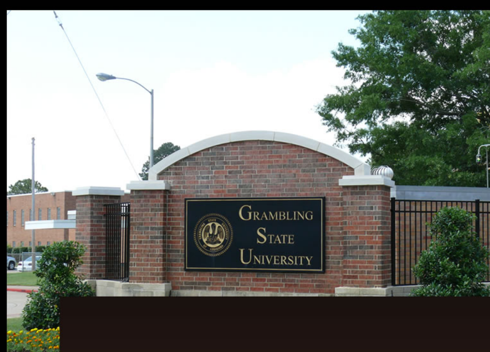
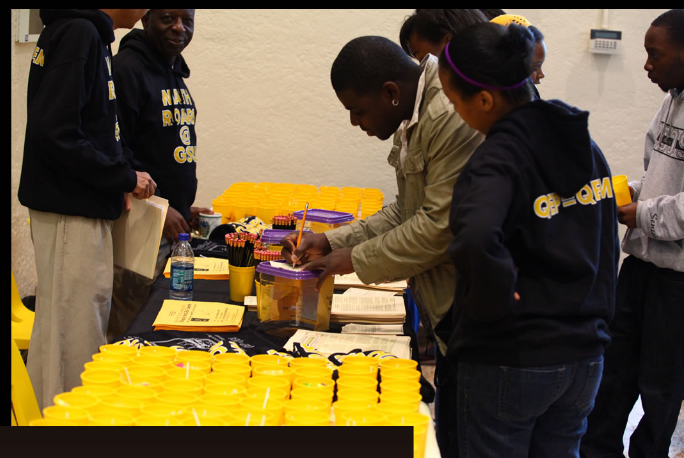
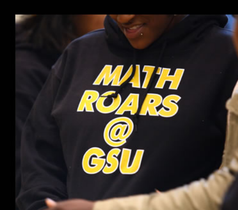
GSU

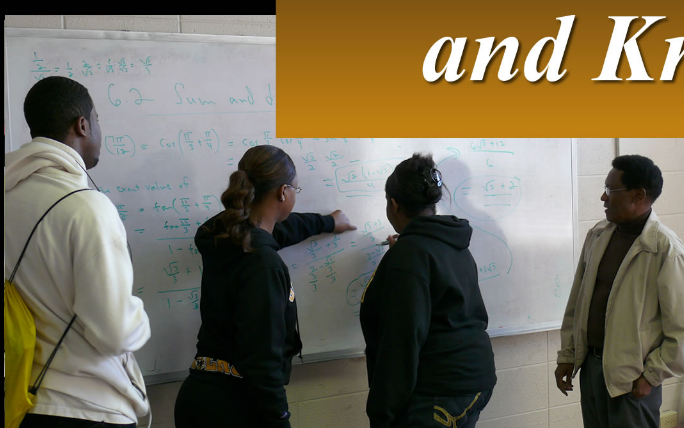
2010 Quality Enhancement Plan

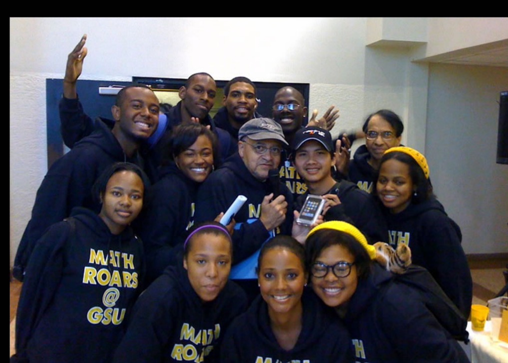




The Improvement of Mathematical Skills and Knowledge







Grambling State University
Grambling, LA 71245
Dr. Frank Pogue, Interim President
March 2010

Quality Enhancement Plan
The Improvement of Mathematical Skills and Knowledge

Submitted to the
Commission on Colleges
Southern Association of Colleges and Schools

by

Grambling State University

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Interim President

March 2010

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CHAPTER 1

EXECUTIVE SUMMARY

Grambling State University's (GSU) Quality Enhancement Plan (QEP) stems from one of the university's biggest challenges – the need to improve mathematical knowledge and skills. After a comprehensive needs assessment and feedback from a broad base of constituent groups, the university selected "The Improvement of Mathematical Skills and Knowledge" as its QEP topic. The selected topic arose from a five-year analysis of Rising Junior Examination data, students' performance in English and mathematics courses, and ACT/SAT scores. This analysis clearly indicated that the weakest link in student learning at GSU is a poor mathematical foundation. Therefore, GSU has chosen to focus on improving mathematics instruction by adopting novel curricular, instructional, and assessment strategies in selected general education courses. The Leadership Team formed a diversified Quality Enhancement Plan Team to develop the QEP. Throughout the development process, team members sought input from faculty and students and promoted understanding of the QEP's long term impact on student learning. The purpose of GSU's QEP is to improve the mathematical skills and knowledge of all students irrespective of their majors; therefore, it targets the entire student population. This purpose will be achieved through two goals:

1. To increase student knowledge and comprehension of general mathematical concepts.
2. To develop student ability to think analytically and to reason quantitatively in solving real world problems.

The first goal incorporates six student learning outcomes (SLOs) and aims to provide theoretical foundations in general mathematics. The second goal incorporates three SLOs and aims to develop students' problem solving skills. In addition to two pre-calculus courses, the QEP also includes a quantitative approach to teaching courses in non-mathematics areas. Upon review of the literature coupled with the experiences gained from successful programs at GSU, the QEP Team has identified a number of strategies for implementation. Activities that help in building a firm foundation for the implementation of the QEP include but not limited to; curricular changes, continuous monitoring of student progress, peer tutoring, and reduction of class size. New pedagogical methods include interdisciplinary approach to teaching mathematics, use of technology, mathematics through writing, and process-oriented guided-inquiry learning. The plan also contains faculty development and student seminars.

The QEP includes a comprehensive assessment plan. Both formative and summative assessments will be done, using multiple instruments, for continuous monitoring. Quantitative and qualitative data will be collected. In addition to monitoring the progress of SLOs, the process will also monitor the effectiveness of new teaching methods. The QEP timeline includes a six-year period. In 2010-11 preparations will be made for implementation of the QEP in the Fall of 2011. Courses and teaching methods included in the QEP (Table 6.4) will be implemented in phases. An Advisory Board will perform the overall evaluation and relate it to institutional effectiveness. The university has committed adequate resources (Table 7.2) for successful implementation. The QEP will generate measurable improvement in students' understanding of mathematical concepts and in their abilities to solve real world problems. Consequently, an increase in pass rates on the Rising Junior Examination and in pre-calculus courses is expected.

CHAPTER 2

INTRODUCTION

"History has taught us that most important future applications are likely to come from some unexpected corner of mathematics." – Renewing U.S. Mathematics, 1990

2.1 Institutional Background

Grambling State University (GSU), founded in 1901, is a state-supported institution, originally created for the purpose of meeting the educational, cultural, and social needs of black citizens of the north central region of Louisiana. A constituent member of the University of Louisiana System, GSU is fully accredited by the Southern Association of Colleges and Schools. Its instructional programs are delivered through four colleges: Arts and Sciences, Business, Education, and Professional Studies; and its School of Graduate Studies and Research. The university offers 44 baccalaureate degree programs, master's degrees in 13 areas, and 3 doctoral programs in education. The Fall 2008 student enrollment was 5,253. During a five-year period (2004-2008), GSU graduated a total of 3,523 students. There are 259 full-time faculty members, 56 percent of whom hold terminal degrees. An excerpt from the GSU mission statement indicates:

> *The University prepares its graduates to compete and succeed in careers related to its programs of study, to contribute to the advancement of knowledge, and to lead productive lives as informed citizens in a democratic society. … The University expects that all persons who matriculate and who are employed at Grambling will reflect through their study and work that the University is indeed a place where all persons are valued, "where everybody is somebody."*

In Louisiana, institutions of higher learning are divided into four categories: flagship, statewide, regional, and open admission. Grambling State University is categorized as a regional university. At the beginning of the academic year 2007-08, the university initiated a transitional change in its admissions criteria from open to selective to meet the requirements of a regional university. Furthermore, Grambling State University has taken a number of steps to meet the state mandated requirements for admitting more competitive students. Several of the initiatives implemented are listed below:

- Revision of the General Education Program. On January 5, 2006, the former provost established a Task Force of faculty members to engage in this endeavor. The Task Force completed its work in December 2007 and recommended 47 hours of general education requirements, 60 hours for the major program and cognate requirements, and 18 hours of free electives.
- Assessment of Computer Technology. This assessment led to the development of a new website, an intranet for staff and student use, email accounts for all students, improvement in security, and the development of a back-up system.
- Addition of more than 60 new faculty members in various disciplines since Fall 2004. Most of these individuals hold doctoral degrees in their areas of specialty.
- Establishment of 18 Endowed Professorships in various disciplines.

- Creation of a campus Master Development Plan. This plan provides the direction for improvements in residential life. The university added 2,000 new beds between Fall 2006 and Spring 2008. Favrot Student Union and the Dining Hall were renovated. A 23 million-dollar all-purpose assembly building and a new Performing Arts Center were completed.
- Procurement of external funds from private, state, and federal agencies.
- Continuation of individual accredited programs that are mandated to have professional accreditation by the Louisiana Board of Regents.

2.2 Evolution of the Quality Enhancement Plan at GSU

Grambling State University is fully committed to developing and implementing its Quality Enhancement Plan in order to produce graduates who can meet the challenges of graduate education and of a 21st century global society. Grambling State University believes that the plan should be a unifying link among several disciplines and that the plan should provide useful tools for solving problems, irrespective of a student's academic major. It is also important to identify areas of significant challenge that must be addressed to improve student learning. The evolution of GSU's Quality Enhancement Plan (QEP) stems from one of the biggest challenges that the university has faced – the need to improve mathematical knowledge and skills. After a comprehensive needs assessment and feedback (Chapter 3) from constituent groups (faculty, staff, students, board members, recent graduates, alumni chapters, emeriti faculty, and a select group of employers of GSU graduates) Grambling State University selected "The Improvement of Mathematical Skills and Knowledge" as its QEP topic. Both the Leadership Team and the Quality Enhancement Plan Team (Appendix I) concluded that the selected topic is crucial to the improvement of learning for all undergraduate students. Furthermore, institutional data collected over an extended period of time supported the selection of this topic. The challenge represented by this topic is evident in the performance on the mathematics section of the Rising Junior Examination (RJE) and the number of students receiving grades lower than C in College Algebra (MATH 131), Trigonometry (MATH 132), Pre-calculus I (MATH 147), and Pre-calculus II (MATH 148). Grambling State University uses the Measure of Academic Proficiency and Progress (MAPP) Test developed by the Educational Testing Service as its Rising Junior Examination (RJE).

Since 2004, one of the major initiatives has been to improve the mathematics preparation of GSU graduates and to enhance the teaching and learning of mathematics. Without proficiency in fundamental mathematical knowledge and skills, it is doubtful that students will gain admission to graduate programs or become productive members of the workforce. It is crucial that students understand elementary mathematical concepts, reason analytically, think quantitatively, and engage in problem solving. Initiatives at both the university and the departmental levels have been taken for the purpose of helping students to acquire mathematical knowledge and skills. As stated above, the provost established a Task Force to revise the General Education Program. One of the outcomes of this endeavor was to replace College Algebra (MATH 131) with Pre-calculus I (MATH 147) and replace Trigonometry (MATH 132) with Pre-calculus II (MATH 148). At the beginning of Fall semester 2008, the Task Force's recommendation was implemented and all new eligible freshmen enrolled in MATH 147 as their entry level mathematics course, followed by MATH 148. Prior to Fall 2008, MATH 147 and MATH 148 were taken only by mathematics and science majors. The implementation of this recommendation will benefit all GSU students because the mathematical content in MATH 147 and MATH 148 is more rigorous than that which is contained in MATH 131 and MATH 132. For example, MATH 147 deals with functions at a higher level that include composition and decomposition and inverse functions. It also incorporates sets, logic, proofs, and a special project. MATH 148 includes: solving trigonometric equations; proving trigonometric identities; Laws of Sines & Cosines; DeMoivre's Theorem; and certain topics in analytic geometry (conic sections). It should also be noted that MATH 147 and MATH 148 serve as prerequisites for Calculus I.

To better prepare students in mathematics, Grambling State University has put significant resources into the Department of Mathematics and Computer Science. Because the Department of Mathematics and Computer Science offers general education courses in mathematics to the entire GSU student population, it formerly relied heavily on adjunct faculty. However, since 2004, GSU has hired more full-time faculty and allocated resources to the department. Between 2004 and 2008, seven new mathematics faculty members were hired and an endowed chair in mathematics was established. It is worth noting that GSU is the only historically black university in the nation that currently has an endowed chair in mathematics. To further demonstrate the administration's commitment to improve the quality of education and research in mathematics, the mathematics discipline now hosts one endowed professorship.

In 2005, Grambling State University received a $2.4 million grant from the National Science Foundation to establish the Center for Mathematical Achievement in Science and Technology (CMAST). One of the main objectives of CMAST has been to increase the percent of students earning passing grades (C or better) in two pre-calculus and two calculus courses from a five-year average of 40 percent to 75 percent over a five-year period. Contributing factors to this 60 percent failure rate were identified as follows:

1. Placement of incoming students in mathematics courses in which they were ill prepared.
2. Number of hours the classes met per week.
3. Students' inability to see the relevance of many topics covered in mathematics.

All three factors are being addressed and appropriate measures are being taken to improve performance in the two pre-calculus and two calculus courses. Course modules, which include applications, have been developed for the pre-calculus courses. In Fall 2005, an additional problem-solving hour was added to each of these courses. This hour is not used as a typical lecture hour; instead, it is used to engage students in the subject matter through participation in solving problems and the development of study skills. The addition of the fourth contact hour and the approach taken to utilize this hour have positively affected student performance. Incoming students are now given an examination developed by the mathematics faculty that aids in advisement and course placement. The measures taken have increased the success rate of students in the pre-calculus and calculus courses as summarized in Table 2.1. Data for student performance in these courses are averaged for eight (8) semesters (Fall 2001-Spring 2005) and data for student performance in these courses following the changes made are averaged for six (6) semesters (Fall 2005-Spring 2008). There is an overall increase in the percent of students who received grades of A, B, or C (satisfactory grades). There is also a corresponding decrease in the percent of students who received grades of D, F, or W (unsatisfactory grades).

Table 2.1: Summary of Effect of New Measures Taken for Pre-calculus and Calculus

Courses	Total % of A, B, and C Grades (Satisfactory Grades)		Total % of D, F, and W Grades (Unsatisfactory Grades)	
	Before	After	Before	After
Pre-calculus I	27.68%	57.66%	72.32%	42.34%
Pre-calculus II	45.58%	60.84%	54.42%	39.16%
Calculus I	31.22%	69.23%	68.78%	30.77%
Calculus II	30.96%	49.62%	69.04%	50.38%

In addition to the above-mentioned measures, the following initiatives have been taken to reshape mathematics at GSU:

- The establishment of weekly seminars in the Department of Mathematics and Computer Science since Fall 2006. Faculty members and students (juniors and seniors) from science and mathematics disciplines deliver these seminars to all science and mathematics majors.
- The establishment of a seminar series under the CMAST program where guest mathematicians and scientists deliver lectures to students and faculty.
- The inclusion of Calculus I in the biology curriculum since Fall 2007. This is consistent with the recommendations of the National Research Council's "BIO 2010: Transforming undergraduate education for future research biologists" (*BIO 2010*, 2003). Furthermore, Calculus II and Probability & Statistics I are now the recommended electives for biology majors. The inclusion of more mathematics courses in the biology curriculum is expected to strengthen the ability of students who major in biology to engage in quantitative reasoning.
- The inclusion of Calculus I and Calculus II in the GSU Laboratory High School curriculum since Fall 2007.
- The establishment of faculty development initiatives under the CMAST program.

In 2009, Grambling State University received two grants from the National Institutes of Health. The Minority Access to Research Careers (MARC) was funded for over $1.54 million for a period of three years and the Research Initiatives for Scientific Enhancement (RISE) was funded for over $1.08 million for four years. The purpose of both grants is to improve the competitiveness of science and mathematics students to gain admission and complete advanced degree programs in the biomedical sciences.

The seminar series and some of the curriculum enhancement initiatives (as described above) are geared toward mathematics, science, and engineering technology students. The reform of the pre-calculus courses through CMAST and the change made in the General Education Program to make the pre-calculus courses a part of general education are aimed at all undergraduate students. The Quality Enhancement Plan seeks to build on the foundation laid by these considerable endeavors to enhance the teaching and learning of mathematics. The changes that will take place as a result of the implementation of the QEP will be grounded in research, both local and national. The plan is informed not only by research and best practices in higher education, but also by the body of knowledge and experience of the mathematics and science faculty. The expectation is that quantitative reasoning and the relevance of mathematics will become pervasive in the undergraduate curriculum. The derivatives that are expected to stem from the QEP are substantial. They include an increase in overall retention of first year students, higher grades in mathematics courses, and an increase in graduation rates at GSU. Additionally, it is expected that the QEP will motivate faculty members to submit grant proposals to federal and other agencies addressing issues related to the enhancement of mathematical knowledge and skills for non-science majors.

The initiative to improve the mathematical skills and knowledge of students also supports the national need to revitalize undergraduate mathematics (Kirwan et al. 1991). A considerable number of reports (Glenn, et al. 2000; Gonzales, et al. 2007; Baldi, et al. 2006; National Mathematics Advisory Panel 2008) indicate that American students have not been performing in mathematics at a level expected of the US, an international leader. At the National Academy of Sciences held on April 27, 2009, President Obama stated, "Our schools continue to trail other developed countries and, in some cases, developing countries. Our students are outperformed in mathematics and science by their peers in Singapore, Japan, England, the Netherlands, Hong Kong, and Korea, among others. Another assessment shows American 15-year-olds ranked 25th in mathematics and 21st in science when compared to nations around the world."

2.3 Organization of the Quality Enhancement Plan Document

The Quality Enhancement Plan document is organized into seven chapters. Chapter 3 describes the process used for development. It provides a detailed analysis of the assessment of the institutional data that supports the choice of the QEP topic. It also describes how GSU engaged all of its constituents in the selection of a topic that supports the university's mission and goals and one that is consistent with the Academic Master Plan (2007-2012). Chapter 4 briefly describes the literature and the best practices which provide a guide in developing the student learning outcomes, the adoption of effective activities and pedagogical methods in implementing the QEP, and principles and instruments used for assessment. Chapter 5 includes the overall purpose, goals, and student learning outcomes (SLOs). This chapter also describes the rationale for the selection of goals and student learning outcomes. The student learning outcomes address the central requirement for SACS reaffirmation - changes in knowledge, skills, and behaviors in student learning. The implementation of the QEP including actions to be taken, the pedagogical methods to be used, and a detailed timeline for the implementation of major activities are described in Chapter 6. The methodologies and SLOs relevant to the selected topic are supported by research and best practices. One of the salient features of this QEP is that it will be implemented not only through two mathematics courses but also through other general education courses, i.e., biology, economics, and physics. The QEP will directly affect 38% of the courses from the General Education Program. Chapter 7 describes the overall structure of the QEP assessment process which ties goals and SLOs to assessment. It includes how students' progress and how implementation of the QEP will be monitored systematically using appropriate measurement instruments. Formative and summative assessments will be used. This chapter also includes the resources required and a detailed budget for QEP activities during the preparation period (2010-11) and for the five-year implementation period.

CHAPTER 3

DEVELOPMENT OF THE QUALITY ENHANCEMENT PLAN

The Quality Enhancement Plan at Grambling State University has been developed through a broad base of GSU constituent participation. The process has been intense and recursive, one where faculty, staff, students, alumni, board members, recent graduates, alumni chapters, emeriti faculty, and a select group of employers of GSU graduates have played a part in all aspects of its development. The Quality Enhancement Plan process began in March of 2008 with the establishment of a Leadership Team for SACS reaffirmation of accreditation. Members of the Leadership Team attended a SACS orientation in Atlanta in June 2008. In July, the Leadership Team created several teams, including the Quality Enhancement Plan Team, to address different tasks associated with reaffirmation. An on-campus orientation was held on July 24, 2008 for all teams to begin preparing for the SACS visit in April 2010.

The Quality Enhancement Plan Team consists of a cross section of GSU community members representing several departments. The Team had its first meeting on August 15, 2008. At this meeting the former Provost and Vice President for Academic Affairs gave the team its charge, to develop the QEP. Subsequently, the Team was divided into three subcommittees. These were the Literature Review and Research on Best Practices Subcommittee, the Data Collection and Analysis Subcommittee, and the Publicity Subcommittee. A list of teams (Leadership, Coordination and Planning, and Quality Enhancement Plan) related to the QEP is included in Appendix I.

Grambling State University has used a systematic process and incorporated several factors in selecting its QEP topic. These factors include an assessment of five-year institutional data; a QEP topic that enhances student learning, supports the institutional mission, goals, & the academic master plan; and feedback from constituent groups. The performance of students on the Rising Junior Examination (RJE), which is described in greater detail below, and the failing grades in general education mathematics and English courses have been a major concern at the university for a number of years.

3.1 Identification of the QEP Topic

The selection of the QEP topic evolved, in part, from an assessment of institutional data (Fall 2003-Spring 2008): (1) Rising Junior Examination, (2) grade distributions in English and mathematics courses specifically in Freshman Composition I (ENG 101), Freshman Composition II (ENG 102), Advanced Composition (ENG 213), College Algebra (MATH 131), Trigonometry (MATH 132), Pre-calculus I (MATH 147), Pre-calculus II (MATH 148), Calculus I (MATH 153), & Calculus II (MATH 154), and (3) ACT/SAT scores. These data sources were chosen because they serve as an early indicator of student academic progress in three critical areas: reading, writing, and mathematics.

The Measure of Academic Proficiency and Progress (MAPP) Test, which GSU uses as its Rising Junior Examination, is an integrated test that assesses general education skills in four core areas – reading, writing, mathematics, and critical thinking. This test provides student performance at three proficiency levels. To be considered proficient at level one, a student must be able to solve word problems that would most likely be solved by simple arithmetic. To be considered proficient at level two a student should be able to solve arithmetic problems with some complexity. Word problems using algebraic expressions solved successfully would indicate proficiency of students at level three. The test is administered each year during the months of November and April. It is expected that students will take the MAPP Test at the end of the sophomore year; however, many of the students take the test at their discretion. The MAPP is the successor of the Academic Profile, which was used from 1990 until Spring 2006 (*MAPP User's Guide*, 2007). The analysis of students' RJE scores was one of the important factors in the selection process of the QEP topic. Table 3.1 includes a summary of the students' pass rate in reading, writing, and mathematics for ten semesters (Fall 2003 - Spring 2008). This table is divided into two sections: the first section includes data for the Academic Profile Test over the course of six semesters (Fall 2003 - Spring 2006) and the second section includes data for the MAPP Test over the course of four semesters (Fall 2006 - Spring 2008).

An examination of these data shows that the pass rate in mathematics Level 1 is consistently lower than the pass rate in reading and writing for all ten semesters. The six-semester average indicates that the pass rate in mathematics for Level 1 is 29% compared to the pass rate of 61% in writing and 51% in reading. The four-semester average indicates that the pass rate in mathematics for Level 1 is 18% compared to the pass rate of 46% in writing and 42% in reading. For Level 2, the pass rate in mathematics is consistently lower than the pass rate in reading but comparable to writing. For Level 3 the pass rate in all three areas is dismal. These results indicate that although all three areas must be strengthened, GSU students have a bigger challenge in mathematics than in reading or writing.

An analysis of the grades for introductory English and mathematics courses was also done to assess the relative weakness of students in these areas. Two sets of courses were chosen for this analysis. The first set includes ENG 101, ENG 102, ENG 213, MATH 131, MATH 132, MATH 147, and MATH 148 (General Education Courses). Prior to Fall 2008, MATH 131 and MATH 132 were taken by all non-science majors and MATH 147 and MATH 148 were taken by all science majors. Therefore, the three courses in English and the four courses in mathematics are taken by most of the GSU student population. The second set of courses includes Calculus I and Calculus II which are taken mostly by science, mathematics, and engineering technology students. Appendices II through VI show the grade distribution for English and mathematics courses for 10 semesters (Fall 2003 - Spring 2008). The ten-semester average of these courses was computed and, for the sake of simplicity, the results were classified into two categories. The first category includes the sum of A, B, and C grades representing "satisfactory performance" (shown in green) and the second category includes the sum of D, F, and W grades representing "unsatisfactory performance" (shown in red). The grade of W represents withdrawal from a course and should be considered since it affects retention and graduation rates. A summary of the ten-semester average of students' performance in selected English and mathematics courses is shown in Table 3.2.

Table 3.1: Number & Percentage of Students who Passed the RJE by Level and Section (Fall 2003 - Spring 2008)

	Reading						Writing						Mathematics						Total
	Level 1		Level 2		Level3*		Level 1		Level 2		Level3		Level 1		Level 2		Level3		
	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#	%	#
Fall 2003	108	49	17	8	0	0	139	63	15	7	1	0	66	30	16	7	3	1	222
Spring 2004	175	53	36	11	0	0	208	63	13	4	3	1	101	31	15	5	3	1	331
Fall 2004	167	51	30	9	2	1	200	61	13	4	2	1	83	25	25	8	0	0	330
Spring 2005	147	51	24	8	1	0	175	60	17	6	3	1	84	29	15	5	4	1	290
Fall 2005	176	52	36	11	2	1	196	58	9	3	8	2	98	29	24	7	5	1	336
Spring 2006	207	52	42	11	3	1	237	59	25	6	6	2	124	31	20	5	5	1	400
Six-semester Average**		**51**		**10**		**0.5**		**61**		**5**		**1**		**29**		**6**		**0.8**	
Fall 2006	132	47	32	11	2	1	134	48	23	8	6	2	47	17	14	5	1	0	281
Spring 2007	162	43	39	10	3	1	184	49	25	7	2	1	72	19	25	7	1	0	377
Fall 2007	141	41	31	9	3	1	151	44	25	7	4	1	60	18	17	5	3	1	341
Spring 2008	112	36	27	9	3	1	135	44	26	8	7	2	50	16	18	6	7	2	307
Four-semester Average***		**42**		**10**		**1**		**46**		**8**		**2**		**18**		**6**		**0.8**	

***** The Level 3 Reading Component measures Critical Thinking Skills

** RJE test used the Academic Profile

*** RJE test used the MAPP

Table 3.2: Ten-semester Average of Students Performance in English and Mathematics Courses

Course	ENG 101	ENG 102	ENG 213	MATH 131	MATH 132	MATH 147	MATH 148	MATH 153	MATH 154
Satisfactory Performance	53.48%	55.59%	57.83%	42.98%	62.47%	41.82%	54.67%	50.80%	40.31%
Unsatisfactory Performance	46.51%	44.39%	42.15%	57.02%	**37.53%**	58.19%	45.34%	49.20%	**59.68%**

On average, the data indicates that the performance of 38% to 60% of the students in fundamental English and mathematics courses was categorized as unsatisfactory between Fall 2003 - Spring 2008. At a minimum, this high level of unsatisfactory performance leads to lower retention and graduation rates. Furthermore, deficiencies in core courses lead to a poor foundation and this, in turn, precludes students taking full benefits of their education.

The scores of entering GSU students on the ACT/SAT were compared to national data, Louisiana data, and the data from three neighboring states (Mississippi, Arkansas, and Texas) as shown in Appendices VII through IX. The comparison shows that students who enter GSU have far lower ACT/SAT scores in mathematics, English, and critical reading than their counterparts nationally, in Louisiana, and in the above-mentioned neighboring states. The five-year average ACT composite score of students entering GSU is 16.4 compared to a national average of 20.8 (Appendix IX). Consequently, the university faces a bigger challenge in adequately preparing students to compete and be productive in the 21st century workforce.

Although the QEP is a SACS-mandated process, Grambling State University views this as an opportunity to make significant strides in student learning. The topic selected for the QEP is in consonance with the institution's needs, mission, goals, and the Academic Master Plan (2007-2012). Grambling State University's Academic Master Plan (2007-2012, 64) recommends several strategies to improve numeracy, reading, and writing for all GSU students. The QEP is an excellent vehicle that provides GSU with an opportunity to systematically implement some of these strategies. This, in turn, will support the university in achieving its goal to produce graduates who possess excellent numeracy (quantitative reasoning), critical thinking (analytical thinking and problem solving), and oral and written communication skills.

The factors described above guided the University's Leadership Team to include three topics in a QEP survey distributed to all the constituent groups during Summer/Fall 2008. The survey was distributed in person as well as mailed with associated correspondence. The topics included in the survey were: *Improving Mathematical Knowledge and Skills*; *Improving Writing Skills*; and *Improving Reading and Critical Thinking Skills*. There were a total of 414 respondents to the QEP topic selection survey. Of these participants, 181 were faculty and staff members, 214 were students, ten (10) were designated other participants (emeriti faculty, board members, employers, etc.), and nine (9) were alumni chapters. It should be noted that the nine (9) alumni chapters included the responses of many individual chapter members. The 214 students who participated in the survey represented 11 academic departments as well as the

Student Government Association. The break down by the departments is shown in Table 3.3.

Table 3.3: Distribution of Student Participants by Department in Topic Selection Survey

Dept. Name	Arts	Biol.	Business	ET	Eng.	FL	Hist.	Mass Comm.	Pol. Sc.	SW	TR	SGA	**Total**
	19	20	21	21	10	10	6	12	14	22	20	39	**214**
ET: Engineering Technology; FL: Foreign Languages; SW: Social Work; TR: Therapeutic Recreation SGA: Student Government Association													

An analysis of the survey indicated that of the 414 respondents, 195 selected Reading and Critical Thinking; 124 selected Mathematics; and 98 respondents selected Writing as their number one choice for the QEP topic. These results, prepared by the Office of Planning and Institutional Research, were sent to the Quality Enhancement Plan Team.

The Quality Enhancement Plan Team met on October 27, 2008 to discuss and prepare its recommendation to the Leadership Team on the QEP topic. The team took into account the following factors in making its recommendation:

1. The Rising Junior Examination results from Fall 2003 through Spring 2008, grades in English & mathematics courses, and ACT/SAT scores.
2. The QEP survey results provided by the Office of Planning and Institutional Research.
3. Faculty members' experiences with student mathematical knowledge and critical thinking skills.
4. Flexibility to incorporate the critical thinking aspect through two mathematics and several non-mathematics courses.

After much deliberation and consideration of the above-mentioned factors, the QEP team unanimously decided to recommend "Improving Mathematical Knowledge and Critical Thinking Skills across the Disciplines" to the Leadership Team as the QEP topic. The team argued that including the critical thinking component would incorporate the opinion of a large group of people (about 47%) on the survey. In addition, the QEP team established that the inclusion of mathematics rather than reading in the topic statement is necessary because students generally have poor mathematical knowledge and skills. Furthermore, since Fall 2003, the results of the Rising Junior Examination (RJE) have consistently shown a poorer performance in mathematics compared to reading. Another look at the students' performance on the RJE, as shown in Table 3.1, reveals that between Fall 2003 and Spring 2006, an average of 29% passed Math Level 1 while 51% passed Reading Level 1; an average of 6% passed Math Level 2 while 10% passed Reading Level 2. The performance between Fall 2006 and Spring 2008 shows an even larger discrepancy between mathematics and reading. During this period, an average of 18% passed Math Level 1 while 42% passed Reading Level 1; 6% passed Math Level 2 while 10% passed Reading Level 2. The results of the writing section are better than both reading and mathematics over the period considered. These results clearly indicate that there is a bigger challenge in mathematics than in reading. This conclusion is also supported by the poor performance in College Algebra (Appendix IV) and Pre-calculus I (Appendix V) in contrast to performance in Freshman Composition I (Appendix II).

The results of Level 3 are very disappointing for all three sections - mathematics, reading (critical thinking), and writing. The results show that between Fall 2003 and Spring 2006, 0.80% of the students passed mathematics Level 3, 0.50% passed critical thinking, and 1.0% passed writing. Between Fall 2006 and Spring 2008, 0.80% of the students passed mathematics, 1.00% passed critical thinking, and 2.00% passed writing as shown in Table 3.1. This further motivated the QEP Team to recommend both mathematics and critical thinking to be included in the QEP topic. The team suggested that the critical thinking skills component may be enhanced through both mathematics and non-mathematics courses. Therefore, on the basis of the results of the survey, scores on the RJE (Table 3.1), performance in mathematics courses (Appendices IV - VI), and the experience of the faculty, the QEP team recommended the topic "Improving Mathematical Knowledge and Critical Thinking Skills across the Disciplines" to the Leadership Team**.**

After reviewing the recommendation sent by the QEP team, the Leadership Team noted that inclusion of "Critical Thinking Skills across the Disciplines" in the topic would make it too broad to implement. In addition, SACS suggests that it is important to choose a topic which focuses on a specific problem, that is easy to implement, and one that impacts student learning. Therefore, the Leadership Team selected the topic **"The Improvement of Mathematical Skills and Knowledge."** The Quality Enhancement Plan Team agreed with the Leadership Team because the selected topic is more focused but sufficiently broad to serve as a major enhancement to student learning. This topic will significantly serve the needs of the institution by addressing the major challenge of improving mathematical knowledge and skills of GSU students. The topic also supports the national need to improve mathematics education.

Deficiency in mathematical skills and knowledge is also a national issue. School aged children in the United States as a whole have consistently been ranked lower than many other developed and developing countries in mathematics and science (Obama 2009; National Mathematics Advisory Panel 2008; Rimer 2008; Gonzales et al. 2008; De Salazar 2007; Glod 2007; Baldi et al. 2007; CBS News 2006; Manzo & Cavanagh 2008). American adults and citizens were also deemed wholly deficient in quantitative literacy (NAAL 2003). College students are no exception to the rule. According to a CBS News Report (2006), between 20 and 30 percent of college students were able to demonstrate only basic quantitative skills. Mathematics is not only at the core of science and technology but is equally important to all aspects of life. In a technologically driven society the range of mathematical and quantitative skills required to solve problems is considerable and will continue to grow (Renya & Brainerd 2007). Not only is mathematical proficiency essential to the workplace, it is required for the tasks of everyday living.

Mathematics is important in its own right; however, many experts believe that improving mathematical knowledge and skills is directly related to the enhancement of student learning, critical thinking, and the ability to solve word problems. Research findings have established a positive relationship between taking mathematics and science courses and critical thinking (Tsui 1999). Teaching mathematics across the curriculum further improves critical thinking (Elliot, et al. 2001). Quantitative literacy seeks to increase the ability of students to think logically and subsequently become better informed citizens and employees (Lott 2003, 175; Sutcliffe 2003, 189).

3.2 Development of the QEP

Following the selection of the QEP topic, the Team began the literature review process, research on best practices, and data collection & analysis. Initially, meetings focused on an overall plan derived from the *Quality Enhancement Plan Handbook* developed by SACS. The entire team met twice a month during the Fall of 2008. The QEP team members were assigned to one or more subcommittees focusing on the above-mentioned tasks. Each subcommittee developed a specific plan of action for its assigned tasks which was discussed with the entire Team and shared with the former provost. Starting in the Spring of 2009, the full team met at least once a month, with individual subcommittees meeting at least every two weeks. During the summer of 2009, team members met several times a week developing and refining the QEP document. Members of the Leadership Team attended various QEP and subcommittee meetings and played an integral part in the development process. In addition, the chair and director met regularly with the former and current provost and vice president for academic affairs.

In December 2008, Dr. Parashu Sharma (Chair) and Mrs. Michelle Williams Young (Director) participated in the SACS-COC Annual Meeting in San Antonio, Texas. For four days they attended seminars, panel discussions, roundtable discussions and general sessions that provided valuable information fundamental to the development of a successful QEP. They were also afforded the opportunity to interact with faculty and staff from other institutions that had recently completed the reaffirmation process; they provided tips and suggestions for preparation of the QEP document. In addition, four QEP Team members had the opportunity to attend The Institute on Quality Enhancement and Accreditation in Houston, Texas, sponsored by The Commission on Colleges in July 2009. At this conference, members were informed about successful assessment practices and exposed to quality enhancement initiatives related to improving student learning. This meeting gave members the opportunity to collect information from individuals who were at various stages of the QEP process at their respective institutions. In December 2009, Dr. Frank Ohene and Dr. Parashu Sharma attended the SACS-COC Annual Meeting in Atlanta, Georgia. This meeting included sessions on assessment techniques, use of technology in assessment, and the availability of several commercial software packages among others. The team received feedback during the roundtable conferences about various software platforms available for assessment.

The Literature Review and Best Practices Subcommittee spent 14 months reading relevant documents and researching other institutions in support of the development of the QEP. Members of the team met with faculty members from the mathematics department to discuss the importance of the QEP and to get their feedback in developing the purpose, goals, student learning outcomes, and predetermined criteria for success. Team members also met with the College of Education faculty to get feedback on the goals, student learning outcomes, and assessment. They also conducted roundtable discussions with faculty from mathematics, biology, chemistry, economics, and physics to review and assess the depth of mathematical knowledge and skills required in these disciplines. The roundtable discussions led to the identification of certain mathematical concepts useful in various courses. In addition, the QEP Team Chair and the Director met with several individual faculty members from various departments to receive feedback on the QEP document at various stages in the development of the plan. These efforts are documented in a Chronology of Interaction Table that contains the dates of meetings, names of the individuals, and the type of discussions or activities held.

Members of the Data Collection and Analysis Subcommittee compiled and analyzed data obtained from Information Technology Center, the Office of Planning and Institutional Research, and the Office of Testing and Assessment. Faculty and student surveys were conducted to seek information on student interest, confidence, and their knowledge of a number of mathematical concepts. Faculty surveys were distributed via e-mail and in departmental meetings. The purpose of the faculty surveys was to determine whether the knowledge of particular mathematical concepts will help students to better learn the subject material taught in various courses. One hundred and fourteen (114) faculty members participated in this survey. An analysis of the faculty survey indicated that there is great potential for improvement of student performance if elementary mathematical deficiencies are minimized. Student surveys were distributed in classes. The purpose of the student survey was to assess the comfort level of students with certain mathematical concepts. It should be noted that the same mathematical concepts were included in both surveys. Five hundred and fifty one (551) students participated in this survey. An analysis of the student survey indicated that student perception of the QEP is positive. The general opinion of the students is that they will benefit in their areas of study if they acquire knowledge of the general mathematical concepts listed in the survey. It is important to note that the opinion of the students aligns well with the opinion of the faculty. The committee compiled data from these surveys which helped to identify the QEP goals and the student learning outcomes (Chapter 5).

The Publicity Subcommittee was given the task of informing the greater Grambling community about the GSU Quality Enhancement Plan. The subcommittee developed a broad set of communication activities that have been used to inform all of the constituent groups about the development of the QEP. The initial communication by the former provost was the survey for the selection of a topic which was sent to constituent groups as early as July 2008. Although no topic had been chosen at the time, individuals around the country were aware that a QEP process was underway at GSU. The team created and maintained favorable relations with the university and these constituent groups to ensure that each remained continuously informed. Through various media, the Publicity Subcommittee kept all constituent groups informed. A QEP Newsletter, "Math Does Matter," was published monthly. However, this newsletter will be published twice a semester during the implementation phase. Articles on Grambling's QEP were published in local and area newspapers: *The Ruston Daily Leader, Monroe News Star and The Shreveport Times*. Members of the QEP Team were also invited to participate on the KGRM-FM Radio show "Good Morning Grambling" in order to reach the broader Grambling community. A website which provides detailed information about the QEP will be created; it will also be used as a resource for faculty members. Some of the items that will be included on the website are the "Math Does Matter" Newsletters, research publications, information about what is going on with the QEP, training manuals for faculty, goals, student learning outcomes as well as assessment findings.

Grambling students were involved in the publicity campaign. A group of approximately fifty QEP Student Ambassadors was assembled. These ambassadors are GSU students who are well informed and responsible for keeping other students knowledgeable about the QEP. The ambassadors met at least monthly and also prior to all activities to receive updated information about the QEP. They gave informational talks to various classes, distributed surveys, participated in radio remotes, distributed flyers, and organized QEP activities during homecoming events. They also read QEP Public Service Announcements on KGRM-FM. In addition, student members of the QEP Team wrote articles for the Grambling student newspaper, *The Gramblinite*.

Updates on the status and activities of the QEP have been frequent and continuous. *The College of Arts and Sciences Newsletter* published updates on the QEP in Fall 2008 and Spring 2009. PowerPoint presentations were given at faculty meetings by the QEP Team members. Members of the QEP Team attended departmental faculty and staff meetings to give updates and answer questions about the QEP (agendas and minutes are available in the QEP office). Students were informed about the QEP via a number of media including messages on electronic monitors and kiosks in various buildings across campus.

The actual process of writing the QEP document began in February of 2009. Each portion of the document was shared with various members of the faculty and staff across the university as documented in the Chronology of Interaction Table. This process has been recursive; additional suggestions and recommendations were discussed among the team members, and integrated into the document. The team has met at least three times per week and several weekends and evenings this academic year for the purpose of finalizing the document.

CHAPTER 4

LITERATURE REVIEW AND BEST PRACTICES

A subcommittee was established to conduct a literature review and to examine best practices that can be used to improve mathematical knowledge and skills for students at Grambling State University. It focused on studies that support the following:

- The national need to revitalize undergraduate mathematics.
- An understanding of general learning principles and learning principles in mathematics.
- Best practices in implementing effective methodologies for teaching and learning.
- Systematic and effective assessment practices in undergraduate mathematics.

4.1 National Need to Revitalize Undergraduate Mathematics

Deficiencies in mathematical skills and knowledge have been cited as a national issue that negatively impact society as a whole (The Education Alliance 2006). The extent of these deficiencies was demonstrated in the Program for International Student Assessment (PISA), sponsored by the Organization for Economic Cooperation and Development (OECD). According to the report, United States 15-year-old-students, who participated in the competition, scored lower than their counterparts in 31 other countries (23 OECD jurisdictions and 8 non-OECD jurisdictions) (Baldi, et al. 2007). The Trends in International Mathematics and Science Study (TIMSS) provides reliable and timely data on the mathematics and science achievement of U. S. 4th and 8th grade students compared to that of students in other countries. The TIMSS results of 2007 (Gonzales 2008) show that U. S. students lag behind their Asian counterparts as they did in 2003. In an effort to provide states with an International benchmark to compare how students are performing in mathematics and science, a report – *Chance Favors the Prepared Mind* (Phillips 2007) concluded that "the highest achieving states within the United States are still significantly below the highest achieving countries." *Before It's Too Late*, a report from the National Commission on Mathematics and Science Teaching for the 21st Century (Glenn, et al. 2000) states that "in an age now driven by the relentless necessity of scientific and technological advances, the current preparation that students in the United States receive in mathematics is, in one word, unacceptable." The improvement of mathematical skills and knowledge has been recognized as one of the national goals for education in the United States (National Education Goals Report 1993). Several studies (National Mathematics Advisory Panel 2008; De Salazar 2007) indicate that the United States is losing the edge that it had as a mathematics leader in the 20th century. Also, the achievement of American students in mathematics is at a mediocre level when compared to their peers worldwide. Beyond that, there are still large disparities in mathematics achievement related to race and income.

4.2 Learning Principles

The shift in the goal of higher education from building a very specialized knowledge foundation to the production of highly knowledgeable individuals has led to new methods of teaching traditional subjects (Dochy, Segers & Sluijsmans 1999, 332). Chickering and Gamson (1987) provided educators with 7 principles to consider when they choose to adopt a new way of teaching in hopes of improving student learning. These basic principles are:

> (1) Encouraging frequent contact between students and faculty in and out of classes; (2) developing reciprocity and cooperation among students by creating learning groups; (3) using active learning techniques like structured exercises or classroom discussions; (4) giving prompt feedback; (5) emphasizing time on task; (6) communicating high expectations by requiring at risk students to attend workshops concerning issues that will contribute to their academic success such as study skills, test taking skills, and time management; and (7) respecting diverse talents and ways of learning.

Mathematics reform documents suggest that students should be engaged in frequent discussions of mathematical ideas (NCTM 1991, 2000 as cited in Engle & Conant 2002, 400). However, it is also clear that these discussions rarely take place in the classroom (Stodolsky 1988 as cited in Engle & Conant 2002, 400). Engle & Conant (2002, 400-401) state that there are four principles that can be applied in the classroom that encourage productive mathematical engagement: (1) allowing students the opportunity to address intellectual problems; (2) giving students the authority to address the problems; (3) holding students accountable to themselves and to others; and (4) providing students with the resources they need.

In a report, *Mathematics Matters,* The National Centre for Excellence in the Teaching of Mathematics (NCETM) in the United Kingdom published a list of best practices for effective teaching. This report suggests that educators:

> Build upon the knowledge learners already have; expose and discuss common misconceptions and other surprising phenomena; use higher-order questions; use collaborative group work appropriately (after students have been given an opportunity for independent reflection); encourage reasoning rather than 'answer getting'; use rich, collaborative tasks; create connections between topics both within and beyond mathematics and with the real world; use resources, including technology, in creative and appropriate ways; confront difficulties rather than seeking to avoid or pre-empt them; develop mathematical language through communicative activities; recognize both what has been learned and also how it has been learned (NCETM 2008, 4).

A report, *Closing the Achievement Gap: Best Practices in Teaching Mathematics* (The Education Alliance 2006, 7-8), synthesized a list of significant principles related to mathematics teaching and learning given by Sabean and Bavaria. The salient best practices suggested are: conceptual understanding of mathematical principles, problem based activities focused on concepts and skills, written explanation of mathematical concepts, engagement at a high level, use of students' prior knowledge, students self-monitor their progress, and appropriate time devoted to tasks.

4.3 Best Practices in Implementing Effective Methodologies

A. Interdisciplinary Approach

Traditionally, mathematics has been taught using a "top-down approach" where students are taught in an abstract or generalized manner resulting in a lack of student learning (Alsina 2001). Teaching in terms of real world context is important for student learning

(Forman & Steen 2000; Nelson 2003). Students should be given the opportunity to practice their newly acquired mathematical skills through activities that require the measurement of tangible items they can relate to their experiences (Packer 2003b). Encouraging positive attitudes toward learning mathematics should be an interdisciplinary effort that can be accomplished by demonstrating the applicability and importance of mathematics across the curriculum and in life (Korey 1999; Johnson 1996; Lamoureux 2000; Engle & Conant 2002). All courses should attempt to reduce mathematics related anxiety and fear that many students feel by helping them learn to appreciate its relevance (Lamoureux 2000). Economics courses could accomplish this by showing them how mathematics can be used as a tool to communicate analytical concepts. Students should be encouraged to inquire about the concept being taught and search for solutions to real world problems that are presented to them (Hiebert et al. 1996). For business majors, this may include problems involving management and quality control issues. The ability to apply the concepts being taught to real life situations increases students' understanding and helps to reiterate the importance of the subject matter (Packer 2003b; Steen 2003; Ganter 2003; and Niss 2003). Students learn best by critically analyzing, discussing, and using content in meaningful ways by not merely memorizing and regurgitating what they have written in their lecture notes (Meyers & Jones 1993). According to Brophy & Alleman (1991, 14) "good activities engage students in actively processing curriculum content, developing personal ownership and appreciation of it, and applying it to their lives outside of school." Students also learn from research projects that provide opportunities for application of knowledge and further development of their mathematical skills. The involvement of students in research can serve to motivate learning as well as increase interest in the subject matter (Clark 1997).

The manner in which the knowledge of relevant course material is assessed significantly impacts the way students study and learn the material. Moreover, research indicates that students will adapt to the manner in which they are being assessed (Trigwell & Prosser 1991, 251). Professors who use assessment tools that require recall only (multiple choice or other methods that can be accomplished through rote learning) encourage a surface approach toward studying and learning. A surface approach does not require students to seek meaning and subsequently does not foster a true understanding of the concept. A deep approach toward studying and learning requires students to seek meaning through application questions and discussions. Groenestijn (2003) states that it is not enough to teach students a mathematical concept, they must be encouraged and feel confident about newly gained skills in order to properly apply them in real life.

B. Use of Technology

According to the National Council of Teachers of Mathematics, technology is essential to teaching and learning mathematics. The use of computer laboratories and mathematics software for the enhancement of instruction in college mathematics courses has led to some promising changes. The idea behind this significant change in pedagogy is that students learn mathematics by "doing mathematics rather than passively listening." The computer laboratory provides them with the opportunity to practice these newly learned skills in a safe and constructive learning environment. The use of technology and computer-assisted instruction (CAI) offer students an alternative to traditional classroom teaching and can result in positive learning experiences (Carle & Miller 2009; Sendag & Odabasi 2009). Today, many textbooks are accompanied by supplementary computer software to provide students with yet another practice tool. Kodippili and Senaratne (2008) examined computer-generated interactive mathematics homework assignments to determine if they were more effective than traditional instructor-graded homework. Seventy percent of students that used CAI (My Math Lab) homework assignments passed with an overall grade of C or higher, whereas only 49% of students enrolled in the course that used traditional instructor graded homework earned an overall grade of C or higher.

C. Mathematics through Writing

Writing provides an opportunity for students to develop and refine their thoughts about mathematical concepts (Stehney 1990; Morrel 1999). Writing assignments also help instructors differentiate between what students concretely understand versus what they merely recognize (Keith 1990). Writing promotes learning and retention as opposed to traditional methods that rely upon student memorization (Keith 1990; Morrel 1999). The inclusion of writing assignments within a mathematics course provides students with an opportunity to understand concepts at a more fundamental level. The underlying reason for introducing writing assignments in mathematics courses is to increase students' level of understanding and to promote "clear thinking" as opposed to sheer "memorization" (Henrikson 1990, 51; Ko & Knuth 2009). Mathematics through writing can use both informal and formal assignments (Sipka 1990; Rose 1990; Brandau 1990; Morrel 1999; Ko & Knuth 2009).

D. Process-Oriented Guided-Inquiry Learning (POGIL)

Despite many reports on the effectiveness of non-traditional approaches to instruction, the lecture model remains the preferred form of classroom presentation at Grambling State University. Lecturing is based on a series of assumptions about the cognitive capabilities of students and their learning strategies. The lecture methodology assumes that all students need the same information, at the same pace, without much dialogue. Although lecturing is an efficient way to present information, it does not automatically result in efficient learning (Hale & Mullen 2009; Rasmussen & Kwon 2007; Ward & Bodner 1993; Zoller 1993). Several studies show that many students have difficulty understanding and applying concepts, finding relevance, transferring skills within and across disciplines, and identifying and developing the skills for success in college and in careers (Green 1989; Hewitt 1991; McDermott 2001). The significance of the subject matter is often lost in the process. Consequently, students lose interest and develop negative perceptions about the subject matter (Hewitt 1991). Many students simply read solution manuals, or copy solutions and memorize the algorithms used in the solutions. They do not actually understand how to apply the concepts. In addition, most of the students work independently and, therefore, do not gain any experience in teamwork and associated skills needed in the workplace (Johnson, et al. 1991).

Using inquiry as an instructional method has been recognized as a progressive problem solving approach that nurtures and provides essential ingredients for improved student learning (Crockett 2004; Glassman 2001; Rodgers 2002; Rasmussen & Kwon 2007; So & Brush 2008). Over the past 20 years, as criticism of conventional professional development programs has increased, an interest in school-based communities of teacher inquiry has accelerated. Communities of inquiry have a variety of names and forms, such as teacher research (Zeng & Takatsuka 2009), inquiry groups (Crockett 2004), and learning teams. These emergent programs of collaborative inquiry also represent a wide range of options in terms of duration, complexity, rigor, processes employed, and types of data that emphasize reflection and analysis (Ferrance 2000; Dewiyanti, et al. 2007). Student work, student interviews, student questionnaires, checklists, self-assessments, portfolios, systematic classroom observations and test results are all potential sources of data that instructors might use to obtain feedback from the inquiry process (Ferrance 2000; Fernandez et al. 2003).

Process-Oriented Guided-Inquiry Learning, a process based on philosophy and strategy for teaching and learning, is a methodology that encompasses specific ideas about the nature of the learning process and the expected outcomes that are consistent with the key ideas listed by Hanson and Wolfskill (2000). They maintain that there are five key ideas about learning in the cognitive sciences which are listed below:

- Constructing understanding based on students' prior knowledge, experiences, skills, attitudes, and beliefs.
- Following a learning cycle of exploration, concept formation, and application.
- Connecting and visualizing concepts and multiple representations.
- Discussing and interacting with others on a team.
- Reflecting on progress and assessing performance.

In addition, POGIL methodology offers promise for intellectual challenge. As a learning team becomes involved in a lesson, the different information, perceptions, opinions, reasoning processes, theories, and conclusions of the members may lead to disagreement. When managed constructively with the appropriate interpersonal, social, and collaborative skills, such controversy promotes questioning, an active search for more information, and finally a restructuring of knowledge. This process results in a greater mastery and retention of material and more frequent use of critical thinking and higher-level reasoning compared to the competitive and individualized modes (Johnson et al. 1991). The effectiveness of POGIL methodology has been applied to chemistry instruction at a number of institutions and the outcomes have been assessed. The general outcome of POGIL implementation in these institutions is that student mastery of content is at least as high as the mastery gained with traditional lecture instructional methods. It is interesting to note that students generally prefer the POGIL approach over other methods. Assessment data from these institutions show that adoption of POGIL has proven to be an effective learning methodology (Hanson & Wolfskill 2000).

4.4 Best Practices in Assessment

A significant number of sources in literature on assessment and evaluation are available. This section briefly describes assessment principles/practices recommended by mathematics professional societies in the US, the UK, and by individual assessment experts.

The Mathematical Association of America (MAA) focuses primarily on undergraduate mathematics education in the United States and has organized in-depth studies on assessment of undergraduate mathematics programs (Gold et al. 1999; Steen et al. 2006).

The Subcommittee on Assessment formed by the MAA's Committee on the Undergraduate Program in Mathematics recommends the following principles:

- Assessment should not be a single event, but a continuous cycle.
- Assessment must be an open process.
- The assessment process should promote valid inferences to make improvements. Data should be analyzed carefully so that the assessment process can isolate true reasons for the results obtained.
- The assessment that matters should always employ multiple measures of performance. This principle complements the third principle and suggests that it is necessary to use a number of appropriate assessment instruments to reach possible conclusion(s). For example, if one wants to assess the conceptual knowledge of the students about a particular topic one should use instruments such as "mathematics concept inventories" and students' ability to solve real-world problems and/or individual/group projects building mathematical models that make use of such concepts.
- Assessment should measure what is worth learning, not just what is easy to measure. Instruments that measure higher order skills and contextual problem solving should be used.
- Assessment should support every student's opportunity to learn important mathematics. This principle also echoes recommendations given by both the Mathematical Sciences Education Board and the National Council of Teachers of Mathematics.

Most of the assessment work in the United Kingdom has been carried out by the Assessment Research Group (ARG) and some members of the International Community of Teachers of Mathematical Modeling and Applications (Houston 2001, 417). Houston (2001, 410) has provided guidelines for the purpose of assessment. These guidelines are as follows: inform learners about their own learning; inform teachers of the strengths and weaknesses of the learners and of themselves; inform other stakeholders – society, funders, and employers; encourage learners to take a critical-reflective approach; and provide a summative evaluation of achievement. A consortium of academics from fifteen British Universities, with a nucleus of members from ARG, secured a large grant from the Higher Education Funding Councils in the UK for the Project "Mathematics Learning and Assessment – Sharing Innovative Practices" under the Effective Teaching and Assessment Program (Haines & Houston 2001, 435). Burton and Haines (as cited in Haines & Houston 2001, 437) provide the following assessment objectives from the Mathematics Learning and Assessment Project:

> Recall, select and use mathematical facts, concepts, and techniques; construct mathematical arguments; formulate mathematical models; evaluate mathematical models; develop the skills of criticism; organize mathematical information; interpret mathematical information; communicate mathematical ideas; develop oral and written communication skills; read and comprehend mathematics; develop logical thinking; provide students with vocational education; encourage independence of thought and initiative; and develop group-working skills.

Palomba and Banta (1999, 6-16) suggest the following six strategies as essential for successful assessment:

- Agreement on goals and objectives for learning.
- Designing and implementing an approach to assessment planning.
- Involvement of individuals from on/off campus.
- Selection and implementation of data collection.
- Examination and sharing of assessment findings.
- Regular reexamination of the assessment process.

The Assessment Cycle

The standard steps used in a typical assessment cycle are: development of broader goals and specific student learning outcomes; choosing appropriate teaching/learning strategies based on the best practices; selecting appropriate assessment methods to measure student progress toward completion of goals and student learning outcomes; gathering, summarizing, and interpreting assessment data; and making use of the assessment results to further improve the quality of student learning (Suskie 2009; Gold et al. 1999). In summary, assessment is the continuous four-step cycle of: establishing learning goals; providing learning opportunities; assessing student learning; and using the results for the continuous feedback and improvement of learning (Suskie 2009, 4).

The assessment process should include planning, instruction, and evaluation. During the planning phase a rubric for data collection can be developed that shows what data are to be collected; who will be responsible for collecting these data; when and how these data will be collected; and how these data will be used to improve the program. During the instruction phase, care should be taken to use the pedagogical methods which are effective for student learning. Evaluation should be done both during instruction throughout the semester (formative assessment) and at the end of the semester/year (summative assessment). Formative assessment should monitor both the implementation (whether the plan is being implemented as expected) and the progress (whether students are advancing adequately) made in learning outcomes. Black and William (2008), after reviewing about 580 research articles and book chapters, reached the conclusion that formative assessment is one of the most effective mechanisms of improving student learning. Summative assessment should seek the final impact of the instruction after a designated time period such as at the end of the semester or the year. At this point, a comparison should be made between the actual outcomes and the expected outcomes. Any discrepancy between actual outcomes and the expected outcomes should be analyzed, and these results should be used to improve the process of student learning.

In addition to quantitative assessment, qualitative assessment is equally important as it adds human dimension to an assessment process. "Qualitative assessment uses flexible, naturalistic methods and are usually analyzed by looking for recurring patterns and themes" (Suskie 2009). The instruments used for qualitative assessment can include effective written feedback given by students such as minute papers, Blackboard and classroom discussion threads, faculty reflections, and student surveys.

CHAPTER 5

PURPOSE, GOALS, AND STUDENT LEARNING OUTCOMES

5.1 Purpose

The purpose of the Quality Enhancement Plan is to improve the mathematical skills and knowledge of all GSU students irrespective of their academic majors. It is essential that students clearly understand fundamental mathematical concepts in algebra, geometry, trigonometry, statistics, and probability. Furthermore, it is important that they become proficient in applying mathematical knowledge and skills to enhance understanding of their respective academic disciplines. This is consistent with the mission of the university as it seeks to prepare its graduates to compete and succeed in careers that contribute to the advancement of knowledge. It also prepares them to lead productive lives as informed citizens in a democratic society (Lott 2003, 175; Sutcliffe 2003, 189; Niss 2003, 215). The improvement of mathematical skills and knowledge is also recognized as one of the national goals in the United States (Glenn et al. 2000; Gonzales, et al. 2007; Baldi, et al. 2006; National Mathematics Advisory Panel 2008; National Education Goals Report 1993). Grambling State University's Quality Enhancement Plan is designed to support two university goals which include numeracy across the curriculum (quantitative reasoning) and the ability to think critically (analytical thinking and problem solving capabilities). The GSU Academic Master Plan (2007-2012) on page 43 states that "Numeracy or quantitative skills must receive a unified effort in order to prepare undergraduates to function in a society whose use of technology grows exponentially. To be able to analyze a simple set of data, understand simple graphs and information presented graphically, solve simple algebraic equations, and identify fallacious arguments are essential skills for competing in tomorrow's workforce."

5.2 Goals of the QEP

It is essential that all students understand general mathematical concepts well and acquire the ability to use those concepts as versatile tools in problem solving. It will be beneficial to take an approach which provides students opportunities for engagement with various mathematical concepts in a number of courses in addition to mathematics courses (Forman & Steen 2000; Nelson 2003; Korey 1999; Johnson 1996). The mathematical abilities acquired through quantitative analysis and problem solving in other disciplines such as those in the sciences, engineering, and business help students to master the required mathematical concepts and also gain knowledge and skills in their own majors. Therefore, a unified approach will be taken to implement this QEP through Pre-calculus I, Pre-calculus II and several courses in biology, physics, and economics. Overall, it will directly influence 38% of the general education courses required in the GSU undergraduate curriculum. The goals of the QEP are:

1. To increase student knowledge and comprehension of general mathematical concepts.
2. To develop student ability to think analytically and to reason quantitatively in solving real world problems.

These goals incorporate both theoretical and applied aspects of student learning. The first goal aims to strengthen the theoretical aspect of mathematics; and the second goal addresses the enhancement of problem solving skills with the purpose of making students more competitive in careers related to their programs of study. According to Lester and Kroll (as quoted in Muir et al. 2008, 229), "Problem solving performance is influenced by five factors: knowledge acquisition and utilization, control, beliefs, affects and social/cultural context. Problem solvers must be able to connect their own knowledge representation and the problem situation at hand and the extent to which we are able to do this, in turn impacts on their success with solving the problem. The ability to recognize the mathematical structure of the problem is an important element." Lack of flexible knowledge has been reported to have a direct correlation to low academic achievement in mathematics (Hiebert et al. 1996).

The proposed goals match the needs of GSU students as evidenced by the following institutional data, and as summarized in Chapter 3: student performance on the Rising Junior Examination (Table 3.1), and student performance in introductory mathematics courses (Appendices IV & V; Table 3.2). In addition, faculty and student surveys were conducted, as described in Chapter 3, to seek input from them to develop the goals and student learning outcomes of the QEP. The student learning outcomes (SLOs) for GSU's QEP are listed below.

5.3 Student Learning Outcomes

The student learning outcomes (SLOs) associated with each goal are as follows:

Goal 1: To increase student knowledge and comprehension of general mathematical concepts.

SLO 1a: Students will demonstrate proficiency in factual knowledge in algebra.

SLO 1b: Students will demonstrate proficiency in conceptual knowledge in algebra.

SLO 1c: Students will demonstrate proficiency in procedural knowledge in algebra.

SLO 1d: Students will demonstrate proficiency in factual knowledge in trigonometry.

SLO 1e: Students will demonstrate proficiency in conceptual knowledge in trigonometry.

SLO 1f: Students will demonstrate proficiency in procedural knowledge in trigonometry.

Goal 2: To develop student ability to think analytically and to reason quantitatively in solving real world problems.

SLO 2a: Students will be able to present and interpret mathematical ideas numerically, graphically, and symbolically.

SLO 2b: Students will be able to solve word problems of various complexities that involve ratios, proportionality, percent, weighted average, properties of real numbers, exponents, algebraic equations, similarity of geometric figures, and probability & statistics.

SLO 2c: Students will be able to solve, interpret, and analyze real world problems of various complexities from a number of disciplines.

Student learning outcomes associated with the first goal aim to increase student knowledge and comprehension of general mathematical concepts and to provide theoretical foundations in algebra and trigonometry. To achieve these student learning outcomes, it is essential to focus on factual, conceptual, and procedural categories of knowledge (Anderson & Krathwohl 2001). Student learning outcomes 1a, 1b, and 1c will be achieved through Pre-calculus I (MATH 147) and student learning outcomes 1d, 1e, and 1f will be achieved through Pre-calculus II (MATH 148). The alignment between the mathematical content and each of these SLOs is included in the syllabi for the two pre-calculus courses (MATH147 & MATH148). By incorporating all three categories (factual, conceptual, and procedural), students will get a spectrum of knowledge pertaining to a particular mathematical concept. It is important to note the relevancy of these three categories, as each provides a unique component of the learning process. The activities through which these SLOs will be achieved are described in Chapter 6.

Factual knowledge encompasses familiarity with basic terminology, definitions, and a discrete set of rules. Anderson & Krathwohl (2001, 45) state that "Factual knowledge contains the basic elements students must know if they are to be acquainted with the discipline or to solve any problems in it. For the most part, factual knowledge exists at a relatively low level of abstraction." A thorough familiarity of factual knowledge is essential for further growth of student learning because the basic elements learned act as nucleation on which this growth builds. It has been the experience of the mathematics faculty at GSU that a thorough acquaintance with basic factual knowledge of mathematical content increases the preparedness and efficiency of students in understanding advanced topics. Improvement of factual knowledge of the subject matter is contained in student learning outcomes 1a (algebra) and 1d (trigonometry).

Although factual knowledge acts as a seed for student learning in almost all disciplines (quantitative areas such as mathematics, sciences, economics, sociology and engineering), it is not enough to know just factual knowledge. Factual knowledge alone limits one to rote memorization and precludes the real purpose of education. It is crucial to possess a deeper understanding of a particular concept so that the same concept can be applied to a variety of situations. It is stated that "Conceptual knowledge includes schemas, mental models, or implicit or explicit theories in different cognitive psychological models. These schemas, models, and theories represent the knowledge an individual has about how a particular subject matter is organized and structured, how the different parts or bits of information are interconnected and interrelated in a more systematic manner, and how these parts function together" (Anderson and Krathwohl 2001, 48). Improvement of conceptual knowledge of the subject matter is contained in student learning outcomes 1b (algebra) and 1e (trigonometry). An understanding of conceptual knowledge helps in solving a variety of problems using the same concepts. For example, a conceptual understanding of exponential functions can help build simple mathematical models to solve problems in biology, chemistry, or economics. Simple mathematical models using the exponential function include growth/decay of population, prediction of the half-life of a radioactive isotope, and continuous compounding of money. In other words, the enhancement of conceptual knowledge helps students to develop tools for solving a variety of problems by making learning more versatile.

As the name indicates, procedural knowledge shows *how* something is done. In mathematics, procedural knowledge means using a technique, method, or an algorithm to solve problems. This is an important piece of knowledge because without knowing various procedures, advancement cannot be achieved. Procedural knowledge is important in improving skills that enable students to use conceptual knowledge. Procedural and conceptual knowledge feed on each other in that practicing one reinforces the other. It is important that students become proficient in carrying out mathematical procedures and be able to use certain algorithms to solve problems. Some of the examples include solving a system of simultaneous equations, finding the inverse of functions, proving trigonometric identities, performing algebra on matrices, or using a procedure to demonstrate whether a second degree equation represents a circle, an ellipse, or a hyperbola. Anderson and Krathwohl (2001, 52) state that "whereas factual knowledge and conceptual knowledge represent the *what* of knowledge, procedural knowledge concerns the *how* of knowledge." In a recent study, it is suggested that the lack of conceptual knowledge is related to incorrect procedures when solving equations (Booth, et al. 2007). Although this study was conducted for middle and high school students, GSU faculty suggested that the relevancy of these findings also holds true for freshman level mathematics courses. Improvement of the procedural knowledge of subject matter is contained in student learning outcomes 1c (algebra) and 1f (trigonometry).

The student learning outcomes associated with the second goal aim to develop the ability of students to think analytically and to reason quantitatively in solving real world problems. This supports GSU's mission to help students contribute to the advancement of knowledge and to lead productive lives as informed citizens. When students have become proficient in these SLOs, it also means they are better prepared for the MAPP test (Rising Junior Examination) and other standardized tests such as the GRE, the GMAT, and the Praxis. The alignment between the mathematical content and each of these student learning outcomes is included in the syllabi for the two pre-calculus courses. The expectation is that the ability to think analytically and reason quantitatively will help them in their entire curriculum and better prepare them in their majors. These student learning outcomes will be achieved through three (3) hours each in Pre-calculus I (MATH 147) and Pre-calculus II (MATH 148) and twelve additional hours in the General Education Curriculum. These twelve hours are selected from the following: 9 hours of biological/physical sciences and three hours of Macroeconomics (ECON 201). The 9 hours of biological/physical sciences can be taken as 6 hours of biological sciences and 3 hours of physical sciences or vice-versa. Students have the option to choose these 9 hours from the following courses: Principles of Biology I (BIOL 103); Principles of Biology II (BIOL 104); Physical Science Survey I (SCI 105); and Physical Science Survey II (SCI 106). Due to the fact that these twelve hours represent diversified disciplines, they will provide a broad base of real world problems for the utilization of the mathematical knowledge and skills learned in the two pre-calculus courses. Integrating mathematical concepts (analyzing graphs of functions, data analysis, chart readings, etc.) with the above-mentioned courses in the General Education Curriculum will enhance student interest in the subject matter, improve their skills and knowledge, and provide students with a quantitative approach to thinking. It should be noted that these courses will be incorporated in phases for QEP implementation. The implementation time-line is provided in Chapter 6 (Table 6.4).

The mathematics faculty will work collaboratively with the faculty members from non-mathematics departments to help in implementing a quantitative approach to teaching. The syllabi will be modified for each course and will reflect problem solving and quantitative methods. For each course with multiple sections, the syllabus, course content, mid-term, and final examinations will be the same. For example, all sections of BIOL 103 will have the same syllabus. Each area will select a course coordinator who will meet his/her respective group on a regular basis to assess and emphasize uniformity of content coverage. To make the process of learning effective, deliberate efforts will be made to let students know when a certain mathematical concept is relevant to any of the non-mathematics courses (Johnson 1996). For example, when teaching exponential functions, the mathematics instructors will let the students know that they will see this material applied in their biology, economics, or physics classes. Similarly, the biology, economics, or physics instructors will remind students that they have learned this concept in the pre-calculus courses. The specific examples where mathematics is used in these general education courses will be identified and put in a booklet with cross-references for instructors (Johnson 1996). This booklet will remind instructors of both courses to reiterate the usefulness of mathematics in these courses. It is expected that this process will improve student attitude toward mathematics in that they will realize the relevance and importance of mathematics in other disciplines. Faculty members from the mathematics department and other participating departments have already developed matrices. These matrices include general mathematical concepts that correspond to concepts from the above-mentioned non-mathematics courses. Table 5.1 provides a summary of these matrices which indicates the application of a particular concept in the other five (5) courses selected. This table also includes how these mathematical concepts align with student learning outcomes. For example, concept # 15 on equations for straight lines, circles, and parabolas is useful in biology, physics, and economics and aligns with SLO 2c. These matrices will be continuously modified during the implementation phase of the QEP.

Both pre-calculus courses have theoretical and applied components. Implementation of the QEP will enhance mathematics comprehension by frequently engaging the students both in theory and application of mathematical content. Instructors teaching these courses will use a pedagogy that engages students in dialogue to provide them with an opportunity for active learning (Chapter 6). Furthermore, teachers will introduce each new mathematics topic via an application, where applicable. In contrast to mere recitation of computations and procedures, real world applications will engage students and give them a broader view of the topic. To enhance their understanding of the topic, applications will be followed by the development of theoretical concepts. After a theoretical basis has been developed, students will then be engaged in numerous exercises involving mechanics, theory, and applications.

5.4 Rationale for Goals and Student Learning Outcomes

Analyses of a variety of GSU student data such as performance on the MAPP Test (Rising Junior Examination), performance in the introductory mathematics courses (Appendices IV and V), and ACT/SAT mathematics scores (Appendix VII) clearly indicate inadequate mathematical knowledge and limited ability to solve problems. In addition to these data, faculty members from mathematics and other departments realize that a large number of students enter GSU with inadequate preparation of the basic mathematics required for college level courses. This is also evident in the analysis of the faculty survey. Only 10% of the students were rated in the faculty survey (question # 12) as "good" in mathematical knowledge and skills. Furthermore, mathematics faculty members indicate that many students do not possess the knowledge of elementary mathematical concepts expected of them. For example, when asked to simplify

Table 5.1 Mathematical Concepts Used in Other General Education Courses and their Alignment with SLOs

Mathematical concepts and corresponding Student Learning Outcomes	BIOL 103	BIOL 104	SCI 105	SCI 106	ECON 201
1. Ratio, proportion, percentages **(SLO 2b)**	X	X	X	X	X
2. Averages (arithmetic, geometric mean, weighted average) **(SLO 2b)**		X	X	X	X
3. Algebraic/Arithmetic Expressions (order of precedence of operations) **(SLO 1b)**		X	X	X	X
4. Translate statements into equations (i.e. solve word problems) **(SLO 2c)**			X	X	X
5. Scientific Notation (i.e. 5.6×10^{-3} is 5.6e-3 or 8.4×10^{6} is 8.4e+6) **(SLO 1b)**	X	X	X	X	X
6. Properties of Real Numbers and their representation on number line **(SLO 1a)**				X	X
7. Exponents and Roots including squares and square roots **(SLO 1c)**	X	X	X	X	
8. Direct or inverse proportionality **(SLO 2b)**	X	X	X	X	X
9. Independent and Dependent variable identification **(SLO 2c)**	X	X	X	X	X
10. Real World applications of mathematics **(SLO 2c)**	X	X	X	X	X
11. Distance between two points and the midpoint of a line segment			X	X	
12. Properties of triangles, polygons, circles, parallel, perpendicular lines **(SLO 1b)**		X	X	X	X
13. Height and Displacement problems using geometry **(SLO 2c)**					
14. Perimeter, surface area, volume	X	X	X	X	
15. Equations for straight lines, circles, and parabolas **(SLO 2c)**	X		X		X
16. Understand links between graphical, numerical, algebraic expressions **(SLO 2a)**			X	X	X
17. Domain, range, intercepts, symmetries, discontinuities, intervals of increase/decrease **(SLO 1a)**		X	X	X	X
18. Distinguish between (and use) trigonometric functions **(SLO 1e)**		X	X	X	
19. Distinguish between (and use) exponential functions and log functions **(SLO 2c)**		X			X
20. Addition, subtraction and multiplication of matrices					
21. Solve linear equations using matrices **(SLO 1c)**			X	X	
22. Statistical concepts (Mean, Median, Mode) **(SLO 2b)**	X	X			X
23. Statistical concepts (Range, Variation Standard Deviation, and Coefficient of Variation) **(SLO 2b)**	X	X	X	X	X
24. Statistical concepts (Empirical and theoretical probabilities) **(SLO 2b)**	X				
25. Logic Concepts (Making generalizations from cases and analogies related to events)			X	X	
26. Number of combinations **(SLO 2b)**	X				
27. Units	X	X	X	X	
28. How to use and read graphs **(SLO 2a)**	X	X	X	X	X

expressions such as $\frac{3}{4}+\frac{2}{3}$ or $(a+b)^2$ or $\sin(a+b)$, many students incorrectly answered: $\frac{5}{7}$, or a^2+b^2 *or* $\sin a+\sin b$, respectively. Employers of the 21st century are looking for graduates who are better prepared mathematically, and who can think analytically and logically to solve problems. Results from the faculty survey (question # 20) indicate that 94% of the faculty members feel that there will be an increase in marketability of their students if they are better prepared mathematically. These results clearly suggest that there is a need to provide students fundamental knowledge and comprehension of content from algebra, geometry, trigonometry, probability, and statistics. Effective instruction in both the pre-calculus courses would be expected to build a solid foundation for advanced courses in mathematics and provide students with useful skills for other disciplines.

At some point, a need arises that requires one to solve real world problems in any given field (Brophy & Alleman 1991; Forman & Steen 2000; Nelson 2003). This may require skills learned from different fields of study (Brakke 2002). Often, mathematics satisfies that need. Many companies employ mathematicians and non-mathematicians to study, quantify, and analyze problems concerning society (Forman & Steen 2000; Packer 2003a). The academic world provides an excellent environment where students can learn how to apply mathematics to different disciplines. By solving problems, students will learn how to use mathematics and integrate elements from different fields by constructing a mathematical model to study a problem or phenomenon. In most cases, the real world problems are presented as written narratives that require critical reading and thinking abilities (Sterrett 1990). In today's workforce, the productive employee is the one who can use mathematics to synergize resources and perform tasks utilizing an interdisciplinary approach at the levels of research, technology, and service (Packer 2003b). Modules containing real world problems were developed for the two pre-calculus courses under the auspices of the CMAST program. These modules will be expanded further by the mathematics faculty during implementation of the QEP. These modules will be used by all sections of MATH 147 and MATH 148. In addition, a uniform approach to teaching these courses will be introduced in the form of a handbook in training sessions with faculty.

With the advent of high speed computers and the emergence of the information age, the need for quantitative reasoning is as important as reading and writing in a well-rounded educational system. It is important that students enhance their ability to think analytically, reason quantitatively, and be able to interpret relevant data, across the media and cyber-world, which affect their daily lives. Quantitative reasoning is important from both personal and societal perspectives. It is important that citizens understand their own financial matters, medical records, and mortgage issues. Also, they need to understand global issues such as environmental effects, government decisions, and consumer issues. In "The Third R in Literacy," Richardson & McCallum (2003) report that "the explosion in both the amount and variety of quantitative information, and the necessity of using such information in daily decisions, make the need for quantitative literacy both new and urgent." Bernard Madison (2003) maintains that "despite every person's need for quantitative literacy, in the discipline dominated K-16 educational system in the United States, there is neither an academic home nor an administrative promoter for this crucial competency." Therefore, it becomes imperative that educational institutions take the initiative to include this aspect in their curricula and provide students with the opportunity to develop their skills for quantitative reasoning. The GSU Quality Enhancement Plan provides an opportunity to include this aspect in one of the goals to reiterate the national need and reinforce the mission of the university. The enhancement of analytical thinking and quantitative reasoning will not only be helpful in the students' understanding of both personal and societal issues; it will also help them in performing well on the MAPP Test (Rising Junior Examination) and applying knowledge learned in the two mathematics courses to better understand various courses taken. This also supports the idea of "the democratization of mathematics" (Carnevale & Desrochers 2003). Both authors recommend that "mathematics be more accessible and responsive to the needs of all students, citizens, and workers."

5.5 Feasibility of Achieving Goals/Student Learning Outcomes

The achievement of the selected goals/student learning outcomes is feasible because GSU has the necessary infrastructure and resources to support the activities that will lead to successful student learning outcomes. The university is also committed to further enhance the existing resources to achieve these goals/SLOs (Chapter 7).

The mathematics faculty strongly believes that strengthening the content knowledge and problem solving skills is crucial to the success of students. Faculty members strongly support the initiatives included in this QEP, are willing to go that extra mile to help students in a variety of ways to improve student learning, and are willing to take additional measures to help realize the goals stated in this QEP. These measures include making changes in course syllabi, developing course modules on certain topics, and adopting new pedagogical methods (Chapter 6) and frequent assessments that will lead to early intervention in improving student learning (Chapter 7). The mathematics faculty has already modified syllabi for MATH 147 and MATH 148 to show an alignment between the mathematical contents and the stated student learning outcomes. In addition to the support extended by the mathematics faculty, the faculty members from participating departments have also extended their full cooperation and support for the realization of goals/student learning outcomes. They are also willing to modify course syllabi appropriately, make changes in textbooks, and invite mathematics faculty for guest lectures in their classes, as appropriate. Their commitment to implement the QEP is documented in the letters of support received from several departments (Appendix X).

The university administration is committed to providing the required resources in terms of reduction in class-sizes, hiring additional faculty members, and providing resources for faculty training in new teaching methods and assessment (Appendix X). Furthermore, Grambling State University has developed the necessary technological infrastructure to support faculty in their efforts. The detailed description about resources and the budget required to implement the QEP is included in Chapter 7.

There appears to be a climate of acceptance among students about the QEP and what it is expected to achieve. This acceptance is expected to motivate faculty to meet the purpose, goals, and the student learning outcomes of the QEP. Faculty enthusiasm, inter-departmental cooperation, administration's support, student receptiveness, and availability of technological resources make it feasible to implement activities pertaining to achieving student learning outcomes.

CHAPTER 6

IMPLEMENTATION OF THE QEP

Grambling State University will take a number of actions to effectively implement the Quality Enhancement Plan. These actions are divided into two parts. The first part includes activities that help in preparing a firm foundation for its implementation. This part requires both administrative support and faculty participation. The second part is the adoption of effective pedagogical methods that enhance student learning. The latter requires participation of both faculty and students. Details of both parts are described in this section.

6.1 Part 1: Actions to be Implemented

Part 1 of this chapter describes the initiatives that will provide the foundation for the QEP's implementation. Actions to be implemented in this part are further divided into two components. The first component includes activities which are currently in practice at GSU but require expansion. The second component includes new practices that are supported by a considerable body of literature. These actions will provide the needed infrastructure to implement the QEP.

A. Expansion of the Current Activities

1. Change in Course Syllabi

Course redesign will include strategies that increase both the effectiveness of teaching and the learning process. Syllabi for all courses involved in the implementation of the QEP will be changed to reflect the goals and student learning outcomes and include new teaching methodologies to be implemented in this plan. Faculty members will attend the National Center of Academic Transformation (NCAT) Conference for training and information on course redesign. The courses involved are: Pre-calculus I (MATH 147), Pre-calculus II (MATH 148), Principles of Biology I (BIOL 103), Principles of Biology II (BIOL 104), Physical Science Survey I (SCI 105), Physical Science Survey II (SCI 106), and Macroeconomics (ECON 201). Changes in the course syllabi will differ and will depend upon the particular courses taught and the student learning outcomes met. For example, in order to achieve the student learning outcomes stated in goal # 2 (SLOs 2a and 2b), it is important to include the concepts covered on the MAPP Test (Rising Junior Examination) in Pre-calculus I and Pre-calculus II courses so that students are formally prepared for the knowledge and skills required. This will not only benefit students for the Rising Junior Examination, but will also help them in other standardized examinations such as Praxis, GRE, or GMAT. A review of concepts from arithmetic and geometry is also required in the Pre-calculus I course. This review will help students to understand how they can generalize the concepts from arithmetic to algebra. Although Grambling State University is in the process of implementing the Board of Regents mandated selective admission procedures, it still has to address a large body of students who continue to come unprepared for pre-calculus courses. Therefore, the syllabus for MATH 147 will include concepts from arithmetic and geometry. Faculty members have agreed to spend about four class periods to review these concepts. This need is also reinforced by the results obtained from both faculty and student surveys. It is important to note that MATH 147 will continue to satisfy the requirements for the Statewide Articulation Matrix for college algebra. The Statewide Articulation Matrix, authorized by the Board of

Regents, is designed to facilitate the transfer of course credits among colleges and universities in Louisiana.

To implement the second goal, it will be necessary to adopt a quantitative instructional approach for the above-mentioned five non-mathematics courses. A committee consisting of instructors who teach these courses will be formed to consider appropriate changes in syllabi, prepare a list of the concepts to be taught with a quantitative approach, change existing textbooks to those that include a quantitative approach as well as a qualitative approach (specifically in biology), develop course modules, develop common pre-tests, mid-terms, and final examinations (post-tests) for classes with multiple sections, and to use new assessment techniques. It should be noted that although the pre- and post-tests will contain the same content, they will be different.

2. Continuous Monitoring of Student Progress

It is important to continuously monitor students' progress in any given course. Therefore, measures will be taken to provide early and continuous feedback to students on their understanding of the subject material. This will be achieved through one-minute papers (Angelo & Cross 1993, 148-153), frequent quizzes, class discussions, web-based homework assignments, regularly paced one-hour examinations, and comprehensive mid-term and final examinations. One-minute papers can be one of the effective techniques to daily assess students' progress in a course. Students will be asked to answer two or three short questions focusing on the material covered during a particular class period. According to Bressoud (1999, 97) examples of such simple questions should focus on the important points made in class and solve unanswered questions students may still have. The answers to such questions will be collected after every class period and students will be given feedback by the next class period. Common difficulties will be discussed at the beginning of each class period. In addition, the students will know their quiz results by the next class period and their test results within a week. Web-based assignments will also be used to provide immediate feedback. All these initiatives will be helpful in conducting formative assessment and providing students with early and continuous feedback, thereby, resolving their learning issues as they progress in the course. The information collected during such continuous monitoring will help with building a course portfolio as described in Chapter 7.

3. Student Advisement

It is imperative that students take their mathematics courses in a specified order. All students will be advised to take Pre-calculus I (MATH 147) in the first semester of their freshman year and Pre-calculus II (MATH 148) in the second semester of their freshman year. Students will be advised to sign up for the Rising Junior Examination (GET 300) in the semester that they are enrolled in MATH 148. This will help to assure that all students take their Rising Junior Examination at the same time during their program of study. In addition, students will get the benefit of taking this examination immediately after the completion of the two pre-calculus courses to obtain the best results. This will be ensured through proper advisement of all students. Faculty advisors from all the departments will be reminded to make sure that these courses are taken in the proper order. Periodically, this information will be reiterated in various formats: during the GSU general faculty meetings, departmental meetings, and via e-mail announcements. Curriculum sheets for each department will be scrutinized to ensure that students follow the above schedule for enrolling in these three courses. There is a distinct advantage in taking mathematics courses during the freshman year because it allows students to make use of their mathematical knowledge in other quantitatively-based courses. In turn, the quantitatively-based courses will reinforce their mathematical concepts.

4. Peer Tutoring

Peer tutoring is one of the most successful strategies for student learning. Grambling State University has adequate resources and physical facilities to implement peer tutoring. Such resources include the Retention Office, the Living and Learning Center, the Center for Mathematical Achievement in Science and Technology, the Minority Access to Research Careers Program, the Research Initiatives for Scientific Enhancement Program, and the Supplemental Instruction Program. In addition to these resources, faculty members will identify capable mathematics, secondary mathematics education, and science majors who are interested in becoming peer tutors. Tutors will be given basic training for effective tutoring. The tutors will also be required to attend lectures given by their assigned instructor (Hawkins & Schiflett 1993, 39). A peer tutoring schedule will be set and communicated to all concerned students. Care will be taken to make tutors available during evening hours. The funds required for the peer tutors are included in the QEP budget (Chapter 7).

5. Seminars/Workshops for Students

It is beneficial for students to participate in seminars/workshops that will constantly expose them to different areas of mathematics. Participation in these seminars will help them to understand the applications of mathematics in a number of interdisciplinary fields. The Department of Mathematics and Computer Science arranges weekly seminars whereby faculty members from the College of Arts and Sciences talk about their research. The Center for Mathematical Achievement in Science and Technology invites external experts to make presentations on a wide range of topics from the history of mathematics to teaching/learning strategies. The Endowed Chair in Mathematics also hosts an outside-speaker seminar series for students and faculty. These efforts will be strengthened further by organizing special seminars that will enhance students' affective skills, motivate them in the study of mathematics, and reduce anxiety. Ultimately, student anxiety should be alleviated and the relevance of mathematics appreciated (Lamoureux 2000). Students enrolled in the pre-calculus courses will be motivated to attend these seminars by providing extra credit for this activity as supported by faculty.

B. Introduction of New Practices

1. Reduction in Class Size

Currently, the pre-calculus courses have an average of 45 students per section. It is difficult for a faculty member to remain effective and attain desired student learning outcomes with such a large number of students in a particular class. Therefore, all sections of MATH 147 and MATH 148 will be reduced to a maximum of 28 students per section. This will ensure that instructors have adequate time to support students as they attempt to learn mathematics using new and improved pedagogical methods. Implementing Process-Oriented Guided-Inquiry Learning (POGIL) and other teaching strategies require a smaller number of students. Any group beyond 28 in one class becomes difficult to manage. An average of 800 students enroll in Pre-calculus I and 200 students in Pre-calculus II during any given fall semester. This would require a total of 36 sections with 28 students in each section. Allowing a faculty member to teach four (4) sections per semester will require nine (9) instructors for these two pre-calculus courses. The mathematics department currently has 12 full-time faculty members including an endowed chair and the department head. Therefore, the department will require four (4) additional faculty members to cover approximately 14 other mathematics courses. Funds have been included for four additional faculty members at the level of Assistant Professor in mathematics (Chapter 7).

2. Mathematics Clinic

For some time, mathematics faculty members have been deliberating on setting up a mathematics clinic for students. The Quality Enhancement Plan provides an opportunity to implement this idea. A mathematics clinic will be available to students for 36 hours per week, from 9:00 a.m. to 6:00 p.m., Monday through Thursday. The clinic will be run by members of the mathematics faculty. The time required for running the proposed clinic will be taken from the regular office hours of faculty. At present each faculty member is required to provide ten (10) office hours per week. Upon implementation of the QEP, faculty members will allocate up to three hours per week from their office hours for this purpose. The advantage of the mathematics clinic is that there will always be a faculty member available to students at a specified place and time.

3. Professional Development Seminars/Workshops for Faculty

Grambling State University faculty members are open to new ideas for the purpose of enhancing student learning; however, they will require additional support and resources to help them accomplish this goal. Professional development seminars/workshops for faculty will be organized every year for the six-year period. The workshops will begin one year prior to the implementation of the QEP. This will allow faculty members to be trained and practice the skills being introduced. These seminars/workshops will be held on a continuous basis to reinforce the pedagogical methods and to support the faculty. The topics of these seminars/workshops will include: an interdisciplinary approach to teaching, the use of technology including computer-aided instruction, new teaching/learning strategies such as Process-Oriented Guided-Inquiry Learning (POGIL), and course assessment techniques. These workshops would provide faculty with the opportunity to meet with their peers from other departments to share techniques and best practices in mathematics instruction across the curriculum and learn from each other. Blackboard training will help faculty members to manage their courses and facilitate the use of available software. A detailed timeline for the proposed professional seminars/workshops is provided in Tables 6.3 and 6.4. Adequate funds have been included in the QEP budget for this activity (Chapter 7).

4. Continued Support for Faculty through the School Year

In order to reinforce the material presented to faculty in the professional development seminars/workshops, mentoring on these topics will be provided to faculty throughout the school year. Faculty will have an opportunity to discuss issues associated with implementing the new strategies in their monthly group meetings as well as with in-house faculty members who have been using these methods for an extended period of time. The faculty members will also have an opportunity to contact external presenters on an individual basis, via e-mail or telephone, throughout the school year to seek additional information and resources. Furthermore, a library of reference material accumulated during the literature review and best practices research will be housed on the QEP website for faculty access.

6.2 Part 2: Pedagogical Methods

This section describes the new pedagogical methods that will be used to implement the QEP. These methods were presented previously in the chapter on best practices (Chapter 4). While the lecture model remains the preferred form of classroom presentation at GSU, it is essential that instructors incorporate additional teaching/learning strategies to improve student learning as described in the literature review. Therefore, GSU faculty, in addition to the lecture mode, will use the following multi-pronged approaches to teaching/learning in the implementation of its QEP: (1) Interdisciplinary Approach, (2) Technology in Teaching/Learning, (3) Mathematics through Writing, and (4) Process-Oriented Guided-Inquiry Learning. These approaches are described in greater detail below.

A. Interdisciplinary Approach

The introduction of mathematical concepts using real world problems helps students appreciate the importance of mathematics in their own fields. This approach enhances student interest and curiosity in the subject matter (Forman & Steen 2000; Packer 2003b; Brophy & Alleman 1991). At Grambling State University, this approach has been used in the pre-calculus and the calculus courses since Fall 2005. An additional 4^{th} contact hour introduced in all these courses was used to engage students in solving application problems. As shown in Table 2.1, the results of this approach were favorable as indicated by the significant increase in pass rates.

The interdisciplinary approach to teaching will be delivered through modeling exercises both in and outside the classroom. This provides a derivation of a mathematical model (equation) that describes a real world experience. The exercises involve a basic knowledge of the different disciplines that undergirds the practical experience. Basic information will be provided by the teacher in a series of interdisciplinary lessons. Teachers in MATH 147 and MATH 148 will engage students in: (1) the use of different disciplines to define and quantify a practical system and (2) the use of linear, quadratic, trigonometric, exponential, logarithmic, or hyperbolic functions to develop mathematical models that will allow them to study real world systems. This method will also develop students' ability to identify the parts of a system, identify the relationship between its significant parts and, ultimately, build a mathematical model. Students will also engage in the interpretation of these mathematical models quantifying results in the context of the system being modeled. This approach will be instrumental in building students' conceptual knowledge (SLOs 1b/1e), the procedural knowledge (SLOs 1c/1f), and enhance their capabilities of solving real word problems (SLOs 2a, 2b, & 2c). In this approach, mathematics courses will be supported by biology, physics, and economics as students will see how the same mathematical concepts can be used to solve problems from different areas. Faculty members from mathematics and other departments have collaborated and developed matrices. These matrices include general mathematical concepts that can be used to teach concepts in the above-mentioned non-mathematics courses. Table 5.1, which provides a summary of these matrices, shows the application of a particular mathematical concept in five (5) other courses. This table also includes the alignment of various mathematical concepts with student learning outcomes. Furthermore, the mathematics faculty members are committed to delivering guest-lectures in non-mathematics courses, as appropriate.

B. Technology in Teaching/Learning

Technology in the teaching/learning process has the potential to lead to "increased student writing, enhanced cooperative learning, enhanced integration of curriculum, greater application of learning style strategies, increased teacher communication, enhanced community relations, and enhanced global learners" (Carle, Jaffee, & Miller 2009; Gürsul & Keser 2009). Two components are necessary to establish a technology infrastructure to implement the teaching/learning process.

The first component is the establishment of a distance learning program using a virtual learning environment (VLE). A prerequisite of a modern distance learning program is to have an efficiently developed technology infrastructure. Grambling State University has an established infrastructure that supports both instructional and student learning using technology. The technology infrastructure has enabled GSU to establish a distance learning program using a VLE instructional platform. The technology instructional platforms currently in use are Blackboard and Moodle. These platforms feature important functions that enable instructors and students to communicate, present course content, interact online, and manage the course. It also includes the following features: questionnaires, discussion forums, chat, tracking tools, and assessment portals. One of the most striking features of the VLE is the ease with which course materials can be developed and refined in an iterative fashion. The QEP will incorporate this established technology at GSU into the new pedagogical initiatives.

The second component refers to specific mathematical software programs associated with student learning. Current textbooks provide software packages that can be used to supplement classroom instruction. Students will be encouraged to engage in solving additional problems at their own pace and at their own convenience. Such involvement will help students in enhancing their conceptual and procedural knowledge (SLOs 1b/1e & 1c/1f). It will also enhance their capability of solving a wide variety of word problems (SLOs 2a & 2b). Some of the mathematics faculty members have been using homework management systems such as Enhanced WebAssign from Cengage Learning. The mathematics faculty is committed to exploring other systems such as the Hawkes Learning Systems and Mathzone. Members of the QEP team visited the University of Louisiana at Monroe (ULM) to observe its computer laboratory with the Hawkes Learning System. Such learning systems provide an environment for students in terms of unlimited homework problems with error-specific feedback. The faculty will have the convenience of generating homework assignments, quizzes, and tests and assessing students' academic progress. By Fall 2011, the mathematics faculty will reach a consensus about the adoption of a specific computer-assisted learning system for the implementation of the QEP.

Integration of VLE into Mathematics Instruction

Instructional applications of computer technology using VLE instructional platforms frequently augment college student learning and are believed to support academic achievement (Lei & Zhao 2007; Bradford, et al. 2007; Shroff, et al. 2008; Krentler & Willis-Flurry 2005; Davies & Graff 2005; Holliday et al. 2006; Foster & Lin 2007; Crippen & Earl 2007). Approximately 90% of GSU faculty members who use VLE to support their classroom instruction employ the Blackboard Learning Management System. They post announcements online with reference to the course content, including problems and exercises, which will be covered during a particular period. The potential benefits of using VLE to supplement traditional face-to-face instruction include: increased availability, quick feedback, improved communication, tracking, and skill building. Selected faculty members will attend NCAT conferences annually. One focus of NCAT is course redesign that takes advantage of the capabilities of information technology to achieve better learning outcomes at reduced cost (NCAT 2010).

Grambling State University faculty members who integrated VLE into their course instruction have found it to be a great way to organize, manage, and deliver supplemental course materials that they provide during the traditional lecture. The use of multimedia tools to create activities makes the learning process friendlier for students. As a consequence, these activities increase student interest. In addition, instructors provide students with additional resources that they generally cannot show in the classroom due to time constraints. There has been positive feedback from GSU students whose instructors use VLE with lectures (anecdotal evidence). Their general feeling is that Blackboard helps them to reinforce their learning and application of new skills. This perception is encouraging and suggests that integration of Blackboard/Moodle into mathematics instruction will provide much needed improvement in comprehension. The quiz and homework assignments can be generated in terms of knowledge, comprehension, application, and syntheses questions and can easily be aligned with student learning outcomes. Apart from the questions, there are many parameters one can adjust in the quizzes such as the date and duration, as well as the number of attempts students have taken to solve a particular problem. The online assignments, group assignment participation, discussion forum, number of online visits and performance on the online quizzes will help students prepare for in-class examinations.

In the QEP classes, virtual learning environment activities will be introduced on the first day. Students will be provided with a syllabus which will include (but not be limited to), the course objectives, activities, and evaluation criteria. In addition, the course syllabus will explain how and why Blackboard/Moodle will be used and will describe how this will be integrated into course activities and assessment. The approach for utilizing Blackboard/Moodle to solve problems collaboratively is described below:

- Students will be introduced to the Blackboard/Moodle learning management system on the first day of class in order to allow students to become familiar with menus, navigation, and other features of the system.
- Students will be divided into groups of four and be required to introduce themselves.
- Individual group members will present their ideas on solving the problem and provide constructive criticisms/suggestions to other members of the group. These discussions will be conducted in a synchronous format using the chat room or asynchronously using the Discussion Board in Blackboard or Forum in Moodle. In these sessions, group members will be encouraged to share any prior knowledge that might contribute to the solution of a problem (SLOs 1b/1e).

- Instructors will monitor group sessions to ensure learner-focused student participation. The instructor may interject questions or suggestions that encourage development of higher level analytical thinking skills (SLO 2c).

Supplementing classroom instruction with an accessible, asynchronous learning environment has multiple benefits for the learning community. Online activities tend to address diverse learning styles which are difficult to incorporate into the traditional lecture format. Opportunity exists for dialogue between students and instructors (collaborative learning). Instructors may incorporate assessment tools that allow students to gauge their understanding of core concepts throughout the course. Chat sessions and/or Discussion Board postings will be used by the instructors to evaluate the contribution of each group member. In summary, adoption of VLE is expected to:

- Foster interactions among student groups and faculty members.
- Increase student interest in learning.
- Allow students to take control of the learning process.
- Increase student ability to self-assess.
- Increase knowledge acquisition through the use of formulas and definitions. (SLOs 1a/1d & 1c/1f)
- Minimize negative perceptions about mathematics through online discussions.

An effective implementation of the activities and the pedagogical methods described above will help in achieving the QEP goals and several student learning outcomes.

C. Mathematics through Writing

At Grambling State University, mathematics faculty members have discussed using writing as one of the strategies to teach mathematics. Writing across the disciplines is also a university-wide commitment as listed on page 55 (objective 4.5) of The Academic Master Plan 2007-2012. The standing requirement that students communicate in both oral and written forms in the sciences and non-sciences will reinforce the QEP's purpose to improve mathematical knowledge and skills. The underlying reason for introducing writing assignments in mathematics courses is to increase understanding and "clear thinking" as opposed to sheer "memorization" (Ediger 2006; Henrikson 1990, 51). These efforts also ensure that students are able to successfully communicate their understanding of the learned concepts to others. Furthermore, students are usually willing to express their concerns or questions anonymously in writing rather than in person during or after class (Collins 2007; Hartz 1990, 103). This will be achieved through both informal and formal writing assignments. Informal writing assignments are primarily used to help students reiterate a newly learned concept, whereas formal writing assignments examine both the content and quality of student writing. Informal writing assignments may be given during class time or as homework and can be accomplished individually or in groups. When students are allowed to work together they are encouraged to think of mathematics as a collaborative subject (Keith 1990, 9). Several student learning outcomes will be achieved using this strategy. Examples of informal writing assignments expected to achieve a particular SLO include:

- Engaging students in the explication of concepts in their own words (SLO 1b/1e).
- Assigning homework to discuss particular concepts, their significance, and applications in different areas (SLOs 1b/1e, SLO 2c).

- Asking students to explain the meaning of certain theorems in their own words (SLOs 1a/1d & 1b/1e).
- Allowing students to write a letter to their professors after lecture to identify concepts they understood, those they did not understand, and any other concerns they might have (Sipka 1990, 11). The professor will then be able to read and address problematic issues during the next class period (SLOs 1b/1e).
- Requiring all students to read biographies of certain mathematicians and to summarize in their own words (content-specific).
- Requiring students to keep a journal throughout the semester (Sipka 1990, 11; Rose 1990, 63; Brandau 1990, 75; Hartz 1990, 103) where they express their thoughts, fears and feelings (good or bad) about the course material being covered without fear of earning a bad grade (content-specific).

Formal assignments are typically completed outside of class and are graded for substance, structure, organization, grammar and spelling (Sipka 1990, 11). Examples of formal writing assignments include:

- Doing theoretical assignments that require creation of proofs through the use of definitions, theorems, and rules (SLOs 1a/1d).
- Using rules and techniques to derive formulas and identities (SLOs 1c/1f).
- Summarizing articles from journals such as *Undergraduate Mathematics* published by the Mathematical Association of America (content-specific).
- Writing mini-research projects/papers and submitting them as formal papers.

The syllabi for MATH 147 and MATH 148 will include a percentage of assignments that require students' written responses.

D. Process-Oriented Guided-Inquiry Learning (POGIL)

Process-Oriented Guided-Inquiry Learning (POGIL) is a research-based pedagogical method that includes seven components to help students acquire both discipline content and key process skills important for learning. The components are: use of self-managed learning teams, guided-inquiry activities to develop understanding, questions to promote critical and analytical thinking, problem solving, reporting, meta-cognition, and individual responsibility (Hanson 2006, 3). Grambling State University has some experience using this method in general and physical chemistry courses. A combination of POGIL and the lecture mode used in these chemistry classes demonstrated that this methodology has an inherent potential in engaging students to become active learners. Based on the success of this pilot experience, coupled with the experience of other programs found in the literature (Zeng & Takatsuka 2009; Zech et al. 2000; Hanson & Wolfskill 2000; Farrell, Moog, & Spencer 1999; Hanson 2006), it is expected that the adoption of POGIL will be one of the appropriate methodological approaches for the implementation of the QEP. The current literature reveals that POGIL has also been used in teaching undergraduate mathematics courses (Rasmussen & Kwon 2007; Ju & Kwon 2007). Incorporation of POGIL will give GSU faculty an additional technique to teach mathematics courses and help students have a deeper understanding of mathematics.

POGIL Methodology

An introductory presentation on POGIL will be done to introduce all participating students to this new pedagogical method and describe how it will be implemented in the classroom. A thorough discussion will be held to ascertain that students have understood how the method works as well as what their individual role will be in making this method successful. During the first session, students will be divided into teams of four. The team members will be designated as manager, spokesperson, recorder, and strategy analyst (Hanson 2006). The role of each of these team members will be clearly described. In order to provide a diversified experience, the roles of these members will be rotated each week. Activities associated with POGIL will begin with members of each group getting to know each other on a more personal level and sharing opinions and ideas within the group. The POGIL method will be introduced with simple problems in order to initiate discussion among group members and to familiarize members with the process. The complexity of the POGIL assignments will be increased incrementally as time progresses during the semester. In this manner, students will slowly develop the skills to learn from each other and use their problem solving skills and reasoning abilities to deepen their mathematical understanding. This is an opportunity for students to communicate, connect, and apply what they have learned using their POGIL activities. Instructors will design questions that lead to identifying methods and processes to solve problems (guided-inquiry). The purpose of the questions is to provide an in-depth understanding, increase analytical thinking, and provide immediate feedback. As problem solving is one of the important components of POGIL, students will be encouraged to use a set of heuristics given in Table 6.1 (Hanson 2006, 10). At the end of each POGIL activity, the spokesperson in each group will be required to orally present the solution and submit a brief written summary report.

Anticipated outcomes will include students' ability to:

- Identify terms, relationships, and previously learned relevant procedures to solve problems (SLO 1b/1e & 1c/1f).
- Solve problems in a group setting, think analytically, and improve their communication skills (SLOs 2b & 2c).
- Learn how to work as team members (Affective Skills).
- Explain concepts to other members of the group to broaden their own understanding (SLO 1b/1e).
- Use personal experiences that might be pertinent to the problem at hand.
- Ask questions clearly and concisely to describe what they do not understand.

At its best, this approach utilizes small group discussion as the medium for construction and restructuring of knowledge in the minds of the learners. Key cognitive steps in this process will include making inferences, identifying misconceptions, resolving contradictions, generalizing, integrating previous knowledge, and posing and solving problems. All these are natural elements of small group discussions. Active involvement in the classroom, including student-student and student-instructor interactions, have been identified as having the largest positive effect on academic achievement, personal development, and the satisfaction of college students (Schroeder 2007; Martin-Blas & Serrano-Fernandez 2009). The syllabus will reflect a certain percentage of the grade allocated to POGIL activities.

Table 6.1: Problem-Solving Methodology and Strategies (Hanson, 2006, 10)	
1. Define the problem.	a. Restate the problem, mention what is being sought. b. Draw a sketch or diagram of the situation.
2. Evaluate the information.	a. Identify what information is relevant and what is not. b. Identify additional information that is needed and where it can be obtained. c. Identify and evaluate assumptions or simplifications that have been made.
3. Identify the important issues.	a. Identify what is given (the knowns). b. Identify what needs to be found (the unknowns). c. Identify the constraints. d. Identify the concepts that are relevant. e. Identify the connections between the knowns and the unknowns.
4. Plan a solution.	a. Identify a qualitative approach (utilize concepts, make analogies with known problems and solutions, brainstorm, hypothesize, take risks). b. Show how the unknowns can be related to the knowns and the constraints, use the connections, perhaps work backward from the target (what is being sought) to what is known. c. Make valid assumptions or simplifications if necessary. d. Divide into manageable pieces or sub-problems if possible. e. Set up a mathematical description of the problem. f. Utilize concepts in equation form. g. Develop as many independent equations as there are unknown variables. h. Utilize dimensional analysis.
5. Execute the plan.	a. Use algebra to obtain an expression with the unknown on one side of an equation and the known variables on the other side. b. Use computer technology if necessary. c. Substitute numerical values. d. Perform mathematical operations to obtain a numerical answer. e. Use dimensional analysis to obtain the units of the answer. f. Combine the solutions to the sub-problems.
6. Validate the solution.	a. Compare the solution with the statement of the problem. b. Compare the solution with experience, expectations, and real world behavior.

	c. Ascertain that the solution is complete. d. Ascertain that the sign is correct, expected, or reasonable. e. Ascertain that the magnitude is reasonable. f. Ascertain that the units are correct and reasonable. g. Explore whether the assumptions can be removed to produce a better result.
7. Assess understanding of the solution.	a. Summarize the procedure. b. Summarize the relevant concepts. c. Identify how the concepts were used in the procedure. d. Examine and compare with alternative procedures or solutions. e. Generalize the solution, the process, and alternatives for use in other contexts.

It is important to note that different pedagogical methods will serve to achieve different student learning outcomes. Table 6.2 provides a suggested alignment between the student learning outcomes and proposed pedagogical strategies.

Table 6.2: Alignment of Student Learning Outcomes with Pedagogical Strategies

Student Learning Outcomes	L	I	T	W	P
1a: Students will demonstrate proficiency in factual knowledge in Algebra. 1d: Students will demonstrate proficiency in factual knowledge in Trigonometry.	X X			X X	
1b: Students will demonstrate proficiency in conceptual knowledge in Algebra 1e: Students will demonstrate proficiency in conceptual knowledge in Trigonometry	X X	X X	X X	X X	X X
1c: Students will demonstrate proficiency in procedural knowledge in Algebra. 1f: Students will demonstrate proficiency in procedural knowledge in Trigonometry	X X	X X	X X		X X
2a: Students will be able to present and interpret mathematical ideas numerically, graphically, and symbolically.	X	X	X		
2b: Students will be able to solve word problems of various complexities that involve ratios, proportionality, percent, weighted average, properties of real numbers, exponents, algebraic equations, similarity of geometric figures, and probability & statistics.	X	X	X		X
2c: Students will be able to solve, interpret, and analyze real world problems of various complexities from a number of disciplines.	X	X		X	X

L – Lecture Mode, I -Interdisciplinary Approach, T -Technology, W -Mathematics through Writing, P - POGIL

6.3 Timeline for Implementing Major QEP Activities

The implementation of the QEP at Grambling State University will begin in Fall 2011 after SACS has approved the QEP in December 2010. However, the academic year 2010-11 will be used to make preparations for effective implementation. Consequently, the timeline for implementing QEP activities is divided into two parts. The academic year 2010-11 refers to “the preparation phase” (Table 6.3), and the period 2011-12 through 2015-16 refers to “the implementation phase” (Table 6.4). Table 6.4 clearly shows the course implementation schedule, using different pedagogical strategies, for all five years. In this Table, ‘I’ refers to Interdisciplinary Approach, ‘T’ refers to Technology, ‘W’ refers to Mathematics through Writing and ‘P’ refers to Process-Oriented Guided-Inquiry Learning. Based on the discussions held with two external consultants and several faculty members, the QEP team came to the conclusion that the QEP should be implemented in phases. Therefore, the courses as well as the pedagogical methods have been phased in over a five-year year period. For example, during year 2011-12 the QEP will be implemented only through MATH 147 using the Interdisciplinary Approach (I); during year 2012-13 the QEP will be implemented through both pre-calculus courses using Interdisciplinary Approach (I) and Technology (T) et-cetera. By 2015-16, all the pedagogical methods (I, T, W, and P) will have been used for all the courses except Macroeconomics, which will be included during the sixth year. However, if significant success has been achieved in the implementation of the QEP, Macroeconomics may be included during the fifth year. Year six may see the inclusion of other courses like Introduction to Social Science (SOC101). Table 6.4 also includes a detailed schedule for professional faculty development workshops, course material development, and assessment activities along with the individual entity responsible for the implementation of these activities.

Table 6.3: Activities during the Preparation Phase (Academic Year 2010-2011)

Activity	Responsible Entity	Projected Completion Dates	
		Fall 2010	**Spring 2011**
1. Identification and Appointment of QEP Personnel			
Identify and appoint QEP supervisor	Provost and Dean of Arts and Sciences	10/15/2010	
Identify and appoint departmental coordinators and QEP faculty	Dean, Department Heads and QEP Director	10/15/2010	
Identify and appoint internal advisory committee	Provost, Dean, and QEP Director	11/30/2010	
Identify and appoint external advisory committee	Provost, Director & Internal Advisory Committee		03/31/2011
Interview potential candidates and select QEP Data Analyst	Director & Internal Advisory Committee		05/31/2011
Identify potential Peer Tutors	Faculty and Departmental Coordinators		04/30/2011
2. Professional Development of Faculty			
Identify potential facilitators and schedule faculty workshops	QEP Staff	10/31/2010	
Faculty workshops on expectations & requirements of the QEP	QEP Director		03/31/2011
Faculty workshops on interdisciplinary teaching approach	QEP Director and Departmental Coordinators		04/30/2011
Faculty workshops on Blackboard/Moodle training	QEP Director and Departmental Coordinators		04/30/2011
Faculty workshops on assessment	QEP Director and Departmental Coordinators		04/30/2011
3. Documents Preparation and other activities			
Prepare and release QEP Newsletters	QEP Staff	11/30/2010	04/30/2011
Revise MATH 147 and MATH 148 Syllabi	Math QEP Coordinators and Mathematics Faculty		03/01/2011
Create QEP Operational Manual for faculty training	QEP Director & Internal Advisory Committee	12/15/2010	
Develop course modules to cover material for Rising Junior Examination	Math QEP Coordinators and Mathematics Faculty		4/30/2011
Develop modules for Interdisciplinary Teaching Approach/Math Concept Inventory	Math QEP Coordinators and Mathematics Faculty		8/15/2011
Develop job responsibility manual for all concerned QEP personnel	QEP Director		5/30/2011
Develop QEP assessment instruments including surveys	QEP Director, Departmental Coordinators, & Faculty		6/30/2011
Request class size limit for MATH 147 to 28 students for Fall 2011	Mathematics & Computer Sc. Department Head		3/15/2011
Collect baseline data for Rising Junior Exam and two pre-calculus courses	QEP Staff		7/31/2011

Table 6.4: Schedule of Courses and QEP Activities during the Implementation Phase (2011-12 through 2015-16)

Activity	Responsible Entity	Projected Implementation/Completion Dates									
		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
		Fall 2011	Sp 2012	Fall 2012	Sp 2013	Fall 2013	Sp 2014	Fall 2014	Sp 2015	Fall 2015	Sp 2016
1. Course Implementation Schedule											
MATH 147	Math & Comp Sc. Department	I	I	I,T	I,T	I,T,W	I,T,W	I,T,W,P	I,T,W,P	I,T,W,P	I,T,W,P
MATH 148	Math & Comp Sc. Department			I,T	I,T	I,T,W	I,T,W	I,T,W,P	I,T,W,P	I,T,W,P	I,T,W,P
BIOL 103	Biology Department					I,T		I,T,P		I,T,P	
BIOL 104	Biology Department						I,T		I,T,P		I,T,P
SCI 105	Physics Department							I,T,P		I,T,P	
SCI 106	Physics Department								I,T,P		I,T,P
2. Professional Faculty Development											
Workshops on Technology	Director and Dept. Coordinators	10/15/11	3/15/12	10/15/12	3/15/13	10/15/13	3/15/14	10/15/14	3/15/15	10/15/15	3/15/16
Workshops on Interdisciplinary Approach/POGIL	QEP Director and Departmental Coordinators		3/31/12		3/31/13		3/31/14	10/31/14		10/31/15	
Workshops on assessment techniques	Director and Dept. Coordinators	11/20/11	4/30/12	11/20/12		11/20/13		11/20/14		11/20/15	
Workshops for non-math faculty on quantitative approach to teaching	QEP Director and Departmental Coordinators				4/30/13		4/30/14		4/30/15		4/30/16
3. Documents Preparation and other activities											
Release QEP news letters	QEP Staff	11/30/11	4/30/12	11/30/12	4/30/13	11/30/13	4/30/14	11/30/14	4/30/15	11/30/15	4/30/16
Revise BIOL 103 and BIOL 104 syllabi	Department Coordinators and respective Faculty members				4/30/13						
Revise SCI 105 and SCI 106 syllabi	Department Coordinators and respective Faculty members						4/30/14				
Revise ECON 201 syllabus	Department Coordinators and respective Faculty members										4/30/16
Develop POGIL modules for Mathematics, Biology, & Science	QEP Coordinators and faculty members					8/30/13	4/30/14	8/30/14	4/30/15	8/30/15	4/30/16
Develop course modules for Biology	Biology faculty members				4/30/13	11/30/13	4/30/14	11/30/15			
Final Identification of peer tutors and their training	Math QEP Coordinators and mathematics faculty members	09/15/11	2/10/12	09/15/12	2/10/13	09/15/13	2/10/14	09/15/14	2/10/15	09/15/15	2/10/16
Organize workshops for students	QEP Staff	11/30/11	4/30/12	11/30/12	4/30/13	11/30/13	4/30/14	11/30/14	4/30/15	11/30/15	4/30/16
Reduce class size (28) for MATH 147 and MATH 148	Mathematics & Comp. Sc. Department Head	10/15/11	3/15/12	10/15/12	3/15/13	10/15/13	3/15/14	10/15/14	3/15/15	10/15/15	3/15/16

I -Interdisciplinary Approach, T -Technology, W -Mathematics through Writing, P - Process-Oriented Guided-Inquiry Learning

Activity	Responsible Entity	Projected Implementation/Completion Dates									
		2011-2012		2012-2013		2013-2014		2014-2015		2015-2016	
		Fall 2011	Sp 2012	Fall 2012	Sp 2013	Fall 2013	Sp 2014	Fall 2014	Sp 2015	Fall 2015	Sp 2016
4. Assessment											
Build electronic course portfolio	Faculty members	X	X	X	X	X	X	X	X	X	X
Conduct formative assessment	Faculty members	X	X	X	X	X	X	X	X	X	X
Develop common pre-test	Department Coordinators and QEP Faculty	08/30/11	01/25/12	08/30/12	01/25/13	08/30/13	01/25/14	08/30/14	01/25/15	08/30/15	01/25/16
Collect & analyze pre-test grades	Faculty members and Data Analyst	09/07/11	02/05/12	09/07/12	02/05/13	09/07/13	02/05/14	09/07/14	02/05/15	09/07/15	02/05/16
Develop common mid-term test	Department Coordinators and QEP Faculty	10/03/11	03/05/12	10/03/12	03/05/13	10/03/13	03/05/14	10/03/14	03/05/15	10/03/15	03/05/16
Collect & analyze mid-term grades	Faculty members and Data Analyst	10/15/11	03/15/12	10/15/12	03/15/13	10/15/13	03/15/14	10/15/14	03/15/15	10/15/15	03/15/16
Meet with QEP faculty for mid-term updates and feedback	QEP Staff and Internal Advisory Committee	10/22/11	03/22/12	10/22/12	03/22/13	10/22/13	03/22/14	10/22/14	03/22/15	10/22/15	03/22/16
Develop common final examination	Department Coordinators and QEP Faculty	12/02/11	05/03/12	12/02/12	05/03/13	12/02/13	05/03/14	12/02/14	05/03/15	12/02/15	05/03/16
Collect & analyze final exam grades	Faculty members and Data Analyst	12/15/11	05/17/12	12/15/12	05/17/13	12/15/13	05/17/14	12/15/14	05/17/15	12/15/15	05/17/16
Collect & analyze final grades	Faculty members and Data Analyst	12/15/11	05/17/12	12/15/12	05/17/13	12/15/13	05/17/14	12/15/14	05/17/15	12/15/15	05/17/16
Analyze electronic course portfolios	Faculty members, Data Analyst, and QEP Director	02/10/12	06/20/12	02/10/13	06/20/13	02/10/14	06/20/14	02/10/15	06/20/15	02/10/16	05/20/16
Seek faculty feedback and review data	Data Analyst, faculty, QEP Director, and Internal Advisory Committee	02/20/12	06/30/12	02/20/13	06/30/13	02/20/14	06/30/14	02/20/15	06/30/15	02/20/16	06/30/16
Collect & Analyze Assessment Data on Rising Junior Examination	Data Analyst			X	X	X	X	X	X	X	X
Share all Assessment Data with Internal and External Advisory Committee Members	QEP Director		07/10/12		07/10/13		07/10/14		07/10/15		07/10/16
Overall yearly evaluation of the QEP	QEP Director, Internal & External Advisory Committees		07/20/12		07/20/13		07/20/14		07/20/15		07/20/16
Incorporate changes to include in next Academic Year	QEP Director, Department Coordinators and QEP Faculty	X	X	X	X	X	X	X	X	X	X
Send five year report to SACS	Provost and QEP Director										X

CHAPTER 7

ASSESSMENT

Grambling State University views assessment of the QEP as a systematic ongoing process based upon predetermined criteria. Therefore, both formative and summative assessments will be conducted. The formative assessment, which will be conducted monthly, is designed to determine the extent to which the QEP is being properly implemented. It will also determine progress on achieving the goals and the student learning outcomes. In this way, progress of the QEP will be monitored continuously, and strategies will be developed to address issues and problems as they arise. The summative assessment will evaluate the impact of the QEP at the end of each semester/year and also over the entire course of the project (2011-12 through 2015-16). A comparison will be made between the actual outcomes and the expected outcomes. Any discrepancy between actual outcomes and the expected outcomes will be analyzed based on the predetermined criteria as shown in Table 7.1 and in Section 7.4. These results will be used to improve the process of teaching and student learning.

The QEP Office, in conjunction with the Advisory Board, will have the responsibility to assess the overall success of the QEP. Faculty members will develop all assessment instruments (Table 7.2) in cooperation with the QEP Director and the Data Analyst. The Data Analyst will analyze all data and prepare reports summarizing the results. These results will be submitted to the QEP Internal Advisory Committee on a monthly basis to review the progress. The Advisory Board will evaluate the progress of the QEP annually. Section 7.5 describes the composition and role of the Internal Advisory Committee and the Advisory Board.

7.1 <u>Structure of the QEP Assessment Process</u>

As indicated above, the Quality Enhancement Plan has a formative and a summative assessment component. Formative assessment will evaluate the extent to which (1) faculty indicate that they have learned new teaching strategies presented through the professional development seminars/workshops, and that these strategies have been reinforced through continued faculty mentoring; (2) the new teaching strategies have been fully implemented by faculty; and (3) students have reacted positively to the presentation of these new strategies and shown evidence of continued improvement in student learning. Summative assessment will evaluate the extent to which the student learning outcomes have been achieved while taking into account the extent to which the QEP has been successfully implemented. Both quantitative and qualitative data will be collected in order to conduct the assessment. The timeline for such data collection is included in Table 6.4 (page 45-46) and Table 7.1 (pages 51-53).

As mentioned in Chapter 5, the Quality Enhancement Plan will be implemented through two pre-calculus courses and several non-mathematics courses. The syllabi for the two pre-calculus courses (MATH 147 and MATH 148) include the mathematical content that corresponds to each student learning outcome. The syllabi for non-mathematics courses will be modified appropriately to include such alignment as implementation progresses through the years. Data will be collected from all the courses; however, the bulk of the data will come from the two pre-calculus courses. The detailed timeline for the implementation of the various courses is included in Table 6.4 (page 45). It should be noted that all of the courses will have multiple sections. In order to group the assessment data from all the sections of a particular course, the Quality Enhancement Plan will incorporate procedures for standardizing sections in terms of course syllabi, common pre-tests, mid-terms and final examinations for assessing student learning. A variety of quantitative and qualitative data will be collected to assess student learning outcomes. Table 7.1 (page 51) presents a data collection rubric for quantitative assessment of student learning outcomes and goals. Multiple assessment instruments, as recommended by the principles of assessment, will be used to collect these data. All data related to a particular course will be collected by the faculty member in charge of a section of the course. Faculty members will construct and maintain an electronic course portfolio using these data. The assessment instruments used to collect relevant quantitative and qualitative data will meet the requirements of all the goals and student learning outcomes of the QEP. Table 7.2 (page 54) presents a list of the assessment instruments, the purpose of the instruments, their applicability for formative/summative assessment, and their use for specific student learning outcome/s.

To maintain uniformity of summative assessment across sections of each course, only selected assessment instruments, as described in Table 7.2, will be used for the overall evaluation of the QEP. These instruments are: a common pre-test, a common mid-term comprehensive examination, and a common final comprehensive examination (post-test). Scores on the pre-test and final examination will be used to assess the extent to which students mastered the material. The comprehensive nature of these examinations will provide a basis for assessing the required course content in all the sections. Appropriate questions will be included from *Whimbey Analytical Skills Inventory* (Whimbey & Lochhead 1991) and *Mathematics Concept Inventory* to assess the conceptual understanding and analytical thinking of the students in solving problems. The common syllabus and mid-term examination will further ensure that all sections of a particular course progress at the same pace. Each of the student learning outcomes will be assessed using appropriate instruments. The alignment between the percentage of questions attributed to specific student learning outcomes and the assessment instruments used are given in Table 7.3 (page 54). Two additional and vitally important assessment instruments that will be used by the QEP Office to evaluate the overall success of the QEP are final course grades and the MAPP Test.

7.2 Formative Assessment Plan

A. Effectiveness of Professional Development Seminars/Workshops and Continued Faculty Mentoring

Faculty will complete a survey (Participant Reaction Form) at the end of each professional development seminar/workshop. This survey will measure the extent to which the faculty members understand the material presented, their perception of the need for continued mentoring, the ease with which the new strategies can be incorporated into their courses, their plan and desire to implement the new strategies. The forms will contain both close-ended (numeric) and open-ended questions that allow participants to record reactions to the seminar/workshop. Quantitative data from these survey forms will be analyzed using descriptive statistics (frequency distributions, mean scores, measures of variability, etc.). Content analysis will be used to analyze the open-ended questions on the survey. Results will be distributed to the Internal Advisory Committee within two weeks after the completion of each seminar/workshop. This timeline will enable modifications to be made in the next workshop, if necessary. It will also provide time to present supplemental instruction on the seminars/workshops.

Data will be collected to assess the extent to which continued faculty mentoring is a useful approach for reinforcement of the material learned in the professional development seminars/workshops. Data collected will include consistency of attendance at monthly QEP faculty meetings, minutes from these meetings, and an analysis of the faculty survey administered at the end of each semester. The consistency of attendance at monthly meetings will provide information on the extent to which faculty use these mentoring resources. These data are quantitative and will be analyzed with descriptive statistics. Minutes from the monthly faculty meetings will be analyzed using content analysis. They will be examined for discussion on the issues and problems with implementation, successful approaches for incorporating the new strategies, the extent to which mentoring occurs, the need for continued mentoring, and other topics that may surface. The QEP Internal Advisory Committee will receive monthly updates that summarize results from the attendance and minutes of the meetings. In addition, the Internal Advisory Committee will receive a report that summarizes results from all data collected during the semester dealing with professional development and continued faculty mentoring. The committee will meet as needed during the semester and also at the end of each semester to discuss and analyze the data. Cumulative results will be discussed at the annual Advisory Board meeting.

B. Implementation of Proposed Teaching Strategies

Multiple sources of data will be collected in order to assess the extent to which faculty implement the QEP-related teaching strategies. Data sources include: (a) selected peer observation of faculty classes, (b) student assessment of POGIL assignments, (c) student survey administered at the end of the semester assessing the extent to which they observed the new strategies being implemented, and (d) faculty survey administered at the end of each semester. Faculty members willing to participate in the peer evaluation component of the formative evaluation will be observed during the semester by another faculty member skilled in the use of the proposed teaching strategies. The faculty member will provide a list of proposed observation dates. The peer observer will assess the faculty member's class on the extent and integrity of the implementation of the QEP-related teaching strategies. A form (that will be developed later) which contains quantitative measures as well as open-ended questions will be used to record his/her reactions and suggestions for improvement. The response will be reviewed by the Internal Advisory Committee and the team will share the results with the faculty member within one month after the peer observation. In addition, students will rate POGIL assignments after completion. The survey instrument used for assessing POGIL assignments will include a series of closed-ended questions. This will measure the success of the assignments based on student participation in the POGIL exercises. Data will be analyzed using descriptive statistics. This way, the instructor can monitor the extent to which all of the students are engaged in the POGIL assignments. Data will be aggregated for each course and section and submitted to the QEP Internal Advisory Committee for review. In addition, students will complete a short survey at the end of each semester. The QEP Internal Advisory Committee will receive a report summarizing the data using descriptive statistics for each class. The instructors will receive a copy of the results for their classes prior to the beginning of the next semester. This will provide instructors and the Internal Advisory Committee with the information needed and allow them the time to refine the current strategies or develop alternative strategies. The faculty survey, administered at the end of the semester, will also contain closed- and open-ended questions dealing with the faculty member's (self-rated) implementation of QEP-related strategies, factors that facilitate implementation, barriers to implementation as well as suggestions for further improvement.

C. Student Reactions and Performance

At the end of each semester, students' reactions to the methodologies will be measured through the student survey administered at the end of the semester. The survey will include questions on the reactions of the students to the various teaching strategies used (traditional strategies as well as the newly proposed ones for the QEP). It will also include questions assessing students' confidence in their abilities to solve problems pertaining to student learning outcomes as a result of the introduction of new teaching strategies and on their intent to take additional mathematics-related classes. In addition, the percentage of students completing the class with a grade of C or higher will be calculated. It is expected that implementation of the QEP will increase class retention. Moreover, the academic performance of students in QEP classes will be monitored using scores on specific items on the pre-test, mid-term, and final examination as shown in Table 7.3. This provides an alignment between the percentage of questions attributed to specific SLOs and the assessment instruments. The academic performance of students on assignments, quizzes, and tests will also be monitored for the formative assessment. A course portfolio will be constructed for each section of a particular course.

The course portfolio is a efficient and useful way to organize data from multiple sources. It will be used both for formative assessment and summative evaluation. An advantage of the course portfolio is that it puts faculty in charge of monitoring, documenting, and improving the quality of teaching and learning as the semester progresses. This mechanism provides time for reflection, peer review, standard evaluation, and discussion among faculty members. Faculty members can demonstrate that they have used certain pedagogical methods and determine how these methods have impacted students. A course portfolio provides peer feedback that may serve as a tool for professional accountability (Dunbar 1999). Continuous improvement in student learning becomes a cooperative process in that faculty members will have opportunities to discuss their experiences. The mathematics faculty has some experience in assembling course portfolios for the accreditation of the computer science program by the Computing Accreditation Commission of Accreditation Board for Engineering and Technology (ABET). The ABET requires a computer science program to prepare course portfolios for all required computer science and mathematics courses. A course portfolio will consist of the following documents:

Table 7.1: Data Collection Rubric for Quantitative Assessment of Student Learning Outcomes of the QEP

Institutional Mission (Partial): The university prepares its graduates to compete and succeed in careers related to its programs of study, to contribute to the advancement of knowledge, and to lead productive lives as informed citizens in a democratic society.

Institutional Goal (1): The university aims to produce graduates from its undergraduate programs who possess excellent oral and written communication, **numeracy,** and computer technology skills.

QEP Goal 1: To increase student knowledge and comprehension of general mathematical concepts

Student Learning Outcomes	Quantitative predetermined Criteria for Success[0]	Summary of Data to be collected[1] Who &What	Data Collection Schedule How & When	Use of Results
1a: Students will demonstrate proficiency in factual knowledge in algebra	At least 80% of the students enrolled in MATH 147 will demonstrate proficiency in 85% of mathematical content aligned with the factual knowledge	**Course instructors** % of correct responses about factual knowledge in assignments, quizzes, & tests. % of correct responses about factual knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of factual knowledge. A course portfolio will be continuously built using these data and the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
1b: Students will demonstrate proficiency in conceptual knowledge in algebra	At least 70% of the students enrolled in MATH 147 will demonstrate proficiency in 75% of mathematical content aligned with the conceptual knowledge	**Course instructors** % of correct responses about conceptual knowledge in assignments, quizzes, & tests. % of correct responses about conceptual knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of conceptual knowledge. A course portfolio will be continuously built using these data & the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
1c: Students will demonstrate proficiency in procedural knowledge in algebra	At least 75% of the students enrolled in MATH 147 will demonstrate proficiency in 80% of mathematical content aligned with the procedural knowledge	**Course instructors** % of correct responses about procedural knowledge in assignments, quizzes, & tests. % of correct responses about procedural knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of procedural knowledge. A course portfolio will be continuously built using these data &the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.

Student Learning Outcomes	Quantitative predetermined Criteria for Success[0]	Summary of Data to be collected[1] Who &What	Data Collection Schedule When & How	Use of Results
1d: Students will demonstrate proficiency in factual knowledge in trigonometry	At least 70% of the students enrolled in MATH 148 will demonstrate proficiency in 75% of mathematical content aligned with the factual knowledge	**Course instructors** % of correct responses about factual knowledge in assignments, quizzes, & tests. % of correct responses about factual knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of factual knowledge. A course portfolio will be continuously built using these data and the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
1e: Students will demonstrate proficiency in conceptual knowledge in trigonometry	At least 60% of the students enrolled in MATH 148 will demonstrate proficiency in 65% of mathematical content aligned with the conceptual knowledge	**Course instructors** % of correct responses about conceptual knowledge in assignments, quizzes, & tests. % of correct responses about conceptual knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of conceptual knowledge. A course portfolio will be continuously built using these data & the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
1f: Students will demonstrate proficiency in procedural knowledge in trigonometry	At least 65% of the students enrolled in MATH 148 will demonstrate proficiency in 70% of mathematical content aligned with the procedural knowledge	**Course instructors** % of correct responses about procedural knowledge in assignments, quizzes, & tests. % of correct responses about procedural knowledge in pre-test, midterm, and final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of procedural knowledge. A course portfolio will be continuously built using these data & the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.

0: These are the expected baseline data at the end of year one (2011-12). It is reasonable to expect a 3 to 5 percent increase per year for the remaining four years.

1: A detailed timeline for collecting these data and the responsible entity is given in Table 6.4 (page 46)

2: For the summative assessment, the instruments used will be a common pre-test, mid-term, final exam, final course grades, and scores on the MAPP Test (Rising Junior Examination). More details are available in Table 7.2 (page 54) & Section 7.4 (pages 56-58).

3: It is expected that students will show better performance each subsequent year with the improvement in the QEP implementation process.

Institutional Goal (4): The university aims to produce graduates from its undergraduate programs who are able to think critically

QEP Goal 2: To develop students ability to think analytically and to reason quantitatively in solving real world problems

Student Learning Outcomes	Quantitative predetermined Criteria for Success[0]	Summary of Data to be collected[1] Who &What	Data Collection Schedule When & How	Use of Results
2a. Students will be able to present and interpret mathematical ideas numerically, graphically, and symbolically.	At least 80% of the students enrolled in the QEP math and non-math courses will demonstrate proficiency in 80% of the subject material pertaining to SLO 2a.	**Course instructors** % of correct responses pertaining to SLO 2a in assignments, quizzes, tests. % of correct responses pertaining to SLO 2a in pre-test, midterm, & final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of SLO 2a. A course portfolio will be continuously built using these data and the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies & students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
2b. Students will be able to solve word problems of various complexities that involve, ratios, proportionality, percent, weighted average, properties of real numbers, exponents, algebraic equations, similarity of geometric figures, and probability & statistics.	At least 80% of the students enrolled in two pre-calculus courses will demonstrate proficiency in 80% of the subject material appear on standardized examinations pertaining to SLO 2b.	**Course instructors** % of correct responses about SLO 2b in assignments, quizzes, and tests. % of correct responses pertaining to SLO 2b on pre-test, midterm, & final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of SLO 2b. A course portfolio will be continuously built using these data & the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.
2c. Students will be able to solve, interpret, and analyze real world problems of various complexities from a number of disciplines.	At least 70% of the students will demonstrate proficiency in solving 70% of the real world problems of various complexities in math and non-math courses pertaining to SLO 2c.	**Course instructors** % of correct responses about SLO 2c in assignments, quizzes, and tests. % of correct responses pertaining to SLO 2c on pre-test, midterm, & final exams. Also collect qualitative data.	Continuous building of Electronic Course Portfolio **Throughout the semester[2]** All relevant course data sent to the QEP Office **End of the semester[2]**	The specific responses will be used for the formative assessment of SLO 2c. A course portfolio will be continuously built using these data & the qualitative feedback from minute papers and other discussions. During the summative assessment, **data[3]** will be analyzed to see the impact of teaching strategies &students' difficulty in certain course material. The recommendations of the Advisory Board will be sent to all concerned groups.

Table 7.2: Assessment Instruments used for Formative and Summative Assessments (Alignment with SLOs)

Assessment Instrument	For Type of Assessment	Description/purpose	Related SLOs
Pre-test	Summative	To assess the initial mathematical knowledge and skills	All
Homework assignments	Formative	To assess the progress of the students during the semester	All
Quizzes	Formative	To assess the progress of the students during the semester	All
Tests	Formative	To assess the progress of the students during the semester	All
Common mid-term comprehensive exam	Summative	To assess the progress of the students up to the middle of the term	All
Common final comprehensive exam (post-test)	Summative	To assess the progress of the students at the end of the semester and treated as the post-test.	All
One minute papers	Formative	To daily get the feedback from students	1a/1d & 1c/1f
Whimbey Analytical Skills Inventory	Both	To assess the analytical thinking and quantitative reasoning	2a, 2b, 2c
Mathematics Concept Inventory	Both	To assess the conceptual understanding of the mathematical content	1b/1e & 2b, 2c
Final course grades	Summative	To assess the overall impact of the QEP on retention and graduation	N/A
Scores on the MAPP Test	Summative	To assess the overall impact of the QEP on pass rate of students on RJE	N/A
Various survey instruments	Summative	Both faculty and student surveys will be used to assess various aspects	N/A

Table 7.3: Alignment between the Percent of Questions Attributed to Specific SLOs and the Assessment Instruments

Student Learning Outcomes	Pre-test	Mid-term Exam	Final Exam
1a/1d. Students will demonstrate proficiency in factual knowledge in algebra/trigonometry	10% of questions	15% of questions	10% of questions
1b/1e. Students will demonstrate proficiency in conceptual knowledge in algebra/trigonometry	25% of questions	20% of questions	25% of questions
1c/1f. Students will demonstrate proficiency in procedural knowledge in algebra/trigonometry	25% of questions	20% of questions	25% of questions
2a. Students will be able to present and interpret mathematical ideas numerically, graphically, and symbolically.	10% of questions	10% of questions	10% of questions
2b. Students will be able to solve word problems of various complexities that involve ratios, proportionality, percent, weighted average, properties of real numbers, exponents, algebraic equations, similarity of geometric figures, and probability & statistics	10% of questions	15% of questions	10% of questions
2c. Students will be able to solve, interpret, and analyze real world problems of various complexities from a number of disciplines.	20% of questions	20% of questions	20% of questions

1. Course syllabus with explicit QEP student learning outcomes.
2. Copies of the pre-test, homework assignments, quizzes, POGIL assignments, tests, the mid-term comprehensive examination, and the final comprehensive examination. Although, the pre-test and post-test will have the same content, they will be different tests.
3. Examples of graded student work that would include assignments, quizzes, minute papers, POGIL assignments, tests, mid-term examinations, and final examinations. It should be noted that these instruments will make use of the *Whimbey Analytical Skills Inventory* (Whimbey & Lochhead 1991) and *Mathematics Concept Inventory* to assess conceptual understanding, analytical thinking, and the quantitative reasoning of students. The course portfolio will contain three categories of students' work: excellent, average, and poor. Although a course portfolio will contain only samples of students' work, it will include a rubric that will provide the percentage of correct answers for all questions contained in various assessment instruments (assignments, tests, quizzes, mid-term, etc.). The rubric will contain such information for all student learning outcomes. This will provide information on the proficiency of each student in mathematical content which is associated with each student learning outcome. Finally, the course portfolio will also contain the percentage of students who earned final satisfactory grades (grade of C or above).
4. Informal and formal student evaluations. Informal class evaluations will be compiled through occasional minute papers (Angelo and Cross, 1993). Faculty members will summarize information from minute papers and will include a summary in the course portfolio along with samples of student work. Formal evaluation will be obtained from different survey instruments.
5. The final element of the course portfolio will be a *Course Reflection Memo* (Dunbar, 1999). This will include the faculty member's opinion on student progress and his/her recommendations for improvement.

Thus, a portfolio would serve as a valuable source for an exhaustive course record. It should be noted that it does not contain all the records of each student; however, it is constructed from individual records and will be used for formative and summative assessments.

7.3 Summative Assessment Plan

The summative evaluation of the QEP will be based upon the overall performance of students in achieving a desired proficiency in learning outcomes as stated in Table 7.1. As described earlier, the student learning outcomes are achieved through the contents and methods of teaching covered in Pre-calculus I and Pre-calculus II and through a number of non-mathematics courses. These are general education courses at GSU, and upon completion of these courses, it is expected that the student will have developed the following perspectives and backgrounds:

- A thorough understanding of factual, conceptual, and procedural knowledge in algebra and trigonometry. It is expected that students would have overcome their math-anxiety in higher level mathematics courses they might take as a result of a good foundation in the mathematical content covered in the two pre-calculus courses.

- The ability to read, communicate, and understand mathematical ideas verbally and in writing, making use of numerical, graphical, and symbolic viewpoints (both through mathematics and non-mathematics courses).
- The ability to use mathematical ideas, analytical thinking, and quantitative reasoning to solve real world problems in the biological sciences, physical sciences, and business.

As indicated above, each instructor will build an electronic course portfolio containing relevant data for his/her own section. However, the summative evaluation process will involve the compilation of data from multiple sections. Common elements from each of the course portfolios of individual sections will be combined. These common elements are scores on pre-test, mid-term examination, final examination, and the final course grades. The data analyst in cooperation with the individual faculty member and course coordinator will have the responsibility to compile the data from different sections and build one combined course portfolio for each course (each semester). This combined course portfolio will also have the information on the final course grades of all students registered in a particular course during a given semester. The data analyst will also collect and analyze the results of the MAPP Test (Rising Junior Examination) to be included as part of the summative evaluation. The QEP Internal Advisory Committee will receive a report summarizing results for each section, as well as combined results across sections. This report will include results from different surveys, retention rates, and the academic performance in the two pre-calculus courses and on the MAPP Test. These reports will enable the committee to monitor student performance and implement changes in the QEP, as necessary. These reports will also be shared with the QEP Advisory Board who will make appropriate decisions to improve the effectiveness of the QEP process. The composition and the responsibilities of the QEP Advisory Board are described in Section 7.5.

7.4 Utilization of Results from Summative Assessment of the QEP

Chapter 2 discusses how the QEP topic evolved from poor performance on the MAPP Test (Rising Junior Examination) and the small number of students passing algebra and trigonometry courses. It is imperative that the summative assessment of the QEP be linked back to these two factors. The overall success of the QEP will be determined by comparing the baseline data (grades for two pre-calculus courses and the scores on the Rising Junior Examination) with a projected percent increase in passing grades in the two pre-calculus courses and all three levels of the mathematics component of the Rising Junior Examination. Therefore, the overall evaluation of the QEP will be performed as follows:

A. Student Grade Distributions in the Pre-Calculus Courses

Final grades will be used to measure the overall impact of the QEP on student learning. Grades will be collected and analyzed in order to track student performance both in Pre-calculus I (MATH 147) and Pre-calculus II (MATH 148). As a result of the implementation of the QEP, Grambling State University projects a 10% per year increase in the passing rates in both pre-calculus courses over the baseline data. Baseline data will be determined as an average of Academic Years 2008-09 through 2010-11. The reason for using the starting year as 2008-09 is that since the beginning of Fall semester 2008 new eligible freshman were enrolled in MATH 147. Prior to Fall 2008, the two pre-calculus courses were taken only by mathematics and science majors.

B. Educational Testing Service-MAPP Test (Rising Junior Examination)

The MAPP standardized test not only provides university wide data but also provides comparative data from peer institutions. This test has been used because of its wide acceptance as a statistically sound tool for measuring general education learning outcomes at three levels. As a result of the implementation of the QEP, Grambling State University projects a 15% passing rate increase per year on the Rising Junior Examination in Level 1, an 8% increase per year in Level 2, and a 5% increase per year in Level 3. Baseline data will be determined as an average of Academic Years 2006-07 through 2010-11. The reason for using the starting year as 2006-07 is that since Fall 2006 the Educational Testing Service replaced the Academic Profile Test with the Measure for Academic Proficiency and Progress (MAPP) Test.

C. Quantitative Predetermined Criteria for Success in SLOs

The quantitative predetermined criteria for success for each of the student learning outcomes are included in column 2 of the Table 7.1. Data in column 2 represent the baseline data at the end of the first year (2011-12) of implementation. It is expected that in subsequent years, larger number of students will improve their performance every year in each of the student learning outcomes. It is reasonable to expect a 3 to 5 percent increase per year for the remaining four years. For example, at the end of the second year (2012-13), at least 83% of the students should demonstrate proficiency in 88% of the mathematical content included in SLO 1a.

7.5 The QEP Advisory Board

The Provost and Vice President for Academic Affairs will appoint a QEP Advisory Board. This Advisory Board will perform the overall evaluation of the QEP and relate it to the institutional effectiveness of the university. The QEP Advisory Board will be comprised of an Internal Advisory Committee and an External Advisory Committee. The Internal Advisory Committee will include the QEP Director, QEP Data Analyst, QEP Mathematics Supervisor, department heads from biology, economics, mathematics, and physics, a representative from the Office of Planning & Institutional Research, two assessment experts, an information technology representative, and student representatives from the Student Government Association. The External Advisory Committee will include two external mathematics and/or assessment experts.

As shown above, these committees will be comprised of individuals with diversified backgrounds to perform a variety of tasks. The QEP Director will be responsible for the implementation and overall assessment of the QEP. The data analyst will be responsible for the collection and analysis of data from participating departments and the Testing Center. A QEP Supervisor will be a mathematics faculty member who will coordinate the activities between various departments and oversee collaboration among faculty members. In consultation with the QEP Director, he/she will also coordinate faculty training and development workshops on the interdisciplinary teaching approach, POGIL, technology, and assessment. The supervisor will also assist the director in making sure that the assessment process is on schedule. A data analyst will be hired with a sound knowledge of statistical methods and relevant experience in statistical software such as SPSS (Statistical Package for the Social Science) now known as PASW (Predictive Analytics Software). The data analyst will be responsible for quantitative and qualitative analysis of data using descriptive statistics and content analysis. The role of participating department heads is crucial as they maintain constant contact with faculty members. This group will provide feedback about all the aspects of the implementation of the QEP. The Advisory Board will be able to extract important conclusions from such feedback to strengthen the implementation process. The representative from the Office of Planning and Institutional Research will be able to take recommendations from this committee and link the role of QEP with overall institutional effectiveness. The committee will also consist of two internal assessment experts who will assist in the analysis of the data and will modify the assessment process when needed. A representative from the Information Technology Center will provide institutional data. It is important that the Advisory Board receive feedback from students; therefore, representatives from the Student Government Association will be included on the committee. These representatives will provide students' perspectives on the QEP and its implementation. The External Advisory Committee will include experts on content and/or assessment. These experts will provide advice on various matters that will improve the implementation of the QEP.

Members of the Internal Advisory Committee will meet with departmental coordinators and faculty each month to review the progress of the QEP. Committee members will review the collected assessment data at the end of every semester and provide recommendations for various aspects of the QEP. The electronic course portfolio built by each faculty member will play an important role in these recommendations. The Internal Advisory Committee will analyze grades from the pre-calculus courses and scores on the Rising Junior Examination; it will also compare these two parameters with predetermined criteria to indicate whether the student learning outcomes are met.

The QEP Advisory Board will meet annually in August to review all QEP data collected from both semesters. The Board will also evaluate and review the effectiveness of various actions taken to implement the QEP and the pedagogical methods used. Assessment results and the recommended programmatic changes will be shared with the entire university community. Recommendations from the Advisory Board will be incorporated into the QEP implementation plan for the next academic year and the process will become recursive.

7.6 Resources and Budget

Grambling State University will provide adequate physical, human, and financial resources necessary to develop, implement, and sustain the Quality Enhancement Plan. Detailed expenditures required for these resources are included in Table 7.4.

A. Physical Resources

The QEP will take advantage of the resources already in place at GSU. The physical resources available include Distance Learning, computer laboratories, the Curriculum Resource Center, and the Retention Center. The Office of Distance Learning will provide training to faculty members in Blackboard/Moodle. An adequate infrastructure in terms of network, computers and other technological tools are already in place. High speed DS-3 Internet connections are available in computer laboratories, the library, faculty offices, student dormitories, and administrative offices. Wireless Internet connections are available in all student dormitories, the library, and in certain locations on campus. Therefore, students have flexible study environments for individual and group work in and out of the classrooms. Discussions are underway with the Interim Provost, Vice President for Finance, and the Associate Vice President for Information Technology to establish a new computer laboratory with 50 computers specifically dedicated to the teaching of the pre-calculus courses using appropriate software such as Hawkes Learning System. Assistance will be sought from the University of Louisiana at Monroe to set up such a laboratory. In addition to this laboratory, plans are also under consideration to establish five smart classrooms. The funds for the laboratory and the smart classrooms will be sought by submitting a proposal to university Title III Office during Spring 2010. The QEP budget includes 12 laptop computers, an LCD projector, and materials & supplies for the QEP related activities. The budget for part-time technology support personnel is also included.

Grambling State University is in the process of purchasing TracDat from SunGard Higher Education collaborative member Nuventine. One of the important features of TracDat is that it has the capability of creating electronic portfolios that can incorporate student work. Therefore, this system will be useful for maintaining electronic course portfolios for the formative and summative assessments of the QEP. TracDat, being an Enterprise Assessment Management System, will also be able to link QEP data with overall institutional effectiveness.

B. Human Resources

The current QEP staff consists of a director and a coordinator. The director has been an integral part of the QEP Development Team. She will be responsible for coordinating pertinent activities such as faculty professional development workshops, releasing QEP Newsletters, sharing assessment data with the Advisory Board, and overall yearly evaluation. A data analyst will be hired by the end of May 2011. Currently, GSU has 12 full-time mathematics faculty members. Over the past five (5) years, eight (8) mathematics faculty members were hired. The university is committed to hiring four (4) additional faculty members by Fall 2011. This will cover additional sections created due to the decrease in class sizes of two pre-calculus courses. New faculty members will be expected to share the vision of the QEP and demonstrate a strong commitment to fulfill its goals. In addition to this, the funds for seven (7) departmental coordinators, twenty peer tutors, faculty professional seminars, and for the development of teaching/learning modules are included in the QEP budget (Table 7.4).

Table 7.4: The Quality Enhancement Plan Budget for the Six-year Period

BUDGET ITEM	2010-11*	2011-12	2012-13	2013-14	2014-15	2015-16
Personnel Salaries and Fringe Benefits						
QEP Director (Already included in the GSU Operating budget since Fall 2008)	$70,000	$71,400	$72,828	$74,285	$75,770	$77,286
QEP Coordinator (Already included in the GSU Operating budget since Fall 2008)	$34,000	$34,680	$35,000	$35,373	$36,080	$36,802
QEP Data Analyst	N/A	$55,000	$56,100	$57,222	$58,366	$59,533
Mathematics Faculty Members (4, two during 2010-11 & two during 2011-12) Four (4) mathematics faculty members will be required to teach additional sections created due to the reduction in class size to 28 students per section $55,000/faculty member/year	$110,000	$220,000	$224,400	$228,888	$233,465	$238,135
Fringe Benefits for the QEP Staff (21%)	$44,490	$80,027	$79,590	$79,590	$79,590	$86,469
QEP Supervisor $7,500 per semester	$3,750	$15,000	$15,000	$15,000	$15,000	$15,000
Departmental Coordinators A total of 7 departmental coordinators: (4) for math and one (1) each for Biology, (1)Economics, & (1)Physics $3,750/coordinator/semester	$7,500	$15,000	$33,750	$45,000	$48,750	$45,000
Peer Tutors (20) for MATH 147 and MATH 148: 6 hours/week for 24 weeks per year @ $8.00 per hour	N/A	$23,040	$23,040	$23,040	$23,040	$23,040
Professional Development/Training of Faculty/External consultants						
NCAT Course Redesign Workshop (Travel)	$14,000	$14,000	$14,000	$14,000		
Consultants for two workshops (Interdisciplinary Approach/POGIL Two consultants @$3,000 each	$6,000	$6,000	$6,000	$6,000	$6,000	-
Consultants for two workshops per year on Assessment: Two consultants @$3,000 each	$6,000	$6,000	$6,000	$6,000	$6,000	-
Consultants for one workshop per year for Biology and Economics faculty on quantitative approach to teaching	-	$3,000	$3,000	$3,000	$3,000	-
Stipends for participating faculty for summer and weekend training (15@$1,000)	$15,000	$15,000	$15,000	$15,000	$15,000	
External Advisory Board Members (Two @ &3,500 each)	-	$7,000	$7,000	$7,000	$7,000	$7,000
Development of Modules						
Modules for Interdisciplinary /POGIL /Math Concept Invent: $2,500/faculty member (8)	$20,000	$20,000	$20,000	$20,000	$20,000	-
Modules for the Rising Junior Examination: $1,500/faculty member (2)	$3,000	$3,000	$3,000	-	-	-
Modules Biology: $2,500/ faculty member (2)			$2,500	$5,000	$2,500	
Technology and Office Operating Expenses						
12 Laptops (1,600) for faculty, 1 Laptop & LCD (2,000) projector for QEP Office	$13,200	$9,600	-	-	-	-
SPSS (PASW) Software	$5,500	-	-	-	-	-
One part-time technology support personnel (hardware and software)	N/A	$5,000	$5,000	$5,000	$5,000	$5,000
Materials and supplies for QEP activities	$5,000	$10,000	$10,000	$10,000	$10,000	$10,000
TOTAL	$357,440	$612,747	$631,208	$649,398	$644,561	$596,386

***** Prior to implementation year **Grand Total: $3,491,740**

CHAPTER 8

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APPENDIX I

Reaffirmation of Accreditation
Organization of Teams

Leadership Team

Dr. Frank G. Pogue (Chair), Interim President
Dr. Horace A. Judson (Chair), Former President
Dr. Connie Walton-Clemons, Interim Provost and V.P. for Academic Affairs
Dr. Robert M. Dixon, Former Provost and V.P. for Academic Affairs
Mr. Daarel Burnette, Vice President for Finance
Dr. Janet A. Guyden, Associate V.P./Dean, School of Graduate Studies and Research
Ms. Nettie Daniels, Associate V.P., Planning and Institutional Research

Coordination and Planning Team

Dr. Connie Walton-Clemons (Chair), Interim Provost and V.P. for Academic Affairs
Dr. Robert M. Dixon (Chair), Former Provost and V.P. for Academic Affairs
Dr. Janet A. Guyden, Dean, School of Graduate Studies and Research
Ms. Nettie Daniels, Associate V.P., Planning and Institutional Research
Mr. Winfred Jones, Associate V.P., Information Technology Center
Dr. Parashu Sharma, Professor, Department of Mathematics and Computer Science
Ms. Niena V. Kidd, Special Assistant to the Provost

Quality Enhancement Plan Team

Dr. Parashu Sharma (Chair), Professor, Department of Mathematics and Computer Science
Mrs. Michelle Williams Young, Director of the QEP
Dr. Brett Sims, Former Head and Associate Professor, Department of Mathematics and Computer Science
Ms. Melissa Aldredge, Assistant Prof., Dept. of Accounting, Economics & Information Systems
Dr. Tabbettha Dobbins, Assistant Professor, Department of Physics
Dr. Uju Ifeanyi, Associate Professor, Department of English
Dr. Milford W. Greene, Associate Professor, Department of Biological Sciences
Dr. Avaine Strong, Associate Professor, Head, Department of Physics
Dr. Frank Ohene, Professor, Acting Head, Department of Chemistry
Dr. Elizabeth McMullan, Former Assistant Professor, Department of Criminal Justice
Mr. Lamark Hughes, Kinesiology/Education Major
Mr. Steven Jackson, Hotel Restaurant Management Major
Ms. Dormeka Johnson, Chemistry Major
Ms. Clarita Monrose, Accounting Major

Appendix II: Grade Distributions for Freshman Composition I (ENG 101) & Freshman Composition II (ENG 102) from Fall 2003-Spring 2008

English 101	**Term**	**Total Students**	**A**		**B**		**C**		**D**		**F**		**W**	
		#	#	%	#	%	#	%	#	%	#	%	#	%
Freshman Composition I	Fall 2003	821	99	12.06%	234	28.50%	200	24.36%	90	10.96%	127	15.47%	71	8.65%
	Sp 2004	447	39	8.72%	74	16.55%	74	16.55%	62	13.87%	129	28.86%	69	15.44%
	Fall 2004	988	167	16.9%	250	25.30%	202	20.45%	117	11.84%	178	18.02%	74	7.49%
	Sp 2005	556	67	12.05%	80	14.39%	106	19.06%	51	9.17%	192	34.53%	60	10.79%
	Fall 2005	920	155	16.85%	202	21.96%	233	25.33%	105	11.41%	193	20.98%	32	3.48%
	Sp 2006	365	48	13.15%	61	16.71%	71	19.45%	45	12.33%	113	30.96%	27	7.40%
	Fall 2006	927	96	10.36%	160	17.26%	202	21.79%	172	18.55%	248	26.75%	49	5.29%
	Sp 2007	531	72	13.56%	72	13.56%	102	19.21%	59	11.11%	173	32.58%	53	9.98%
	Fall 2007	1022	124	12.13%	228	22.31%	261	25.54%	138	13.50%	210	20.55%	61	5.97%
	Sp 2008	548	64	11.68%	100	18.25%	114	20.80%	68	12.41%	168	30.66%	33	6.02%
	Average of 10 semesters			**12.75%**		**19.48%**		**21.25%**		**12.52%**		**25.94%**		**8.05%**
	Summary	**Total of Grades A, B, and C: 53.48%**							**Total of Grades D, F, and W: 46.51%**					
English 102	**Term**	**Total Students**	**A**		**B**		**C**		**D**		**F**		**W**	
		#	#	%	#	%	#	%	#	%	#	%	#	%
Freshman Composition II	Fall 2003	356	33	9.27%	67	18.82%	90	25.28%	53	14.89%	53	14.89%	60	16.85%
	Sp 2004	731	113	15.46%	196	26.81%	173	23.67%	69	9.44%	111	15.18%	69	9.44%
	Fall 2004	351	33	9.40%	59	16.81%	66	18.80%	56	15.95%	94	26.78%	43	12.25%
	Sp 2005	794	101	12.72%	204	25.69%	186	23.43%	83	10.45%	119	14.99%	101	12.72%
	Fall 2005	273	26	9.52%	42	15.38%	62	22.71%	34	12.45%	80	29.30%	29	10.62%
	Sp 2006	653	80	12.25%	143	21.90%	191	29.25%	84	12.86%	115	17.61%	40	6.13%
	Fall 2006	297	53	17.85%	51	17.17%	56	18.86%	40	13.47%	62	20.88%	35	11.78%
	Sp 2007	708	120	16.95%	132	18.64%	145	20.48%	82	11.58%	141	19.92%	88	12.43%
	Fall 2007	344	62	18.02%	49	14.24%	62	18.02%	32	9.30%	88	25.58%	51	14.83%
	Sp 2008	789	115	14.58%	142	18.00%	202	25.60%	113	14.32%	145	18.38%	66	8.37%
	Average of 10 semesters			**13.61%**		**19.36%**		**22.62%**		**12.48%**		**20.36%**		**11.55%**
	Summary	**Total of Grades A, B, and C: 55.59%**							**Total of Grades D, F, and W: 44.39%**					

Appendix III: Grade Distributions for Advanced Composition I (ENG 213) from Fall 2003-Spring 2008

English 213	Term	Total Students	A		B		C		D		F		W	
Advanced Composition		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	463	47	10.15%	91	19.65%	149	32.18%	55	11.88%	36	7.78%	85	18.36%
	Sp 2004	424	39	9.20%	84	19.81%	122	28.77%	54	12.74%	37	8.73%	88	20.75%
	Fall 2004	503	76	15.11%	124	24.65%	122	24.25%	50	9.94%	58	11.53%	73	14.51%
	Sp 2005	434	49	11.29%	87	20.05%	94	21.66%	49	11.29%	66	15.21%	89	20.51%
	Fall 2005	434	30	6.91%	71	16.36%	125	28.80%	71	16.36%	75	17.28%	62	14.29%
	Sp 2006	391	41	10.49%	68	17.39%	92	23.53%	33	8.44%	97	24.81%	60	15.35%
	Fall 2006	390	58	14.87%	88	22.56%	119	30.51%	41	10.51%	38	9.74%	46	11.79%
	Sp 2007	427	31	7.26%	102	23.89%	114	26.70%	42	9.84%	74	17.33%	64	14.99%
	Fall 2007	427	51	11.94%	88	20.61%	104	24.36%	41	9.60%	86	20.14%	57	13.35%
	Sp 2008	409	69	16.87%	73	17.85%	80	19.56%	44	10.76%	75	18.34%	67	16.38%
	Average of 10 semesters			**11.41%**		**20.36%**		**26.06%**		**11.16%**		**14.92%**		**16.07%**
	Summary	**Total of Grades A, B, and C: 57.83%**							**Total of Grades D, F, and W: 42.15%**					

Appendix IV: Grade Distributions for College Algebra (MATH 131) & Trigonometry (MATH 132) from Fall 2003-Spring 2008

Math131	Term	Total Students	A		B		C		D		F		W	
College Algebra		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	722	64	8.86%	105	14.54%	184	25.48%	62	8.59%	145	20.08%	162	22.44%
	Sp 2004	561	41	7.31%	59	10.52%	112	19.96%	64	11.41%	121	21.57%	164	29.23%
	Fall 2004	870	96	11.03%	142	16.32%	200	22.99%	90	10.34%	190	21.84%	152	17.47%
	Sp 2005	641	50	7.80%	62	9.67%	135	21.06%	100	15.60%	160	24.96%	134	20.90%
	Fall 2005	703	95	13.51%	107	15.22%	146	20.77%	115	16.36%	172	24.47%	68	9.67%
	Sp 2006	528	47	8.90%	61	11.55%	87	16.48%	72	13.64%	194	36.74%	67	12.69%
	Fall 2006	704	71	10.09%	94	13.35%	149	21.16%	99	14.06%	184	26.14%	107	15.20%
	Sp 2007	486	53	10.91%	56	11.52%	104	21.40%	85	17.49%	142	29.22%	46	9.47%
	Fall 2007	807	116	14.37%	106	13.14%	160	19.83%	93	11.52%	223	27.63%	109	13.51%
	Sp 2008	543	53	9.76%	36	6.63%	85	15.65%	93	17.13%	213	39.23%	63	11.60%
	Average of 10 semesters			**10.25%**		**12.25%**		**20.48%**		**13.61%**		**27.19%**		**16.22%**
	Summary	**Total of the Grades A, B, and C: 42.98%**							**Total of the Grades D, F, and W: 57.02%**					
Math132	**Term**	**Total Students**	**A**		**B**		**C**		**D**		**F**		**W**	
Trigonometry		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	261	77	29.50%	59	22.61%	42	16.09%	13	4.98%	31	11.88%	39	14.94%
	Sp 2004	380	120	31.58%	68	17.89%	69	18.16%	19	5.00%	41	10.79%	63	16.58%
	Fall 2004	257	88	34.24%	54	21.01%	39	15.18%	8	3.11%	33	12.84%	35	13.62%
	Sp 2005	472	127	26.91%	84	17.80%	63	13.35%	27	5.72%	75	15.89%	96	20.34%
	Fall 2005	262	80	30.53%	60	22.90%	42	16.03%	11	4.20%	45	17.18%	24	9.16%
	Sp 2006	485	127	26.19%	117	24.12%	89	18.35%	27	5.57%	85	17.53%	40	8.25%
	Fall 2006	249	58	23.29%	55	22.09%	47	18.88%	29	11.65%	40	16.06%	20	8.03%
	Sp 2007	384	75	19.53%	58	15.10%	72	18.75%	35	9.11%	97	25.26%	47	12.24%
	Fall 2007	245	46	18.78%	47	19.18%	34	13.88%	21	8.57%	57	23.27%	40	16.33%
	Sp 2008	456	93	20.39%	68	14.91%	80	17.54%	51	11.18%	117	25.66%	47	10.31%
	Average of 10 semesters			**26.09%**		**19.76%**		**16.62%**		**6.91%**		**17.64%**		**12.98%**
	Summary	**Total of the Grades A, B, and C: 62.47%**							**Total of the Grades D, F, and W: 37.53%**					

Appendix V: Grade Distributions for Pre-calculus I (MATH 147) & Pre-calculus II (MATH 148) from Fall 2003-Spring 2008

Math147	Term	Total Students	A		B		C		D		F		W	
Pre-calculus I		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	128	2	1.56%	5	3.91%	6	4.69%	14	10.94%	44	34.38%	57	44.53%
	Sp 2004	98	2	2.04%	6	6.12%	2	2.04%	10	10.20%	31	31.63%	47	47.96%
	Fall 2004	161	7	4.35%	5	3.11%	13	8.07%	38	23.60%	42	26.09%	56	34.78%
	Sp 2005	113	9	7.96%	6	5.31%	26	23.01%	16	14.16%	35	30.97%	21	18.58%
	Fall 2005	182	18	9.89%	32	17.58%	27	14.84%	14	7.69%	61	33.52%	30	16.48%
	Sp 2006	89	8	8.99%	24	26.97%	23	25.84%	20	22.47%	10	11.24%	4	4.49%
	Fall 2006	142	21	14.79%	15	10.56%	17	11.97%	34	23.94%	45	31.69%	10	7.04%
	Sp 2007	82	10	12.20%	14	17.07%	28	34.15%	9	10.98%	13	15.85%	8	9.76%
	Fall 2007	126	24	19.05%	30	23.81%	26	20.63%	11	8.73%	27	21.43%	8	6.35%
	Sp 2008	76	16	21.05%	16	21.05%	27	35.53%	3	3.95%	11	14.47%	3	3.95%
	Average of 10 semesters			**10.19%**		**13.55%**		**18.08%**		**13.67%**		**25.13%**		**19.39%**
	Summary	**Total of the Grades A, B, and C: 41.82%**							**Total of the Grades D, F, and W: 58.19%**					
Math148	**Term**	**Total Students**	**A**		**B**		**C**		**D**		**F**		**W**	
Pre-calculus II		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	48	10	20.83%	18	37.50%	12	25.00%	2	4.17%	2	4.17%	4	8.33%
	Sp 2004	43	3	6.98%	6	13.95%	7	16.28%	1	2.33%	2	4.65%	24	55.81%
	Fall 2004	29	2	6.90%	2	6.90%	2	6.90%	0	0.00%	8	27.59%	15	51.72%
	Sp 2005	52	3	5.77%	7	13.46%	11	21.15%	5	9.62%	15	28.85%	11	21.15%
	Fall 2005	32	1	3.13%	1	3.13%	8	25.00%	7	21.88%	13	40.63%	2	6.25%
	Sp 2006	100	25	25.00%	18	18.00%	19	19.00%	7	7.00%	27	27.00%	4	4.00%
	Fall 2006	51	7	13.73%	8	15.69%	19	37.25%	6	11.76%	8	15.69%	3	5.88%
	Sp 2007	55	6	10.91%	9	16.36%	10	18.18%	4	7.27%	22	40.00%	4	7.27%
	Fall 2007	49	21	42.86%	12	24.49%	11	22.45%	2	4.08%	2	4.08%	1	2.04%
	Sp 2008	73	20	27.40%	11	15.07%	20	27.40%	5	6.85%	10	13.70%	7	9.59%
	Average of 10 semesters			**16.35%**		**16.46%**		**21.86%**		**7.50%**		**20.64%**		**17.20%**
	Summary	**Total of the Grades A, B, and C: 54.67%**							**Total of the Grades D, F, and W: 45.34%**					

Appendix VI: Grade distributions for Calculus I (MATH 153) & Calculus II (MATH 154) from Fall 2003-Spring 2008

Math153	Term	Total Students	A		B		C		D		F		W	
Calculus I		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	58	8	13.79%	4	6.90%	6	10.34%	7	12.07%	14	24.14%	19	32.76%
	Sp 2004	50	0	0.00%	1	2.00%	1	2.00%	4	8.00%	8	16.00%	36	72.00%
	Fall 2004	57	4	7.02%	5	8.77%	3	5.26%	4	7.02%	10	17.54%	31	54.39%
	Sp 2005	41	3	7.32%	4	9.76%	8	19.51%	4	9.76%	5	12.20%	17	41.46%
	Fall 2005	51	8	15.69%	6	11.76%	8	15.69%	16	31.37%	8	15.69%	5	9.80%
	Sp 2006	37	8	21.62%	10	27.03%	11	29.73%	6	16.22%	2	5.41%	0	0.00%
	Fall 2006	116	22	18.97%	19	16.38%	29	25.00%	21	18.10%	18	15.52%	7	6.03%
	Sp 2007	81	24	29.63%	18	22.22%	32	39.51%	2	2.47%	4	4.94%	1	1.23%
	Fall 2007	84	22	26.19%	12	14.29%	10	11.90%	8	9.52%	20	23.81%	12	14.29%
	Sp 2008	88	38	43.18%	14	15.91%	27	30.68%	4	4.55%	2	2.27%	3	3.41%
	Average of 10 semesters			**18.34%**		**13.50%**		**18.96%**		**11.91%**		**13.75%**		**23.54%**
	Summary	**Total of the Grades A, B, and C: 50.80%**							**Total of the Grades D, F, and W:49.20%**					
Math154	**Term**	**Total Students**	**A**		**B**		**C**		**D**		**F**		**W**	
calculus II		#	#	%	#	%	#	%	#	%	#	%	#	%
	Fall 2003	31	2	6.45%	4	12.90%	2	6.45%	9	29.03%	1	3.23%	13	41.94%
	Sp 2004	36	6	16.67%	7	19.44%	5	13.89%	7	19.44%	3	8.33%	8	22.22%
	Fall 2004	14	0	0.00%	1	7.14%	1	7.14%	4	28.57%	0	0.00%	8	57.14%
	Sp 2005	26	1	3.85%	1	3.85%	2	7.69%	5	19.23%	4	15.38%	13	50.00%
	Fall 2005	30	1	3.33%	2	6.67%	6	20.00%	8	26.67%	6	20.00%	7	23.33%
	Sp 2006	39	3	7.69%	5	12.82%	16	41.03%	5	12.82%	4	10.26%	6	15.38%
	Fall 2006	29	0	0.00%	2	6.90%	12	41.38%	7	24.14%	0	0.00%	8	27.59%
	Sp 2007	76	10	13.16%	3	3.95%	8	10.53%	11	14.47%	30	39.47%	14	18.42%
	Fall 2007	59	10	16.95%	25	42.37%	4	6.78%	7	11.86%	4	6.78%	9	15.25%
	Sp 2008	53	12	22.64%	11	20.75%	11	20.75%	4	7.55%	5	9.43%	10	18.87%
	Average of 10 semesters			**9.07%**		**13.68%**		**17.56%**		**19.38%**		**11.29%**		**29.01%**
	Summary	**Total of the Grades A, B, and C: 40.31%**							**Total of the Grades D, F, and W:59.68%**					

Appendix VII: ACT & SAT Mathematics Scores from 2004-2008

Year	Grambling		Louisiana		National		Mississippi		Arkansas		Texas	
	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT
2004	15.7	413	19.2	561	20.7	504	17.9	547	19.5	555	20.3	499
2005	15.7	429	19.8	562	20.7	505	17.8	554	19.6	552	20.3	502
2006	16.5	433	19.4	571	20.8	518	18.0	541	19.9	568	20.6	506
2007	16.5	410	19.5	567	21.0	515	18.1	549	19.9	566	20.8	507
2008	16.8	422	19.7	564	21.0	515	18.2	556	20.1	567	21.2	505
Average	**16.24**	**421**	**19.5**	**565**	**20.8**	**511**	**18.0**	**549**	**19.8**	**562**	**20.6**	**504**

Appendix VIII: ACT & SAT English/Critical Reading Scores from 2004-2008

Year	Grambling		Louisiana		National		Mississippi		Arkansas		Texas	
	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT	ACT	SAT
2004	15.2	418	19.9	564	20.4	512	18.9	562	20.6	569	19.4	493
2005	15.1	439	19.9	565	20.4	513	18.8	564	20.5	563	19.3	493
2006	16.2	428	20.3	570	20.6	503	19.1	556	20.7	574	19.4	491
2007	15.7	405	20.3	569	20.7	502	19.0	568	20.5	578	19.5	492
2008	16.8	417	20.5	566	20.6	502	19.3	574	20.7	575	19.8	488
Average	**15.8**	**421**	**20.2**	**567**	**20.5**	**506**	**19.0**	**565**	**20.6**	**572**	**19.5**	**491**

Appendix IX: ACT Composite Scores from 2004-2008

Year	Grambling	Louisiana	National	Mississippi	Arkansas	Texas
2004	16.0	19.8	20.9	18.8	20.4	20.2
2005	15.9	19.8	20.9	18.7	20.3	20.2
2006	16.6	20.1	20.1	18.8	20.6	20.3
2007	16.5	20.1	21.2	18.9	20.5	20.5
2008	17.0	20.3	21.1	18.9	20.6	20.7
Average	**16.4**	**20.0**	**20.8**	**18.8**	**20.5**	**20.4**

GRAMBLING
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Office of the President

February 23, 2010

Dr. Parashu Sharma
Team Leader
Quality Enhancement Plan Team
Department of Mathematics & Computer Science
Grambling State University
Grambling, LA 71245

Dear Dr. Sharma and the QEP Team:

RE: Letter of Support for the Quality Enhancement Plan

I am delighted to offer support for the Quality Enhancement Plan for Grambling State University. On behalf of the entire university family, I wish to thank you and the Quality Enhancement Plan Team for making us aware of this informative and instructive process. The plan, "The Improvement of Mathematical Skills and Knowledge" is excellent and will have a major and positive impact on future Grambling products.

During my tenure as a student, professor, interim president, and president in the academy, I have never known a more unique and special institution than Grambling State University. Its brand is special in every way. It is my intention not only to help preserve this special brand, but to see that it is enhanced. I am certain that the Quality Enhancement Plan will go a long way toward doing just that.

These are trying times for institutions. Budget cuts are the rule. All of us are mandated to do more with less. However, I pledge not only my support to this bold plan, but to ensure that the resources – human, physical and financial – are in place to fully implement the plan. We are certain that the successful implementation of the QEP will provide our students with a unique edge in their future careers.

We are looking forward to meeting our visiting review team from the Southern Association of Colleges and Schools on April 6.

Yours truly,

Frank G. Pogue, Ph.D.
Interim President

FGP:jj

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GRAMBLING STATE UNIVERSITY GRAMBLING, LOUISIANA

Student Government Association

FSU Office # 214● 403 Main Street ● GSU Box 1297 ● Grambling, LA 71245 ● 318/274-2540
Sjacks17@gsumail.gram.edu

Office of the President

February 3, 2010

RE: Letter of Support for the Quality Enhancement Plan

Dear Dr. Sharma,

The Student Government Association takes pride in documenting its support of the Grambling State University Quality Enhancement Plan. As you know Lamark Hughes, Vice President of the Student Government Association and I have worked on the plan as students members on the Quality Enhancement Plan Team. It was our pleasure to sponsor QEP activities especially during Homecoming. I also enjoyed joining you, Mrs. Young, and Dr. Greene on the KGRM "Good Morning Grambling" radio show that focused on the QEP. It has been a learning experience and it has added to our skill sets in numerous ways.

The establishment of the QEP Team student Ambassadors has become an excellent vehicle for apprising the student body of the importance of the QEP. In spite of challenges in that regard, we have persevered and reached a critical mass of the student body. We are delighted that you accepted our invitation to make a presentation on the QEP during the SGA Council meeting. The SGA Council members are very supportive of all QEP activities. In fact, we plan to sponsor more of these activities utilizing SGA funds. We will do more to encourage students to participate in the mathematics contests that appear in the QEP Newsletter "Math Does Matter."

The Student Government Association is poised to push forward in support of the QEP; we are ready to assist you in welcoming the visiting team from the Southern Association of Colleges and Schools in April.

Steven P. Jackson

Steven P. Jackson
SGA President

Office of the Provost and Vice President for Academic Affairs

February 24, 2010

Dr. Parashu Sharma, Team Leader
Quality Enhancement Plan
Grambling State University
Grambling, LA 71245

RE: Support Letter for the Quality Enhancement Plan

Dear Dr. Sharma:

It has been a pleasure to work with you and the Quality Enhancement Plan (QEP) Team over the past year and a half, first as the Dean of the College of Arts and Sciences, and now in my new role as Interim Provost and Vice President for Academic Affairs. I am pleased that you kept me informed during every stage of the QEP development process where my suggestions in developing goals, student learning outcomes, and the teaching methods were taken into consideration. The leadership and dedication you and the QEP Team have brought to this process are commendable.

Curriculum is arguably the most significant piece of the province of Academic Affairs. There is always a continuing need for improvement. The QEP, when implemented will represent a major advancement in curriculum, content, and style. I am certain that "*The Improvement of Mathematical Skills and Knowledge*," and employing current best practices throughout the University, will have a lasting effect on Grambling State University graduates. Indeed, the implications are profound. It is important that we have chosen to implement the QEP through both mathematics and non-mathematics courses. This in itself will help students realize the importance of mathematics in their major fields and possibly reduce their math-anxiety.

I offer my unwavering support to you, and the Team, as we move toward reaffirmation and begin implementation of the Quality Enhancement Plan. Again, I am grateful to you and the Team for the work that has been done, and for the work that is yet to come.

Sincerely,

Connie Walton

Connie Walton, Ph.D.
Interim Provost and Vice President

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Office of the Vice President for Finance and Administration

February 24, 2010

Dr. Parashu Sharma, Chair
Quality Enhance Plan Team
Professor of Mathematics and Computer Science
Grambling State University
Grambling, LA 71245

RE: Letter of Support - Grambling State University Quality Enhancement Plan

Dear Dr. Sharma,

It is with much pleasure and enthusiasm that I write this letter of support for the Quality Enhancement Plan (QEP) at Grambling State University. I have had the opportunity to review and discuss the QEP with various members of the team. The QEP will address a campus wide goal which is strengthening mathematical skills.

As Chief Financial Officer (CFO), I see the importance of having a strong foundation in mathematics. Our students, if they are to compete successfully in the job market, must possess the ability to think analytically and quantitatively. I strongly believe that Grambling, as a whole, will benefit from "The Improvement of Mathematical Skills and Knowledge."

It was a great pleasure to discuss the QEP budget in detail with Mrs. Michelle Young and Dr. Parashu Sharma. As a result of our conversations, I clearly see the need for four new faculty members in mathematics to support smaller number of students in the classrooms to enhance the instruction quality. I endorse all the activities and strategies that will be used to implement the QEP. Keeping in view, the impact that QEP will make upon its implementation, Grambling State University is fully committed to provide needed funds to support all the activities described in the QEP.

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Further, the Office of Finance and Administration is excited about having SMART classrooms and the addition of a computer laboratory in the Mathematics and Computer Science Department. This technology will buttress the efforts of Grambling State University to attract an even greater number of highly-qualified students. My office is cooperating with Dr. Sharma to submit a proposal to the Title III Office at Grambling to fund the four additional math instructors, SMART classrooms and a computer laboratory.

Grambling has the adequate classroom space to accommodate this new academic initiative as prescribed above. I am committed to identifying the funding resources required to launch the QEP program and its associated outcomes.

Sincerely,

Daarel E. Burnette
Vice President for Finance and Administration

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GRAMBLING STATE UNIVERSITY
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College of Arts and Sciences

February 23, 2010

Dr. Parashu Sharma, Chair
Quality Enhance Plan
Department of Mathematics & Computer Science
Grambling State University
P. O. Box 4257
Grambling, LA 71245

Dear Dr. Sharma:

On behalf of the Office of the Dean of the College of Arts and Sciences, I am gratified to have the opportunity to write in support of the Grambling State University Quality Enhancement Plan (QEP). The theme, "The Improvement of Mathematical Skills and Knowledge" is most appropriate as there is indeed a dire need to help students understand and appreciate the role of mathematics in their lives. Moreover, the QEP provides an opportunity to help students improve their mathematical skills as well as their critical thinking skills. As the Interim Dean, I welcome any action, especially the QEP which is destined to have a profound impact on the university.

Although the QEP will impact students from across disciplines, the College of Arts and Sciences is where most of the QEP will be implemented in the Departments of Mathematics & Computer Science, Biology and Physics. I, along with Dr. Danny Hubbard, interim associate dean, and Dr. Ellen Smiley, assistant dean, welcome the opportunity to be of support to the heads of the departments through which the QEP will be implemented. Indeed, we will work with them in helping to provide the resources necessary to bring about the successful implementation of the QEP.

We also welcome the opportunity to be of continuing support to the QEP Team in preparation for the April visit from the Southern Association of Colleges and Schools (SACS). We look forward to playing our part in the important chapter in the life of our great university.

Sincerely,

Evelyn Wynn
Evelyn Wynn, Interim Dean
College of Arts and Sciences

FACULTY SENATE

February 22, 2010

Dr. Parashu Sharma, Team Leader
Quality Enhancement Plan Team
113C Carver Hall
Department of Mathematics and Computer Science
Grambling State University
Grambling, LA 71245-2715

RE: Letter of Support for the Quality Enhancement Plan

Dear Dr. Sharma:

On behalf of the Faculty Senate, I write to congratulate the Quality Enhancement Plan (QEP) Team on the completion of the Plan and to pledge the support of the Senate in its implementation. As you know, the Faculty Senate is representative of the entire faculty of instruction and is comprised of a significant portion of the senior tenured faculty. We have enjoyed your frequent presentations and updates as well as the opportunity to give input to the development of the plan. As an associate professor in the Department of Physics, my interest in the QEP's goal to improve GSU's learning outcomes in mathematics is both professional and personal. I am honored by the fact that Dr. Avaine Strong, head of my academic department, is a member of the QEP Team.

Of course, the really tough part, *i.e.*, approval by the visiting committee from the Southern Association of Colleges and Schools (SACS) and the Plan's subsequent implementation, is yet to begin. The Senate supports you and your Team and is looking forward to April 6. If you need assistance from the Faculty Senate or from me personally, then please let me know. The Senate will provide whatever assistance you request to ensure a successful site visit.

Again, congratulations on completing Grambling State University's Quality Enhancement Plan. Thank you and the QEP Team for the work that you performed to complete the task. Let us ensure that the SACS site visit will meet with equal success.

Yours truly,

Matthew F. Ware

Dr. Matthew F. Ware, Assoc. Professor
Department of Physics
President, Faculty Senate

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GRAMBLING
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Department of Mathematics and Computer Science

February 04, 2010

RE: Letter of Support for the Quality Enhancement Plan

The faculty in the Department of Mathematics and Computer Science is pleased to write this letter of support for the Grambling State University Quality Enhancement Plan. The department has been encouraged by the steady and considerable involvement it has had in the development of the plan to increase the mathematical skills and knowledge of Grambling State University students. As a mathematics faculty we were happy to work, over the past year and a half, to insure that this will be a successful effort. We strongly support the initiatives included in this QEP and are willing to go that extra mile to help students in a variety of ways to improve their learning. As the members of the lead department, we will engage in making changes in course syllabi, developing course modules on certain topics, participating in faculty workshops, and adopting new pedagogical methods included in the QEP. We will cooperate with the QEP office to provide them necessary data for the assessment of the QEP.

As we prepare for the upcoming visit by the team from the Southern Association of Colleges and Schools, the Department of Mathematics and Computer Science stands ready to assist the GSU QEP team in any way possible. As the department through which much of the plan will be implemented, we hope to offer leadership as well as support to other Departments specifically Biological Sciences and Economics.

The Department of Mathematics and Computer Science stands ready to meet the challenge of anchoring the preparation of Grambling State University students for greater problem solving ability in a competitive society.

Truly yours,

The Mathematics Faculty

(Fred Semwogerere, Acting Head)	(Arun Agarwal)	(Gregory Battle)	(Bassidy Dembele)
(Sandra Gamble)	(Fred Gibson)	(Aderemi Kuku)	(Carl Roberts)
(Abdulalim Shabazz)	(Parashu Sharma)	(Eugene Taylor)	(Leummim Yao)

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GRAMBLING
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Department of Biological Sciences

February 19, 2010

Dr. Parashu Sharma, Chair
Quality Enhance Plan Team
Professor of Mathematics and Computer Science
Grambling State University
Grambling, LA 71245

RE: Support Letter for the Quality Enhancement Plan
Dear Dr. Sharma:

The Department of Biological Sciences takes pride in supporting Grambling State University (GSU) Quality Enhancement Plan (QEP). We are pleased that Biological Sciences is one of the departments through which the plan will be implemented. The Principles of Biology courses (BIOL 103, 104, 105, and 106), for the most part, have been taught descriptively. But, the GSU QEP when implemented, will offer a more quantitative approach to the content of these courses.

Although most Biology faculty members have been involved in the development of QEP, Dr. Tony Leung has played a major role in developing the content for the above-mentioned courses. Another faculty member, Dr. Milford Greene, has been a valued member of the QEP team since its inception.

New findings occur almost on a daily basis in the biological and health sciences. We are certain that improved mathematical knowledge and skills will go a long way toward helping Grambling State University students better understand these advances. More importantly, improved quantitative knowledge should enhance their skills in solving problems in the non-science areas.

The Department of Biological Sciences looks forward to welcoming the Southern Association of Colleges and Schools in April. We are certain the visiting team will find the GSU QEP a solid plan that will impact student learning in a very positive way.

Yours truly,

Felix I. Ifeanyi, Ph.D.
Professor/Head
Dept. of Biological Sciences

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GRAMBLING
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Department of Physics

RE: Letter of Support for the Quality Enhancement Plan

February 18, 2010

Dear Dr. Sharma:

As a member of the Quality Enhancement Plan Team and head of the Department of Physics, it is a pleasure to write in support of the Quality Enhancement Plan. Over the past two years, I have had the opportunity to engage in research on best practices in maximizing student learning outcomes and the utilization of technology in the classroom that do the same. Some of these practices are being incorporated into the courses (Science 105 and 106) to be offered by the Physics Department under the Quality Enhancement Plan.

To say that the department embraces a more quantitative approach to solving problems would be an understatement. We think it is an excellent way to train non-science students. Ultimately, almost anything can be expressed mathematically.

The literature is replete with stories of how poorly trained our students are mathematically, how the United States is losing its competitive edge in the global world. Not only do we need to do a better job with our science students, we need to make sure that all our students, non-science as well graduate with superior quantitative skill sets. The QEP should do it for the Grambling students.

In the near future, we have the opportunity to demonstrate to the world that Grambling is outstanding. Let it be said that Grambling State University is leveling the playing surface with mathematics and quantitative reasoning. Best wishes for a successful reaffirmation process.

Yours truly,

Avaine Strong, Ph.D.
Member of the QEP Team
Head, Department of Physics

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Department of Accounting, Economics and Information Systems

February 24, 2010

Letter of Support from Economics Program

Dear Dr. Sharma:

The Department of Accounting, Economics, and Information Systems wishes to express its support for the Grambling State University Quality Enhancement Plan. We are pleased to be one of the departments through which the plan will be implemented and are also pleased to have participated in the development of the plan's curriculum.

It goes without saying that over the past two years, we have witnessed the importance of economics to our country, our state, and our city, indeed the world. Teaching economics to our non-majors from a more quantitative perspective should better prepare them for understanding how markets operate throughout the world and at the same time, undergird their skills for solving problems in their various disciplines and in the world of work after graduating from Grambling State University.

If we may be of further support in any way prior to, during, and/or after the Southern Association of Colleges and School's visit in April, please do not hesitate to call on us. We pledge our support and stand ready to assist you.

Truly yours,

John Nwoha

Dr. Ogbonnaya John Nwoha
Interim Head of Department

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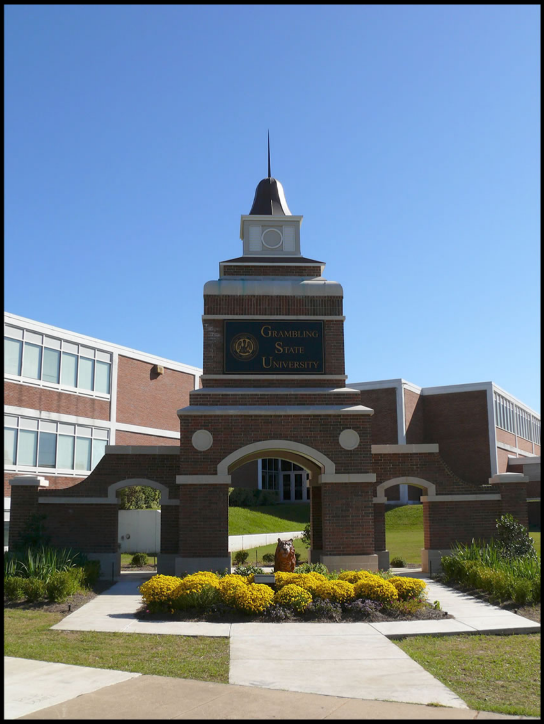
Math Does Matter



The Quality Enhancement Plan
Equals
Quality Enhancement in Mathematics

QEP = QEM