two-TAs available to answer questions
- **ScaleUp:** this face-to-face delivery utilizes team-based learning such that students either view lectures of course material before class and spend the class period problem solving with teammates or receive lecture for the first half of class and then problem solve with teammates for the remainder of the period
- **Online:** each general education math course is also offered asynchronously online

Roughly 2,800 are enrolled in these general education math courses every semester.

The syllabi for the mathematics listed above are linked: MATH [101](#), [102](#), [103](#), [104](#), [110](#), [111](#), [112](#), and [131](#).

Appendix B

QEP Assessment



https://ncat.az1.qualtrics.com/jfe/form/SV_9ysuluQEHTCa3LD

QEP Co-Directors:

Dr. Thomas Redd (tcredd@ncat.edu)

Dr. Stephanie Kelly (sekelly@ncat.edu)

Appendix C



PAGE NAVIGATION



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QUALITY ENHANCEMENT PLAN (QEP)

The concept of quality enhancement is at the heart of the Commission's philosophy of accreditation. Each institution seeking reaffirmation of Accreditation is required to develop a Quality Enhancement Plan (QEP). Engaging the wider academic community and addressing one or more issues that contribute to institutional improvement, the plan should be focused, succinct, and limited in



length. The QEP describes a carefully designed and focused course of action that addresses a well-defined topic or issue(s) related to enhancing student learning.

The plan is directly related to institutional planning efforts and is selected through ideas generated from a wide range of constituents. The focus of the QEP is on improving institutional/ student performance, with a clear relationship between the activities of the QEP and the improvement of student learning.

To ensure the success of the QEP, a very detailed budget is developed to demonstrate institutional commitment to the effort. Detailed timetables are established that clearly indicate that the QEP can realistically be implemented and completed in five years.

Review of the QEP by SACSCOC is based on the institutional process used to develop the plan, the focus of the plan, the institutional capability for the initiation, implementation, and completion of the plan, broad-based involvement in the development and implementation of the plan, and the assessment of the plan.

The QEP developed by the University in the 2010 SACSCOC accreditation cycle was *Critical Thinking: Learning to Make Informed Decisions*. This project was designed to change student behavior in critical thinking through instructional practices integrated into the



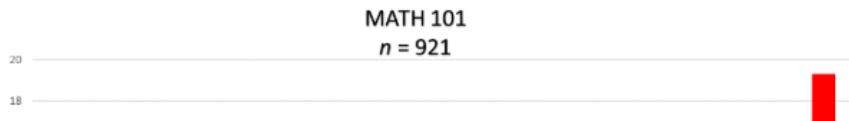


curriculum and in assessment activities within selected courses. It was evaluated through direct and indirect measures (including surveys of key student groups and focus groups).

Current QEP

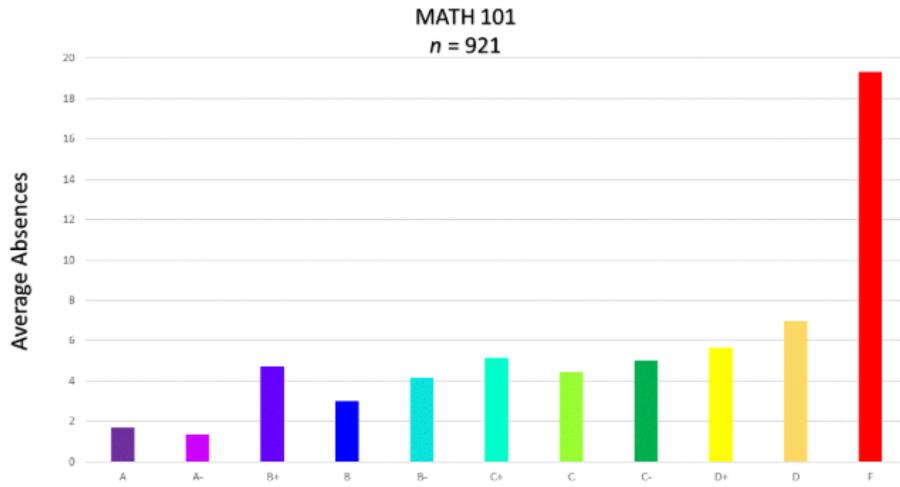
The Quality Enhancement Plan (QEP) begins with a review of institutional data to identify barriers to student learning or success within the university. As of spring 2018, 33% of A&T students were earning a D, F, or W (withdraw) in general education math courses. Data from across the institution indicates that students who fail their general education math courses are less likely to complete their degree than peers who pass these courses. They are also less likely to complete their degree in four years, investing more time and money into the same degree as their peers.

Focus group data conducted on the math faculty at A&T point to attendance as a primary cause of students not passing these courses. Students who regularly attend courses tend to pass. Data provided by general education math faculty who have kept meticulous attendance records from 2011-2019 corroborate this sentiment; a sample of this data is provided visually below for MATH 101.



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*Note: This data was provided by faculty who kept daily attendance records in MATH 101 between Fall 2011 and Spring 2019. A&T did not have a +/- grading system until Fall 2014.

Now it's time to decide how to best address attendance. A survey conducted Spring 2019 on students in general education math courses indicated that the math faculty are doing extremely well communicating the material effectively and building rapport with their students, but some students are still not committed to attend class. So, what is the best intervention? Please, share your ideas at the links below:

- Faculty Feedback Link: <https://tinyurl.com/yytp8e66>
- Student Feedback Link: <https://tinyurl.com/y6gz5pns>

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Appendix D

Please think about your time spent doing work in your math class (e.g., homework, readings, study problems). Please select the choice that best describes your goal when doing this work.

Completion	<input type="radio"/>	Comprehension						
Getting the work done	<input type="radio"/>	Understanding the work						
Working quickly	<input type="radio"/>	Working carefully						
Finishing the work	<input type="radio"/>	Mastering the material						