Final Report

August 15, 1998 – May 31, 2004

The Enhancement of Overall Student Performance Through a Statistics Research Program for Students who are Recruited into Science, Engineering and Mathematics Programs

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Award Number: N00014-98-1-0764

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DISTRIBUTION STATEMENT A
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20040915 232

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

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1. REPORT DATE *(DD-MM-YYYY)*	2. REPORT TYPE	3. DATES COVERED *(From - To)*
8/12/04	Final	1 August 1998 - 31 May 2004

4. TITLE AND SUBTITLE
The Enhancement of Overall Student Performance Through a Statistics Research Program for Students who are Recruited into Science, Engineering and Mathematics Programs

5a. CONTRACT NUMBER

5b. GRANT NUMBER
N00014-98-1-0764

5c. PROGRAM ELEMENT NUMBER

5d. PROJECT NUMBER

5e. TASK NUMBER

5f. WORK UNIT NUMBER

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8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
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10. SPONSOR/MONITOR'S ACRONYM(S)

11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution in unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT
This document summarizes the outcomes of grant N00014-98-1-0764 during the period 1 August 1998 - 31 May 2004. The objective of the grant is to recruit freshmen students into science, engineering and mathematics and to do research on student performance assessment. Section 1 provides a more detailed overview of the project's goals and objectives. Sections 2 and 3 summarizes the outcomes associated with stated objectives and other activities. Section 4 lists papers presented over the duration of the project while Section 5 lists proposals that were submitted. Sections 6 and 7 give information that's related to graduates of this program.

15. SUBJECT TERMS
Infrastructure, statistics, mathematics, scholarships

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			19b. TELEPHONE NUMBER *(Include area code)*

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1. Organization and Overview

1.1 Introduction

This Mathematics Scholarship Program (MSP) operated from 1 August 1998 to 31 May 2004 in the Mathematics Department at Alabama A&M University (AAMU). It was supported by the Historically Black College and Universities (HBCU) and Minority Institutions Infrastructure Program of the U.S. Navy. The program director was Dr. Enoch Temple and his administrative assistant was Ms. Theresa McCants. Various other duties were performed by a variety of mathematics faculty members.

1.2 Overview

A primary goal of this project was to improve the quality of science, engineering and mathematics programs at AAMU. Another goal was to increase the number of under represented bachelor degree graduates who are prepared to do graduate work in the sciences. The project proposed to achieve its goals by using a five-fold approach: 1) Recruit high-ability students into a summer enrichment program for recent high school graduates who have committed to major in science, engineering or mathematics (SEM). 2) Provide each recruit with a scholarship provided he/she enrolls in SEM during follow-on fall semester. 3) Require each recruit to take a core of courses in statistics and mathematics while retaining a major in SEM. 4) Have each participant to formulate and execute a statistics research plan and report findings in a well-written report. 5) Have PI to engage in extensive research on student performance at AAMU. We have completed the six-year funded project and this document is a final report.

2. Results of the Project

For the convenience of the reader, the project objectives are restated in this section followed by actual outcomes for the stated objective.

Objective 1: Recruit high-ability students into a summer enrichment program for recent high school graduates who have committed to major in science, engineering or mathematics (SEM).

Outcomes 1: In January of 1999 and 2000, the Director of the MSP developed a brochure that describes the scholarship program. The Administrative Assistant distributed a copy of this brochure and an application form to a large group of high schools throughout the state of Alabama. In 1999, 30 complete applications were received and 26 were received in 2000.

In November 2000, the AAMU Project Director was notified that the Office of Naval Research (ONR) would focus future Infrastructure Program funding on other important needs such as instrumentation and research. This meant that this Education Program (N00014-98-0764) must under-go a phase-down and was invited by ONR to submit a phase-down proposal which was to cover June 2001 through May 2004. The phase-down proposal was submitted and subsequently funded for above mentioned phase-down period. Because of the phase-down, no new students were recruited in 2001, nor in later years.

Objective 2: Provide each recruit with a scholarship provided he/she enrolls in SEM during follow-on fall semester.

Outcomes 2: Of the 56 applications received in 1999 and 2000, a total of 27 scholarships were awarded over the two-year period: 17 in 1999 and 10 in 2000. In Summer 1999, one student withdrew because of being home-sick and another dropped out because of unknown reasons. A follow-up investigation revealed that the last dropout enrolled in another university, but later dropped out of that university. Therefore, this program retained 25 students for at least 1 year. Of the 25, 15 were among the 1999 enrollees and 10 had enrolled in 2000. Table 1 shows the number of scholarships awarded and the number who graduated with a BS degree in SEM. Table 2 shows how scholarship awards were distributed over the SEM majors. Eight students in Table 2 changed their major out of SEM or transferred to another institution or simply dropped the MSP because they were unsuccessful in the calculus sequence and/or the statistics courses.

Table 1*: *Graduation Numbers in SEM

Year Entered	Awarded Scholarship	Changed Major but remained at AAMU	Transferred out of AAMU	Graduated with SEM Major
1999	17	3	3	11
2000	10	1	1	8
Total	27	4	4	19

Table 2: Distribution of Awards by Major

SEM Major	Number of Scholarships Awarded	Number Graduated	Changed Major or Transferred
Biology	4	1	3
Computer Science/Math	19	15	4
Engineering	3	2	1
Physics	1	1	0
Total	27	19	8

Objective 3: Require each recruit to take a core of courses in statistics and mathematics while retaining a major in SEM.

Outcomes 3: As shown in Tables 1 and 2, 19 of the 27 participants graduated with an SEM degree. All SEM graduates completed the 18-hour statistics requirement. A few students, especially the biology majors, found the statistics to be difficult.

Objective 4: Have each participant to formulate and execute a statistics research plan and report findings in a well-written report.

Outcomes 4: For the duration of this project, most students had several opportunities to conduct research and present their findings in a well-written report. This is especially true for those students who participated in summer internships. The internship issue will be discussed later.

All MSP participants who became seniors, and were mathematics majors, enrolled in a Senior Project class (MTH 481). Each MTH 481 enrollee selects a faculty member who serves as his/her mentor. Participants in other majors were required to enroll in a similar course that was offered by their major department. Specific publications are listed in Section 4.

Project difficulties occurred as a result of not having enough statistics faculty members who were available to serve as mentors. A lapse in the supervision of student registration into MTH 481 generated this problem. That is, all the scholarship students registered for the seminar at the same time. This problem will be corrected for future seminar classes.

Objective 5: Have PI to engage in extensive research on student performance at AAMU.

Outcomes 5: These outcomes are detailed in Progress Reports for 1999 and 2002. Section 5 of the 1999 report shows the results of placement procedures which allow student placement in mathematics courses to be more effective. The 1999 report also reported on the assessment of the effectiveness of the elementary statistics course (MTH 355). The 2002 Progress Report provided details of research that was done on student performance. More specifically, this research sought to uncover the relationship between performance variables (several types of GPAs) and other student academic variables. The information from the 1999 Progress Report was used to make adjustment in the teaching of MTH 355. The 2002 report identified how certain demographic and academic variables drive academic performance. Information from these reports may be used to improve the student selection process when selecting students into future program that are similar to the MSP.

3. Other Activities

3.1 Student Workers

Five undergraduate student workers (work-study) were employed by the MSP per semester. These students were SEM majors who were assigned to a variety of duties such as computer lab assistants, tutors in mathematics, statistics or in a physical science. Each student-worker was associated with at least one SEM faculty member who serves as a mentor for the student-worker. Each student devoted between 10 and 20 hours to work activities.

3.2 Summer Internships

This summary of internship activities includes those internships offers received by any of the MSP participants or any of the MSP-supported work-study students. Internship host agencies were the University of North Carolina, Alabama A&M University, NASA, University of Wisconsin, University of Iowa, Miami University (Ohio), National Science Foundation and Elizabeth City State University (North Carolina), Alabama State University, Virginia Polytechnic Institute, University of Colorado, University of Maryland, and Cornell University. Table 1 shows how the MSP has influenced the growth trend in the number of internship offers since 1999. The first year of MSP student participation in summer internships was 2000 and MSP students received 8 of the 10 offers for that year. In 2002, MSP students accounted for 90% of internship offers in math/statistics while making up less than 25% of the mathematics majors. The decrease in the number of internship offers in 2003 is due to a decrease

(graduations) in the number of MSP students available for internship participation. The 2004 column shows that some MSP seniors who graduated in May 2004 also participated in an internship after graduation.

Table 3: ***Total Number of Summer Internship Offers in Mathematics/Statistics***

YEAR	1999	2000	2001	2002	2003	2004
Number of Internship Offers	3	10	21	30	18	6

3.3 Project Director's Visits to other Universities

The Director of the MSP has visited several statistics departments at universities such as the University of Alabama, University of Alabama at Birmingham, Harvard University and, the University of Wisconsin (UW). During each of the visits, the role that AAMU may play in supplying students to the visited graduate programs was discussed. See Section 7 for list of graduate programs that have admitted MSP graduates. Three MSP graduates are at the UW campus which is the largest number at a single school.

3.4 Graduate Assistants to MSP

The MSP supported a total of four graduate assistants. They all were enrolled in the AAMU Master level mathematics education program. All of these students learned to use computing packages such as SAS, MAPLE, and Minitab and assisted with computer lab instruction for MSP students. Three of the graduate assistants graduated with a 4.00 GPA and the fourth earned a 3.3 GPA. The four are currently teaching mathematics at the high school level where they are among the few high school mathematics teachers who are prepared to teach statistics.

4. Dissemination

4.1 Student Presentations/Papers

Each MSP participant completed a senior project which resulted in a written report and oral presentation. Shown below are additional papers.

- Green, R. (2001), "Some Formulae for Evaluation of a Class of Single and Repeated Indefinite Integrals," Proceedings of the National Conference on Undergraduate Research, March 15-17, 2001.

- Rambo, M. (2001), "Statistical Classification Methods Applied to Locally Collected Data Sets," Proceedings of the National Conference on Undergraduate Research, March 15-17, 2001.
- West, D. and Morgan R. "Two Bases for the Complex Binary Number System", Proceedings of the National Conference on Undergraduate March 15-17, 2001.
- Carmichael, L and Green R. had paper accepted for the 2002 National Conference on Undergraduate Research. However, they did not go to Utah to make the presentations.

4.2 Papers and Presentations by Staff

In order to brief the AAMU faculty and administration on the progress of this project, several on-campus seminars were sponsored by the MSP. Additional presentations are listed below.

- Temple, E (2000), "Student Performance Assessment Research and Its Application to Curriculum Development," Appeared in Materials presented at the NASA MU-SPIN Ninth Annual User's Conference. Miami, Florida.
- Temple, E. (1999), "Research in Student Performance", a paper presented at the Annual Regional HBCU Summit on Retention. Ocean City, MD.
- McCants, Theresa (Administrative Assistant to MSP), (2001), "A Description of the Mathematics Scholarship Program'. Presented at an AAMU Seminar.

5.

Table 4: **Proposals Submitted Between December 1, 2001 - May 31, 2004**

Date Submitted	Agency	Principal and Co-Investigator	Title	Duration Years	Total Requested	Status
1/31/2002	AHRQ Infrastructure	Dr. Enoch Temple* Dr. Joseph Tahsoh Dr. Sampson Hopkins	Statistical Infrastructure for Health Services research	3	$1,162,750.00	Not Funded
6/13/2002	NASA-Kennedy	Dr. Enoch Temple	Student Performance and Participation in Internships for Statisticians	1	$119,357.00	Funded
10/30/2002	ONR	Dr. Enoch Temple	Discriminant Analysis Using Spectral Data	3	$620,924.00	Not Funded
11/1/2002	Ed	Dr. Enoch Temple	McNair Scholars for Doctoral Study	5	$1,113,486.00	Not Funded
10/15/2003	Sloan Foundation	Dr. Enoch Temple	A Masters in Applied Statistics	1	$6,000.00	Funded
3/12/2004	Ed	Dr. Enoch Temple	A Statistics Curriculum for Science and Engineering Undergraduate Students	3	$299,970.00	Pending

An NSF proposal is under development.
A Proposal to the Sloan Foundation is under development.
*Principal Investigator

6. Program Graduates who are in Graduate School

The 19 MSP participants graduated between May 2003 and May 2004. The number of participants who have been admitted to graduate school is listed below.

Table 4: Graduate Admission

NUMBER ADMITTED	SCHOOL	MAJOR
3	University of Wisconsin	Statistics
1	North Carolina State University	Statistics
1	University of Alabama	Mathematics
1	University of Michigan	Statistics
1	University of Alabama at Huntsville	Engineering
1	University of South Alabama (Mobile)	Unknown
1	Alabama A&M University	Physics
1	DePaul University	Computer Science
1	Towson University	Statistics

Note 1: There are other students who have applied for graduate school admission but have not yet informed the Director of their application outcome.

Note 2: One MSP graduate has completed the Navy's Officer Candidate School and is now assigned to the National Security Agency.

7. Graduation Impact

Table 5 shows the average undergraduate AAMU enrollment in SEM departments over years 1998-2002. Year 2002-2003 has been added for the Mathematics Department because its data was available for this report. Furthermore, MSP had its first graduates in 2003. Table 5 also shows the impact of the MSP on the Mathematics Department's enrollment, number of graduates, number admitted to SEM graduate programs and number of internships offered. The impact of MSP on other SEM departments is not impressive. This is because the Mathematics Department contained the largest number of MSP participants while other departments retained at most two through graduation.

Table 5: Undergraduate Enrollment/Graduate

Department	Year	Average Enrollment Per Semester (Fall, Spring)	Total Graduated (Fall, Spring, Summer)	Number Graduated With at Least 3.00 GPA	Number Admitted to Graduate School in SEM	Number of Internships Offered Undergraduate Students
Mathematics	1998-1999	33	5	2	1	3
	1999-2000	45	7	4	1	10
	2000-2001	45	8	3	1	21
	2001-2002	50	8	4	0	30
	2002-2003	52	15	10	5	18
Computer Science	1998-1999	502	110	8	10	0
	1999-2000	607	99	10	34	0
	2000-2001	726	107	11	14	4
	2001-2002	655	112	18	32	16
Industrial Technology	1998-1999	64	7	1	1	2
	1999-2000	87	9	3	3	2
	2000-2001	101	16	5	9	1
	2001-2002	106	22	9	12	2
Physics	1998-1999	24	5	3	3	2
	1999-2000	32	6	3	2	2
	2000-2001	20	11	9	7	4
	2001-2002	15	2	1	1	1
Chemistry	1998-1999	30	5	2	1	1
	1999-2000	28	4	2	0	1
	2000-2001	22	6	2	1	2
	2001-2002	25	7	3	2	2
Plant/Soil Science	1998-1999	36	6	3	2	4
	1999-2000	35	5	2	2	3
	2000-2001	37	7	4	3	4
	2001-2002	32	7	4	3	8
Biology	1998-1999	372	38	12	7	2
	1999-2000	365	52	22	10	2
	2000-2001	417	165	36	14	10
	2001-2002	420	93	30	8	10

8. Plans to Build on Project's Outcomes

This report shows that AAMU has demonstrated success with its undergraduate minor in applied statistics. The Director of the MSP, with the support of the AAMU Graduate Dean, is in the process of studying the feasibility for developing a Professional Science Masters (PSM) degree program in applied statistics. It is anticipated that a PSM will build on these successes and hence the existing undergraduate statistics minor will become stronger. The small funded grant from the Sloan Foundation (see Section 5) supports the above mentioned feasibility study. A follow-on proposal to the Sloan Foundation is under development.