Research Experiences program for Undergraduates in an Historically Black college and University.

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Abstract

Involving undergraduate students in research has been recognized as a method of developing the intellectual capacity of undergraduate student. This paper reports operation, achievements and challenges of a Science Engineering and Mathematics (SEM) Summer Research Training program, which has been in operation for over seven years at Morgan State University. The objective of this program are to (a) increase the number of students who participate in undergraduate research; (b) enhance student's learning and commitment to their studies; (c) increase the number of students attending graduate schools; (d) and provide students with professional development training. Two hundred and thirty eight (238) students have participated in the program since its inception. Out of the ninety-two participants since 1999 over 18% have gone on to graduate school.

Introduction

National concern have been expressed about the status of the U. S. science and engineering base-specifically the human talent, knowledge and infrastructure that generate innovations and under gird technological advances to achieve national objectives. Analyses have shown that there may be a significant shortage in the entry-level science and engineering labor pool, and that scientific and technical fields could be significantly affected. Demographic data show a future with proportionately fewer young people and a work force comprised of growing numbers of minorities and the economically disadvantaged. These groups, which the economy must increasingly rely, have been historically underrepresented in science, engineering and related fields. The added dimension of a projected shortage of qualified science and mathematics instructors at the pre-college and undergraduate levels could have serious consequences for the nation's scientific and technological literacy and, therefore for our capabilities to compete economically with other industrialized counties [1]. In 1990 less than 2% of the Science Engineering and Mathematics (SEM) workforce hailed from the African-American community. While African-Americans Hispanic/Latinos and American Indians comprise 23% of the U.S. population, they make up only 4.5% of those holding scientific doctorates [2]. In a report to the Maryland Higher Education Commission in March 1992, the Task force on Engineering Education wrote, "The representation of Africa-American almost disappears at the graduate level, with only 3% of all Maryland master's degrees granted in 1990 going to African-Americans. There are no doctorates awarded to African-Americans" [3].

Based on these facts a proposal with the specific objective directed at increasing the number of minority graduates prepared to effectively contribute to the U.S. SEM workforce was submitted by Morgan State University (MSU) to the Department of Defense to establish the Infrastructure Support Education Program (ISEP), National Science Foundation (NSF) and Office of Naval Research (ONR).

Morgan State University is a Historically Black College and University (HBCU), located in Baltimore, Maryland and enrolling over 6600 students. In 1988, Morgan was designated as *Maryland's Public Urban University***,** addressing the needs of the residents, schools and organizations of the Baltimore Metropolitan area. Morgan's mission is consistent with its designation and one component of its mission is **"**to enroll an undergraduate student body that is diverse in its socioeconomic characteristics and its Pre-College academic preparation. It is to educate a broad range of students, including those who are among the best prepared as well as those who might not obtain the baccalaureate without the extra support that the University provides." The University has a rich history in the sciences and has "attained national eminence among historically black institutions, especially for the production of African-American engineers," according to the Maryland Higher Education Commission (MHEC) *"Educating For the 21st Century: The Maryland Plan for Postsecondary Education* [3]."

In 1993 Morgan State University was funded through the Office of Naval Research's (ONR) Infrastructure Support Education Program (ISEP) for multifaceted intervention and outreach programs with Dr. P. Mack as the principal investigator. This grant was implemented in order to strengthen and integrate the University's science, engineering and mathematics (SEM) projects and initiatives directed at increasing the number of minority students who graduate prepared to effectively contribute to the SEM workforce. The primary objectives of the program were to:

1. To double the number of SEM degrees awarded to African –Americans from 140 to 280 in three years and to triple them in five years.
2. To achieve this by increasing the first and second year retention rates of SEM majors from 75 to 85% (1st year) and 60 –80% (2nd year) respectively
3. To maintain a 30% graduate school going rate for SEM graduates. The number which is about 10% percentage points above the National average, should have a significant impact on future industries leaders and SEM faculty
4. To increase the number of graduates in each of the SEM majors offered so as to become the largest per capita producer of African-Americans receiving the degrees in each of the fields in the MSU curriculum base.
5. To raise two year retention rate in Engineering from 1993 rate of 60% to 80% in 1996
6. To raise the number of engineering degrees awarded from 50 in 1993 to 80 in 1996
7. To graduate students from a program that incorporates a more applied, product-oriented curriculum [4].

The programs were divided into semi-distinct components; namely Pre-College, Enrichment and Support, Undergraduate Researcher/Trainee Opportunities and Faculty Development. In pursuit of the third objective the SEM Summer Research / Trainee program was started in 1994 to provide financial support to Morgan State University underrepresented minority students in science, engineering and mathematics the opportunity to gain research experience by allowing them under the supervision of a faculty member or professional scientist mentor at an industrial, governmental or

university laboratory site. The objectives of this program are:

- To increase the number of students who participate in undergraduate research.
- To enhance students' learning and commitment to their studies.
- To increase the number of students attending graduate schools.
- To provide students with professional development training.

Research in the undergraduate engineering curriculum remains a significant contributor to the educational preparation of new practitioners for an increasingly complex technical society. Continued specialization is needed to provide the basic foundations of new and emerging technologies. It is therefore, important to modify curricula continuously to incorporate more applied, product-oriented programs while maintaining the concepts of basic science, mathematics and engineering sciences. It is also important to periodically refocus the research paradigm. Today, that means a shift towards the nation's domestic welfare needs as well as global economic competitiveness. The engineering research programs at MSU have a discipline-based focus in various sub-specialties in civil, electrical and industrial engineering. However, increasing attention is being paid to cross-disciplinary studies. Our undergraduate research agenda includes increased emphasis on applied topics, including total quality management, design for manufacturing, and continuous product/process improvement with attention to client satisfaction, environmental considerations, and global economics.

During the first year, ISEP funds in this category were mainly used to support undergraduate research and traineeships at Morgan, although through ISEP interventions, there were students placed in REU (Research Experience for Undergraduate) programs at other Universities and Industrial labs with little to no matching from ISEP. A total of 20 students were supported and assisted with travel, housing and/or a stipend.

Table 1 Academia, Industry and Government Agency Participants

Participating Universities		**Participating Industries**		**Participating Government Agencies**
SUNNY Binghamton,	John Hopkins University	Hughes Space Center STX	Polygram Group Distributors	New York Department of Health
University of Wisconsin	University of Virginia	TRW	John Hopkins Hospital	Department of Defense (DOD)
Carnegie Mellon	University of Florida	EDS	Bell Atlantic	National Aeronautical Space Administration (NASA)
MIT	Princeton University	GTE	NYMA	Water Quality Management
University of Baltimore	University of South Carolina	Clorox		
University of Illinois	Morgan State University	Booz Allen & Hamilton		

During the second year, thirty-nine students were funded. There were a variety of internships funded, particularly at industrial sites. More participants were partially supported who worked in industry. Since housing cost varies from state to state and some states like California, Northern Virginia and New York can have exorbitant costs,

the students' housing was subsidized in some instances. Table 1 provides a summary of the numerous university, industry and governmental locations which participants of this program were located [4].

In 1996, the Summer Science Engineering Mathematics (SEM) Undergraduate Research/Trainee program was established at Morgan with the same objectives. The average number of participants in the SEM Summer Undergraduate Research program was twenty-six for the first four years but the number has decreased as a result of decreased funding. Table 2 provides a summary of the number of participants over the duration of the program. Although the number decreased, more financial support was provided to students in academic settings. In many cases, students were fully funded.

Table 2. SEM Undergraduate Internship/Trainee Program

Year (Summer)	# of Participants	MSU	Univ. (Other)	Industry	Government
1994	20	14	4	2	0
1995	39	3	11	20	5
1996	34	12	2	20	0
1997	30	24	4	0	2
1998	25	24	0	1	0
1999	25	25	0	0	0
2000	24	23	1	0	0
2001	18	18	0	0	0
2002	12	12	0	0	0
2003	11	11	0	0	0
Total	238	166	22	43	7

Description of the Program

The SEM Undergraduate Summer Research/Training program is a ten-week long. The participants are selected based on the following eligibility criteria:

- Underrepresented minorities who are US citizens
- Full-time student during the academic year
- At least a sophomore (25 credits or more by the end of Spring 2001 semester)
- Minimum CUM GPA of 3.0 (exceptions may be made based on the review of the applicant's last coursework and faculty recommendation)
- Show significant interest in research and participating in ongoing research.

The financial support depends on the student's academic classification. Seniors and juniors are awarded $5000 and $4000 for rising sophomores over the 10-week period. This includes a research stipend of $35 for juniors and seniors and $2500 for sophomores, and a $1500 allotment toward room and board for resident participants.

Students are required to abide by the following regulations:

- Students selected for the program may NOT enroll in summer courses.
- Students may NOT work at any other employment during the course of the program.

- Each student will be required to participate in the research training, and attend and give technical presentations throughout the program.
- Participants will be required to submit weekly journals.
- Each student will be required to prepare a written and oral final report describing the results of her/his research.
- Each student is required to participate in the research symposium once a week prior to the end of the program.
- Students not living in close proximity to the University must live on campus. On campus housing will not be provided for students living close to the University, unless there are extenuating circumstances [5].

The program is divided into two phases is shown in Table 3. The first phase, which lasts 1-2 weeks, includes a series of lectures on research methodology, technical writing (e.g. proposals, reports and papers), keeping research records in journals and effective communications. Each student presents a proposal of his/her research project during the professional Development Activity (PDA). The second phase, which lasts 8-9 weeks, involves students working on the projects under faculty supervision; weekly meetings also take place during which participants report on the progress of their research (PDA II). The titles of the projects worked on by participants since 1999 are listed in Table 4. The program ends with a one-day symposium during which students give either an oral presentation or a poster presentation. Professionals from the funding agencies and other governmental agencies attend the symposium. In 2001 the symposium was jointly organized with the Washington Baltimore Hampton Roads- Louis Stokes Alliance for Minority Participation (WBHR-LS AMP) with students from Bowie State University, Hampton University, Howard University, Norfolk State University, and University of District Columbia, Virginia State University presenting papers [6].

Table 3. 2003 SEM Summer Research Program May 27 – August 2, 2003

Week	Dates	Activities	Time/Room Assignment/ Coordinator
1.	May 27, 2003 Tuesday	Participants staying in the Hall of Residence arrive. Reception and Welcoming SEM Participants & Faculty- Mentors. Introduction to The Program by Dr. P. Leigh-Mack (PI); PDA I Research Methodology & Proposal – Journal Preparation.	9:00AM /Check –in **Male Pete Rawlings Hall; Female Harper/Tubman** 2:00 P.M./MEB 122/ **M &O**
1	May 28, 2003 Wednesday	**Effective Communication.** Meeting with mentors	9:00 AM – 12:00 Noon MEB 122/**W** **All Afternoon**
1	May 29, 2003 Thursday	Meeting with Mentors	
1	May 30, 2003 Friday.	Effective Communication	9:00 AM – 12:00 Noon MEB122/**W**

2	June 2, 2003 Monday	Effective Communication Meeting with mentors	9:00 AM –12:00 Noon MEB 122/ **W** **All Afternoon**
2	June 3, 2003 Tuesday	Meeting with Mentors PDA II Discussion of Proposal	All Morning 6:30 –8:30 P.M./ MEB 122/**O**
2	June 4, 2003 Wednesday	PDA II Discussion of Proposal	6:30 PM –8:30 PM/ **O**
2	June 5, 2003 Thursday	PDA II Discussion of Proposal	6:30 PM –8:30 PM/ **O**
2	June 6, 2003 Friday	Effective Communication	9:00 A.M –12:00 P.M. MEB 122/**O**
2	June 9, 2003 Monday	Proposal Due	12:00 Noon
3	June 10, 2003 Tuesday	PDA III Technical Paper Presentation	6:30 PM –8:30 PM MEB 122/**O**
3	June 11, 2003 Wednesday	PDA III Technical Paper Presentation	6:30 PM - 8:30 P.M MEB122/**O**
3	June 13, 2003 Friday	Journal Due	12:00 Noon SEB 317/ **O**
4	June 18, 2003 Wednesday	PDA III Technical Paper Presentation	6:30 P.M - 8:00 P.M. MEB 122/**O**
4	June 20, 2003 Friday	Journal Due	5:00 P.M MEB122/**O**
5	June 25, 2003 Wednesday	**First Draft of Report Due (Introduction, Background, Bibliography)**	5:00 P.M SEB 317/**O**
5	June 27, 2003 Friday	PDA II Discussion of Report. Journal Due.	6:30 P.M - 8:00 P.M. MEB 122/**O**
6	June 30, 2003 Monday	PDA II Discussion of Report	6:30 P.M - 8:00 P.M. MEB 122/**O**
6	July 2, 2003 Wednesday	**Preliminary Title Due**	12:00 Noon SEB 317/**O**
6	July 4, 2003 Friday	Journal Due	12:00 P.M SEB 317/**O**
7	July 7, 2003 Monday	PDA III First Presentation of Project (Group I)	6:30 PM – 8:30 PM MEB 122/**O**
7	July 9, 2003 Wednesday	PDA III First Presentation of Project (Group, II)	6:30 PM – 8:30 PM MEB 122//**O**
7	July 11, 2003 Friday	PDA III First Presentation of Project (Group I). Journal Due	6:30 PM – 8:30 PM CMEB 122//**O**
8	July 14, 2003 Monday	PDA III First Presentation of Project (Group, II)	6:30 PM – 8:30 PM CMEB 122//**O**
8	July 16, 2003 Wednesday	PDA III First Presentation of Project (Group, I) First Final Draft of Report Due	6:30 PM – 8:30 PM CMEB 126//**O**
8	July 18, 2003	PDA III First Presentation of Project	6:30 PM-8: 30 P.M.

	Friday		CMEB 122/**O**
8	July 19, 2003 Saturday	PDA III Project Presentation Final Dress Rehearsal	10.00 AM- 2.00 PM/O
9	July 21, 2003 Monday	Travel To Norfolk State University	
9	July 22, 2003 Tuesday	Symposium At Norfolk State University	
9	July 25, 2003 Friday	Symposium at Morgan State University	9.00 AM – 3.00 PM RM 241 SEB
10.	July 28, 2003 Monday	Second Draft of Final Report Due	
10.	July 30, 2003 Wednesday	PDA II Second Draft of Final Report Due	
10.	July 31, 2003 Thursday	PDA II Second Draft of Final Report.	9:00 – 12:00 Noon
10.	August 1, 2003 Friday	Final Report Due	12:00 Noon

Profile of Students

The profiles of students that have participated in the program in the last four years are shown in the tables 5 & 6. Fifty three percent of the students who have participated in program over the past five years were male, twenty five percent were sophomore, 42 % were juniors and 33% were seniors. Two percent of the students that have participated in the program in the last five years were from the civil engineering department, 87% were from the electrical and computer engineering department, 5% from industrial manufacturing and information engineering, 3% from Engineering Physics department, 3% from computer science department, 1% from mathematics department and 12% from the biology department.

Table 4. Title of Students' Project

Year	Science Project	Engineering Projects
1999	1. Analyzing Metorites Using Mossbauer Spectroscopy. 2. Magnetic Susceptibility Measurements of Species Using Mark II Balance. 3. Mathematics Profile, Placement, and Perfo Engineering Freshman. 4. Synthesis Of ß-methyltrimethylsilyl-phenylethyl Amine Hydrochlorides.	1. A new Coupled Model Of Vortex-Induced Vibration: A numerical Analysis. 2. Applying Neural Networks to Pattern Recognition. 3. Characterizing and Testing Analog Digital Converters. 4. Development and Evaluation Of Cogeneration Capability At Morgan State University (MSU). 5. Implementing The Effects Of Inelastic Behavior Into A Seismic Structural Analysis Program. 6. Design of a Broadband Amplifier Using a Small Signal Model of a Pseudomorphic High Electron Mobility Transistor (PHEMPT). 7. Digital Design Using Field Programmable

		Logic Devices. 8. Fast Fourier Transform Coding on Texas Instrument's TMS320C67x Digital Signal Processor. 9. Image Coding for the TMS320C6701 Digital Signal Processor. 10. Image Processing-using Matlab: Histogram Equalization. 11. Implementing A Virtual Office for Web-site Development. 12. Prospects for Tutorial on Powder Metallurgy Using Multimedia Web Design Tools. 13. Target Identification Using A Multiplayer Neural Network 14. The Creation and Implementation Of A Training Program for The MacAfee Helpdesk Software. 15. The Design of a Fourth Order Butterworth Bandpass Filter from a lowpass Prototype. 16. Using An Artificial Neural Network To Model A High Electron Mobility Transistor (HEMT).
2000	1. Analysis of The Meteorite Grosnaj. 2. Physical-Chemical and Enzymatic Removal of Azo Dyes: Application of Chitosan. 3. The Binding Characteristics Of P-Aminobenzoic Acid To Sulfanilamide. 4. Determining The Function Of The Refusum Diseases Gene In The *Caenorhabditis elegans*... 5. Polymerase Chain Reaction For The Detection of *Wuchereria bancrofti* in Urban Anopheles And Culex Mosquitos From Ghana. 6. The Development of *Caenorhabditis elegans* Mutant Strain dpy-5fer-1. 7. The Effects Of Sleep Deprivation On The Body Composition Of Rats. 8. The Effects Of Sleep Deprivation on Stress Activated Protein Kinase (SAPK) Activity.	1. A Model For Si/SixGel-x Heterojunction Conduction Band Edge. 2. A Systematic Optimum Design Of Waveguide-to- Microstrip Transition. 3. Calculating Current Using Neural Networks in C++ Programming. 4. Compression Of Images Using Different Basis Functions For The Discrete Wavelet Transform. 5. Design Of A Web Page For The Scientific Visualization and Semi-conductor Characterization (SVSC) Laboratory Using HTML and Java. 6. Developing A Software Package That Extracts The Intrinsic Elements Of A Small Signal Equivalent FET Model. 7. Design A Class C Amplifier Using The Angelov Model. 8. Feasibility Study of An Automated Fabricated Facility for Printed Circuit Boards. 9. Feasibility Study Of Fuel Cell Technology. 10. Image Compression Using The Discrete Cosine Transform. 11. Implementation of A 3-D Discrete Cosine Transform. 12. Microwave Enhanced Reactions Diels-Alder Reactions of various Dienes and Dienophiles. 13. The Design of A Microwave Frequency Doubler Using High Electron Mobility. 14. The Extraction Of A Nonlinear Model

		For A High Electron Mobility Transistor. (HEMT) Device.
2001	1. Assessing the Water Quality of the Patapsco/Back River Watershed to increase Public Awareness of the Impacts of land-use on Chesapeake Bay Tributaries 2. Development of Students Understanding The Function Concept. 3. Effects of Early Stressors on Abnormal Cortical Development. 4. Effects of Early Stressors on Behavior Resulting from Plasticity in Mouse Cortex. 5. Effects of Neonatal Cholinergic Lesions in Mice on Secondary Messenger Molecules in Neocortex.	1. A Scalable Graphics Cluster System On A Linux Platform. 2. A Scalable Graphics Cluster System On A Windows Platform. 3. 4-Bit Analog to Digital Converter. 4. Design and Development of Data Logger to Monitor Bacteria. 5. Design of A Class A Amplifier using A User-Defined Ebers-Moll Model. 6. Micro-electromechanical Systems Design and Analysis On IntelliSuite. Modifying The (Rc, Crf) Branch To Result In Optimal Performance Of The Angelov Model 7. The Development of a Field-Effect Transistor (FET) Small Signal Model Using TOTEX and DTEP 8. The Development of a Small-Signal Model to be used in the Development of a Broadband Amplifier. 9. The Study of Object-Oriented Modeling for Use in Developing Model Based and Executable Requirements. 10. Using Neural Networks to Incorporate Scaling Techniques to Predict I-V Curves for FETs.
2002	1. Analyzing Corrosion on Stainless Steel Implant Materials using Conversion Electron Mossbauer Spectroscopy. 2.Application to Air Quality Control of A Novel Quantitative Pyrogen Assay Based on IL-1beta Production by Human Blood 3. Characterization Of The Biological Function Of Three Expressed Genes In *Caenorhabditis Elegans.* 4. Methods For Detecting and Handling *NEW* Operator Memory Allocation Failures In C++. 5. Multi-Variant Chemometric Analysis of Major Blood Components. 6. Selection of Polymer Substrate As a Basis for a Fluorescence Resonance Energy Transfer Biological Sensor.	1. A Haptic Computer Interface for the Blind and Visually Impaired. 2. Implementation Of A User-Defined Field Effect Transistor (FET) Model In A Class A Amplifier. 3. Investigation of the Effect of Various Parameters on the Registration Process using Mutual Information. 4. The Refurbishing of An Automatic Thermal Annealer and An Evaporator. 5. The utilization of A Neural Network Model To Design solid State Power Amplifier Which Will Produce A Maximum Power Output At 10Ghz. 6. The Implementation of A KNNE Model in a Power Amplifier Design.
2003	1. Interactive Tutoring And Question Answering Systems For Closed Databases. 2. Mössbauer Resonance Effect Study Of Stainless Steel Using Backscatter Geometry. 3. Natural Killer (NK) Cells in the Pathogenesis of Perinatal and Postnatal Stress Syndrome (PPSS) In Balb/cByJ Mice. 4. Optimizing An Elisa For A Novel Assay For The Detection Of Airborne Bio-toxins. 5. Strategies For Developing Techniques To Enhance The Development Of Efficient And Rapid Programming.	1. An Investigation Of The Trends Of Output Voltages In Particular Electronic Circuits. 2. Development Of A Tutorial For Basic Circuit Analyzes Utilizing MATLAB. 3. Implementing The Effects Of Inelastic Behavior Into A Seismic Structural Analysis Program. 4. The Use Of Mutual Information For Image Registration Of Ophthalmic Images.

	6. The Effects Of HGF/SF On Dedifferentiation Of Isolated Mouse Skeletal Muscle Fibers In Vitro.	

Table 5. Profile of Students

Year	No. of Males	No. of Females	Sophomores	Juniors	Seniors	Total
1999	14	14	9	14	5	28
2000	12	12	5	12	7	24
2001	10	8	4	4	10	18
2002	6	6	4	3	5	12
2003	7	3	1	6	3	10
Total	**49**	**43**	**23**	**39**	**30**	**92**

Table 6. Students Profile by Discipline

Year	CE	ECE	IMIE	Chemistry	Eng. Physics	Computer Science	Math	Biology	Total
1999	1	18	4	4	1	-		--	28
2000	--	16	1	4	--			3	24
2001	-	12	-	1	-		1	4	18
2002	-	6		2	1	1		2	12
2003	1	4			1	2		2	10
Total	**2**	**56**	**5**	**11**	**3**	**3**	**1**	**11**	**92**

CE: Civil engineering, **ECE:** Electrical and Computer engineering; **IMIE:** Industrial Manufacturing and Information engineering;

Program Evaluation

On the last day of the program, participants are afforded the opportunity to evaluate the program. They are provided with an evaluation form covering topics such as comments relative to the content, schedule, instruction, interaction with mentors and directors and any comments they considered pertinent to any aspect of the program. Recommendations for future programs are also requested. A summary of the student's response is presented in Table 7.Some of the comments have been addressed in subsequent programs. For example the time spent on professional development have been reduced to one week so that most of the remaining nine weeks are devoted to research activities.

Table 7. Student's Evaluation of Program

A. Research project Organization and planning: 1. Student's Strongly Agreed that the mentors explained research Requirements. 2. The Students Strongly agreed that their mentor's participation was evident. 3. Students agreed that the Mentors used their time well. 4. Student's strongly agreed that their mentors were helpful.
B. Communications: 5. Student's Strongly Agreed that their mentor's instructions were clear. 6. Student's Strongly Agreed that their mentor's examples were clear. 7. Students Agreed that their mentor's use of challenging questions and/or problems was useful. 8. Student's Strongly Agreed that their mentors showed enthusiasm for the research project.
C. Mentor/Mentee Interaction:

9. Student's strongly agreed that their mentors were helpful and responsive.
10. Students strongly agreed that their mentors were respectful.
11. Students strongly agreed that their mentors were concerned for their progress.
12. Students strongly agreed that their mentors were willing to listen to the students' ideas and opinions.

D. Research Project Outcomes:

13. Students strongly agreed that they learned a lot from the project.
14. Students strongly agreed that they made progress toward achieving research goals.
15. Students Agreed that their interest in research had increased.
16. Students strongly agreed that the research actively involved them in what they had been learning.

E. Student effort and Involvement:

17. Student's strongly agreed that they put effort into their research projects.
18. Students agreed that they were prepared for each research meeting.

Students Strongly Agreed that they were challenged by the research.

F. Research project Difficulty and Workload:

19. On a Scale of 1-5, students rated the level of difficulty of the research as 1.571, with 1 being the most difficult and 5 being the least difficult.
20. Students agreed that the workload for the project was appropriate.

G. Overall Evaluation:

21. On a Scale of 1-5, with 1 being the best and 5 being the worst, the students rated the quality of instruction/assistance in the project as 1.429

H. Pre -Research Preparation:

22. Students agreed that the research methodology lectures were useful.
23. The students agreed that the Effective Communications Skills lectures were useful.
24. The students Strongly Agreed that the time devoted to pre-research preparation was adequate.
25. On a scale of 1- 5, 1 being the best and 5 being the worst, the students rated the quality of the instructors as 1.571

I. Future Goals:

26. All the students plan to attend Graduate School.

J. Presentation Skills:

27. Students mentioned an improvement in their
- Presentation Skills,
- Information gathering skills, and;
- Scientific Research and Writing

K. Student Comments:

28. During the program, Students Enjoyed
- Working with their Mentors
- Giving Presentations
- The feeling of doing something Worthwhile
- Meeting stimulating people
- Exploring their fields, and
- Learning productive skills.

29. Students Disliked:
- The issue of how small errors could greatly set back the research process
- All the meetings they were required to attend during the program
- They did not get a chance to celebrate the success of the program

30. Students believed that the program could be improved by:
- lessening the intervention of the research
- More useful meetings
- More meeting between the students to enable networking
- more Presentations
- More leisure Activities
- Better organization
- Assignments should be well explained beforehand to eliminate redundancy
- Directors should be on one accord with regard to expectations from the students.

Program Administration

The program is administered by a program director that is a faculty and an administrative assistant who is a staff or student. The program director for 1999, 2000, 2002 and 2003 has been Dr. Oguntimein while Professor Davy was the director in 2001. The administrative assistants were Ms Lila Curry 1994-1999, Elisha Duggins 2000, 2001, Adekunbi Adeyemo 2002 and Autumn Wallace 2003.

Pursuit of Graduate Studies

Seventeen participants have gone on to pursue graduate studies at Morgan state University, Howard University, University of Maryland Baltimore, George Mason University. Eight of these students are female and nine are male. Three are biology majors, three chemistry majors, one computer science major and ten electrical and computers engineering majors (Table 8).

Table 8. Number of SEM Participants in Graduate Schools

CE	ECE	IE	Biology	Chemistry	Computer Science	Eng. Physics	Mathematics	Total
-	10	-	3	3	1	-	-	17

CE: Civil engineering, **ECE:** Electrical and Computer engineering; **IMIE:** Industrial Manufacturing and Information engineering;

Conclusion

The number of participants has decreased as a result of reduced funding. The program did provide the opportunity for undergraduate students to participate in research directed by a faculty member. The activities included in the program such as maintenance of a journal, instruction in effective technical writing and a series of sessions to improve the quality of presentation of their research results certainly were in keeping with the objectives of the program enabled frequent interaction with mentors. Perhaps the best way to assess the effectiveness of the program is to analyze the comments of the participants. It is clear from these comments that the participants valued the opportunity to perform and to present their findings in a forum of their peers, mentors and the wider

academic community. One persistent comment was that the program should be extended from 10 to 12 weeks to give participants more time to round out their research efforts. Whereas some participants felt that aspects of the program could have been better organized or delivered, the prevailing sentiments suggested that they benefited very positively from the experience. In addition one of the feedback from the participants is that they have gained research and technical experience under the supervision of a faculty member, which has kindled their interest in pursuing graduate studies.

Based on data collected on graduate school enrolment eighteen percent of the students[i] who have participated in the program since 1999 have pursued graduate studies in universities the Maryland and Virginia states which is also one of the objectives of the program.

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Gbekeloluwa Oguntimein is an Associate Professor in the Department of Civil Engineering at Morgan State University in Baltimore. He is the Director of the Science Engineering and Mathematics Research Trainee program funded by The Office of Naval Research (ONR) and National Science Foundation in 2000, 2001, and 2003. Dr Oguntimein received his B.S. and Ph.D. degrees in Chemical Engineering from Iowa State University in 1974 and 1979 respectively

Pamela. Leigh-Mack
Pamela Leigh-Mack is an Associate Professor and Chair of the Department of Electrical and Computer Engineering at Morgan State University. She is the Principal Investigator of the Infrastructure Support Education Program funded by ONR, which sponsored the SEM Undergraduate Research Program for several years. Dr. Leigh-Mack received her B.S. degrees in 1980 in mathematics and electrical engineering from Virginia Union University and Howard University, respectively. She received a master's degree in electrical engineering from Howard University in 1982 and a Ph.D. in 1991 from the University of Delaware.

Bert Davy
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