

LENOIR COMMUNITY COLLEGE (LCC)

# It All Adds Up @ LCC

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A Quality Enhancement Plan (QEP) to Address the  
Needs of Developmental Mathematics Students

**On-Site Review October 1-3, 2013**

The QEP proposal includes the foundations and purpose for LCCs' faculty and staff selection of developmental mathematics as the content area for quality enhancement. The document includes proposed interventions for LCC's targeted student population of 17-24 year old, first-time developmental mathematics students. This proposal offers detailed supporting data, strategies, and a comprehensive plan for the resources and personnel required for implementation, assessment, and sustainability.

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### Definitions of LCC's QEP Terms

1. Dimension-an aspect of a student's life at a given point of time that impacts his or her ability to focus on education
  - A. Dimension One--cognition, aptitude, and past educational formation that influence a student's ability to grasp academic concepts
  - B. Dimension Two--psychosocial factors such as motivation, self-efficacy, and past educational experiences that positively or negatively influence a student to persist or withdraw when faced with academic challenges
2. Developmental Mathematics--pre college-level mathematics courses that support student toward college-level courses
3. Developmental Mathematics Modules (DMAs)--developmental mathematics courses that have been reduced and separated into smaller learning components that are delivered in four-week sessions
  - A. Developmental Mathematics 010--first level of developmental mathematics that replaces Mathematics 060
  - B. Developmental Mathematics 020--second level developmental mathematics that replaces Mathematics 060
  - C. Developmental Mathematics 030--third level of developmental mathematics that replaces Mathematics 060
4. First-Time Completers--students who enter and successfully complete Developmental Mathematics Modules 010-030 on their first attempt
5. Student Learning Outcomes--First-time developmental mathematics students will demonstrate satisfactory progress through DMAs 010-030.
  - A. With the support of supplemental instruction, 65% of first-time students will improve their mathematics skills in DMAs 010-030 to meet the desired threshold of achievement at an overall average of 80% on homework assignments, projects, quizzes, and final exams.
  - B. With the support of a College Achievement Coach, students who demonstrate low self-efficacy, poor attendance, or external impediments to learning will meet the desired threshold of persistence at a projected 65%.
6. Interventions--extracurricular support services prescribed for students to overcome incremental challenges in developmental mathematics classes

- A. Supplemental Instruction (SI)--prescribed, targeted, and focused extracurricular instruction by tutors who attend classes with students and help them overcome challenges in solving developmental mathematics problems
  - B. College Achievement Coach (CAC)--an LCC staff member dedicated as a point of referral and support for students to identify non-cognitive impediments to learning and persistence in developmental mathematics courses
7. Triggers--incremental measures that signal an instructor or achievement coach that a student is in need of interventions
8. American College Testing (ACT) ENGAGE College Survey--a self-efficacy assessment that is delivered to Developmental Mathematics 010-030 students during their first class as a means to early identify personal variables that may hinder student success

## **Quality Enhancement Plan (QEP) Team Assignments**

### **QEP Identification Team**

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## **Quality Enhancement Plan (QEP) Proposal: Addressing the needs of developmental mathematics students**

### **Executive Summary**

The faculty, staff, and administration at Lenoir Community College (LCC), in consideration of one of the most pressing needs to improve student learning, have chosen to focus on developmental mathematics for the College's quality enhancement plan (QEP). This executive summary includes the rationale for selecting this content area, the targeted student population, and the proposed intervention strategies to promote enhanced student learning in the entry levels of developmental mathematics.

The overall goal of the QEP is to improve the percentage of first-time completers at the entry level for developmental mathematics, which includes Developmental Mathematics Modules (DMAs 010-030). The target population is students between the ages of 17-24 based on demographic program data from 2007-2012. This population represents the largest traditional student population at LCC and one that is commonly used nationally as a benchmark in educational research. The students will be identified through North Carolina Community College System (NCCCS) assessment and placement measures and will be assigned to the appropriate DMAs that will be fully implemented fall 2013.

LCC is proposing interventions that are based on two identified dimensions. The first includes cognitive factors that are related to aptitude and previous academic preparation. Early and incremental interventions are proposed to support student achievement. The second dimension focuses on psychosocial factors related to a student's external influences, level of motivation, and self-efficacy related to mathematics. Faculty and staff will collaborate to document students' progress toward learning outcomes. Progress will be measured and reviewed through the use of a customized database for tracking and reporting.

### **Background Information**

In fall 2013, the North Carolina Community College System (NCCCS) will formally implement a redesigned developmental mathematics curriculum that will require all 58 community colleges in the system to adopt a modularized system of developmental mathematics courses. The program consists of 8 four-week modules that replace the previous system of Developmental Mathematics 060-080, with each of the previous courses designed for 16 weeks of instruction. Lenoir Community College (LCC) began developing its Quality Enhancement Plan for mathematics 060 in 2010, prior to the modularized design mandated by the NCCCS. The College has adapted to the requirements of the new system; however, the fundamental goals for student outcomes have not changed. Under the new system that will formally begin fall 2013, a student entering the mathematics redesign program in North Carolina has the opportunity to begin at the first level in the sequence Developmental Mathematics (DMA) 010, successfully advance through DMA 080, and complete the entire program in thirty-two weeks. This is achieved when the student is a first-time completer at each level in the process.

A second component of the NCCCS developmental mathematics redesign is a diagnostic assessment to replace the currently authorized Accuplacer and Compass assessments. The goal for changing assessments is to provide more accurate information regarding specific areas of student deficiency and to target those areas by placing the student in one or more modularized courses from the developmental mathematics list. The new assessment was scheduled for implementation in late spring 2013, but institutions may utilize their existing authorized assessments until a final version of the assessment is formally prescribed. Initial trials with the new diagnostic tool presented challenges that required the NCCCS to review the assessment and redesign parts of the tool. LCC has chosen to continue utilizing Accuplacer as its placement

assessment through fall 2013 to maintain a reliable and consistent tool until further evaluation of the new diagnostic tool is completed. It is also important to utilize a stable assessment tool so the College can gather reliable baseline data on student performance in DMAs 010-030 for fall 2013 semester.

During the fall 2012 semester, the NCCCS sponsored a series of training sessions related to the use of Multiple Measures of Placement (MMP) (See Appendix A) to determine appropriate placement in developmental mathematics. Instead of using a single standardized assessment, institutions in the NCCCS will implement the use of overall un-weighted high school grade point average (GPA), Scholastic Aptitude Test (SAT) or American Colleges Testing (ACT) scores, or a newly designed diagnostic assessment. The implementation of these multiple measures will be fully implemented beginning fall 2015; colleges are phasing in this process as local conditions direct. LCC is utilizing GPA, SAT, and ACT scores for fall 2013. Full implementation of the North Carolina Diagnostic Assessment and Placement (NC DAP) is pending based on NCCCS updates. The purpose of MMP is to more accurately predict student outcomes prior to placement in the developmental mathematics sequence or bypass the sequence entirely if the student's high school GPA, SAT, or ACT scores reach the prescribed threshold to exempt a student from developmental studies. According to Robbins, Allen, Casillas, Hamme, and Le (2006), using multiple assessments may explain "variations seen in college outcomes" (p.599). The North Carolina Community College System's decision to use multiple measures for placement is supported by two recent studies: Belfield and Crosta (2012) and Scott-Clayton (2012). These studies examined the role of high school GPA in predicting college-level success in students who began in developmental mathematics. The purpose of using multiple measures is to avoid over- and under-placement of students in developmental education. According to the

studies, high school GPA can improve error rates on community college developmental mathematics placement.

While the NCCCS proposes a new system of multiple measures of placement and modularized developmental mathematics courses, the way in which LCC supports students through that process remains the responsibility of the local institution. Supplemental services to address cognitive and psychosocial factors that may inhibit achievement of student learning outcomes (SLOs) will be the focus of LCC's QEP. This approach is supported by research of promising practices in developmental mathematics education. The use of multiple instructional strategies and supplemental services is cited in a report sponsored by the Office of Vocational and Adult Education (OVAE) and authored by Golfin, Jordan, Hull, & Ruffin (2005). The report highlights the efficacy of using supplemental instruction, class and lab integration, project-based learning, and counseling services. Additional studies cite the effectiveness of SI in both academic success and reducing withdrawal rates among those who receive supplemental services for specific and targeted needs (Hays, 2010; University of Missouri, 2007). The implementation and adaptation of the enhanced SI program at LCC has been developed in light of NCCCS requirements and standards. There will be adjustments on the part of the faculty and staff at LCC as the NCCCS defines all of the parameters for the implementation of the new modularized developmental mathematics system. However, the constant for the QEP is the role of institutional supplemental services to help students who demonstrate challenges in the classroom or from other external factors that may inhibit progress toward achievement of SLOs.

### **Description of the Study**

Cohen (1995) describes past and current challenges of mathematics education at two-year colleges and the ongoing dilemma for educators serving under-prepared students:

Higher education is situated at the intersection of two major crossroads. There is a growing societal need for a well-educated citizenry with a workforce adequately prepared in mathematics, science, engineering, and technology; but at the same time, there are increasing numbers of academically under-prepared students (p.3).

The mission statement of Lenoir Community College expresses its role as a public two-year institution offering educational programs and services that provide opportunities for the intellectual, economic, social, and cultural development of students and the community. A primary institutional goal is to promote student learning and persistence across the curriculum of academic, technical, and professional programs. Among the values that LCC promotes are exemplary teaching and effective learning, equal access and opportunity, and maintaining quality in all educational endeavors. These supporting values are foundational to the administration, faculty, and staff of LCC. In implementing this mission and supporting values, the ability of students to achieve their goals must be considered when measuring the success of the institution. The success of students in their pursuit of academic, technical, and professional goals is a message that is promoted at a national level by community college leaders. The American Association of Community Colleges (AACC) described the role of community colleges as “one where knowledge and skill sets are the crucial determinants of career achievement” (2006, para.14).

The faculty, staff, and administration at LCC have chosen to focus on developmental mathematics for the College’s QEP. This focus reflects the College’s desire to honor its mission and improve success for all students regardless of ability. This plan includes the rationale for selecting this content area, the targeted student population and supporting data, the proposed intervention strategies, and the resources and personnel required for implementation,

assessment, and sustainability.

The overarching goal of LCC's QEP is to improve the percentage of first-time completers through DMAs 010-030. The content of these newly-developed modules is comparable to the previous Developmental Mathematics 060 course under the NCCCS system that was completely phased out fall semester 2013. The target population for the QEP is students between the ages of 17-24. The College faculty and staff arrived at the decision to focus on this target audience based on demographic and student performance data from 2007-2012. This population represents the largest developmental mathematics student group at LCC and will allow for a large, yet focused, case study of the efficacy of the College's interventions. Beyond the initial case study of the target group, LCC has proposed a timeline (See Appendix B) for expanding interventions to broader and diverse audiences. The students to be served under the QEP have been identified through NCCCS assessment measures and have been placed in appropriate DMAs for fall 2013.

To support student progress toward successful completion of the initial three developmental mathematics modules, the College is proposing interventions based on two identified dimensions that may impact student learning. The first includes cognitive factors that are related to aptitude and previous academic preparation. Students enter developmental mathematics with varying levels of performance and experience in the content areas. The first level of intervention begins with instructors utilizing common instructional strategies and course assessments that will identify a student's need for additional services to help him or her grasp the course concepts. In dimension one, prescribed supplemental instruction (SI) will be scheduled for students who fall short of the target level of proficiency as defined in the learning outcomes. The fundamental concepts have been identified for each developmental mathematics

module with SI designed to support student achievement for each of the SLOs. Incremental measures are in place to trigger referral to SI when the student demonstrates an immediate need.

The second dimension of intervention focuses on psychosocial factors related to a student's level of motivation, self-efficacy, and connection to established academic and career goals. "Do beliefs of personal efficacy contribute to human functioning?" (Bandura & Locke, 2003, p.87) This question is foundational in LCC's proposed interventions to support student progress. Baseline data on motivation and self-efficacy have been collected using ENGAGE, a standardized assessment from ACT. The main focus of dimension two interventions is to help students manage issues that are personal and external to cognition and aptitude. These factors may affect students' desire or availability to dedicate the appropriate amount of time to class preparation and study or to remain in the class because of attendance problems.

The information gathered from in-class observations and College Achievement Coach (CAC) interactions with students will be used to enhance interventions for students who demonstrate a lack of progress during in-class activities and assessments, poor study skills, inconsistent assignment completion, or poor attendance. Two interventions, each applied in its appropriate measure and time, will be utilized to retain students and support their progress towards achievement of SLOs. The nature of the interventions offered to students is important to the QEP in order to target more effectively the needs of students rather than simply apply a generic treatment or instructional strategy without a deeper understanding of the students' issues. In addition, students who do not require additional assistance or interventions will not be called to participate in supplemental activities; this will free the instructors and SI tutors to support those most in need of intervention.

The assessment of the interventions for LCC's QEP will be documented through

collaboration between developmental mathematics instructors and the College Achievement Coach (CAC). They will work together at each phase of the student experience to intervene when established triggers of student performance signal that an intervention is warranted. The CAC will be the initial point of contact for student issues related to attendance or matters external to cognition or aptitude. The collaboration between the CAC and classroom instructors will be managed by student referrals that are outlined in the implementation section of this proposal. Documentation of student referrals to supplemental instruction or sessions with the CAC will be tracked under four categories:

1. Students who complete the prescribed DMA modules with no need for interventions
2. Students who require only supplemental instruction
3. Students who require only coaching interventions
4. Students who require both supplemental instruction and coaching interventions

### **Experimental Design**

The experimental design for the QEP is nonrandomized. The purpose for choosing this format is to allow those students with the greatest needs to receive intervention(s). The hypothesis under investigation is whether or not the prescribed intervention(s) will increase the percentage of first-time completers for DMAs 010-030.

To assess this hypothesis, LCC began fall 2013 DMA 010-030 course sections by gathering baseline data on the performance of students with no enhanced interventions. This is necessary due to the transition from Mathematics 060 to the new DMAs. The College must assess the performance of students as the NCCCS has prescribed in the Common Course Library, which is in effect fall 2013. The fall semester will serve as a period of training and assessment for faculty, staff, and SI tutors. The nature of the transitions in both course sequence and

standards for grading from the NCCCS make it necessary to train the faculty and staff during fall 2013. This period will allow the College to refine the processes of enhanced interventions prior to implementation spring 2014.

Beginning with spring semester 2014, and with the approval of SACSCOC, a pilot implementation of DMAs 010-030 with enhanced interventions will be applied to approximately one half of the DMA 010-030 sections offered at LCC. Test groups will be defined as first-time students ages 17-24. While all of the students in the test groups will be eligible to receive enhanced interventions during this pilot phase, for purposes of assessing the efficacy of LCC's interventions on the target group, the College will filter the reports to reflect the performance of the proposed target population. This will support the reliability of the results by controlling for a defined group of students who represent a commonly researched constituency in higher education studies. During the spring 2014 semester, there will be control groups who receive all standard services for developmental mathematics students as prescribed by the NCCCS and following current LCC practices. The control group students will not receive enhanced interventions. Test group participants will be referred for intervention(s) if they fail to meet an acceptable threshold (as outlined in the implementation section) throughout the duration of the DMA modules. The control group will be defined as those students who are flagged for, but will not receive, interventions through the duration of the DMA module.

Because this design is not random, it is important to control for potential confounding factors. This design attempts to prevent anomalies by controlling for the following factors:

1) Instructor variety:

Various instructors will have both test and control groups. This will prevent the assumption of a certain instructor, which may impact the experiment (See Appendix C).

2) Course section variety:

Sections at different times of the day and different times of the semester will be part of the design. This variety allows for the capture of data at various times of the day and during various weeks of the semester (See Appendix C).

3) Class size:

The class size for each DMA section will be no more than 15 students. While some sections may have more than others, the relatively small class size will allow each student individual time with his or her instructor during class.

4) Common course content assessments:

Common course content assessments will be administered to all students. This will help reduce outcome variation based on assessment variety.

5) Content Assessment Grading:

All DMA section instructors will grade content assessments similarly.

6) Potential change in test and placement NCDAP:

The NCCCS has proposed a new diagnostic assessment for mathematics. At this time, the transition is not complete.

To examine the efficiency and viability of the proposed tracking categories, LCC is implementing piloted phases of the QEP to acquire baseline data on student performance without interventions. The initial pilot will allow for assessment of control groups with students who complete the mathematics modules without receiving any additional learning assistance beyond the current and standard assistance that all students would receive. Enhanced SI or services from the CAC are reserved during test phases to assess more fully the efficiency and efficacy of the processes prior to a more expansive and comprehensive roll out of the enhanced services.

Interventions for students who are part of the target group and are in need of either supplemental learning assistance or coaching will be documented and tracked to the students' subsequent achievement of SLOs. The goal of these planned interventions is to improve student performance and to increase the percentage of first-time completers through the initial levels of DMAs 010-030. A pilot implementation of the QEP processes is scheduled for fall 2013. This pilot is necessary to document the implementation process that combines updated instructional content with LCC's data tracking tools and enhanced support services. In spring 2014, student interventions will be piloted with the tools and enhanced services outlined in the QEP. In fall 2014, all first-time DMA 010-030 students will receive prescribed interventions. In order to appropriately document the transition to the new modularized system of developmental mathematics, LCC must gather baseline information on student performance to set appropriate benchmarks.

The goal of the QEP mirrors that of the NCCCS's goal to advance students through the developmental education mathematics curriculum by promoting a greater percentage of first-time completers at member institutions. However, LCC has considered additional dimensions of supplemental instruction and psychosocial elements in the student experience that reach beyond assessment, placement, and modularization of developmental mathematics courses, particularly in students who score in the lower third of developmental mathematics placement and self-efficacy assessments. By focusing on students who enter developmental mathematics with limited skills and limited success in past experiences in mathematics, the College believes that this target group will benefit most by considering both cognitive and psychosocial factors through the initial three developmental modules, DMAs 010-030.

The College's foundational principle in approaching this goal is to develop a mutual

understanding between the instructor and the students regarding both the cognitive and psychosocial factors required for success in developmental mathematics. Students enter LCC with varying degrees of personal challenges, motivation, and belief in their abilities to succeed. The College will support the development of student motivation and self-efficacy so that the desire to achieve is greater than the obstacles individual students may face. McClusky's (1974) research supported the need for institutions to address these external factors that influence the success of adult learners. The QEP has identified two dimensions with associated intervention strategies that may support the learning process and facilitate successful outcomes for students in the developmental mathematics process.

### **QEP Learning Outcomes**

First-time developmental mathematics students will demonstrate satisfactory progress through DMAs 010-030.

1. With the support of supplemental instruction, 65% of first-time students will improve their mathematics skills in DMAs 010-030 to meet the desired threshold of achievement at an overall average of 80% on homework assignments, projects, quizzes, and final exams.
2. With the support of a College Achievement Coach, students who demonstrate low self-efficacy, poor attendance, or external impediments to learning will meet the desired threshold of persistence at a projected 65% (based on historical data from 2007-2012). Once baseline data on student persistence from the DMA modules for fall semester 2013 is available, projections may be adjusted.

Mathematics is cumulative. It works like a stack of building blocks. An understanding

of one area is necessary before effectively building upon another area. Hannafin (1983) described the instructional process to support the building blocks as “a structured framework for making instructional sequence decisions” (p.91). The foundation for LCC’s students to build upon for future application, such as rules for operations with integers, fractions, decimals, ratios, proportions, rates, and percentages, is established in basic mathematics, DMAs 010-030.

The following outline of conceptual learning outcomes and proposed interventions explains the connection between the proposed NCCCS mathematics redesign and LCC’s proposal to promote successful completion by students who have traditionally been unsuccessful in developmental mathematics courses. While the number of days in class and the allotted time for mastery has been reduced, the concepts that students must master in four-week modules to be first-time completers remain the same as previous developmental mathematics courses. In the NCCCS redesign, the time focused on each concept has been reduced and students have greater responsibility to maintain attendance and successfully complete assignments and quizzes in a compressed period of time. Therefore, the needs of students to receive supplemental instruction and services remain relevant and necessary for the implementation of the NCCCS redesigned mathematics modules. The following reflect the necessary learning components for students to be successful in their completion of the NCCCS developmental mathematics sequence for modules 010-030:

### **DMA 010 Course Objectives**

Upon completion, the student will be able to

- 1) perform operations with integers and
- 2) solve contextual application problems by applying the operations with integers.

Students will begin at the DMA 010 level with a study of operations with integers. Subsequent mathematics courses will require the students to perform these operations with fractions, decimals, ratios, and percentages. To solidify the students' initial understanding of these operations using integers in DMA 010, real-life projects will be used to show mastery with integers. Students will begin creating and analyzing a monthly budget in order to connect these operations to necessary life skills (See Appendix D). The project will contextualize the need for these skills as the student learns that creating a budget requires addition, subtraction, multiplication, and division. At this stage, the students will be introduced to the Four-Step Problem-Solving Process developed by Pólya (1973), which will be a strategy the students will use in each of their mathematics classes to complete their mathematics program requirements.

### **DMA 020 Course Objectives**

Upon completion, the student will be able to

- 1) perform operations with fractions and decimals (using the operations with integers learned in DMA 010) and
- 2) solve contextual application problems by applying the operations with fractions and decimals.

As students progress to DMA 020, the operations performed with integers used in DMA 010 will be expanded by using these skills to solve problems involving fractions and decimals. A fraction is a number in the form  $\frac{p}{q}$ , where p and q are integers. A decimal is a specially written form of a fraction containing two parts: the integer part and the fractional part. Therefore, in order to effectively perform operations with fractions and decimals, it is necessary to be able to perform these operations with integers. Those who have successfully completed DMA 010 should have a strong framework which will be built upon by the DMA 020 project, assessing the

financial challenges of being forced to move back home to live with one's parents (See Appendix E). Students will use their budgeting skills to compute what fraction of expenses will be shared among the parents and the student. Those students who passed DMA 010 but for whom skill expansion causes difficulty will be supported by the interventions initiated in DMA 010 (SI and CAC sessions).

### **DMA 030 Course Objectives**

Upon completion, the student will be able to

- 1) represent contextual application problems using ratios, rates, proportions, and percentages and
- 2) solve contextual application problems represented by ratios, rates, proportions, and percentages (using the operations with integers, fractions and decimals learned in DMA 010 and 020).

Having reached the DMA 030 level, students should be comfortable using the operations of addition, subtraction, multiplication, and division of integers, fractions, and decimals. All of these skills will be necessary to move to the next level, which is solving applications involving ratios, rates, proportions, and percentages. At this level, students will integrate all of their previous mathematics skills to complete the DMA 030 project, which requires them to convert units in a recipe and to determine the yield of food from the recipe (See Appendix F). Students will need to rely on the strategies they have learned to systematically approach and solve the problem. Continued SI will help students complete the project and demonstrate mastery on the in-class assessments.

The students' skills and understanding of the four basic operations of addition, subtraction, multiplication, and division utilized throughout the first mathematics levels must be

extended to further use of integers, fractions, decimals, percentages, and ratios in subsequent mathematics courses and other disciplines involving mathematics skills. For example, students must become proficient with the operations for fractions and decimals as a necessary prerequisite for understanding ratios, which are used in many higher level mathematics topics such as proportions. Additionally, fractions are heavily intertwined with algebra. They are needed to solve simple equations like  $5x = 2$  and to manipulate fractions involving polynomials and radicals like  $\frac{x^2+2x}{x^2+4x+4}$  and  $\frac{4\sqrt{x}}{\sqrt{x}-3}$ . In summary, without the tools provided by DMAs 010, 020, and 030, students have no foundation upon which to build a successful mathematics framework.

Key incremental learning concepts have been identified for students as necessary to advance to higher levels of developmental and other mathematics courses. Each of the content-specific components for DMAs 010, 020, and 030 will be used as incremental success measures toward satisfactory achievement of SLOs. By using early identification techniques in the classroom, the instructor will be able to intervene and support the student as he or she progresses through each module. If instructors observe a lack of participation: poor attendance, failure to complete assignments or homework, and/or in-class activities, then the student will be flagged for appropriate interventions.

The proposed intervention strategies below form a holistic approach to student success. The goal is to incorporate intervention strategies that support incremental measures of progress, which are tracked through instructor/student interaction and CAC/student interaction. After much collaboration with the developmental mathematics instructors, the members of the QEP team selected the following interventions to promote and support the SLOs of the QEP.

### **Overview of Dimension One Interventions**

Interventions to support the SLOs for DMAs 010-030 are divided into two categories. Dimension one focuses on student performance on daily assignments, common quizzes, and real-life projects. The foundation of this dimension is the connection to a student's cognitive academic ability and the need for support services to improve achievement of SLOs. The goal of dimension one is to develop a learning environment that leads a student toward successful achievement of SLOs by offering early assistance for concepts that are challenging for students and that are relevant to their daily lives. This goal will be accomplished for students by adapting activities to encompass varying learning styles and by maintaining consistent curriculum and assessment across all sections for a given mathematics module. The list below reflects the proposed dimension one activities that will be used to identify students in need of interventions for DMAs 010-030:

- Common testing applied at key points during each module
- Incorporation of real-life projects/dynamics in DMA 010-030
- Observed student avoidance of daily classroom activities

### **Overview of Dimension Two Interventions**

The primary goal of dimension two is to assess psychosocial factors that may inhibit student learning and achievement. These factors are considered to be non-cognitive and external to the consideration of aptitude. They are personal variables that are specific to the student's belief in the prospects of success and motivation to achieve a goal. The objective for these intervention strategies is to establish clear connections between developmental mathematics courses and academic and professional goals that require a level of proficiency in mathematics. The purpose is to bring relevance and meaning to developmental mathematics, so it will

strengthen student motivation to persist and raise the level of achievement in first-time completion of the developmental mathematics sequence. Students who demonstrate a lack of motivation, direction, and self-efficacy may require assistance from a counselor, CAC, and/or additional support services to facilitate the student's development of clear goals and increase the level of motivation to complete DMAs 010-030. Students need to understand that successful completion of these modules is directly related to their academic and career goals. The role of the CAC, counselor, and additional support services is to help students persist and overcome psychosocial challenges by validating students' participation in the college experience as important and meaningful contributors to their personal success and that of the College. According to Carter (2011), "Validation can empower, confirm, and support first generation college students who might be new to higher education. This may enable them to not only feel accepted and capable of college-level work, but also that they have valuable opinions and insights and are worthy of attention and respect of faculty and peers" (p.21). Helping a student believe that his or her participation in the College is contributory may help the student maintain the path to success even when academic and personal challenges arise. The following list reflects strategies to identify and assess the need for interventions.

- Deliver ENGAGE survey through CAC and academic counseling to document the student's level of motivation and belief in his or her ability to succeed as well as determine if there are external factors that may be affecting student learning.
- Assess during CAC sessions with the developmental student his or her interest in a particular program or career opportunity, or if undecided, schedule times for the student to engage in career building and personal inventory activities to promote a connection to an academic, technical, or professional focus

- Advise the student who is referred by the instructor or self-identified for issues related to attendance or an inability to perform under traditional classroom strategies and supplemental instruction.

### **Data Collection**

The faculty and staff at LCC identified clear and precise data on students' performance considering age as only one variable for establishing the target group. The two categories of variables that are considered relevant for quality enhancement and may be impacted positively by institutional interventions are aptitude and self-efficacy. The aptitude variable refers to cognition and past educational experiences. For the purposes of the QEP, aptitude includes students with an overall un-weighted high school GPA below 2.6 and/or a standardized diagnostic assessment placing them in developmental education. Measurement of a student's self-efficacy as a personal variable is considered an affective factor in that the student may improve motivation, goal setting, and belief in achievement to a degree that may promote persistence. Through this process, LCC identified a target population of first-time developmental mathematics students, ages 17-24. Historically, students with an initial placement in the lower third percentile for Essentials of Mathematics (Mathematics 060) have shown greater need for assistance. However, the College will target all students at the entry levels of developmental mathematics to establish baseline performance data for modularized courses DMAs 010-030. The faculty and staff chose to focus on this target population because it represents the most challenging path to success in view of the multiple levels of skills associated with developmental mathematics. In this case, the College used internal reporting data from 2007-2012.

Table 1 represents a summary of grade distribution from 2007-2012. It includes students ages 17-24 who received a grade in the course, which considers all students who were present at the census date of the course. It highlights historical data of the numbers of students at each level of Mathematics 060 who were required to pass this course based on their chosen degree or diploma program. However, according to NCCCS standards effective fall 2013, students must receive a final grade of 80% (B) in DMAs 010-030 to successfully complete each course. Under the previous NCCCS standard, only 47% of first-time students taking Mathematics 060 would have qualified as successfully completing the course. Under the new DMA system, the College will gather baseline data on students' performance and establish updated goals for improvement.

<b>Table 1 Successful and Unsuccessful First-Time Completers 2007-2012</b>						
<b>Age</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>Below C</b>	<b>Total</b>	<b>Percent Unsuccessful</b>
<b>17</b>	0	5	1	1	7	14%
<b>18</b>	105	76	44	71	296	24%
<b>19</b>	55	72	34	71	232	31%
<b>20</b>	24	18	21	44	107	41%
<b>21</b>	7	16	9	18	50	36%
<b>22</b>	11	4	4	12	31	39%
<b>23</b>	3	0	3	7	13	54%
<b>24</b>	0	0	0	2	2	100%
<b>TOTAL</b>	<b>205</b>	<b>191</b>	<b>116</b>	<b>226</b>	<b>738</b>	<b>31%</b>

The information in Table 1 was used to identify those students who may have benefited from interventions throughout the previous Mathematics 060 process to promote first-time student completion and progression to a desired curriculum program or technical or vocational career path.

In the process of determining the level of developmental mathematics that would

have the greatest impact on post-developmental mathematics goals, LCC faculty and staff determined that promoting early success at the initial level of developmental mathematics may establish a pattern of continued success beyond this level. Many students who are seeking an associate in applied science degree may need DMAs 010-050 to satisfy course pre-requisites in mathematics. These students should be connected with their post-developmental goals to have a clear view of how their success as first-time completers in developmental mathematics directly impacts their future success. By supporting students' progress and persistence at the entry level, LCC hopes that students' motivation and sound study skills will carry over to subsequent levels. Crocker and Wolfe (2001) explained that a person's view of his or her self-worth can be very "domain specific" (p.594). For the developmental mathematics student, having early success in the initial modules of developmental mathematics may lead students to a higher level of self-efficacy of their abilities to succeed in subsequent courses.

Table 2 identifies age demographics in Developmental Mathematics 060 from 2007-2012. Students in the 17-24 year-old age group represent a target population that has been commonly utilized as a benchmark in educational research because of the time removed from secondary education.

<b>Table 2 Population by Age</b>	
<b>17-24</b>	<b>1125</b>
<b>25-30</b>	476
<b>31-40</b>	590
<b>41-50</b>	313
<b>51+</b>	184

The focus on the 17-24 year-old target population is based on the demographic information reported in the number of students in need of developmental mathematics from

2007-2012 and who required initial placement in Mathematics 060. The use of this target audience is to provide a more focused approach to measure the efficacy of the proposed interventions. It does not imply that the proposed interventions would not be useful for other constituencies at the College. In addition, the QEP Committee considered circumstantial factors such as gender, race, and ethnicity to identify the College’s Mathematics 060 population from 2007-2012. While there are programs on LCC’s campus that target students based on race and gender, the QEP focuses on interventions that may benefit all student populations.

While gender, race, and ethnicity are not bases for interventions in the QEP, it is important for the College faculty and staff to establish baseline information so that any trends that may develop over the course of this project can be considered as part of the review and analysis of performance data. Table 3 reveals historic data for MAT 060 based on gender, race, and ethnicity.

<b>Table 3 Race and Gender</b>		
<b>Race</b>	<b>Male</b>	<b>Female</b>
African-American	436	513
American Native/Alaskan	3	4
Asian	3	4
Caucasian	466	469
Hawaiian/Pacific Islander	1	2
Hispanic	32	21
Mixed	4	9
Unreported	14	22
Totals	959	1044

These data follow a trend that reflects continued increases in first-time higher education enrollments in the US across a spectrum of demographics. According to the National Center for Education Statistics (2013), total first-time freshman enrollment at colleges and universities has increased 39% from 1996-2010. It is expected to increase 14%

over the next ten years. These data are contextualized with employers' needs for workers with post-secondary technical training and academic preparation as a minimum standard for entry-level positions. LCC's data were also compared with other published studies regarding colleges in the NCCCS using data from the April 2011, *Creating Success Research Brief*. The information provided a point of reference for LCC's plan by comparing local institution data with the total number of students in the NCCCS requiring developmental education for fall 2007. Information on student performance from a statewide perspective will serve as a benchmark for the QEP as LCC progresses to the descriptive phases of the project. One fundamental difference in LCC's QEP proposal and the NCCCS's research brief is the analysis of initial placement test scores and subsequent success in specific mathematics courses (See Table 4). Historical data from 2007-2012 showed a statistically significant correlation between Accuplacer scores and student achievement in Mathematics 060 as documented in LCC's reporting data.

Table 4 summarizes student achievement when comparing students' initial placement and their final grades at each level of developmental mathematics. This placement scale below has been in effect since fall semester 2006 in accordance with NCCCS policy.

**Table 4 Grade Distribution for MAT 060 Based on Initial Accuplacer Score  
Percentage of First-Time Students 2007-2012**

<b>Ages 17-24</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>IP, W</b>
<b>ACCUAR Score Less Than or Equal To 29 n=259</b>	12.39%	22.78%	22.39%	42.47%
<b>ACCUAR Score Between 29 and 41 n=248</b>	31.05%	29.84%	12.50%	26.61%
<b>ACCUAR Score Greater Than or Equal To 41 n=231</b>	41.56%	25.11%	11.69%	21.65%

Table 5 offers an additional view of the correlation between initial placement and student performance including initial and subsequent levels of developmental mathematics. This information helps guide and focus interventions for students who have historically underperformed.

<b>Table 5 Average Initial Placement Score and Final Course Grade</b>					
<b>Course</b>	<b>A</b>	<b>B</b>	<b>C</b>	<b>W</b>	<b>IP</b>
<b>MAT 060</b>	38.8	34.7	31.4	32.5	31.9
<b>MAT 070</b>	56.3	54.7	46.5	52.9	46.4
<b>MAT 080</b>	69.4	64.9	61.8	62.2	52.3

**Process Used to Develop the QEP**

The QEP was developed through a broad-based assessment of the most immediate academic needs in LCC’s three-county service area. To identify the most persistent need from the

perspective of faculty and staff, the Office of Institutional Effectiveness (IE) at LCC collected data from faculty and staff. In addition, student data from 2007-2010 were reviewed and presented campus-wide to narrow the focus to a more pragmatic and realistic approach to selecting the content area of the QEP.

Faculty and staff were asked to consider the needs within and across program areas and departments and to suggest fundamental areas for quality enhancement that would be student success centered and also have the greatest impact by improving students' ability to move forward in the learning process. This meant identifying the greatest impediments to student achievement. From the suggestions presented by faculty and staff, there were two clear areas for consideration, reading and mathematics. The IE Director, senior administration, and QEP co-chairs considered both options and determined that a presentation of the student performance data related to reading and mathematics would help narrow the focus further for faculty and staff and allow them to vote on a specific topic that would have far-reaching impact on student success.

From the student-performance data examined for program years 2007-2010, both developmental reading and mathematics suggested areas for quality enhancement because of the number of students who enter the program at the lowest level and whose initial placement is in the lower third percentage. However, the student data on mathematics appeared to present the greatest challenge for students to pursue academic, technical, vocational, or professional programs with courses that had Mathematics 070 or college algebra pre-requisites. The proposals were presented at a faculty meeting in October 2010. The QEP leadership team presented data on both developmental reading and mathematics and asked the faculty and staff to vote on the two topics. This process was very carefully considered by the QEP leadership

team to ensure that the faculty and staff understood the process for selecting a content area and the procedures for implementing the QEP. The vote was in favor of the developmental mathematics proposal. The topic and focus of the QEP were updated with input from the IE Committee, advisory committees, Administrative Council, faculty and staff across all divisions, and the Board of Trustees.

**Table 6 Broad-Based Involvement**

<b>Date</b>	<b>Activity</b>
3/4/2010	Professional Development Day
4/29/2010	Faculty and Staff Meeting included all full-time employees
10/14/2010	Faculty and Staff Meeting included all full-time employees
10/19/2010	Advisory Committees - all programs have a community based committee, this group as a whole is approximately 200 people.
12/1/2010	Student Focus Group
2/8/2011	Board Retreat presentation
3/3/2011	Professional Development Day
6/27/2011	IE Committee
8/10/2011	Professional Development Day
9/15/2011	Advisory Committees
10/19/2011	IE Committee
1/18/2012	IE Committee
1/25/2012	Foundation Board
3/1/2012	Professional Development Day
6/18/2012	IE Committee
6/20/2012	IE Committee
8/13/2012	Professional Development Day
9/13/2012	Advisory Committees
10/17/2012	IE Committee
1/6/2013	IE Committee
3/25/2013	Board of Trustees meeting
4/24/2013	IE Committee
5/20/13	Board of Trustees meeting
8/12/2013	Professional Development Day
8/12/2013	Professional Development Day
8/13/2013	Adjunct Orientation

Developmental mathematics was selected as the content area with the greatest urgency for attention by the faculty, staff, and administration. While other areas were considered important and deserving of the College's attention, developmental mathematics was revealed to have a foundational impact on student success throughout the College and across all program areas. During spring and summer 2011, the College expanded the QEP Committee to include additional faculty and staff from across the divisions, and included literature review meetings to explore the most recent research on developmental education practices.

In order to present the proposed QEP content area more clearly to the faculty and staff, the QEP team formed smaller working groups based on the intervention strategies targeted in the QEP. This process continued throughout the summer 2011 session and included weekly meetings among the members and larger QEP team to report on findings from each of the smaller groups (See Appendix G). During a faculty and staff presentation in August 2011, the QEP team presented a summary of the four months of group research and discussions, narrowing the content area. In addition, the groups identified multiple student success measures to be considered by the QEP team for relevance and applicability to the overall goals for student success. Since August 2011, the QEP leadership team and committee members have reviewed the literature on the specific dimensions discussed and have developed an implementation plan that includes gathering baseline data, implementing a pilot phase, and assessing and documenting strategies.

### **Research Foundations**

While developmental education placement is a key component in helping students advance to academic, vocational, technical, or professional programs, there is an additional factor, self-efficacy, which Belfield and Crosta (2012) identify, that cannot be accounted for in

either high school GPA or standardized assessment. While self-efficacy may not be a single predictive factor of student success, it may complement other assessment tools in predicting challenges to student success. An initial self-efficacy survey may help faculty and staff more effectively design interventions once a student is appropriately placed in the level of developmental mathematics that corresponds to the NCCCS standards. LCC faculty and staff will gather additional non-cognitive or psychosocial data that may help determine student persistence in DMAs 010-030. This may be achieved by educating faculty and staff on student motivation, self-efficacy, or other related variables that affect success in mathematics.

Much of the education research related to community college developmental mathematics over the past five years has focused on instructional tools, delivery methods, and time in the program (Blair, 2006; Sherer & Grunow 2010; Bailey & Cooper, 2009). While these are important considerations, cognitive development and psychosocial factors should also be considered when developing interventions to improve student success at the developmental level. Students who enter college with high levels of deficiencies may be affected for many reasons beyond cognitive and andragogical factors. According to Mandler (1975), “Frustration is a kind of negative emotion aroused upon encountering an obstacle to satisfying one's needs, goals or expectations, which interrupts the ongoing activity, the more alternative strategies are available immediately following the interruption, the greater the chances for relaxation of stress” (p.121-122). Therefore, both cognitive and psychosocial factors will be examined, and another focus will be the concept of andragogy as opposed to pedagogy to improve student success of our target population. An important distinction needs to be made here between “andragogy” and “pedagogy.” According to Knowles (1980), andragogy is the “art and science of helping adults learn while pedagogy is the art and science of teaching” (p. 43). Andragogy is considered one of

the most well-known models to describe adult learning (Merriam, Caffarella, & Baumgartner, 2007). Andragogy recognizes that adult learners are affected by external factors (Knowles, 1980) such as the ones addressed in the QEP. The need to understand students' attitudes toward learning mathematics and how that impacts their study is critical yet often overlooked in educational research (Prat-Sala & Redford, 2010). This is especially true at the community college level. Grubbs and Cox (2005) described the need for more consideration of students' motivations for learning and purposes for attending college.

...but our knowledge of students and their attitudes toward learning is sorely lacking.... The conventional descriptions of developmental students stress demographic characteristics (for example, first-generation college status and ethnicity) and external demands (such as employment and family), but aside from finding evidence of low self-esteem and external locus of control, there has been little effort to understand how developmental students think about their education (p.95).

The complexities of student success throughout the developmental experience cannot be reduced to a single instructional strategy or an easily defined policy or procedure. Rather, the developmental mathematics experience involves a series of factors that influence a student's ability to persist in the program, find success in the early stages of coursework, and identify firm goals and purpose for continuing and completing developmental education courses. There are numerous historical and contemporary studies that seek to identify key factors to promote student success and to enhance the learning environment. Much of recent literature on developmental education considers the time that students are required to remain in courses and quality of the learning environment as primary factors in student success. If a student required

two or more levels of developmental mathematics, the data indicate that he or she is more likely to drop out of the program or may need to repeat courses multiple times. In terms of time in the program, the goal should never be simply to expedite the process by compromising quality and the student's ability to apply the knowledge in a program of study. The faculty and staff must consider the mission of the College and view developmental education as a way to advance students to further academic, technical, vocational, or professional preparation. The QEP focuses on early assessment and intervention to promote incremental success along the path through developmental education. If a student begins developmental education with a clear understanding of the goals and expectations for achievement, he or she will be better prepared to succeed at each stage. A proposed by-product of incremental success is that students will advance through the program with less course repetition and higher levels of achievement in developmental mathematics courses. Using planned strategies of incremental assessment and early intervention in conjunction with deliberate course sequencing and career building activities may well offer an opportunity to reach a student population that has not progressed through developmental mathematics with the level of success required to advance to more meaningful academic and professional opportunities. Stigler, Givvin, and Thompson (2010) summarized LCC's philosophy best in the following report:

An assumption we make in this report is that substantive improvements in mathematics learning will not occur unless we can succeed in transforming the way mathematics is taught. In particular, we are interested in exploring the hypothesis that these students who have failed to learn mathematics in a deep and lasting way up to this point might be able to do so if we can convince them, first, that mathematics makes sense, and then provide them with the tools and

opportunities to think and reason. In other words, if we can teach mathematics as a coherent and tightly related system of ideas and procedures that are logically linked, might it not be possible to accelerate and deepen students' learning and create in them the disposition to reason about fundamental concepts (p.3).

A foundational principle in the QEP is that students need to experience initial success and understand the relevance of mathematics to future academic and professional opportunities. The student who has had negative experiences in mathematics prior to attending LCC will need to experience a “turning point,” an experience where a student’s perception, leads to success (Howard & Whitaker, 2011). One of the primary responsibilities of the faculty and staff is to develop opportunities for connection between the career goals and the developmental education sequence. Mathematics instruction is focused on improving the students’ understanding of mathematical processes as well as developing learning opportunities in academic, technical, vocational, and professional environments. In addition, coaching and supplemental instruction will support efforts to identify those students most at risk of failing to remain in the course or those who fail to achieve the required level of success to advance.

### **Review of Literature**

#### **Developmental Mathematics: Success Equals Motivation, Understanding, and Persistence**

The following review of the literature highlights foundational research supporting LCC’s approach to quality enhancement and also reveals current gaps in research on approaching developmental mathematics enhancement by considering cognitive and psychosocial factors that may impact student achievement.

In the article, “*Against the Odds: Academic Underdogs Benefit from Incremental Theories*” Davis, Burnette, Allison, and Stone (2011) described the condition of students who find themselves facing uphill challenges in their attempts to be successful academically. Davis et al. (2011) asked the questions, “When students perceive themselves as academic underdogs, are they likely to believe that they lack the ability to succeed or are they likely to feel determined to succeed against all odds?” (p.334) In the application of the “underdog” theory, students have two options in reacting to their position as an underdog. Students can perceive failure as inevitable, or they can perceive that positive change will take place through additional effort. This distinction is fundamental and foundational for LCC’s discussion of quality enhancement in developmental mathematics for both cognitive and psychosocial factors. Numerous educational studies have highlighted the impact of developmental mathematics students who place into more than one level. They are significantly less likely to persist and achieve their goals (Bailey & Cho, 2007; Bonham & Boylan, 2012). However, the cognitive and psychosocial processes that students experience are not so clearly defined. In much of the current literature related to impediments for student success in developmental mathematics, time is considered to be a primary factor in student persistence. While the College desires to expedite student progress, the student’s perception of his or her potential for succeeding must be considered in designing intervention strategies for success. Davis et al. (2011) clearly explained the benefit of raising a student’s belief in his or her ability to achieve success in a developmental mathematics class. “Feeling self-efficacy in the face of challenge is predictive of academic achievement (p.334).” The potential benefit of developing intervention strategies that promote self-efficacy and incremental success for students is that they are not dependent on curriculum or delivery method. These intervention strategies will not conflict or compete with the NCCCS’s new methods for

delivering developmental mathematics instruction and will be applicable regardless of system changes related to competencies. In this case, what Davis et al. (2011) asserted is that the perception of the learner has a direct impact on his or her choices, reactions, and motivation. Is there an opportunity to overcome and persist, or does the student believe that his or her personal level of academic development is not improvable? The identification of this state of mind and intervention on behalf of the student may have a direct impact on how the student responds to the challenges in the developmental mathematics classroom and beyond.

Dweck (2006) described the challenges for educators in dealing with the “fixed mindset” of students that inhibits their abilities to overcome early challenges in mathematics. In this state of mind, students believe that their struggles represent a limitation on their abilities to learn, and as such improvement is not considered. This may suggest to educators that early intervention by the instructors to facilitate success for the students may support a more positive and hopeful attitude towards future challenges in mathematics, thus reducing the “fixed mindset” effect on student persistence and achievement. Dweck called this belief orientation a “growth mindset,” which is based on the belief that a student’s basic qualities are things he or she can cultivate through his or her efforts (p. 7). For the student, the goal is to develop a connection between effort and achievement, in that current difficulties can be overcome through hard work and commitment. It helps remove the fatalistic view that failure is inevitable unless an individual is born with a particular set of skills and cognitive abilities (Dweck, 2006). While students may begin with differing levels of abilities and experiences, through effort and persistence, achievement is possible. Developing a “growth mindset” is fundamental to the QEP to promote persistence and achievement. Lenoir Community College’s proposed interventions approach the “growth mindset” by seeking early incremental successes in the classroom to motivate the

student. In addition, proactive coaching and advising may help students maintain a high level of motivation to overcome academic and external challenges that arise during their developmental mathematics course.

In a study of community college first-year student retention conducted by Fike (2008), student retention and persistence to completion are described as a too often overlooked consideration by higher education. In particular, this study looked at community colleges as a case study for examining the efficacies of student persistence interventions. One of the challenges in developing student persistence support is that best practices often do not take into account the particular social and cultural considerations that are exclusive to the local institution. College leaders need to be deliberate in the assessment of retention and student persistence and should design efforts that truly match local needs that can be applied with available resources, and that are scalable to local student populations. Fike highlighted, “Interventions should be tailored to each institution and then evaluated to make sure they are meeting the unique needs of the institution and its students” (p. 68). Fike further explained that by predicting student persistence issues at the local institution, interventions can be designed that will target students’ situations and characteristics in a more effective manner.

For community colleges and higher education in general, public policy is shifting towards more accountability measures as part of higher education success. Over the past 30 years, access has been the fundamental consideration for community colleges with completion as a secondary priority. In recent years, student completion has become more of a critical piece for higher education’s report card, and student persistence is indelibly linked to this goal. In foundational studies, including developmental mathematics, students withdrawing from courses, repeating courses multiple times, and failing to demonstrate satisfactory progress are direct impediments to

the pursuit of technical and vocational, academic, and professional achievement. Is the problem instructional, intrapersonal, or institutional is one of the questions for consideration in this issue. The faculty and staff at LCC are proposing that that the problem consists of a combination of all of these factors, and the interventions required must be tailored in a way that considers the role of the instructor, the student, and the College as an organization that is attentive to the needs of its constituency.

Fike (2008) expanded the discussion of persistence models by describing popular theories to apply to intervention methods. According to Fike, “Understanding why students choose to leave or choose to stay is essential to those wanting to make a difference in students’ lives” (p.69). The models include student integration theory, student attrition model, and the input environment output model. The common theme among all these models is that they include factors that are external to the classroom and attempt to identify key elements in a student’s decision to persist or withdraw. The QEP acknowledges that external factors impact students’ motivation to persist and that identifying these elements will allow for targeted interventions. However, there is one additional component to the LCC plan for intervention, which is not expressly considered by Fike. The QEP team posits that incremental success at key academic points in the learning process may mitigate external factors and provide a level of motivation that will promote the student’s desire to study further and to compartmentalize external challenges. The NCCCS Developmental Mathematics Redesign may provide an opportunity for targeting incremental successes in the classroom in a systematic way. While this may not have been one of the original intents of the mathematics redesign, modularization does provide benefits for faculty members to identify key competencies at the appropriate developmental level. Student achievement and challenges are identified in a timely manner that will either reinforce the

student's confidence and motivation to progress or alert faculty and staff that additional interventions are required. Students will then recognize that the learning process is dynamic and malleable referring to Davis et al. (2011) incremental theory that students must believe that their present circumstances are changeable as a way to motivate them to persist.

Gore (2006) explained that the purpose of measuring self-efficacy in higher education is to determine "what activities students will pursue, the effort they expend in pursuing those activities and how long they will persist in the face of obstacles" (p.92). Gore further highlighted the relationship between "students' self-efficacy beliefs for academic tasks and their performance and persistence in school" (p.93). LCC seeks to increase students' level of motivation such that their desire to persist is greater than the obstacles they face. The challenges that students face outside the classroom are extremely personal and diverse and require interventions that address the unique needs of each student. Recognizing that students have these challenges and getting them to express their needs early in the academic process can help faculty and staff better support students' learning needs by adapting students' schedules, delivery methods, and supplemental activities to allow them to balance and manage school and life. One of the key aspects in approaching student success in current classes is dealing with their past experiences in academic environments and integrating support strategies in and out of the classroom. If a student has traditionally been unsuccessful in mathematics courses in primary and secondary education, there is a likelihood that he or she will continue to struggle at the post-secondary level. Howard (2008) described the role of students' past learning experiences in fundamental mathematics skills that continue to be an issue at the post-secondary level. He stated, "In order to acquire these skills, students' experiences, attitudes, and learning strategies must be different from before; otherwise, students will likely obtain the same results" (p.4). The

connection between secondary and post-secondary performance is being considered by the NCCCS Multiple Measures policies that propose high school GPA as a predictor of student success at the college level. The QEP uses high school performance as part of a broader assessment to identify cognitive, academic, and self-efficacy issues that students may bring to their post-secondary mathematics classroom. In essence, if the student has avoided mathematics throughout school and has been unsuccessful, LCC must address this issue by designing effective intervention strategies that will ensure student success. As Nussbaum and Dweck (2008) described when students have concrete options for dealing with their challenges, their desire to withdraw may be replaced by self-awareness that they can overcome the challenges. LCC's use of SI and CAC satisfies the need for concrete options. Success must be nurtured in response to the learned desire to give up when challenges arise during completion of DMAs 010-030 (See implementation section for strategies on addressing avoidance.)

The idea of college success may have different meanings for the individual student. Kim, Newton, Downey, and Benton (2010) offered a definition that can be applied at an institutional level to support the efforts of faculty and staff to develop student interventions. These authors stated, "College success could mean different outcomes for any individual; however, commonly held definitions include acceptable grade averages, retention toward a degree, and attainment of productive life skills" (p.112). The QEP focuses on first-time completion of DMAs 010-030 as a first step in acquiring knowledge and skills needed to accomplish career goals. The QEP internal data analysis focused on the number of students who traditionally have been unsuccessful at first-time completion of the entry level of developmental mathematics. It is hypothesized by LCC faculty and staff that incremental success at the entry level of developmental mathematics

may set an expectation and develop a level of motivation in the student that will carry him or her toward more long-term goals.

Kim et al. (2010) identified academic achievement and aptitude, circumstance, and personal variables that may have an impact on successful college persistence. Academic achievement and aptitude variables refer to high school GPA and standardized performance tests. Circumstance variables are factors that are outside the control of the student such as socioeconomic status, race, ethnicity, and family history of higher education. Personal variables include motivation, personal interest, study habits, and self-efficacy. The QEP will consider academic achievement and aptitude and personal variables but will not address circumstance variables. According to Kim et al. (2010), personal variables can be improved, and interventions may have a positive impact on persistence and achievement. While a student's aptitude may be a more inherent characteristic, the information of past performance is useful when combined with self-efficacy measures to develop more targeted interventions. For the purposes of the QEP, circumstantial variables are purely identifiers and do not offer opportunities for institutional intervention.

The significance of student support services in the achievement of those who place into developmental education has been traditionally overlooked (Kingan & Alfred 1993; Fonte 1997; Prince 2005;); Bailey, Jeong, & Cho 2010). The researchers explained how students are asked to take an initial assessment without truly understanding its impact on their academic futures. Also, there is very little if any preparation or review as part of this process. LCC's student services division has been working with students scheduling the initial placement assessment to advise them of the significance of their initial placement and to offer students the opportunity to review

the material covered on the assessment. This strategy is outside the scope of the QEP but is a parallel effort with the goal to help students receive a more accurate placement.

The accuracy of student placement in developmental mathematics courses has been a key issue for the NCCCS. Attempting to bring consistent standards to placement with diverse populations can be challenging because of differing circumstances and expectations at member institutions regarding what constitutes success. According to Belfield and Crosta (2012), “Over the longer run, placement tests tended to be better predicting which students will do well (get high college grades) than which students will do satisfactorily (get average grades) (p.5).” In the Virginia Community College System (VCCS) study cited by Belfield and Crosta (2012), reports of accuracy rates among colleges using placement exams as predictors of college success varied so greatly that it is difficult to assess the validity of the placement when used as a single tool. In a VCCS study conducted in 2010 (Belfield and Crosta, 2012), results from the use of COMPASS showed a range of accuracy from 2-43% depending on the individual college’s definition of success. This speaks to the interpretive nature of college placement at individual institutions. The social, cultural, and educational differences in a given community may skew the benefits of using discretionary tools such as high school transcripts or other subjective measures without triangulating those results with the input of a standardized assessment such as ACUPLACER or COMPASS.

While the validity of an assessment under the conditions described by Hughes and Scott-Clayton (2011) may not provide the level of accuracy in prediction that will allow for precise placement, the measure of success may include factors that are beyond the scope of assessment of aptitude. However, under fall 2013 NCCCS MMP, if a student has an overall un-weighted high school GPA of 2.6 or greater, he or she will not receive the additional diagnostic

assessment. Furthermore, Belfield and Crosta (2012) summarized that the validity of placement testing is “extremely context and test specific” (p.5). The validity of placement assessments needs to be considered in light of common accepted standards for the level of competency determined necessary to be successful in a course and subsequent courses.

Time in a developmental program cannot serve as a defining factor in student success; it is an external factor that should be considered in an attempt to promote student persistence and progression. The standard of mathematics competencies for each level of the developmental mathematics courses and gatekeeper courses has been established by the NCCCS. Faculty must determine if a student has the competencies required for each level and the appropriate delivery methods and instructional strategies. The context, culture, and community are important variables that also need to be considered when assessing the students. These are matters that are beyond the scope of system-wide control. As a state higher education authority, the NCCCS may regulate course levels, content, and methods for demonstrating competencies. Colleges must adapt to these new standards in ways that complement LCC’s students. The constant is the NCCCS standard and methods for demonstrating competencies; the variables are cognitive and psychosocial factors. Colleges seek to bring students to a common level of performance in a centralized higher education system. What cannot be accounted for in a standardized assessment are the social, cultural, and prior educational factors that are particular to the student body at an institution. By applying a bi-dimensional strategy to assessment and placement as well as intervention strategies when needed, a student may receive a more comprehensive assessment of competency while controlling for local differences at the institutional level.

## **Detailed Intervention Strategies and Implementation Plan**

### **Dimension One Interventions**

At the intervention point in the process, developmental mathematics instructors facilitate the completion of the first module. Students will follow a prescribed sequence of instructional activities, in-class assessments, and homework assignments. Based on incremental measures of success for each module, when a student fails to reach the required level of proficiency, he or she is referred to Supplemental Instruction (SI) to support the student's success in the deficient skill area. The SI program discussed in the section below is the primary intervention for Dimension One.

In each class offered under this proposed QEP, the traditional classroom will be enhanced by prescribed SI for students who are unsuccessful at benchmarks identified in this plan as incremental measures of success. Progress of students who attend SI will be compared with progress of students who do not comply with the assigned interventions.

### **Prescribed Supplemental Instruction (SI) program**

Since its introduction in the early seventies, SI has proven to be a viable retention strategy and academic-enhancement tool. According to Arendale (2001), "the established goals of SI are 1) improve student grades in targeted courses; 2) reduce attrition rates; and 3) increase students' graduation rates" (p.2). These goals align with a primary goal of the QEP: student persistence. Arendale's research indicates that poor grades affect attrition as students tend to drop difficult classes within the first six weeks of a semester (p.2). The role of supplemental instruction at LCC will be to target both historically difficult courses and at-risk students based on academic and psychosocial assessments. LCC uses Arendale's definition of historically difficult as a course that has 31 percent of the students receiving a grade of D, F, or W.

The QEP team determined that the current SI program needed to be restructured in order to achieve desired results. Previously, SI classes were scheduled on student or instructor request, and participation was low. In the past, SI tutors, who had previously excelled in mathematics, were often no longer enrolled in mathematics classes, which meant they were not familiar with the current content. Furthermore, a lack of available tutors to teach these classes hampered the success of the program and limited the scheduled times for supplemental activities.

For the QEP, the current SI program will be restructured as follows:

- A. A budget has been created to accommodate a professional lead SI tutor and additional student tutors who will rotate teaching responsibilities. Utilizing a small, well-trained staff will ensure quality instruction.
- B. All SI tutors will be trained by the lead mathematics instructor to ensure proficiency in all course competencies. Training began summer 2013 and will continue through fall 2013 in preparation for spring 2014 implementation.
- C. SI tutors will be required to attend daily DMAs 010-030 classes to gain first-hand knowledge of material covered and observe any student difficulties in understanding the material.
- D. SI classes will be conducted daily. A standard afternoon meeting time for SI classes will allow students to adjust their personal schedules and responsibilities in order to attend.
- E. SI tutors will keep detailed logs of participants and concepts addressed and assess students' understanding of concepts. SI tutors will meet with the lead mathematics instructor daily to discuss individual students, questions, and problems or concerns. The data will be used to further streamline the program and enhance its effectiveness.

- F. A designated mathematics instructor will visit the SI classroom two to three times per week to ensure the course is operating effectively.
- G. Lenoir Community College staff will advise incoming students of available SI classes during initial orientation and advising.

**Assessment:** Instructors will report student progress and attendance at SI sessions through the use of a QEP database. This will include progress on quizzes, test grades, and assignments. The database includes a section for comments noting individual improvement in study skills and learning strategies.

Students must develop strategies for resolving problems that may arise in the classroom, a homework assignment or in a real-life application. Developing strategies is part of the process of prescribed SI in that a student will be exposed to various strategies throughout the course to reach reasonable solutions to challenges not purely based on following steps but through a deeper understanding of the concepts. Sierpinska (2006) referring to Mandel's (1975) theory on student frustration described why having a deeper understanding of mathematical concepts is important to student success. "Technical knowledge of a mathematical method without its theoretical justification is not sufficient to provide those 'alternative strategies' at the time of getting stuck on a problem. Frustration thus remains unresolved and may lead to abandoning the task. Yet, the bridging courses tend to focus on the teaching of rigid techniques: one technique for a given type of problem" (Para. 3). The psychology of learning mathematics characterizes mathematics success as much or more than just memorizing a list of rules or carrying out mathematical procedures. In class, the instructor will present the theoretical foundation of the concepts, which will encourage students to develop a relational understanding of the information. These concepts are typically the *what* and the *why* of how students approach solving problems in

the mathematics discipline. Building upon the foundation of these concepts, the supplemental instruction leader will work with students by providing a structured environment where a student can refine and practice the process and procedure needed to develop an instrumental understanding of the concepts.

The combination of both the relational understanding and instrumental understanding of mathematics will afford students the opportunity to build their problem-solving skills, enhance levels of abstraction, and develop new skills to utilize in solving higher-level problems, while fostering self-confidence to attempt problems independently. Students who have early success and understanding in developmental mathematics may be able to connect their learning in mathematics to their desired career goals (Lent, Lopez, & Bieschke, 1993). Ultimately, the goal is reducing student frustration, giving up, and/or student attrition while creating independent learning.

### **Strategies to support learning styles**

To provide students alternatives to deal with challenges and frustration in the classroom, the following strategies will be employed to promote student success, while also serving to identify the need for additional interventions:

#### **I. Adjustment for avoidant and dependent learning styles**

Grasha (1996) provides a framework for developing strategies to counter avoidant and dependent learning styles. The Grasha-Reichmann Student Learning Styles Scales (GRSLSS) is used to “identify the preferences learners have for interacting with peers and the instructor in classroom settings” (p. 129). This inventory categorizes students into six distinctive learning styles: competitive, collaborative, avoidant, participant, dependent, and independent. After

collaboration with the developmental mathematics instructors at LCC, the QEP team determined that the majority of the students who demonstrated performance issues and mathematics anxiety tended to fit into two of the categories: avoidant and dependent. According to Grasha and (1996), students in the avoidant category are unenthusiastic about course content and class attendance. They are unwilling to participate with fellow students or the teacher. Additionally, these students are overwhelmed by classroom dynamics. Dependent learners show little intellectual curiosity and do not attempt to learn more than the required material. This type of learner views the teacher and classmates as sources of support and expects the support structure to provide specific guidelines on what needs to be done. Faculty agreed that the students' insecurities and anxiety about their mathematics skills greatly contributed to dependent and avoidant learning styles.

Data demonstrate that when students are forced to adjust their learning styles to the instructor's teaching styles, learning is difficult, and they often feel frustrated and experience a loss of confidence. On the other hand, when a student is allowed to learn in a manner that is natural to him or her, there are marked improvements in academic achievement, self-esteem, basic skills, creativity, and learner independence (Dunn, 1975).

The following strategies will be implemented to adjust to the two prominent learning styles:

#### **A. Monitored Group Work**

Requiring students to work in small groups to solve problems should minimize the anxiety caused by working alone. Small groups or pairings are less intimidating than class engagement for students who struggle with mathematics concepts. Additionally, group work promotes questions. Instructors would assign students to heterogeneous

groups. Monitoring group work will allow the instructor to provide feedback and correct or challenge student responses.

**Classroom Assessment:**

Guidelines for identifying effective group work include:

1. Students' ability to explain concepts
2. Amount of participation in group activity (verbal and hands-on)
3. Students' ability to produce and share
4. Results of assessment, such as a topic quiz

**B. Incorporation of MyMathLab**

The MyMathLab multimedia library correlates to textbook exercises, which regenerate algorithmically to provide students multiple opportunities to practice concepts. Video application and animation tools are designed to support multiple learning styles. The resources offer guided solutions, sample problems, quizzes, and learning aids.

MyMathLab also provides immediate feedback when students enter incorrect responses to problems, which builds confidence. Most importantly, the feedback and data allow students to self-monitor their own progress and enhance motivation. Hands-on learners are allowed to print the assignment, complete the work on paper, and then input the answers into the computer. The videos have captions for students with disabilities, and several are captioned in Spanish. Instructors will require students to watch specific videos related to the material being covered while allowing students to go beyond specified videos as understanding allows.

**Classroom Assessment:** Supplemental coursework will give students additional practice needed to master course competencies and pass quizzes/tests.

**C. Buddy at the Board (for avoidant learners)**

Mathematics instructors will require all students to work homework and class problems on the board. The Buddy-at-the-Board method allows for collaborative performance and motivates avoidant learners to demonstrate acquired skills. The exercise builds confidence and provides encouragement to work alone. As with group dynamics, instructors must strategically assign partners to achieve expected results.

**Classroom Assessment:** Students will overcome mathematics anxiety as self-confidence builds. This will be observed and noted by in-class activities that require students to participate and demonstrate their understanding of incremental learning concepts.

**D. George Pólya Four-Step Problem-Solving Process (for dependent learners)**

The Pólya program is designed to generate independent thinking by challenging students' curiosity as they solve problems by using stimulating questions. The process teaches students to understand not only the solution to the problem but also the motives and procedures of the problem (Pólya, 1996). Lenoir Community College mathematics instructors trained on the dynamics of the process in spring 2013, prior to implementation of the QEP, to enable them to teach students the four steps of the process for problem solving.

Step One: Understanding the problem

First, the verbal statement must be clear. The student must recognize principle parts of the problem: the unknown, the data, and the condition. Asking specific questions about each component will help. If a figure is connected to the problem, the student should draw it and point out the unknown and the data. The student will consider each

principle part one-by-one and then relate each detail to other details and each to the whole of the problem (6, 33).

**Step Two: Devising a plan**

Moving from understanding of the problem to devising a plan can prove torturous for many students. The materials for solving a problem come from formerly acquired mathematics knowledge. Thus, it is appropriate to draw upon another problem that is related to the unknown of the current problem. If this does not help, the student should restate the problem. This may involve variation, generalization, use of analogy, etc. It may also be necessary to solve a related problem first.

**Step Three: Carrying out the plan**

The plan is a general outline. All details must fit the outline without obscurity. Students must check each step and be convinced of its correctness.

**Step Four: Looking back**

Once the problem is completed, the student cannot merely close the book and move on to something else. He or she must reconsider and reexamine the result and the path leading to it. This consolidates knowledge and understanding and reinforces the student's confidence that he or she has the ability to solve problems (14-15).

**Classroom Assessment:** Students will overcome mathematics anxiety and acquire the confidence and skills necessary to be academically successful in the mathematics course. Instructors will recognize improvement in student skills through participatory efforts and improved test scores.

**E. Incorporation of Real-Life Projects/Dynamics**

Often students in developmental mathematics courses may not be able to appreciate the importance of mathematics in their chosen majors because they may see mathematics as an interruption on the path to their goals. To educate and motivate students, DMAs 010, 020, and 030 curricula will include projects that are relevant to general areas of studies and everyday life. Each assignment will have components that are interesting and have a practical application. A real-life project will be assigned in each mathematics module and include all competencies addressed in the module. Instructors will adjust the content of each project periodically to incorporate different fields of study (See Appendices D, E, and F).

## **II. Common Testing**

The College instructors are creating the common final assessment using the test bank from MyMathLabs. This database of questions is aligned with the North Carolina DMA SLOs. It offers a variety of questions to ensure students have mastered the competencies for each level of DMA and have the skills necessary to move to the next level of mathematics. The North Carolina Critical Success Factors serve as an added incentive for creating a valid assessment. The Critical Success Factors Report is published annually as an accountability measure for NC community colleges. Each college is compared to a standard and to the other colleges on how well their students do on eight performance measures. The report includes a measure of how well developmental students do in their first college level mathematics class.

Developmental mathematics faculty will utilize common testing for all students in DMAs 010-030 in order to facilitate assessment of incremental growth. Common testing will include all quizzes, tests, and nightly homework assignments.

**Assessment:** Testing data will be available to measure students' overall academic success based upon the administration of multiple interventions.

### **Dimension Two Overview**

The intervention strategies proposed for dimension two are based on the guiding principle that faculty and staff cannot change the circumstances in a student's life but can help the student develop strategies to overcome those circumstances. Some of the keys to this process are to identify and direct the student's motivation and help him or her acquire a sense of confidence to persist and achieve, even when the circumstances of life and school are difficult.

The first step in supporting students is to collect background information on their level of self-efficacy, experiences, and perceptions towards mathematics and school in general. This will be accomplished in part by the ACT standardized assessment ENGAGE, which is specifically designed to measure non-cognitive psychosocial factors in college students. In order to promote achievement of SLOs, students will be tracked for an identified academic, technical and vocational, or professional program that will coincide with the completion of the developmental mathematics sequence. Students will have developed a schedule for their second semester that includes at least one course leading to their desired program of study. For those students who do not have an identified post-developmental goal, a CAC will intervene to help them develop an academic, technical, vocational, or professional goal.

Dimension Two intervention strategies will be implemented when the student demonstrates challenges in attendance, responses to instructions, behavior, and/or a lack progress even after receiving supplemental instruction. At this point, the student will be

referred to the CAC for further intervention to discuss what may be occurring in his or her life, the psychosocial challenges that are external to the classroom or are exacerbated by a lack of success in developmental mathematics.

### **Dimension Two Intervention Strategies**

Step 1: Assess the student's self-efficacy and examine current progress in academic performance and course sequencing.

- a. The CAC and/or counselor will meet with the student who has been referred by the instructor.
- b. The CAC will review the student's self-efficacy assessment, high school GPA, or GED scores on areas related to mathematics to determine a pattern from experiences.
- c. The CAC will interview the student to determine why he or she is enrolled at LCC and if the student has a clear academic, technical, vocational, or professional goal for attending school. If not, the CAC will work with the student to identify a path that may match interests, academic performance, and skills.
- d. The CAC will document the meetings to consider alternative schedules, delivery methods, and/or a change of major, if warranted.

By approaching the learning process of the student from cognitive and academic perspectives as well as psychosocial influences, LCC's faculty and staff believe that this is a more complete approach to supporting student persistence and success. To merely focus on classroom issues and not focus on self-efficacy and motivation, would be to ignore an entire facet of the student's presence at LCC. What he or she brings to college is not merely aptitude relevant, it is also the aspects of the internal and external influences that may be manifested in

the classroom through poor performance and attendance, yet originate from non-cognitive variables.

### **College Achievement Coach (CAC)**

The purpose of a CAC is to support student success and retention for students most at risk of failing to persist in their program of study. The CAC will work with students who are identified as “in need of intervention” through instructor referral or by self-identification to support their transition to academic, technical, vocational, and professional programs.

CAC duties may include the following:

- Provide perspective, encouragement, and insight as students set academic goals
- Provide guidance as students develop success strategies to overcome academic difficulties and setbacks
- Assist students to develop skills in planning, resiliency, and persistence
- Meet students individually and in small groups
- Create interventions for individualized needs, such as test anxiety
- Serve as a liaison between students and instructors
- Assist students with career exploration and college transition
- Provide orientation activities to inform students of available opportunities and paths to completion

- Refer students to internal and external supports, such as counselors, government services, housing, food, shelter, childcare, etc.
- Provide workshops and presentations to encourage and foster student success
- Track quantitative and qualitative data regarding student success
- Implement and analyze the ENGAGE College Survey to assess and address any student needs that might hamper academic success and persistence

**Assessment:** DMA 010, 020, and 030 student cohort group will persist through Dimensions One and Two with individualized assistance from CAC in collaboration with faculty.

### **ENGAGE College Survey**

The College will begin using the ENGAGE College Survey to assist with identifying needed interventions for students. ENGAGE is an ACT product, formerly known as the Student Readiness Inventory. The purpose is to measure psychosocial factors known to influence college success and retention. In particular, the College is considering how the variables of motivation and self-efficacy impact students' approaches to study skills and ultimately their desire and ability to persist and complete a course (Prat-Sala & Redford, 2010). The survey is composed of 108 items that form ten scales: academic discipline, academic self-confidence, and commitment to college, communication skills, general determination, goal striving, social activity, social connection, steadiness, and study skills. Focusing on student engagement, performance, and degree completion, each of these scales will be connected to interventions available on campus. Specifically, it will give the CAC a tool to assist with offering guidance to the individual student. The CAC will assess the results of ENGAGE scores to determine if there are potential student challenges that can be addressed early in the student's experience for DMAs 010-030.

Lenoir Community College piloted the ENGAGE survey at the beginning of Spring Semester 2013. The data have been used to assess connections between students' scores in the areas of academic self-confidence and study skills as defined on an initial self-efficacy assessment. This process is part of the College's collection of baseline data to track and assess the relationship between self-efficacy and student performance.

**Assessment:** DMA 010, 020, and 030 student cohorts will achieve the prescribed level of success in each of the SLOs required for the developmental mathematics modules.

## **Dimensions One and Two Implementation Plan**

### **DMA 010**

#### **Operations with Integers**

##### **Initial Assessment**

A common preliminary assessment measuring ability to add, subtract, multiply and divide with whole numbers will be administered as the initial course assessment. Each operation will be assessed individually. Students who do not master these competencies will have difficulties with DMA 010 Objectives.

**Intervention: Any student who scores less than 80% or fails to satisfactorily participate will be referred to Supplemental Instruction and /or the College Achievement Coach for assistance.**

##### **Conceptual Student Learning Outcomes**

1. Distinguish between appropriate use of area and perimeter formulas to solve geometric application problems
2. Represent the events of a geometric application problem included in this module pictorially and evaluate the correct solution using the appropriate formula

3. Demonstrate understanding of exponents by converting between exponential and expanded form
4. Evaluate exponents
5. Calculate the square root of numbers containing perfect squares

**Assessment: Common Quiz One.**

**Intervention: Any student who scores less than 80% will be referred to Supplemental**

**Instruction and/or the CAC.**

6. Correctly represent integers on a number line
7. Demonstrate the correct use of additive inverses
8. Evaluate the absolute value of a number
9. Apply addition and subtraction of integers in solving contextual application problems
10. Demonstrate an understanding of addition and subtraction of integers within contextual application problems
11. Correctly apply the associative and commutative properties

**Assessment: Real-life Project and common Quiz Two. The DMA 010 project and quiz two measure students' understanding of learning outcomes 1 - 11. Checking skills at this point will allow time to address any critical student shortcomings prior to the end of the module.**

**Intervention: Any student who scores less than 80% on quiz two or the Real-Life Project or fails to satisfactorily participate will be referred to Supplemental Instruction and/or the CAC.**

12. Demonstrate an understanding of multiplying and dividing integers within contextual application problems
13. Apply multiplication and division of integers in solving contextual application problems
14. Evaluate integer expressions by using the correct order of operations

**Final Assessment: Common Test: Objectives 1 - 14.**

**Intervention: Any student who scores less than 80% will spend one hour of remediation with the instructor and then retest.**

## **DMA 020**

### **Fractions and Decimals**

#### **Conceptual Student Learning Outcomes**

1. Visually represent fractions
2. Simplify fractions
3. Visually represent equivalent fractions and correctly place the values on the number line
4. Multiply fractions
5. Visually represent multiplication of fractions
6. Divide fractions using reciprocals
7. Add and subtract fractions with like denominators
8. Write an equivalent fraction with a given denominator
9. Add and subtract fractions with unlike denominators using the correct LCD
10. Visually represent the sum and difference of two fractions with unlike denominators
11. Solve conceptual problems involving fractions

**Assessment: Common Quiz One.**

**Intervention: Any student who scores less than 80% or fails to satisfactorily participate will be referred to Supplemental Instruction and/or the CAC.**

12. Visually represent decimals
13. Correctly round decimals to a specific place value
14. Estimate sums, differences, products, and quotients with decimals
15. Demonstrate an understanding of the connection between fractions and decimals
16. Solve conceptual problems involving decimals

**Assessment: Real-Life Project and Common Quiz Two.** The DMA 020 project and quiz two measure students' understanding of learning outcomes 1 - 16. Checking skills at this point will allow time to address any critical student shortcomings prior to the end of the module.

**Intervention: Any student who scores less than 80% or fails to satisfactorily participate will be referred to Supplemental Instruction and/or the CAC.**

17. Distinguish between the appropriate use of circumference and area of a circle in solving geometric applications
18. Represent events in geometric problems pictorially and evaluate solution using correct formulas
19. Correlate negative exponents to fractions and decimals in base 10
20. Convert between standard notation and scientific notation

**Final Assessment: Common Test: Objectives 1 - 20**

**Intervention: Any student who scores less than 80% will spend one hour of remediation with the instructor and then retest.**

## **DMA 030**

### **Proportion/Ratios/Rates/Percentages**

#### **Conceptual Student Learning Outcomes**

1. Write a ratio using a variety of notations.
2. Distinguish between events in a problem that should be represented by a ratio or a rate
3. Calculate a unit rate
4. Demonstrate an understanding of the concepts of ratios, rates, and proportions in the context of application problems
5. Solve application problems using ratios, rates, and proportions
6. Recognize that two triangles are similar and solve for unknown sides using proportions in contextual applications

**Assessment: Common Quiz One.**

**Intervention: Any student who scores less than 80% or fails to satisfactorily participate will be referred to Supplemental Instruction and/or the CAC for assistance.**

7. Represent percent as “parts of 100”
8. Correctly convert between fractions, decimals, and percentages
9. Demonstrate an understanding of the concepts of percentages in the context of application problems
10. Solve application problems using percentages

**Assessment: Real-Life Project and Standardized Quiz Two. The DMA 030 project and quiz two measure students’ understanding of learning outcomes 1 - 10. Checking skills at this point will allow time to address any critical student shortcomings prior to the end of the module.**

**Intervention: Any student who scores less than 80% or fails to satisfactorily participate will be referred to Supplemental Instruction and/or to the CAC.**

11. Convert measurements within the U.S. customary and metric system using unit analysis
12. Convert measurements between the U.S customary and metric Systems using unit analysis

**Final Assessment: Standardized Test: Objectives 1 - 12**

**Intervention: Any student who scores less than 80% will spend one hour of remediation with the instructor and then retest.**

### **Data Tracking Plan**

LCC’s QEP team collaborated with the College’s information technology department to develop a database to track student referrals for prescribed interventions. The purpose of the database is to provide cumulative reporting on students’ initial assessment, classroom performance, interventions, attendance at intervention sessions, and subsequent achievement of

SLOs. The database is designed to track students through the scope of the QEP for DMAs 010-030 with both cognitive and psychosocial variables documented (See Appendix G). The College hopes that precise tracking of student performance, interventions, and outcomes will support meaningful adjustments and improvements to the ways in which it serves students. By using a customized database with linked reporting tools, the efficiency and effectiveness of student interventions will be documented in a manner that will allow LCC to share information internally as well as with institutions across the nation (See Appendix Program Outcomes H).

**Budget and Personnel**

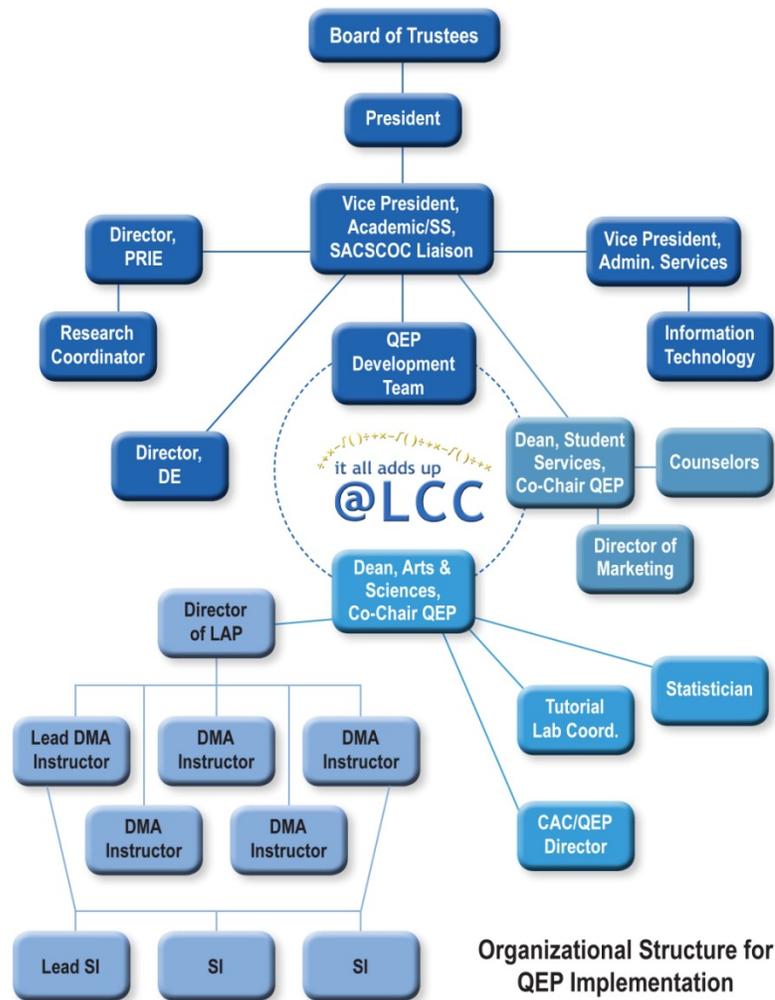
**Table 7 Proposed budget for QEP personnel and resources 2013-2018**

		QEP Budget						
		Planning	Year 1	Year 2	Year 3	Year 4	Year 5	
Item	Development	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	Total
<b>Salaries*</b>								
Director/CAC		62,283	73,294	74,955	133,649	135,377	137,139	616,697
Co-Chairs	69,000	51,000	52,020	53,060	54,122	55,204	56,308	390,714
Faculty	43,700	47,100	48,042	49,003	49,983	50,983	52,002	340,813
IE/data/stats	3,000	9,450	11,000	11,220	11,444	11,673	11,907	69,694
SI Tutors			18,000	27,000	27,540	28,091	28,653	129,283
Support Staff		2,800	12,800	13,056	13,317	13,583	13,855	69,411
<b>Training/Travel</b>		7,700	5,000	2,000	2,000	2,000	2,000	20,700
<b>Marketing</b>			10,000	1,000	1,000	1,000	1,000	14,000
<b>Supplies</b>			2,000	2,000	7,000	2,000	2,000	15,000
<b>QEP Editors</b>		3,500	1,000	-	-	-	-	4,500
<b>Contingency</b>			10,000	10,000	10,000	10,000	10,000	50,000
<b>ENGAGE College Survey</b>		500	8,000	8,000	8,500	8,500	8,500	42,000
<b>Total</b>	115,700	184,333	251,156	251,294	318,555	318,411	323,364	1,762,812

\*includes payroll taxes and benefits

The budget for the QEP is comprised of faculty and staff salaries as well as funds for training, supplies, and the ENGAGE College Survey. The salaries in the budget include the Director of the QEP/College Achievement Coach. This person will dedicate one-hundred

percent of his or her time to the position. When the QEP expands to all students in year three, it is anticipated an additional College Achievement Coach may need to be hired. Currently, funds to cover the costs of personnel, space, instructional resources, assessments, and documentation tools are secured from existing budgets. One of the strengths of the QEP is that the sustainability of the proposed interventions has been calculated as part of the College’s annual budget with resources diverted to meet the needs of the target population identified in this proposal. Future expansion and additional funding has been considered to match the proposed QEP timeline (See Appendix B). The following faculty, staff, and administrators are part of the planning, implementation, and review of the QEP:



Upon approval of the QEP proposal, the Co-Chairs, Dean of Arts and Sciences and Dean of Student Services, will continue to devote approximately one-quarter of their time to the QEP. The Dean of Arts and Sciences will supervise staff and faculty responsible for QEP implementation. The Dean of Students Services will act as a liaison between the College Achievement Coach and counselors. This Dean will also monitor the DMAs' success and the integration of academic and counseling departments to serve students more effectively. Faculty will dedicate its time to the students in the classrooms and work with the QEP's two specific positions for supplemental instruction (SI): the Lead Supplemental Instructor (LSI) and trained student SI tutors. Faculty will work with the LSI and SI tutors to determine the success of instructional strategies. The lead DMAs instructor will meet with the LSI and SI tutors several times a week to discuss any issues and monitor the progress of the LSI and SI tutors. Since there will be a common curriculum that includes tests, quizzes, assignments, and presentations, the faculty will consult with each other about successes and failures as well as needed modifications. As time progresses, faculty will continue monitoring changes and how the changes impact students. This process will involve departmental meetings to discuss the DMAs and student progress. In addition to monitoring implementation and student progress, faculty will enter data in the QEP database.

The IE/Data/Stats line item includes all staff and faculty responsible for data collection and analysis from Planning, Research, and Institutional Effectiveness; the statistician; and Information Systems. Planning, Research, and Institutional Effectiveness staff and the statistician will monitor data while it is being gathered to assure the consistency of the collection, to analyze the data at the end of every semester, and to monitor the database for any assistance required from Information Systems staff.

The LSI will be involved with SI five hours every day. The SI tutors will be involved with SI for three hours daily. This time will include observing DMAs, preparing SI materials, and teaching SI classes. They will also meet with faculty members to discuss current class activities and have any questions answered. In addition, the LSI and SI tutors are responsible for accurate records of student attendance in the SI sessions.

The support staff line includes the instructional assistant in the Arts and Sciences Division and the Coordinator of the Learning Assistance Program Tutorial Lab. These two positions support the plan by ordering supplies for the QEP, organizing rooms for SI, and completing documentation for FTE and SI tutors' pay.

The supply budget will include all of the items required to operate an office. This will consist of everything from paper to small equipment.

The ENGAGE College Survey will be given to every student only during his or her initial entry into DMAs 010, 020, and 030. This line is the estimated cost of the ENGAGE College Survey.

Training/Travel comprises training for the College Achievement Coach and faculty as needed. For the pilot year, the College Achievement Coach will attend training and earn a certification as a Certified Life Coach. The College Achievement Coach will also travel to Central New Mexico Community College, a model program for achievement coaches, for further training. This travel will take place in summer 2013, and the cost is divided between the 2012-2013 and the 2013-2014 budgets. Future training may include specialized training for DMA faculty and the College Achievement Coach when the QEP team identifies students who require additional assistance or general training that would support the entire faculty of the College.

It is important that the College faculty, staff, and students be aware of the QEP, and everything it has to offer. In order to provide training and awareness of the plan, the College has budgeted for marketing. Items in this budget include giveaways such as calculators, mouse pads, and tee-shirts used for generalized marketing and prizes for QEP questions and activities sponsored by the College.

### **Future Implications**

During the initial implementation of LCC's quality enhancement interventions, the faculty and staff will seek clear and documentable evidence that early incremental academic assistance and targeted coaching will improve learning outcomes and promote persistence for students taking DMAs 010-030. This case study focuses on a targeted population of 17-24 year olds in traditional classes in order to control for factors that may be external to common conditions in a college developmental mathematics class. While this is a meaningful attempt to serve and benefit a considerable student demographic at LCC, the goal is to examine the efficacy of the proposed interventions and adapt them well beyond the scope of entry level developmental mathematics. The faculty, staff, and administration believe that the quality enhancements that are proposed in the QEP are applicable and beneficial to all student areas because of the foundational and comprehensive nature of supporting incremental student success and dealing with self-efficacy, motivation, and other factors external to the classroom that may impact student success.

Some of the areas that may benefit from future adaptations of the proposed interventions include higher level developmental mathematics students, developmental reading, and English modules (DREs) that will follow in fall 2015. These areas within the developmental education

family may be able to benefit simply by adapting the intervention strategies used for DMAs 010-030 and applying the strategies to the context of these course areas.

Areas outside developmental education may benefit from stronger connections between entry-level students at LCC and the programs they seek beyond developmental classes. This process will require strong collaboration between the developmental education faculty and staff and program members from across the campus. It is an integral piece to LCC's initial implementation of quality enhancement interventions to help students define their motivations for attending LCC and connecting their goals to the incremental steps to success that is derived from every course on the path to completion. These strategies may have a significant impact on career and technical programs as well as health sciences in that students will have a clearer image of what is required to achieve a desired goal and how each of the steps in the process brings them closer to that end.

For distance education students, the interventions of SI and CAC will be adapted to an online delivery method utilizing tools and strategies appropriate for this environment. LCC's QEP established a time line for expanding and broadening access for distance education students. This plan can be examined more fully in (See Appendix A) of this document.

## References

- AACC Mission: Building a Nation of Learners by Advancing America's Community Colleges (2006). Retrieved April 10, 2013 from <http://www.aacc.nche.edu/About/Pages/mission.aspx>
- Arendale, D. (2001) "Supplemental Instruction: Review of Research Concerning the Effectiveness of SI." Retrieved October 15, 2012 <http://www.tc.umn.edu/~arend011/SIresearchreview01.pdf>
- Bailey, A., & W.Copper. (2009). Supplemental instruction versus remedial classes: Which method should be used by community colleges in the classroom? *EDF 6481*. University of Central Florida. Retrieved from <http://wmacooper.pbworks.com/f/research%20proposal%20combined-final%20TO%20SUBMIT.pdf>
- Bailey, T., D.W. Jeong, & S.W Cho. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review*, 29(2), 255–270.
- Bailey, T., & S.W. Cho. (2007). Developmental education in community colleges. Retrieved March 27, 2013, from Community College Research Center: <http://www2.ed.gov/PDFDocs/college-completion/07-developmental-education-in-community-colleges.pdf>
- Bandura, A., & E.A. Locke. (2003). Negative self-efficacy and goal effects revisited. *Journal of Applied Psychology*, 88(1), 87-99.

Belfield, C. R., & P.M. Crosta. (2012, February). Predicting success in college: The importance of placement tests and high school transcripts. Community College Research Center, 41.

Bonham, B.S., Boylan, H.R. (2012). Developmental Mathematics: Challenges, Promising Practices, and Recent Initiatives. *The Journal of Developmental Education* Volume 36, 2, winter 2012.

Carter, L.P. (2011, May). The Role of Cognitive, Non-Cognitive and Career Development Factors in the Academic Success and Persistence of Traditional and First Generation College Students. Master's Thesis.

Cohen, D. (1995, September). *Crossroads in mathematics standards for introductory college mathematics before calculus*. Retrieved January 19, 2013, from American Mathematics Association of Two-Year Colleges:  
<http://www.amatyc.org/Crossroads/CROSSROADS/V1/chapter1.pdf>

Creating Success Research Brief (2011, April). Highlights of Research on Developmental 'C' Students in Subsequent Math Courses by College. North Carolina Community College System.

Crocker, J., & C. Wolfe. (2001). Contingencies of self-worth. *Psychological Review*, 108(3), 593-623.

Davis, J. L., Burnette, J. L., Allison, S. T., & Stone, H. (2011). Against the odds: academic underdogs benefit from incremental theories. *Social Psychology of Education*, 14(3), 331-346.

Dunn, R. & K. Dunn. "Learning styles, teaching styles." *NAASSP Bulletin*. 59

(1975): 37-49.

Dweck, C. (2006). *Mindset*. New York, New York:Random House.

Fonte, R. (1997). Structured versus laissez-faire open access: Implementation of a proactive strategy. *New Directions for Community Colleges*, 100, 43–52.

Golfin, P., Jordan, W., Hull, D., & Ruffin, M. (2005). Strengthening mathematics skills at the postsecondary level: Literature review and analysis. Washington, DC: U.S. Department of Education, Office of Vocational and Adult Education. Retrieved from ERIC database (ED494241)

Gore, P. A. (2006). Academic self-efficacy as predictor of college outcomes: Two incremental validity studies. *The Journal of Career Assessment* 2006 14:92 Retrieved May 17, 2013 from <http://jca.sagepub.com/content/14/1/92>

Grasha, A.F. (1996) Teaching with style: A practical Gpguide to enhancing learning by understanding teaching and learning styles. Pittsburgh: Alliance Publishers.

Grubbs, N.W. & R.D. Cox. (2005). Pedagogical alignment and curricular consistency: The challenges for developmental education. *New Directions for Community Colleges*, Volume 2005, Issue 129, 93-103.

Hannafin, M. (1983, November). Immediate, sustained, and cumulative effects of an instructional system on mathematics achievement. *Journal of Educational Research*, 77(2).

- Hays, B. (2010, April). How do we know if learning assistance programs work? Paper presented at the meeting of the Research and Planning Group, Pomona, CA.
- Howard, L. (2008). Developmental Students' Perceptions of Unsuccessful and Successful Mathematics Learning. Dissertation, Utah State University, 2008.
- Howard, L., & M. Whitaker. (2011). Unsuccessful and successful mathematics. *Journal of Developmental Education*, 35(2), 2-16.
- Hughes, K.L., Scott-Clayton, J. (2011). Assessing Developmental Assessment in Community Colleges. CCRC Working Paper No.19, Retrieved July 27, 2013 from <http://ccrc.tc.columbia.edu/media/k2/attachments/assessing-developmental-assessment.pdf>
- Kim, E., F.B. Newton, Downey, S.L. Benton. (2010). Personal factors impacting college student success: College learning effectiveness inventory (CLEI). *College Student Journal*, v44 n1 p112-125 Mar 2010.
- Kingan, M. E., & R.L. Alfred. (1993). Entry assessment in community colleges: Tracking or facilitating? *Community College Review*, 21(3), 3-16.
- Knowles, M. S. (1980). *The modern practice of adult education: From pedagogy to andragogy* (2<sup>nd</sup> ed.). New York: Cambridge Books.
- Lent, R. W., F.G. Lopez, & K.J. Bieschke. (1993). Predicting mathematics-related choice and success behaviors: Test of an expanded social cognitive model. *Journal of Vocational Behavior*, 42, 223-236.

- McClusky, H. Y. (ca. 1974). Education for aging: The scope of the field and perspectives for the future. In S. Grabowski & W. D. Mason (Eds.), *Learning for aging* (pp. 324-355). Washington, DC: Adult Education Association of the USA.
- Merriam, S. B., R.S. Caffarella, & L.M. Baumgartner. (2007). *Learning in adulthood: A comprehensive guide* (3<sup>rd</sup> ed.). San Francisco, CA: Jossey-Bass.
- National Center for Education Statistics (2013). *Projections of education statistics to 2021*. Retrieved February 08, 2013 <http://nces.ed.gov/programs/projections/projections2021/>
- Nussbaum, D., & C.S. Dweck. (2008). Defensiveness versus remediation: Self theories and modes of self-esteem maintenance. *Personality and Social Psychology Bulletin*, 34, 599-612. Retrieved from <http://psp.sagepub.com/content/34/5/599>
- Pólya, G. (1996) *How to solve it: A new aspect of mathematics method*. Princeton: Princeton University Press, 1973.
- Prat-Sala, M., & P. Redford. (2010). The Interplay between motivation, self-efficacy, and approaches to studying. *British Journal of Educational Psychology*, 283-305.
- Prince, H. (2005). Standardization vs. flexibility: State policy options on placement testing for developmental education in community colleges (Policy Brief). Boston, MA: Jobs for the Future.
- Robbins, S. B., J. Allen, Castillas, C. Hamme-Peterson, & H. Le. (2006). Unraveling the differential effects of motivational and skills, social, and self-management measures from traditional predictors of college outcomes. *Journal of Educational Psychology*, 98(3), 598-616.

Scott-Clayton, J. (2012, February). Do high-stakes placement exams predict college success?  
Community College Research Center, 40.

Stigler, J. W., K.B. Givvin, & B.J. Thompson. (2010, May). What community college  
developmental mathematics students understand about mathematics. *Mathematics  
AMATYC Educator*, 1, pp. 4-16.

University of Missouri (2007). Supplemental Instruction National Data: Fall-2003-Fall 2006  
Retrieved June 23, 2013, from [http://www.umkc.edu/asm/si/si-docs/National-Data-SI-  
2003-2006.pdf](http://www.umkc.edu/asm/si/si-docs/National-Data-SI-2003-2006.pdf)

Virginias Community Colleges. (2009). *The Critical Point: Redesigning Developmental  
Mathematics Education in the Virginia Community System*. Retrieved from  
[http://www.vccs.edu/Portals/0/ContentAreas/AcademicServices/The\\_Critical\\_Point-  
DMRT\\_Report\\_082010\\_pdf.pdf](http://www.vccs.edu/Portals/0/ContentAreas/AcademicServices/The_Critical_Point-DMRT_Report_082010_pdf.pdf)

**Appendix A. Multiple Measures of Placement**

<p>Unweighted GPA = or &gt; 2.6 And FRC Code 1, 2, 3, or 4*</p>	<p>Student is college ready for any gateway math course and any course that has a DMA prerequisite. Colleges may require students with a GPA &lt;3.0 enrolling in MAT 151, 155, 161, or 171 to take a supplemental math lab as a co-requisite.</p>
<p>Unweighted GPA = or &gt; 2.6 And FRC Code 1, 2, 3, or 4*</p>	<p>Student is college ready for any English course up to and including English 111 and any course that has a DRE prerequisite. Colleges may require students with a GPA &lt; 3.0 enrolling in ENG 110 and ENG 111 to take a supplemental English composition lab as a co-requisite.</p>
<p>Unweighted GPA &lt; 2.6</p>	<p>College will evaluate subject-area ACT or SAT scores to determine if student is college ready in math and English using the following scores (based on national and state validation studies): English: ACT Reading 20 OR ACT English 18 SAT Writing 500 OR SAT Critical Reading 500 Math: ACT Math 22 SAT Math 500</p>
<p>Unweighted GPA &lt; 2.6 and subject-area score(s) below college ready</p>	<p>Student will take the subject-area diagnostic assessment(s) to determine placement. (Colleges will continue to use Accuplacer, Asset or COMPASS until NC's custom diagnostic assessment is fully implemented.)</p>
<p>Students without a recent transcript GPA or without ACT or SAT scores</p>	<p>Student will take the subject-area diagnostic assessment(s) to determine placement. (Colleges will continue to use Accuplacer, Asset or COMPASS until NC's custom diagnostic assessment is fully implemented.)</p>

### Appendix B. QEP Timeline

This timeline reflects the generation and implementation of Lenoir Community College’s Quality Enhancement Plan Proposal: Addressing the Needs of Developmental Mathematics Students.

<b>PRE-QEP</b>	
<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Establish QEP Leadership Team</b>	Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research, and Institutional Effectiveness
<b>Select QEP Topic</b>	Leadership Team, Board of Trustees, LCC Faculty, Staff, other stakeholders, and students
<b>Select College Achievement Coach</b>	Leadership Team
<b>Select QEP Co-Chairs</b>	Leadership Team
<b>Establish QEP Budget</b>	President; Vice President of Academic & Student Services; CFO; QEP Committee; Director of Planning, Research, and Institutional Effectiveness
<b>Pilot Selected Programs</b>	
<ul style="list-style-type: none"> <li>• DMAs 010, 020, 030</li> <li>• ENGAGE College Survey</li> <li>• CAC Training</li> <li>• CAC Referral</li> <li>• Database</li> </ul>	<p>Leadership Team, CAC DMA Lead Instructor, Director of LAP</p> <p>Lead Counselor, CAC</p> <p>CAC</p> <p>DMA Instructors</p> <p>Statistician, Computer Programmer, LAP Instructors, CAC</p>
<b>Select QEP Marketing</b>	Leadership Team, Director of Marketing, Recruiting, and Communication; QEP Committee

**PRE-QEP: Development and Build DMAS 010, 020, 030 (2012-2013)**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Create and Develop DMAs 010, 020, 030</b>	Dean of Arts and Science, Director of LAP, DMA Instructors
<b>Edit Course Content DMAs 010, 020, 030</b>	Dean of Arts and Science, Director of LAP, DMA Instructors
<b>Workshop Course Content DMAs 010, 020, 030</b>	Dean of Arts and Science, Director of LAP, DMA Instructors
<b>Develop Instructional Strategies DMAs 010, 020, 030</b>	Dean of Arts and Science, Director of LAP, DMA Instructors
<b>Edit Course Content DMAs 010, 020, 030</b>	Dean of Arts and Science, Director of LAP, DMA Instructors

**QEP: Year One, Pilot (2013-2014)**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Summer 2013</b>	
<b>Administer ENGAGE College Survey to all First-Time Enrolled Students in DMAs 010, 020, 030 Traditional Classes</b>	Lead Counselor and CAC
<b>Implement DMAs 010, 020, 030</b>	DMA Instructors, Director of LAP
<b>Fall 2013</b>	
<b>Identify and appoint QEP Director</b>	Leadership Team, QEP Co – Chairs
<b>Administer ENGAGE College Survey</b>	Lead Counselor, CAC/QEP Director
<b>Record ENGAGE College Survey Results</b>	Lead Counselor, CAC/QEP Director
<b>Track Student Performance</b>	DMAs Instructors; Director of Planning, Research and Institutional Effectiveness; Statistician; CAC/QEP Director

Spring 2014	
<b>Gather fall 2013 data on student performance and reevaluate benchmarks (to be completed early in semester)</b>	Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Lead Counselor
Apply Interventions to Pilot Sections	
<b>Dimension One</b>	
<ul style="list-style-type: none"> <li>• Utilize common instructional strategies and course assessments</li> </ul>	DMA Instructors
<ul style="list-style-type: none"> <li>• Supplemental Instruction</li> </ul>	DMA Instructors, SI Tutors
<b>Dimension Two</b>	
<ul style="list-style-type: none"> <li>• ENGAGE College Survey Results</li> </ul>	CAC/QEP Director
<ul style="list-style-type: none"> <li>• Identified Low Self-efficacy</li> </ul>	CAC/QEP Director
<ul style="list-style-type: none"> <li>• Identified Psychosocial Issues</li> </ul>	DMA Instructors, CAC/QEP Director, Counselors
<b>Gather Data from DMAs 010, 020, 030 Modules and Assessments</b>	DMA Instructors, CAC/QEP Director, Counselors, Statistician, Director of LAP
<b>Review Data from DMAs 010, 020, 030 Modules and Assessments</b>	Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Lead Counselor
<b>Continue Marketing</b>	Leadership Team; Director of Marketing Recruiting, and Communication; CAC/QEP Director
<b>Continue Training</b>	DMAs Instructors, CAC/ QEP Director, Director of LAP, Tutorial Lab Coordinator, SI Tutors

**Complete Program Outcomes,  
June Each Year**

Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors

**QEP: Year Two (2014-2015) Implementation**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Review Results, Assessments, and Strategies Throughout Semester and at Conclusion of Each Semester</b>	Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Utilize Improvements and Necessary Modifications</b>	DMA Instructors, CAC/QEP Director, Director of LAP, Counselors
<b>Compare Current Database Results with 2013-2014 Results</b>	Vice President of Academic & Student Services; Dean of Student Services; Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors
<b>Continue Training</b>	CAC/QEP Director, DMA Instructors, Director of LAP, Tutorial Lab Coordinator, SI Tutors
<b>Review Previous Marketing and Implement Necessary Modifications</b>	Leadership Team; Director of Marketing, Recruiting, and Communication; CAC/QEP Director
<b>Complete Program Outcomes, June Each Year</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors

**QEP: Year Three (2015-2016) Expanding Implementation  
DMAS 010, 020, 030 Including All Ages and Night Classes**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Review Results, Assessments, and Strategies</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Utilize Improvements and Necessary Modifications</b>	DMA Instructors, CAC/QEP Director, Director of LAP, Counselors
<b>Compare Current Database Results with Previous Years' Results</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician
<b>Continue Training</b>	CAC/QEP Director, DMA Instructors, Director of LAP, Tutorial Lab Coordinator, SI Tutors
<b>Review Previous Marketing and Implement Necessary Modifications</b>	Leadership Team; Director of Marketing, Recruiting, and Communication; CAC/QEP Director
<b>Complete Program Outcomes, June Each Year</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Prepare for Expansion of Distance Education Students 2016-2017</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Proposed Net Tutor</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning,

Research and Institutional Effectiveness;  
CAC/QEP Director; Director of LAP; DMA  
Instructors; Statistician; Counselors; SI Tutors

<b>Determine if additional CAC is needed</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director
<b>Modify CAC Schedule as needed</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director

**QEP: Year Four (2016-2017)**  
**Web Expansion, All Ages and Distance Education Students**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Review Results, Assessments, and Strategies</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Utilize Improvements and Necessary Modifications</b>	DMA Instructors, CAC/QEP Director, Director of LAP, Counselors
<b>Compare Current Database Results with Previous Years' Results</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors
<b>Continue Training</b>	CAC/QEP Director, Director of Distance Education, DMA Instructors, Director of LAP, Tutorial Lab Coordinator, SI Tutors
<b>Review Previous Marketing and Implement Necessary Modifications</b>	Leadership Team; Director of Marketing, Recruiting, and Communication; CAC/QEP Director

**Complete Program Outcomes,  
June Each Year**

Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors

**QEP: Year Five (2017-2018)  
Summary and Projection**

<b>ACTION</b>	<b>RESPONSIBLE</b>
<b>Review Results, Assessments, and Strategies</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors; SI Tutors
<b>Utilize Improvements and Necessary Modifications</b>	DMA Instructors, CAC/QEP Director, Director of LAP, Counselors
<b>Compare Current Database Results with Previous Years' Results</b>	Vice President of Academic & Student Services; Dean of Student Services, Dean of Arts & Sciences; Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director; Director of LAP; DMA Instructors; Statistician; Counselors
<b>Training</b>	CAC/QEP Director, DMA Instructors, SI Tutors
<b>Review Previous Marketing and Implement Necessary Modifications</b>	Leadership Team; Director of Marketing, Recruiting, and Communication; CAC/QEP Director
<b>Summarize Data Findings</b>	Vice President of Academic & Student Services, Dean of Student Services, Dean of Arts & Sciences, and Director of Planning, Research and Institutional Effectiveness; CAC/QEP Director, Director of LAP, DMA Instructors, Statistician
<b>Publish Findings as Innovative, Progressive Education Standards</b>	Vice President of Academic & Student Services, Dean of Student Services, Dean of Arts & Sciences

**Appendix C. Sample Schedule for Test and Control Groups**

	<b>A</b>	<b>B</b>		<b>C</b>			<b>D</b>	
	<b>DMA 010</b>	<b>DMA 010</b>	<b>DMA 020</b>	<b>DMA 010</b>	<b>DMA 020</b>	<b>DMA 030</b>	<b>DMA 020</b>	<b>DMA 030</b>
8:00 AM	Kevin	Wendy	Kevin		Wendy	Kevin		Wendy
9:00 AM	Kevin	Deborah	Kevin		Deborah	Kevin		Deborah
10:00 AM	Wendy	Rita	Wendy		Rita	Wendy		Rita
11:00 AM	Grant	Deborah	Grant		Deborah	Grant		Deborah
12:00 PM	Kevin	Grant	Kevin		Grant	Kevin		Grant
1:00 PM		Kevin		Rita	Kevin		Rita	Kevin
2:00 PM								
3:00 PM								
4:00 PM								
5:00 PM								
6:00 PM	Staff	Staff	Staff		Staff	Staff		Staff

## Appendix D. DMA 010 Project

Student Learning Outcome: Perform operations with integers

Group Project: Students will create a monthly budget using addition, subtraction, multiplication, and division of integers as part of a collaborative and cooperative effort.

### Budgeting Project

Thomas and Anya Smith are the proud parents of two children, a 6 year old girl and a 3 year old boy. The girl is in the first grade and the boy attends day care every day at a cost of \$55 per week.

Thomas has a job with an accounting firm and has an annual salary of \$54,288 after taxes, retirement, etc. Anya is a sales associate at a local department store and earns a weekly salary of \$252 after taxes.

The family has 3 pets: 1 large dog and 2 cats. The dog, Fido, consumes about \$15 worth of food each week. The cats, Fluffy and Fancy, eat \$22 worth of food each week. Each pet receives a yearly check-up from a veterinarian at a cost of \$60 per visit.

Monthly household expenses include a mortgage of \$875, phone/internet service at \$120, electric at \$162, water/sewer at \$50, satellite service at \$72, and garbage pickup at \$20.

Last year they spent a total of \$624 on maintenance and repairs. Their home owner's insurance is \$1872 per year.

Thomas drives a used car and has payments of \$292 per month so that Anya can have a more dependable and family-friendly van that costs \$437 per month. Both are late model vehicles that require repairs so total maintenance is approximately \$150 per month.

Insurance on both vehicles is \$624 every six months. Thomas spends about \$47 for gas each week. Anya spends about \$52 for gas each week.

Anya does the grocery shopping and budgets \$150 per week. This includes Thomas's lunches and snacks for the kids. They eat out as a family once a week for an average cost of \$38.

Thomas' company pays his health insurance, but he pays \$525 per month for a family plan so that Anya and the kids can have coverage. He also pays \$65 monthly for a life insurance policy on both adults. So far, the family has proven to be healthy. They are members of a local gym at a family rate of \$45 per month. Medical expenses are mostly

wellness visits and minor illnesses. They typically have nine visits per year with \$32 co-pay each visit. Medications average to about \$28 per month.

Due to recent unforeseen expenses, Thomas and Anya have an unpaid balance of \$1000, including all fees, on a credit card that they plan to pay off in 5 months.

Both Thomas and Anya wish they could pamper themselves more, but try to maintain a budget. His job requires a professional appearance so he gets a haircut every month for \$10. Anya and the kids get a cut every two months for a total of \$50. Anya has a manicure every two weeks for \$20.

With the kids growing so fast, they know that they have to be frugal in spending on clothes and shoes. They budget \$100 per month for all four of them. Thomas has a couple of sports coats dry-cleaned each month at a cost of \$22.

Use the information provided and the budgeting form to answer the following questions. Base all values on 12 months in a year and 4 weeks in a month.

1. What is the Smith family’s total monthly income?
2. What is the total spent monthly on household expenses?
3. How much is spent monthly on home, health, and life insurance?
4. What are the Smith family’s total monthly expenses?
5. At the end of the month, how much does the family have left to spend or save?
6. In looking at the monthly budget, what are some areas that the family could reduce so that they could save more?

Monthly Budgeting Form

Income		
	Salary 1	
	Salary 2	
	Total Income	

Expenses		
	<b>House</b>	
	Mortgage/ Rent	
	Phone/ Internet	
	Electricity	
	Gas	
	Water and sewer	
	Cable/ Satellite	
	Trash	
	Maintenance / repairs	
	<b>Automobiles</b>	
	Car payment #1	
	Car payment #2	
	Insurance	
	Fuel	
	Maintenance	
	<b>Food</b>	
	Groceries	
	Dining out	
	<b>Other Loans</b>	
	Credit card	
	Credit Card	
	Other	
	<b>Insurance</b>	
	Home	
	Health	
	Life	
	Other	
	<b>Personal</b>	
	Medical	
	Hair/ Nails	
	Clothing	
	Dry Cleaning	
	Gym	
	Childcare	
	Other	
<b>Overage</b>		

**Classroom Assessment:** Students will create a viable monthly budget.

### Appendix E. DMA 020 Project

Student Learning Outcome: Find solutions to applications with fractions and decimals

Group Project: Students will use fractions and decimals to assess the financial challenges of having to move back home to live with one's parents.

#### Recession Project

After Janice's husband lost his job, Janice had to move back home with her parents. She earns \$12.24 per hour as a food service technician. Janet earns time and a half for all hours worked over 40 in a given week.

Last week, Janet had to work eight hours overtime to earn extra money for a visit to the dentist. How much did she earn last week?

Janice also needs money for medical bills and prescriptions. If she worked 8 hours of overtime every week, what would her annual salary be?

Janice was surprised last Christmas with a \$500 bonus. She was devastated to learn she had to pay  $\frac{1}{5}$  of the bonus in taxes to the government. How much did she spend on taxes?

Since Janice had no collision insurance, she had to borrow money from a bank to purchase a new car after she totaled her van in an accident. She is reducing the car loan at the rate of \$350.50 per month. At the end of the loan period, she will have paid \$16,824.00 to the bank. How many months will it take to pay off the loan?

After working three months without a day off, Janice decided to save some money for a day of fun at Lizard World. She thinks that she can comfortably save  $\frac{1}{10}$  of her regular pay (40 hour week) towards the fund every week. How much will she save each week?

Janice's mom insists that Janice pay 50% the electric bill. Last month the bill was \$78.93. How much will she have to pay? Round your answer to the nearest cent if necessary.

Because the house is really not large enough for four people, Janice and her husband have to move into the garage. Janice needs to install carpet in the garage because the concrete floor is very cold. The garage measures  $15\frac{1}{3}$  feet wide and is  $12\frac{3}{4}$  feet long. The area of the garage is given by the formula  $A = l \cdot w$ . How many square feet of carpeting will be needed?

**Classroom Assessment:** Students will use fractions and decimals to determine how to navigate real- life situations on a meager salary.

## Appendix F. DMA 030 Project

Student Learning Outcome: Perform operations with proportions and ratios.

Group Project: Recipe Project

**Part One:** Students will use ratios and proportions to convert units and modify a recipe.

1. This broccoli salad recipe serves 12. Add the bacon, broccoli, cheese, and onion together and divide by 12 to set the serving size.

- ½ cup crumbled bacon
- 6 cups fresh broccoli, chopped
- 1 ½ cups sharp Cheddar cheese, shredded
- ½ cup red onion, chopped
- ¼ cup red wine vinegar
- 1/8 cup white sugar
- 2 tsp. ground black pepper
- 1 tsp. salt
- 2/3 cup mayonnaise
- 1 tsp. fresh lemon juice

2. Convert the recipe to serve 5 salads

**Part Two:** Students will use percent and ratios to determine the yield of food.

There are several kinds of yield used in Culinary Arts. One type is recipe yields, which is used to find the number of portions in a particular recipe. Another important yield has to do with the as-purchased (AP) amount and the edible portion (EP) amount. To anticipate the quantity of food item that will be served, you need to know how much is useable, the EP.

If the yield percent is given, you can find the EP amount by multiplying the yield percent times the AP amount. To find the yield of a particular item, you divide the EP by the AP of the food item.

Find the yield percent of the following:

1. 16 oz. pork tenderloin is reduced to 14 oz. when trimmed.
2. One cup of butter yields  $\frac{3}{4}$  cup of clarified butter.
3. Rice has a raw to cooked weight yield of 634%. Suppose you have 1.2 pounds of raw rice. How many pounds of cooked rice do you have?

Once food is prepared, the plan is to sell it. A selling price or menu price must be determined. The food cost percent equals the plate cost (raw food cost) divided by the selling price.

1. If the raw-food cost is \$2.93, and the menu price is \$4.00, what is the cost percent?
2. Suppose the food-cost percent is 60%. The cost of the plate is \$4.39. What should the selling price be?

**Classroom Assessment:** Students will convert a recipe and determine yield using proportions, rates, ratios, and percentages.

### Appendix G. Sample Database

**DMA010**  
**TRACKING**

Student Type:

**Student Information**

Name:     DOB:     Phone:

ID Number:     Term:     Placement Test Score:

Does the student have a goal?     GPA:     First Attempt:

**Course Grades**

Quiz #1:     Real-Life Project:     Remediation:     Comments:

Quiz #2:     All Objectives Test:     Retest:

**Engage Survey**

Has student taken the survey?     Comments:

SS:     ASC:

**College Achievement Coach**

Achievement Coach:     Other:     CAC:     Method:

Primary Concern:  Transportation     Attendance     Class Work     Personal Matters     Other

Session #1    Session #2    Session #3    Session #4    Session #5

Session #1 Notes

**Supplemental Instruction**

Supplemental Instruction:     Referred By:     Date Referred:

Is the student attending?

Comments

### Appendix H. Program Outcomes Form

<b>I. PROGRAM OUTCOMES:</b>	
List program outcomes. Why does the program exist? What is the purpose of the program? What do we want students to be able to do know, think or do as a result of completing the program?	
1.	First-time developmental mathematics students will demonstrate satisfactory progress through DMAs 010-030.
<b>II. STUDENT LEARNING OUTCOMES:</b>	
List measurable learning outcomes: i.e. what do you expect students to be capable of	
<i>Please Note:</i> These <b>outcomes are</b> specific to your program. The outcomes should be <u>clearly written, specific, and measurable</u> . Each program should have between three to five student learning outcomes. Add columns as needed.	
1.	First-time developmental mathematics students will demonstrate satisfactory progress through DMAs 010-030.
A	With the support of supplemental instruction, 65% of first-time students will improve their mathematics skills in DMAs 010-030 to meet the desired threshold of achievement at an overall average of 80% on homework assignments, projects, quizzes, and final exams.
B	With the support of a College Achievement Coach, students who demonstrate low self-efficacy, poor attendance, or external impediments to learning will meet the desired threshold of persistence at a projected 65% (based on historical data from 2007-2012). Once baseline data on student persistence from the DMA modules for fall semester 2013 is available, projections may be adjusted.

		Description of Process (who, what, when, how and benchmarks)	Direct or Indirect (D/I)	Formative or Summative (F/S)	Instrument	Instrument Attached (Y/N)
1A	a	65% of the students will score at least 80% on Quiz 1 in DMA 010	D	F	Quiz	N
	b	65% of the students will score at least 80% on Quiz 2 in DMA 010	D	F	Quiz	N
	c	65% of the students will score at least 80% on the Module Assessment in DMA 010	D	S	Test	N
	d	65% of the students will score at least 80% on Quiz 1 in DMA 020	D	F	Quiz	N

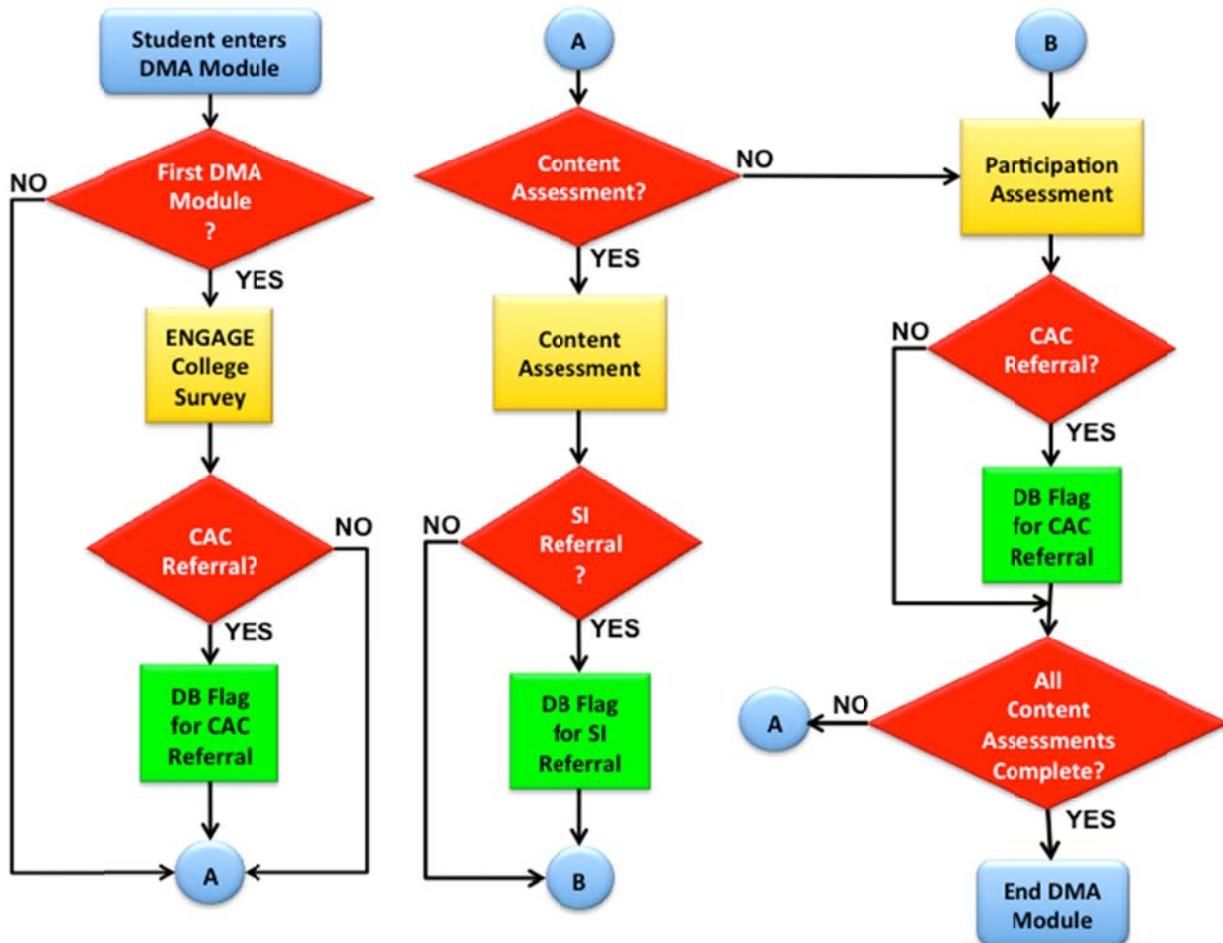
	e	65% of the students will score at least 80% on Quiz 2 in DMA 020	D	F	Quiz	N
	f	65% of the students will score at least 80% on the Module Assessment in DMA 020	D	S	Test	N
	g	65% of the students will score at least 80% on Quiz 1 in DMA 030	D	F	Quiz	N
	h	65% of the students will score at least 80% on Quiz 2 in DMA 030	D	F	Quiz	N
	i	65% of the students will score at least 80% on Module Assessment DMA 030	D	S	Test	N
1B	a	65% of the students who are referred and meet with the CAC will receive a final grade of "P" in DMA 010	D	S	Final Grade	N
	b	65% of the students who are referred and meet with the CAC will receive a final grade of "P" in DMA 020	D	S	Final Grade	N
	c	65% of the students who are referred and meet with the CAC will receive a final grade of "P" in DMA 030	D	S	Final Grade	N

**Appendix I. Performance Data Sheet**

<b>Comparison of First-Attempt Pass and Repeat Percentages</b>										
	No Referral		SI Referral		CAC Referral		SI & CAC Referral		Total	
Pass/Repeat	P	R	P	R	P	R	P	R	P	R
DMA 010 (Control Groups)										
DMA 010 (Test Groups)										
DMA 020 (Control Groups)										
DMA 020 (Test Groups)										
DMA 030 (Control Groups)										
DMA 030 (Test Groups)										
Total										

Appendix J. Flowcharts for Fall 2013-Spring 2014

Pilot Group Fall 2013



Flowchart for Spring 2014 Test Group

