EVALUATION OF THE TECHNOLOGY, ENGINEERING, MATH AND SCIENCE (TEMS) SUMMER ACADEMY 2000-2002

June 2003
Revised July 3, 2003

MONITORING AND EVALUATION SERVICES

INFORMATION
FOR

DECISION-MAKING

ALEXANDRIA CITY PUBLIC SCHOOLS

Evaluation of the Technology, Engineering, Math and Science (TEMS) Summer Academy 2000-2002

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ALEXANDRIA CITY PUBLIC SCHOOLS

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EXECUTIVE SUMMARY

The present evaluation report provides a description of the Technology, Engineering, Math and Science (TEMS) Summer Academy program in the Alexandria City Public Schools (ACPS) which has been offered to rising 7th through 9th grade students since the summer of 2000. The objective of the TEMS Summer Academy is to expand the awareness of potential scientific, technical, engineering and mathematical career opportunities among minority and female students, while promoting their ability to enter and complete higher-level, post-secondary programs in mathematics, science, engineering and technology. The TEMS Summer Academy provides participants with a 'co-curricular' introduction to science and technology, by combining mentorships, business and college partnerships, career-guidance, and hands-on science activities with classroom instruction in science, mathematics and computer technology.

Data for the evaluation were collected from program documentation, staff surveys, interviews and reviews of student records. The focus of the evaluation was upon an assessment of four key aspects of the TEMS Summer Academy: Implementation (including staffing, student selection, facilities, and the curriculum), Community and Business Partnerships, Student Participation and Achievement, and Cost Analysis.

Major findings of the study were as follows:

The TEMS Summer Academy promotes comparative performance gains in the areas of student attendance and achievement in mathematics and sciences.

TEMS participants had decreased mobility, suspension and infraction rates, when outcomes for two cohorts of participating students were compared with those of a matched control group of non-participating students.

The TEMS program has been highly successful in developing community and business liaisons. The program encourages the active involvement of the community, parents, businesses and professional associations.

Student selection efforts should be carried out in a more systematic manner. Suggestions for changes in recruitment strategies are outlined.

There is a need for a local program evaluation to assess the program's effectiveness with regard to college enrollment and employment in science and technology career tracks.

Justification for the program's mission is supported by a persistent achievement gap between minority and non-minority students, both in the ACPS and nationwide, on standardized tests of achievement in mathematics and science.

The report concludes with eleven recommendations based upon the analysis of program features.

INTRODUCTION

The purpose of the present report is to provide an evaluation of the Technology, Engineering, Math and Science (TEMS) Summer Academy for middle school students. The TEMS Summer Academy was developed four years ago at the initiative of the Secondary Training and Education (STEP) Crisis Center Director, Mr. John Nunn, with Alexandria City Public Schools (ACPS) central office administrative endorsement. The TEMS Summer Academy program was designed to foster middle school student achievement in the areas of mathematics, science and technology among students traditionally under-represented in applied science and technology careers. The report provides administrators and policy makers with a description of the TEMS program and an assessment of its impact on academic performance of participating students.

BACKGROUND OF THE TEMS SUMMER ACADEMY

The TEMS Summer Academy was conceived with the objective of expanding the awareness and accessibility of scientific, technical, engineering and mathematical career opportunities among minority students traditionally under-represented in these fields. The premise on which the TEMS program was founded is that the discrepancy in student achievement and career advancement in the sciences and technical fields persistent among minority students can be effectively addressed by means of enrichment programs designed to expose minority students to 'real life' applications of science, mathematics, engineering and technology. Thus, the mission of the TEMS program is long-term: to increase the pool of historically under-represented students in these fields, as well as to promote their ability to enter and complete higher-level post-secondary programs in mathematics, science, engineering and technology. The TEMS Summer Academy is designed to provide participants with a unique, 'co-curricular' introduction to science and technology careers, by combining mentorships, business and college partnerships, career-guidance, and participatory science activities in conjunction with classroom instruction in each of the four core areas of instruction.

The initial inspiration for the TEMS Summer Academy grew from the positive experiences of several ACPS sponsored students who attended the TRIO Math/Science program offered to high school students at Howard University in Washington, D.C. during the summers of 1998 and 1999. During the 1999-2000 school year, Mr. John Nunn, director of the ACPS STEP Crisis Center, envisioned a similar school-based program for middle school (7^{th} and 8^{th} grade) minority students. Start-up funding was obtained by Mr. Nunn with support from Maxine Wood, Assistant Superintendent for Educational Programs of the ACPS Central Office, in conjunction with donations from the Metropolitan Consortium for Mathematics, Science, and Engineering (METCON) Program of Howard University College of Engineering, Architecture and Computer Sciences, and the National Society of Black Engincers.

Specifically, the TEMS Summer Academy aims to:

1. encourage student exploration of career opportunities in the fields of computer technology, engineering, mathematics and science;

2. develop and extend student competencies in mathematics, science, engineering and computer technology;

3. improve student performance on standardized tests of mathematics and science and college entrance exams; and

4. increase the number of minority and female students preparing to pursue post-secondary training in technology, engineering, mathematics and science fields.

The TEMS Summer Academy has evolved into a five-week summer program, organized into a set of sequential modules ('theme weeks') in computer technology, environmental science, robotics, rocketry, and careers (career-shadowing and mentorships) in conjunction with cooperating businesses, trade associations, universities, and guest speakers from both local and national engineering, business, science and technology fields.

METHOD OF THE PROGRAM EVALUATION

The program evaluation was designed to both describe and assess the effectiveness of four general features of the TEMS Summer Academy (its implementation, community partnerships, student participation and achievement, and cost analysis) by examining whether expected indicators appropriate to such areas are in evidence. A template summarizing the evaluation objectives and methods is included in Appendix A.

Data collection consisted of the acquisition and analysis of program documents submitted by the Program Director (public relations materials, grant applications, curriculum blueprints, financial reports) in addition to student records. Interviews of program staff and school principals supplemented these analyses. Staff interview protocols can be found in Appendix B.

Student records provided demographic, and special education services information, in addition to records of academic achievement, attendance, infractions, suspensions and student mobility.

The evaluation of TEMS student achievement made use of an ex post facto 'yoked control' design for the purpose of comparing the academic achievement of TEMS participants with a suitable comparison group. Non-participating controls were 'yoked' (matched on demographic and socioeconomic features) to a TEMS participant by school attended, grade level, ethnicity, and services status (English as a Second Language (ESL), Talented and Gifted (TAG), and Special Education). It was then possible to make between-group comparisons on factors of student achievement and other indicators of school performance.

The four program features which served as the focus of the evaluation are described below:

Implementation

The evaluation of program implementation was designed to assess the extent to which the program meets its stipulated objectives. Implementation pertains to both appropriate staffing, student selection, suitability of physical environs, program distinctiveness, consistency of the curriculum with program needs and ACPS/DOE standards, the presence of a local evaluation program, and the availability of staff training.

Community and Business Partnerships

This section assessed whether the program encourages involvement of the community, parents, businesses and professional associations, and whether such involvement is consistent with program goals and stipulations.

Student Participation and Achievement

Student attendance, improvements in student achievement, and academic advancement indicators for participating students were compared to those of a control group of non-participating students matched by gender, ethnicity, grade-level, school, services, and meal status).

Cost Analysis

This portion of the report summarized budget specifications, financial reports, fund-raising efforts, and per-pupil expenditures. The evaluation also addressed whether elements of the program duplicate services delivered through other programs.

RESULTS OF THE PROGRAM EVALUATION

In the following section, findings of the assessment of four focal areas of the evaluation are discussed.

I. Implementation

The analysis of the implementation of the program addressed stipulated objectives for staffing, student selection, the suitability of physical environs, the consistency of the curriculum with program needs as well as assessing whether ongoing evaluation and staff training were being implemented. These issues are taken up in turn.

A. Staffing

Is staffing appropriate to the attainment of program requirements?

The TEMS Summer Academy has been designed to provide four curricular 'modules' each day (computer science, careers, mathematics, science) over the course of the five-week program. The half-day program was staffed in 2000 and 2001 by a part-time program coordinator, and three part-time teachers. During the summer session of 2002, the program expanded to become a full-day summer academy. Over the past three sessions, administrative tasks such as public relations and fund-raising, recruitment, establishment of community liaisons, arrangements for field-trips, and record-keeping have been accomplished by the Program Director. In addition to the Program Director, there are four teaching staff members.

The Program Director stated that, as the program expanded to accommodate an increasing number of students (from 38 in 2000 to 64 in 2002), the administrative tasks grew in magnitude, and pointed to the need for re-allocation of a portion of such duties to the teaching staff. While the reassignment of administrative responsibilities has been of help in reducing the amount of time spent on such tasks by the Program Director, he articulated a need for an additional part-time administrative assistant for assistance in the management of program administration, recruitment, record-keeping and communications.

All teachers in the TEMS Summer Academy have been required to have a Virginia teaching certification in their fields. Both Mathematics and science teachers are required to have experience teaching a range of course levels. Mathematics teachers must be able to teach higher-level mathematics (algebra through trigonometry and calculus). Science teachers must be able to teach physics, environmental science, and biology. The computer science teacher must have experience teaching fundamentals of computer engineering in addition to computer programming and keyboarding. The career guidance teacher is expected to have training in the area of communications in addition to a career guidance background.

The Program Director has specified that the optimal staff/student ratio for the program is 1 teacher to 12 students, enabling the program to accept approximately 60 students per session at current staffing levels. In practice, the instructional/student ratio has ranged from a low of 1:6 during the 2001 half-day session to 1:16 during the 2002, full-day session overall.

B. Student Selection

Is the student selection process equitable?

In assessing whether the program was accessible to all eligible students, three cohorts of students who have participated in the TEMS Summer Academy are described in this section, with an analysis of recruitment and selection following the description of participants.

Description of TEMS Summer Academy Participants

Tables I, II, and III provide a description of the three cohorts of TEMS program participants enrolled during the summers of 2000 through 2002. As can be seen by comparison of these tables, program participation has increased since 2002, when the full-day session was instituted.

Table I. TEMS Participants
Summer 2000

Males	18 (47.4%)
Females	20 (52.6%)
Am. Indian/ Pacific Islander	1 (2.6%)
Asian	2 (5.3%)
Black	23 (60.5%)
Hispanic	8 (21.1%)
White	4 (10.5%)
Francis C. Hammond	13 (34.2%)
George Washington	25 (65.8%)
Rising 7th Grade	19 (50.0 %)
Rising 8th Grade	18 (47.4%)
Rising 9th Grade	1 (2.6%)
ESL Services	3 (7.9%)
Special Education	8 (21.1%)
TAG	7 (18.4%)
F/R Meals	22 (57.9 %)

Table I describes the participants enrolled in the first TEMS Summer Academy in 2000. During the first year, 38 ACPS students participated in the program. The male to female ratio was roughly equal with 18 males (47.4%) and 20 females (52.6%). Most of the initial cohort (hereafter referred to as Cohort I) of TEMS participants attended George Washington Middle School (65.8%), while 34.2% were enrolled at Francis C. Hammond Middle School. Fifty percent of the participants in Cohort I were rising 7th grade students, 47.4% were rising 8th grade students, and there was one rising 9th grade student.

Twenty-three of the Summer 2000 participants were black (60.5%), four were white (10.5%), eight were Hispanic (21.1%), two were Asian (5.3%) and one student was American Indian/Pacific Islander (2.6%). Twenty-two of the participants in Cohort I received free or reduced-price meals (57.9%), three were ESL students (7.9%), eight were Special Education students (21.1%) and seven were enrolled in the TAG program (18.4%).

Table II. TEMS Participants
Summer 2001

Males	17 (68.0%)
Females	8 (32.0%)
Asian	2 (8.0%)
Black	13 (52.0%)
Hispanic	6 (24.0%)
White	4 (16.0%)
Francis C. Hammond	16 (64.0%)
George Washington	9 (36.0%)
Rising 7th Grade	9 (36.0%)
Rising 8th Grade	16 (64.0%)
ESL Services	3 (12.0%)
Special Education	2 (8.0%)
TAG	7 (28.0%)
F/R Meals	17 (68.0%)

Table II depicts the participants enrolled in the second TEMS Summer Academy of 2001 (Cohort II). There were 25 ACPS students enrolled in the program during its second summer session. The male to female ratio of participants was over 2:1 in favor of males (68.0% male, 32.0% female). The majority of students in Cohort II were enrolled at Francis C. Hammond Middle School (64.0%), while 36.0% came from George Washington Middle School. Thirty-six percent of the participants in Cohort II were rising 7th grade students, while 64.0% were rising 8th grade students.

Thirteen of the participants in the 2001 TEMS summer academy were black (52.0%), four were white (16.0%), six were Hispanic (24.0%) and two were Asian (8.0%). Seventeen of the participants in Cohort II received free or reduced-price meals (68.0 %), three were ESL students (12.0%), two were Special Education students (8.0%) and seven were enrolled in the Talented and Gifted (TAG) program (28.0%).

Table III. TEMS Participants
Summer 2002

Males	43 (67.2%)
Females	21 (32.8%)
Asian	10 (15.6%)
Black	38 (59.4%)
Hispanic	11 (17.2%)
White	5 (7.8%)
Francis C. Hammond	34 (53.1%)
George Washington	30 (46.8%)
Rising 7th Grade	8 (12.5%)
Rising 8th Grade	27 (42.2%)
Rising 9th Grade	29 (45.3%)
ESL Services	15 (23.4%)
Special Education	4 (6.3%)
TAG	11 (17.2%)
F/R Meals	17 (26.6%)

Table III describes the 64 participants enrolled in third TEMS Summer Academy held in 2002 (Cohort III). The male to female ratio was once again over 2:1 (67.2% male, 32.8% female). Thirty of the TEMS participants in Cohort III came from George Washington middle school (46.8%), while thirty-four students were enrolled at Francis C. Hammond (53.1%). During the 2002 summer academy, eight of the participants were rising 7th grade students (12.5%), 27 (42.2%) were rising 8th grade students, while twenty-nine students (45.3%) were rising 9th grade students.

Thirty-eight of the participants were black (59.4%), five were white (7.8%), eleven were Hispanic (17.2%) and ten were Asian (15.6%). Seventeen of the participants in Cohort III received free or reduced-price meals (26.6%), fifteen were ESL students (23.4%), four were Special Education students (6.3%) and eleven were enrolled in the Talented and Gifted (TAG) program (17.2%).

Summary of Student Participation

The assessment of student participation began with an assessment of the process by which students become aware of the program, and then focused upon the process of student selection. The Program Director described both elements in detail.

The Program Director reported that he recruits TEMS Summer Academy applicants in the spring of the school year, by e-mailing all mathematics and science teachers at George Washington and Francis C. Hammond Middle Schools, and offers to make an in-class presentation of the program in each class. However, the response rate to the e-mail communication has historically been only about 15% to 20% of science and mathematics teachers according to the Program Director, and thus only a minor proportion of science and mathematics classes are provided with the program overview each year.

After the program presentation has been completed in the science or mathematics classes, students are provided with a brief 'interest survey' which is filled out by the student and returned to the Program Director. The Program Director then sends the student an application form, along with a stamped, self-addressed, return envelope, and a parent letter explaining the nature of the program to the parent. Each applicant is required to submit a counselor and teacher recommendation, and to write a statement of interest in exploring a mathematics, science, technology or engineering career. The Program Director subsequently contacts each applicant by telephone, and interviews the student about his or her interest in the program.

The Program Director stated that most students appear to become aware of the program through 'word of mouth', as well as by virtue of flyers posted around the schools in spring. Mr. Nunn opined that, while there should be improvement in the teacher-referral process, Standard of Learning Assessment preparation in the spring seems to be a commonly cited reason for teachers not to elect to host a TEMS presentation in their classes.

While the program prospectus describes an objective to recruit students by systematic means (e.g. program pamphlets stipulate that middle school students must have a GPA of 2.0, that ninth grade students must have a GPA of 2.5, and that qualified applicants will be identified on the basis of standardized test scores, grades, courses taken, and teacher recommendations), the Program Director reports that, in actual practice, no student who has expressed interest has yet been turned down for participation in the TEMS Summer Academy.

Student selection and recruitment has clearly not been optimally implemented to ensure equal access to the program by students who might by interested in and advantaged by the program. Should a more systematic selection process result in an excess of applications (over 60), the selection process can implement its stated requirements for GPA (2.0 for middle school, 2.5 for 9th grade) in addition to increasing selectivity with regard to teacher-recommendations and an assessment of interest in the science and technology fields which takes into account student academic performance in these curricular areas (grades in science, mathematics, etc.)

Ideally the recruitment of students for the TEMS summer program would be more aligned with program specifications with more systematic recruitment in middle schools in late fall or winter (avoiding classroom interference with SOL review for eighth grade students), and less reliance upon 'word of mouth' recruitment, which may have affected the (initially, equal) ratio of male to female participation highly in favor of male students over the past two sessions. The comparative loss of female to male membership since the first year of the program is a development which merits scrutiny, since female participation is an important goal of program implementation. Should changes in recruitment methods fail to restore the balance of male to female participation in the future, an analysis of curricular strategies by gender may better serve to clarify potential means by which to encourage female participation.

It would seem preferable to mail announcements to students in each of the middle schools during the late fall or winter. A large-group, multi-media presentation (perhaps including former students) in a special school assembly in the auditorium, preferably well in advance of spring SOL reviews (optimally, in late fall or early winter) would allow adequate time for students to become involved and/or for a more systematic selection process to ensue. Interest forms could be disseminated and collected during this meeting. It is also suggested that principals play a role in announcing and endorsing the program and recruitment efforts during the school-wide presentation.

C. Physical Environs and Facilities

Are the physical environs suitable for meeting program requirements, including reasonable growth?

During the 2002 TEMS summer academy, the program made use of four classrooms at the Minnie Howard School (one classroom functioned as the TEMS program office), the school auditorium, and a computer laboratory. All of these facilities, therefore, meet ACPS approved building and safety standards. The program involves three to four field trips per week. Two buses were used for field trips during each of the scheduled events.

The physical environs seem to be entirely suitable to meet the program's curricular requirements, including reasonable growth. The number of instructional areas needed by the program (3 adjacent classrooms, a computer laboratory, an office, and access to the auditorium) are sufficiently available during the ACPS summer school session.

D. Distinct Program Characteristics

Are there identifiable program characteristics which make it distinct from other school programs?

The curriculum of the ACPS TEMS program was developed by the Program Director, Mr. John Nunn, who combined elements of the curricula from similar secondary school programs (e.g. the Maryland Mathematics, Engineering, Science Achievement Program (MESA) sponsored by the Johns Hopkins University Applied Physics Laboratory in Laurel, Maryland, and the SECME[1] program, a three-week residential program for secondary school students sponsored by the N.K. Kellogg Foundation, and the Bill & Melinda Gates Foundation) These programs are geared to secondary school students, and link colleges of Engineering with public school systems, government agencies, and corporate sponsors throughout the country to promote leadership in mathematics and science among under-represented youth.

The career guidance and college preparation activities of the TEMS program are well integrated with the program's unique objective of promoting advancement in the science and technical fields. Creative programming, which makes use of community and business liaisons to provide students with mentoring and job-shadowing experiences, is one of the distinguishing characteristics of the program.

The TEMS Summer Institute is not the only ACPS sponsored program which promotes student achievement through business liaisons, mentoring and internship programs (e.g. The Summer Economics Institute promotes career planning and knowledge of marketing economics through paid internships for rising seniors). However, the TEMS program is distinguished by its focus on technology and science-related careers, and its targeting of minority middle-school students.

Students enrolled in the TEMS program take an active role in the learning process. Curriculum objectives are approached with 'hands-on' and 'team-oriented' workshops and cooperative problem-solving activities. Recreational activities (e.g. riding a roller-coaster at a theme park) often supplement hands-on activities which convey scientific and engineering principles. Curricular objectives are additionally addressed through the engagement of students in making video 'careers' productions which encourage students to integrate mentorships and job-shadowing experiences with knowledge of options in higher education, and of the relevance of secondary school academics to careers in the technology and science fields.

As distinct as the ACPS TEMS Summer Academy is, a survey of principals conducted in the spring of 2003 suggests that system-wide awareness of the program has been limited, with summer school principals on site being most knowledgeable about the program. It is suggested

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[1]SECME was originally an acronym for Southeastern Consortium for Minorities in Engineering but is now a nationally syndicated program which continues to use the name.

that the TEMS staff make a special effort to invite principals, as well as guidance counselors and parents, to the school-based recruitment presentations in order to familiarize them with the opportunities this program affords to ACPS students.

E. Curriculum

Is the curriculum consistent with program needs, and does it meet ACPS, VADOE standards?

The TEMS Summer Academy is a unique, five-week enrichment program designed to boost minority student achievement within the ACPS school division in the mathematics, science, and technology disciplines among middle school and beginning high school students. Its goals and defining characteristics are consistent with national and state-wide efforts to close the 'achievement gap' among females and selected minority students. Its curricular objectives are specifically aligned with the blueprints for Virginia Standards of Learning reporting categories in mathematics (inclusive of Grade 8 Mathematics, Algebra I, Algebra II, and Geometry), science (inclusive of Grade 8 Science, Earth Science and Chemistry), and Computer/Technology. TEMS curricular objectives also converge with selected reporting categories of the Secondary English Writing Standards of Learning. These curricular objectives are approached in a participatory, rather than 'receptive' fashion, through hands-on, team-oriented projects.

The curriculum is additionally consistent with the goals of Career and Technical Education insofar as the program combines academics and exposure to the workplace environment through job shadowing, in order to prepare students for success in the workplace. Each summer academy curriculum varies from year to year in implementation of the core curricular objectives, as it is developed by instructional staff members around the summer schedule of available activities (following the finalization of field trips, available guest speakers, institutional and college tours and other planned applied science excursions).

Specific curricular objectives were set forth in the TEMS Summer Academy of 2000 prospectus and are listed in the following section.

Curricular Objectives of the TEMS Summer Academy

Algebra

Discovery and description of patterns
Discovery and representation of variables and their relationships
Construction of tables and graphs of relationships using graphics calculators
Making connections between tables and associated graphs
Solution of algebraic equations and identification of equivalent expressions.

Data Analysis

Organization of data in meaningful ways
Description and summary of data with both quantitative and graphic/visual measures
Use of technology to construct visual presentations of data
Data analysis and interpretation

Probability

Listing the outcomes of single-stage and multi-stage random experiments
Collection and use of appropriate data to find experimental probabilities
Use of reasoning skills to determine theoretical probabilities
Determination of experimental and theoretical probabilities
Recognition of pairs of independent and non-independent events

Geometry

Description, classification, and construction of plain and solid figures
Application of transformation to geometric figures
Identification of applications of transformations

Aerospace Science and Math

Determination of acid and neutral bases of everyday material by analysis
Identification and plotting of points using x and y coordinate grids
Construction of model demonstrating longitude and latitude lines to find geographic locations on earth
Observation, comparison of compounds to distinguish separation processes of different solvents
Observation that light can be separated into the color spectrum, use of diffraction grating; comparison and contrasting of light sources
Application of metric system to reading of various measurement devices; calculation of volume areas and density
Research on historically or scientifically significant comets
Creation of model ellipses to study mathematical properties of actual orbits
Comparison and contrasting of aerogel and aerogel-lo

Environmental Science

Develop knowledge of science and technology pertinent to the appreciation of the interaction of environment, economy and society toward the protection and improvement of the environment
Develop knowledge of the scientific method with emphasis on data collection, analysis and synthesis on environmental topics and problems, and development of related decision-making and communication skills
Application of scientific method and knowledge toward the solution of environmental problems

Computer Technology

Development of basic computer skills
Processing, storage, retrieval and transmittal of electronic information.
Communication through application software
Communication through networks and telecommunications
Comprehension of computer processing, storage, retrieval, and transmission technologies

English Language Skills

Development of interviewing techniques for information gathering
Preparation and development of interview questions
Compilation and organization of notes for the development of oral reports. English: Writing Skills
Practice in a variety of writing formats including narrative, expository and persuasive writing
Use of pre-writing strategies
Use of standard sentence formation
Editing of final drafts
Use of technology in production and presentation of written products

Research Skills

Use of technology to access research materials on a variety of topics
Use of library and media resources for research and analysis

The schedule of available activities forms the basis of the sequence of curriculum planning around four 'Theme Weeks'. Teachers are requested to develop hands-on group and individual activities designed to encompass SOL reporting categories applicable to their disciplines. Staff have reported that the demand of organizing five weeks of novel hands-on group activities is a yearly challenge requiring much planning and reliance upon program funds for the procurement of kits and other materials. To assist staff in these objectives, it is suggested that TEMS Summer Academy teachers organize a planning consultation with ACPS Curriculum Specialists in Mathematics, Science and Computer Technology, and with the Director of Vocational and Technical Education, for the purpose of keeping abreast of new developments in hands-on, SOL-aligned activities well in advance of each summer academy session. The instructional staff also integrate the learning opportunities for students provided by invited guest speakers and presenters at local sites (e.g. Challenger Space Center, Air and Space Museum, Dike Marsh) where topics and activities augment classroom curriculum objectives.

Through donations and funding, the TEMS program has purchased a number of instructional building kits and software (Lego Robotix, Connex building materials, digital camera, camcorder, graphics calculators) in support of the hands-on curriculum. The use of such materials is consistent with the most recent National Council of Teachers' recommendations for the use of 'manipulatives' in the teaching of mathematics.

Class Sessions and 'Theme Weeks'

The schedule of class sessions has been organized to enable three groups of students (approximately 20 per group) to rotate through three classes of 45 minutes duration. Students usually took part in an all-day field trip one day per week.
A sample schedule of course offerings taken from the 2002 TEMS Summer Academy is provided below:

Time	A	B	C	D
7:40 - 9:00	Computer	Math	Career	Science
9:05 - 10:40	Math	Career	Science	Computer
10:55 - 12:25	Career	Science	Computer	Math
12:30 - 1:50	Science	Computer	Math	Career

Snack Times: 8:40 - 9:00, 11:40 - 12:00

The following narrative account of weekly activities of the five"Theme Weeks" of the 2002 TEMS Summer Academy was provided by the Program Director, and is included here to further illustrate the integration of the academic and career-guidance curriculum:

Week One: Robotics and Team Building

"The program focus for the first week was Team Building and Robotics. In mathematics, the students learned the various functions of graphing calculators and participated in a tallest structure-building contest with drinking straws. The science classes began building and programming robots in production teams, with individuals assigned specific responsibilities as team members. The computer classes discussed retrieving information from the Internet and began developing multi-media presentations on robotics. Damien Lynch from Gibbs School came to the Career Guidance classes to discuss interviewing skills and how to develop a resume. Career Guidance students also participated in career assessment inventories to help them identify possible career opportunities. Mr.William Euille of the William Euille Foundation spoke to the students about education and starting and operating a business."

Week Two: Aerospace Week

"This week the TEMS program focused on careers in Aerospace. On Tuesday July 16th, students and staff visited the National Air and Space Museum. Students were given questions to answer about exhibits displayed in the museum. In addition, students were assigned to groups to work together on developing a group presentation on different Aerospace topics. On July 17th Dr. Horace Jones of Advanced Resources Technologies Inc. spoke with the students about his information technology business. He spoke about the traits of successful individuals and how he

got started in business. Mathematics classes built and designed rockets; each class was divided into launch teams with responsibilities for rocket design, measuring the distance the rockets travel and rocket recovery. Students in computer technology designed story boards and began constructing personal web pages. In science, the classes continued building and programming robots and started construction on model spacecraft. The science classes also competed in a game of Space Jeopardy using information discussed during the week and information gathered on the trip to the National Air and Space Museum. Career Guidance classes worked on career research in Aerospace and began to discuss terminology related to college in preparation for a field trip to George Mason University."

Week Three: Marine Science

"The science classes viewed videos on marine life in preparation for the field trip to the National Aquarium in Baltimore. Students visited Howard University, where they had the opportunity to visit a laboratory and to participate in a discussion with representatives from the admissions office. We visited with students in the Howard University TRIO Mathematics and Science program for rising 10th and 11th grade students. The TRIO Program is a residential program in which students spend six weeks doing hands-on projects, developing academic skills, and gaining insights into what it will take to pursue careers in mathematics and science. The students from Howard University encouraged our students to apply for the program."

"On Monday, all seventh grade students went on a tour of the FBI building in Washington, D.C. On Tuesday, the eighth grade students had an opportunity to tour the FBI building. The FBI tours focused on how technology is being used to solve crimes. Wednesday, representatives from the National Society of Black Engineers discussed various engineering careers and their Pre-College Initiative (PCI) program for students interested in pursuing engineering careers. Career Guidance classes worked on their career portfolios and prepared questions for the trip to George Mason University. All students visited George Mason University School of Information Technology and Engineering. We toured the campus, met with the Dean of the IT&E School, had lunch, and participated in hands-on engineering workshops. Representatives from Civil Engineering, Electrical Engineering, and Systems Engineering discussed their programs with our students. We were treated to an ice cream social before leaving campus."

"On Thursday, the Parson Transportation Group discussed the impact of the Wilson Bridge project on the community. They discussed the engineering jobs involved, the cost, and the impact on the environment. Friday we went to the National Aquarium in Baltimore, MD. We saw a dolphin show and heard a discussion about dolphin behavior and protecting their habitat. The students were placed in groups of three to fill out information forms on various exhibits. Mathematics classes continued working with graphing calculators and worked on the construction of a geodesic dome. Students were required to work on a section of the dome during their class time, and then leave written directions for the next class. The dome was constructed out of newspaper and tape. Computer technology classes completed personal web pages, and began designing career brochures."

Week Four: Environmental Science

"This week, the TEMS program focused on the Potomac Watershed in Environmental Science. The staff decided to start work on the civil engineering roller coaster project as well, because they were concerned about completing the project in time for the closing program. Mathematics classes developed business groups to bid on contracts to build sections of the roller coaster. Roller coaster construction went well this week, student groups are working hard at designing and building their roller coaster. Student groups went out on the Potomac River on Monday, Tuesday and Wednesday, where they collected specimens, conducted experiments, and discussed the Potomac Watershed. On Tuesday, the Fairfax County Water Treatment Authority visited TEMS to discuss the process of water purification. Career Guidance classes prepared questions for upcoming job shadows and completed career portfolios on Marine and Environmental Science. Students went on job shadowing to the following businesses and organizations:

Association of National Chain Drug Stores
Comcast Cable, Inc.
NBC Studios
National Credit Union
Time Life, Inc.
Mind and Media, Inc."

Week Five: Civil Engineering

"This was the final week for the TEMS program. Monday, TEMS went to Six Flags of America to study the physics of rides. The focus for this week was to complete projects for the closing program. Mathematics classes completed roller coaster construction and prepared mathematics presentations on practical uses of the graphic calculator. Science classes prepared robotics demonstrations and completed construction of model spacecraft. Computer technology classes completed career brochures and designed TEMS tee shirts with technology, engineering, mathematics and science themes. Career Guidance completed career portfolios."

"On Tuesday, guest speakers from the National Oceanic Atmospheric Administration (NOAA) discussed their mission, and conducted workshops on practical uses of global positioning systems (GPS). Our students used GPS equipment to communicate with satellites and to measure distances to various locations."

"Thursday was the closing program, held in the Minnie Howard School Cafeteria. Several parents, job shadow hosts, sponsors and central office staff were in attendance, including Mr. Huey Battle, Vice President of Community Affairs for Washington Gas, Mr. William Euille, Vice Mayor of Alexandria, and President of the Euille Foundation, Dr. Horace Jones, C.E.O. of Advanced Resource Technologies, Inc, Ms. Mollie Danforth, ACPS School Board, Ms. Barbara Hunter, ACPS Executive Director of Information and Outreach, Mr. Mat Pasquale, ACPS Director of Career, Technical and Community Education, and Ms. Carolyn Buckenmaier, Executive Director of Elementary and Middle School Programs. Volunteers were presented with certificates of appreciation and several students were recognized for outstanding performance in their participation in this year's program."

Summary of Curriculum Implementation

Both the instructional content and the schedule of field trips planned for the TEMS Summer Academy has been developed with the objective of motivating and boosting achievement among participants in the mathematics, science, and technology disciplines. The curriculum addressed nine specific curricular objectives (algebra, data analysis, probability, geometry, aerospace science and mathematics, environmental science, computer technology, English language skills, and research skills). Of notable absence from the list of curricular objectives in science is any reference to biology. The inclusion of biology in the TEMS summer curriculum would be of value for three reasons: First, as a goal of the program is advanced science course selection, it would seem logical that the kindling of student interest in the subject of biology would be of benefit. Secondly, biology is an important foundation for many careers and advanced programs in the sciences. Finally, Standards of Learning objectives for biology (e.g. scientific investigation, the study of life at the systems, organisms, molecular and cellular levels, and the study of interaction of life forms) are relevant to the environmental science component of the TEMS curriculum.

In reviewing the narrative of the Theme Week activities, it would appear that the eclectic TEMS schedule of activities and field trips does not always succeed in reflecting stated themes of the week. For instance, the FBI field trip on technology in criminology was scheduled during Marine Sciences theme week, and roller coaster design occurred during Environmental Sciences theme week. Greater coherence between stated objectives and activities might be accomplished by discontinuance or modification of the Theme Week approach to curricular organization.

According to recent reports from the U.S. Bureau of Labor Statistics, three fourths of the projected growth in labor through 2010 will arise through professional careers in computer and mathematical occupations, health care practice and related health technologies, and education-training and library occupations. While the emphasis of the TEMS curriculum on the promotion of student interest in and preparedness for careers in science and technology is justifiable in light of the occupational outlook for this area, the curriculum could easily be broadened to promote interest in the health care and related technological fields. Among service occupations, healthcare support occupations are also expected to grow the fastest, with job increases of about 33%[2].

F. Local Evaluation

Is a local program evaluation conducted on a regular basis?

The TEMS staff report having instituted the administration of pre-tests and posts-tests to participants in three subject areas (computer science, mathematics, and science). However,

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[2] Information is taken from the 2003 Occupational Outlook Handbook, U.S. Department of Labor, Bureau of Labor Statistics, Washington, D.C.

records of such testing have not been rendered for purposes of a local program evaluation as analyses of test results have not been systematically conducted. While a local evaluation of student progress is advisable, the use of a pre-test/ post-test design in the context of the TEMS program may not be the optimal framework for such an evaluation, due to the likelihood of pre-test threats to the internal validity of such research[3]. As will be discussed in the conclusion of the present report, the pre-post design may further fail to detect potential long-term effects of such enrichment programs on student performance.

The program has recently developed, in preparation for the 2003 TEMS Summer Academy, a self-report questionnaire which can be used before and after participation to gain insight, in a more qualitative fashion, into the effects of the program on participants. A copy of this questionnaire is included in Appendix C. Future evaluation efforts will benefit most from long-term follow-up of TEMS participants with respect to graduation rates, college attendance, choice of college major, and/or vocational experiences. Only a long-term follow-up of TEMS participants will reveal to what extent the goals of this program (to increase the proportion of under-represented students in science and technology careers and to promote their enrollment in institutions of higher learning in the sciences, in engineering fields, and in technology-related careers) have been attained.

Staff report that a 'reflective meeting' takes place at a local restaurant after the conclusion of the program. During this time of reflection, an informal review of the 'ups and downs' of the program are discussed, with the objective of improving program development for the following season. Such dialogical approaches to program evaluation, if somewhat unsystematic, are nevertheless rare and commendable, and these efforts exemplify the genuine commitment of TEMS Summer Academy staff members to the success of the program.

G. Staff Training

Is there a staff training program? How is it implemented?

All staff selected by the Program Director meet certification requirements, are experienced, creative and resourceful teachers. However, no staff-training appears to be built into the program other than the training provided by vendors of manipulatives (e.g. Lego Robotix) purchased with program funds. As mentioned in an earlier section, and in light of the rapidly changing nature of the technology and applied science fields, the TEMS staff would undoubtedly benefit from taking advantage of all ACPS staff development opportunities within their teaching specialties, as well as from opportunities to meet with ACPS Curriculum Specialists for consultation on a yearly basis. Future staff would likewise benefit from access to curricular planning and materials of prior staff. Thus, it is recommended that an archive of teaching materials and lesson plans be compiled by teaching staff at the conclusion of the Summer Academy program each year.

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[3] Pre-test threats to the validity of outcome findings commonly occur when the exposure of participants to a pre-test interferes with or modifies the effect of the program on participants.

Summary of Program Implementation

The TEMS Summer Academy presently employs four teaching staff and a Program director, and serves approximately 60 to 65 students during the five-week summer program. The program is organized around four curricular 'modules' (computer science, careers, mathematics, science). The half-day program was staffed in 2000 and 2001 by one part-time program coordinator, three part-time teachers and a part-time administrative assistant. During the summer session of 2002, the program expanded to become a full-day summer academy, with four teachers, a Program Director, and no administrative assistant. All administrative tasks have fallen to the Program Director for the past two years, and there is a need for a part-time administrative assistant.

The assessment of student participation revealed a need for a more systematic, school-wide recruitment plan in order to ensure that all eligible students are aware of the program, and to encourage the participation of female students, whose participation has fallen by 50 percent since the first year of the program.

The program is housed in the ACPS Summer School site, and makes use of four classrooms, the school auditorium (special events only) and a computer laboratory. All of these facilities meet ACPS approved building and safety standards.

The program is distinct in providing enrichment opportunities in mathematics and science to under-served middle school and ninth grade students. The program employs a hands-on, team-oriented approach to learning which successfully combines liaison activities with local colleges of engineering, community and government programs, national engineering societies, and corporate sponsors to promote leadership in mathematics and science among students traditionally under-represented in those fields. It is recommended that the scope of the curriculum include topics in biology and activities related to health care and pharmaceutical technologies for which occupational growth is anticipated.

The Summer Academy has instituted no formal local evaluation. It is suggested that a student database be maintained and updated on a yearly basis to track graduates of the program throughout the completion of their high school programs, and thereafter on a 5 year follow-up basis, to determine college attendance and completion in addition to career histories. It is advisable that a follow-up evaluation of student progress be conducted by means of telephone interviews as well as by review of student graduation and guidance department records.

Finally, it is suggested that staff maintain an archival book of lesson plans and resources for the purpose of orienting future staff, and that a staff training plan be developed for each staff member. It is recommended that TEMS Summer Academy faculty members hold a pre-session consultation with ACPS Curriculum Specialists, and that a portion of program funds be allocated for staff development each year.

II. Community and Business Involvement

Does the program involve non-staff parent and community members? Is there an increase in community partnerships/funding associated with the program?

One of the distinguishing characteristics of the TEMS program has been the liaisons forged by the Program Director with professional organizations in the community, with local universities, and with business and civic groups. The TEMS program staff realizes that the academic performance of its students will be fostered through participation in such partnerships. Following their participation in community activities and events, students prepare a 'careers' presentation for the edification of other students in the program. The following is a list of community activities described in program literature:

- Mentorship opportunities from local technology and engineering firms.
- Involvement in local and national residential college-preparatory programs in math, science, technology and engineering.
- Participation in Mathematics, Science, Technology and Engineering internships.
- Part-time employment at local engineering/technology firms.
- Bimonthly after-school and Saturday educational opportunities (workshops on college, financial aid and employment application processes).
- Academic monitoring and support
- Guidance and academic counseling.
- Standardized test preparation.
- Affiliation with local and national engineering associations.
- Enrichment activities (career fairs, field trips, convention attendance).

Parents chaperone frequent field trips, and those with professional experience in applied scientific, technical or business fields are solicited as guest speakers for the TEMS Summer Academy programs. From the start of the program, community members and business groups have taken an active and continuing role in curricular development and are kept informed of relevant activities of the program.

There has been an increase in community partnerships and funding associated with the program, particularly during the 2001 Summer Academy, when $11,000.00 in donations was provided to

the TEMS program by local businesses and professional organizations. Over the past four years, $28,500.00 has been donated to the program by local businesses and foundations for the purpose of funding extra-curricular activities such as field trips, student conference attendance, materials and equipment. Contributors listed by the Program Director include the following organizations:

The William Euille Foundation
Advanced Resource Technologies, Inc.
Metropolitan Consortium on Engineering, Mathematics and Science (METCON)
Women in Technology
Simpson Development Group
Parsons Transportation Group
Howard University College of Engineering, Architecture and Computer Science

In summary, the TEMS Summer Academy program has developed successful and ongoing business and community liaisons which have been instrumental in supporting the program's objectives both financially and educationally.

III. Student Participation and Achievement

In order to evaluate the academic achievement of TEMS Summer Academy participants, academic records available for Cohort I (summer 2000 participants) and Cohort II (Summer 2001 participants) were analyzed by comparison to the performance of a control group drawn from a three-year database of ACPS student records provided by the ACPS Department of Information and Technology Services.

Each participating TEMS student enrolled in Cohorts I and II was 'yoked' (matched on a number of identifying characteristics) to a non-participating 'control' student. The evaluation of TEMS student participation and achievement addressed a series of evaluative questions about student progress, each of which is discussed in the following section.

The tables on the following pages provide the description of TEMS participants and controls by gender, school of enrollment, grade level, and demographic factors. Student performance outcomes (post-TEMS) are presented in Tables VI and IX for cohorts I and II, respectively.

Table IV. TEMS Cohort I
Participants Enrolled Summer 2000 and Controls
Demographic Comparison

	TEMS PARTICIPANTS: N=38	CONTROL GROUP: N=38
Males	18 (47.4%)	18 (47.4%)
Females	20 (52.6%)	20 (52.6%)
FCH	13 (34.2%)	13 (34.2%)
GW	25 (65.8%)	25 (65.8%)
Rising 7th Grade	19 (50.0 %)	19 (50.0 %)
Rising 8th Grade	18 (47.4%)	18 (47.4%)
Rising 9th Grade	1 (2.6%)	1 (2.6%)
ESL	3 (7.9%)	3 (7.9%)
Special Ed	8 (21.1%)	8 (21.1%)
TAG	7 (18.4%)	7 (18.4%)
F/R Meals	22 (57.9 %)	22 (57.9 %)
White	4 (10.5%)	4 (10.5%)
Black	23 (60.5%)	23 (60.5%)
Hispanic	8 (21.1%)	10 (26.3%)
Asian	2 (5.3%)	1 (2.6%)
Am. Indian/ Pacific Islander	1 (2.6%)	0 (0.0%)

In order to compare the academic performance of TEMS participants to a group of students similar in every respect other than their TEMS experience, a control group of subjects was selected through a database search to match by gender, school attended, grade level, ESL, Special Education, TAG, and meal status, as well as by ethnicity, each of the TEMS participants. As shown in Table IV, TEMS students were matched with control students such that the characteristics of the two comparison groups was as close as possible on all relevant features. Chi Square analysis of differences between the experimental (TEMS) group and the control group yielded no significant differences between the two groups on any feature.

Table V. TEMS Cohort I
Participants and Controls Enrolled Summer 2000
Baseline School Performance Information

	TEMS Participants	Control Group
Attendance 99-00 (in days)	173.1 (38)	169.3 (38)
GPA 99-00 (based on a maximum of 4.0)	2.40 (32)	2.12 (27)
Average Math Grade 99-00	2.21 (34)	1.93 (27)
Average Science Grade 99-00	2.58 (31)	2.15 (27)
Average Language Arts Grade 99-00	2.67 (30)	2.14 (28)
Average Per/Student Infractions/Suspensions prior to TEMS Program 99-00	0.66 (38)	0.68 (38)

Table V. permits comparison of the first participating TEMS group (Cohort I) with yoked controls on the averages of measures of six student performance areas at the end of the academic year preceding the TEMS Summer Academy of 2000. Frequencies in parentheses indicate the number of students within each group for whom records were available in the database.

As indicated in Table V, TEMS Cohort I participants differed slightly from the control group in the area of attendance (TEMS participants attended approximately four more days of school than did controls), and across all academic subjects (the TEMS Summer Academy attracted students with slightly higher performance histories in mathematics, science, and language arts courses as well as on overall GPA. The TEMS participants also had, on average, slightly lower infraction/suspension rates when compared to controls. None of these differences in baseline performance measures was statistically significant.

Table VI. TEMS Cohort I
Participants and Controls Enrolled Summer 2000
Comparison of Post-TEMS Academic Performance Indicators

	TEMS Participants: N=38	**Control Group:** N=38
Improved GPA	89.5% (34)	86.8% (33)
Improved Attendance 00-01	68.4% (26)	60.5% (23)
Higher Math Taken 00-02	28.9% (11)	26.3% (10)
Higher Science Taken 00-02	36.8% (14)	26.3% (10)
Improved Math Grade Yr 1	29.6 (8/27)	40.0 (10/25)
Improved Math Grade Yr 2	55.6% (5/9)	33.3% (3/9)
Improved Science Grade Yr 1	16.7% (5/30)	25.9% (7/27)
Improved Science Grade Yr 2	9.1% (1/11)	27.3% (3/11)
Improved Language Arts Yr 1	22.2% (6/27)	29.6% (8/27)
Improved Language Arts Yr 2	27.3% (3/11)	27.3% (3/11)
Dropped Out of School (W08 or W09)	2.6% (1/38)	5.3% (2/38)
Retention 00-02	10.5% (4/38)	18.4% (7/38)
Mobility (any withdrawal code)	10.5% (4/38)	13.2% (5/38)
GPA 00-01	2.49 (38)	2.35 (38)
GPA 01-02	2.28 (35)	1.87 (36)
Average Attendance 00-01	174.4 (38)	167.3 (38)
GPA in Mathematics 00-01	2.18 (28)	2.03 (29)
GPA in Mathematics 01-02	2.36 (11)	1.82 (11)
GPA in Science 00-01	2.15 (33)	2.07 (29)
GPA in Science 01-02	2.54 (13)	1.93 (14)
GPA in Language Arts 00-01	2.67 (30)	2.14 (28)
GPA in Language Arts 01-02	2.32 (28)	2.34 (29)
Infractions 00-01	1.20 (35)	1.78 (36)
Suspensions 00-01	0.46 (35)	1.06 (36)

Table VI on the preceding page shows the performance of TEMS Cohort I participants in comparison to the control group in academic and other school performance indicators during the 2000-2001 school year, following the participation of the TEMS Cohort I in the 2000 Summer Academy program. Second-year comparisons are also depicted in Table VI for selected performance indicators (grades in mathematics, science, language arts, and overall GPA) for students whose grades were available during the 2001-2002 school year.

As can be seen in Table VI, there were small but consistent differences between TEMS Cohort I participants and control group students across nearly all outcome measures of school performance. Most of the participants in the TEMS Summer Academy of 2000 (89.5%) showed improvements in overall GPA during the 2000-2001 school year, a slight increase over that of the control group (86.8%), and 68.4% of TEMS participants (compared to 60.5% of the control group) attended more days of school during the 2000-2001 year than during the previous year.

More TEMS participants took higher mathematics and science courses during the year following their participation in the program than did controls (28.9% of TEMS participants took Algebra I or Geometry after completing the TEMS Summer Academy as compared to 26.3% of controls, and 36.8% took either Chemistry, Biology, or Earth Science, as compared to 26.3% of controls).

There was a slight difference between the control group and the TEMS participants on the percentage of students with improved mathematics and science grades during the first year after the TEMS program (2000-2001) with 29.6 % of the TEMS participants earning higher grades in mathematics, as compared to 40% of the control group during 2000-2001. Additionally, 25.9% of the control group earned higher science grades during the 2000-2001 school year, as compared to 16.7% of TEMS participants. Similar results were found for language arts, with 29.6% of control group students earning higher grades compared to 22.2% of TEMS participants. However, it should be kept in mind that more TEMS Cohort I participants took higher science and mathematics courses than did the control group.

TEMS participants evidenced more improvement in the area of mathematics (55.6% of TEMS participants improved in mathematics during the second year following TEMS participation) as compared to control group students (33.3% of controls showed improved mathematics grades in 2001-2002). The two-year follow-up of improvement in science showed more of the control subjects had improved science grades (27.3%) in 2001-2002 than did TEMS participants (9.1%), but these performance differences should be evaluated in light of the fact that more TEMS participants elected to take higher-level mathematics and science courses .

A comparison of GPA averages in academic courses between TEMS participants and controls indicates that TEMS participants earned higher grades in mathematics, science and language arts during the year following TEMS Summer Academy of 2000 as compared to those in the control group. Following their TEMS involvement, the average GPA in mathematics for participants was 2.18, as compared to a GPA of 2.03 for controls. In science during the 2000-2001 school year, TEMS participants had an average GPA of 2.15 as compared to 2.07 for controls. The language arts average for TEMS participants was 2.32 in 2000-2001 as compared to an average GPA in Language Arts of 1.82 for controls. However, none of these differences was statistically significant.

The differences seen between TEMS students and controls in science and in mathematics during the second year after the TEMS 2000 Summer Academy were larger than for the previous year, indicating that TEMS students persisted in making greater relative progress in mathematics and science over time. The average GPA in mathematics was 2.36 for TEMS participants, as compared to an average GPA of 1.82 for non-participants. Similar results were seen in Science courses, in which TEMS participants earned an average GPA of 2.54 compared to and average Science GPA of 1.93 for the control group. A two-year follow-up performance in language arts indicated that the control group had slightly higher average GPA (2.34) when compared to TEMS participants (2.32), indicating that the achievement differential was specific to the fields of mathematics and science.

Finally, as indicated in Table VI, TEMS participants had, on average, fewer infractions (1.20) when compared to that of the control group (1.78), and less than half the average number of suspensions (0.46) in comparison to controls (1.06) during the 2000-2001 school year. Moreover, the mobility of TEMS participants was lower (10.5% withdrew from school as compared to 18.4% in the control group), the drop out rate of TEMS participants was half of the rate for the control group during the 2001-2002 school year (2.6% vs. 5.3%), and the retention rate for TEMS participants was 10.5%, compared to a retention rate of 18.4% for the control group during the same period.

While the sizes of outcome performance differences between TEMS participants and controls were too small to reach statistical significance, the first cohort of TEMS participants consistently out-performed controls across nearly all school performance indicators. While TEMS participants had higher performance indicators prior to their participation in the Summer Academy, their performance should be evaluated in light of their selection of a greater number of higher-level mathematics and science courses following their TEMS Summer Academy participation.

The second group of TEMS participants took part in the TEMS Summer Academy of 2001. The outcome for this cohort of students during the following academic year was likewise examined by means of comparison to a yoked control group. Participants in the Summer Academy of 2001 are referred to as the TEMS Cohort II.

Table VII on the following page depicts the demographic comparison of Cohort II of TEMS participants in comparison with the control group.

Table VII. TEMS Cohort II
Participants and Controls Enrolled Summer 2001
Demographic Comparison

	TEMS Participants N = 25	Control Group N = 25
Males	17 (68.0%)	17 (68.0%)
Females	8 (32.0%)	8 (32.0%)
GW	9 (36.0 %)	9 (36.0 %)
FCH	16 (64.0 %)	16 (64.0 %)
Rising 7th Grade	9 (36.0 %)	9 (36.0 %)
Rising 8th Grade	16 (64.0 %)	16 (64.0%)
Rising 9th Grade	0 (0 %)	0 (0 %)
ESL	3 (12%)	3 (12%)
Special Ed	2 (8.0%)	2 (8.0%)
TAG	7 (28.0%)	7 (28.0%)
F/R Meals	17 (68.0%)	17 (68.0%)
White	4 (16.0%)	4 (16.0%)
Black	13 (52.0%)	13 (52.0%)
Hispanic	6 (24.0%)	6 (24.0%)
Asian	2 (8.0%)	2 (8.0%)
Am. Indian/ Pacific Islander	0 (0.0%)	0 (0.0%)

TEMS students enrolled in the Summer Academy of 2001 were matched by gender, school of attendance, grade level, ESL, Special Education, TAG and meal status, and by ethnicity with control students drawn from the students enrolled at the same period of time, as depicted in Table VII above.

As indicated in Table VII, the balance of demographic characteristics was the same for both groups, and a Chi Square analysis of group differences yielded no significant differences between the two groups in terms of demographic characteristics.

Table VIII. TEMS Cohort II
Participants and Controls Enrolled Summer 2001
Baseline School Performance Information

	Tems Participants N = 25	Control Group N = 25
Attendance 00-01 (in days)	178.2 (25)	170.0 (25)
GPA 00-01 (based on a maximum of 4.0)	2.89 (25)	2.6 (25)
Average Math Grade 00-01	2.50 (24)	2.45 (22)
Average Science Grade 00-01	2.61 (23)	2.43 (21)
Average Language Arts Grade 00-01	2.76 (21)	2.40 (20)
Infractions/Suspensions 00-01	0.88 (25)	0.44 (25)

Baseline school performance indicators for Cohort II of 25 TEMS participants, and 25 controls, is depicted in Table VIII. TEMS Cohort II participants differed slightly from the control group in the area of attendance (TEMS participants attended approximately eight more days of school than did controls), and across all academic subjects (the TEMS Summer Academy attracted students with slightly higher performance histories in mathematics, science, and language arts courses as well as on overall GPA).

The TEMS participants had a higher average number of infractions or suspensions (.88) when compared to the control group (.44). None of the differences in baseline performance measures between participants and controls was statistically significant. However, as had been true during the previous year, the students choosing to participate in the TEMS 2001 Summer Academy were slightly higher across nearly all school performance indicators than were controls prior to their participation in the program.

Table IX. TEMS Cohort II
Participants and Controls Enrolled Summer 2001
Comparison of Post-TEMS Academic Performance Indicators

	TEMS Participants: N = 25	**Control Group:** N = 25
Improved GPA	44.0% (11/25)	40.9% (9/22)
Improved Attendance 01-02	20.0% (5/25)	40.9% (9/22)
Higher Math Taken 01-02	4.0% (1/25)	8.0% (2/25)
Improved Math Grade Yr 1	33.3% (7/21)	37.5% (6/16)
Improved Science Grade Yr 1	28.6% (6/21)	27.8% (5/18)
Improved Language Arts Yr 1	19.0% (4/21)	35.0% (7/20)
Dropped Out of School (W08 or W09)	0.0% (0/25)	0.0% (0/25)
Retention 01-02	4.0% (1/25)	0.0% (0/25)
Mobility (any withdrawal code)	4.0% (1/25)	8.0% (2/25)
Average Attendance 01-02	164.9 (25)	159.1(25)
GPA 01-02	2.81 (25)	2.18 (25)
GPA in Mathematics 01-02	2.50 (25)	2.24 (25)
GPA in Science 01-02	2.64 (25)	2.16 (25)
GPA in Language Arts 01-02	2.67 (24)	2.40 (20)
Infractions 01-02	0.52 (25)	0.68 (25)
Suspensions 01-02	0.20 (25)	0.23 (25)

Table IX shows the performance of the 25 TEMS Cohort II participants in comparison to the control group on academic and other school performance indicators during the 2001-2002 school year.

Forty-four percent of participants in the TEMS Summer Academy of 2001 showed improvements in overall GPA during the 2000-2001 school year, a slight increase over that of

the control group (40.9%). The number of students in the control group who had better school attendance during the 2001-2002 school year (40.9%) was higher than for TEMS participants (20.0% had better attendance after the TEMS Summer Academy). However, TEMS participants attended an average of six days more during the school year (164.9 days) than controls (159.1). While relatively more controls showed improvements in mathematics and language arts during the 2001-2002 school year, more TEMS Cohort II participants improved in science (28.6%) as compared to the control group (27.8%). Nevertheless, TEMS participants earned higher grades in mathematics, science, and language arts, and had earned a higher GPA overall during the year following TEMS Summer Academy of 2001 as compared to those in the control group.

Following their TEMS involvement, the average GPA in mathematics for participants in Cohort II was 2.50, as compared to a GPA of 2.24 for control group students. In science during the 2001-2002 school year, TEMS participants had an average GPA of 2.64 as compared to 2.16 for controls. The language arts average for TEMS participants was 2.67 in 2001-2002 as compared to an average GPA in Language Arts of 2.50 for controls.

In the non-academic school performance areas, TEMS participants also out-performed controls with a lower average rate of infractions (.52 as compared to .68 for controls), and a lower suspension rate (.20 as compared to .23 for the control group). Finally, as indicated in Table IX, TEMS participants had a lower mobility rate (4.0%) in comparison to that of controls (8.0%) by the end of the school year.

As had been true for Cohort I, the sizes of outcome performance differences between TEMS participants and controls were of insufficient magnitude to reach statistical significance. Nevertheless, the second cohort of TEMS participants consistently out-performed controls across most school performance indicators (both before and after their TEMS Summer Academy participation).

Summary of Student Achievement

In summarizing the evaluation of TEMS student performance as reflected in the results of the post-hoc control group comparisons for both Cohort I and II, the following questions can be addressed:

Is the TEMS program successful in increasing the number of advanced academic courses in mathematics and sciences taken by participants?

The evidence from Cohort I indicates that a greater percentage of TEMS participants in Cohort I took higher mathematics and science courses than did matched controls. Among Cohort II participants and controls, either no differences or minimal differences were found between participants and controls.

Is the TEMS program successful in improving the performance of its participants as indicated by overall GPA?

TEMS participants in both Cohorts I and II earned higher overall GPAs than did matched controls. Furthermore, a two year follow-up of Cohort I TEMS participants indicated that the performance advantage of TEMS participants as compared to controls had increased further during the second year of observation, suggesting that TEMS participants persisted over time in maintaining their academic advantage. It must be born in mind that the TEMS Summer Academies of 2000 and 2001 attracted students with slightly higher overall GPA averages when compared to matched controls.

Is the TEMS program successful in improving student performance in mathematics and science courses?

TEMS participants in both Cohorts I and II earned higher grades in mathematics and science than did controls following their TEMS experience. Furthermore, the performance differential between the two comparison groups in the areas of mathematics and science increased during the second year for Cohort I participants, more of whom took higher level courses in mathematics and science.

Is the TEMS program successful in improving student attendance?

TEMS participants in both Cohorts I and II attended more school days on average than did matched controls during the academic year following the TEMS Summer Academy. Findings suggest that TEMS participants were more engaged in the learning process before their TEMS experience, and remained so after their experience in the program.

Is the TEMS program successful in increasing the percentage of participants who remain in school?

TEMS participants in both Cohorts I and II had lower overall mobility rates than did matched controls, and those in Cohort I had a lower drop-out rate than did matched controls. There were no reported drop-outs among either participants or controls in Cohort II during the 2001-2002 school year.

Is the TEMS program successful in reducing the number of infractions and suspensions per student?

TEMS participants in both Cohorts I and II had a lower average number of infractions and suspensions during the academic year following their participation in the TEMS program as compared to matched controls.

IV. Cost Analysis

How much does the program cost to operate? Are the costs of the program justified?

The program was funded in FY 2001 through the ACPS summer school program as a half-day program with three instructors, a clerical support staff member, and a Program Director. The program expanded in FY 2003 to become a full-day program with four instructors and a Program Director. Table X on the following page provides an overview of budget allocations and fund-raising revenues of the TEMS program since its inception in 2000.

Table X. TEMS Summer Academy Funding 2000-2003

Fiscal Year	ACPS Budget Allocation	TEMS Fund-Raising Revenue
2000		$5,000.00
2001	$23,071.00	$8,000.00
2002	$23,952.00	$11,500.00
2003	$34,980.74	$4,000.00
2004	$53,603.00	

TEMS revenue report for Fiscal Year 2000 indicates that $5,000.00 was raised during this time from the Euille foundation and the Simpson Group. These funds were initially used to sponsor four ACPS secondary students who were admitted to the summer TRIO engineering program sponsored by Howard University.

A budget report for Fiscal Year 2001, when the TEMS Summer Academy program commenced, shows allocations of $23,071.00. These funds were utilized for part-time teaching and staff director salaries, including benefits and costs of transportation services, travel, printing and binding, public carriers, student awards, instructional supplies and refreshments. FY01 budget reports indicate that the program received these requested funds, and additionally raised $8,000.00 during this year from donations from Howard University (METCON).

During Fiscal Year 2002 a proposed budget submitted to ACPS Budget Dept. estimated costs at $23,952.00 for the half-day program. TEMS revenue during this time was $11,500.00 raised from donations by private corporations and foundations: the Euille Foundation, Parsons Transport, Simpson Development Group, Calvert Social Investment, Advanced Resource Technologies, Howard University and NACDS.

Budget reports for FY03 indicate an ACPS budget allocation of $34,980 74 for support of salaries, benefits and instructional supplies. The program raised an additional $4,000.00 this year from three donors (Advance Resource Technologies, the Euille Foundation, and the Simpson Development Group). This was the year in which the program expanded to become a full-day program serving 64 students.

Budget reports for FY04 indicate that ACPS has allocated funds in the amount of $53,603.00 for the 2003 TEMS Summer Academy. At the end of FY03, the TEMS revenue report listed $4,000.00 in unspent funds from the prior year's donations.

As can be seen in Table X, the program has raised approximately $28,500.00 toward costs over the four years of its operation. The cost of the program remained steady for the first two years, after which the program expanded from a half-day to full-day program. This was justified on the basis that frequent field trips and time needed for completion of student projects had resulted in staff often working full-time but receiving only part-time funding in FY01 and FY02. When the full-day program was funded for FY03, the enrollment more than doubled (from 28 ACPS students to 64), such that per pupil expenditures actually were reduced.

While the program's operating costs have increased during its four years of planned operation, the program has always operated within budget guidelines, as no cost overruns have been noted. The TEMS program operating costs for the many enrichment activities it provides has relied upon corporate donations in addition to ACPS funding. New or continued corporate donations must be sought if the program is to continue providing enrichment activities (field trips, conference attendance and travel expenses for students attending out of state conventions) at comparable levels in the future. Per pupil expenditures by ACPS for FY04 are approximately $893.38 per student for the five-week, full day program with an estimated enrollment of 60 students.

The TEMS Summer Academy is justified by the need to provide a summer enrichment program for the purpose of closing the achievement gap in the areas of mathematics and sciences among minority students, and by a long-term need to increase the number of traditionally under-represented students prepared to enter the job market in an increasingly technical world. The TEMS curricular objectives are consistent with Virginia Standards of Leaning as well as those of Career and Technical Education. Nevertheless, the program avoids duplication of services by providing a strategic and innovative approach to the promotion of educational excellence and by encouraging the often untapped potential of historically under-served youth.

CONCLUSIONS

The present evaluation report has been designed to provide administrators and policy makers with a first-time description and evaluation of the Technology, Engineering, Math and Science Program (TEMS) developed four years ago at the initiative of an ACPS employee, Mr John Nunn, the director of the Secondary Training and Employment (STEP) Crisis Center. The TEMS program was designed to promote achievement in the areas of mathematics, science and technology among students traditionally under-represented in applied science and technology careers.

The evaluation focused upon four program features: Implementation, community and business partnerships, student participation and achievement, and cost analysis. The analysis of student achievement employed a post-facto yoked-control design, in which TEMS student performance outcome could be compared with that of a comparable cohort of students who did not participate in the program.

Results of the analysis of program implementation indicated that staffing needs were being sufficiently met for the operation of the full-day program with the exception of the need for a part-time administrative assistant to assist with recruitment, program planning and fund-raising. In addition, local program evaluation would be assisted with the availability of staff resources for database development, particularly in light of the fact that success of the program's objectives of increasing employment and college attendance in the science and technology fields cannot be evaluated without staff resources to conduct follow-up research on participant achievement over time.

Student selection efforts should be carried out in a more systematic manner, and suggestions for changes in recruitment strategies have been outlined. The program's curriculum is consistent with program needs and ACPS/DOE standards. Opportunities for staff training and consultation with ACPS curriculum specialist staff should be encouraged among TEMS teaching staff, as is the institution of local evaluation designed to evaluate the program's effectiveness with regard to college enrollment and employment in science and technology career tracks.

The TEMS program has been successful in developing community and business liaisons, as a result of the Program Director's partnerships with Alexandria City Chamber of Commerce, local university science and technology programs for secondary students and membership in the Junior National Society of Black Engineers. The program encourages the active involvement of the community, parents, businesses and professional associations in a manner consistent with program objectives. The maintenance of existing community and business liaisons, and the development of new funding sources are an integral part of the program's implementation, as many of the unique enrichment opportunities afforded by this program (eg. student travel to conventions, science supply kits, instruments and technical equipment) are made available through fund-raising efforts. The ability of the Program Director to maintain and develop such business and community partnerships will be facilitated by the availability of a part-time office assistant to support other administrative functions of the program.

While the magnitude of effects was not sufficient to reach statistical significance, the analysis of student participation and achievement suggests that the TEMS Summer Academy attracts and promotes student performance gains in the areas of student attendance and student achievement in the sciences. In addition, findings indicated that the TEMS participants had decreased mobility, and decreased suspension and infraction rates, when outcomes for two cohorts of participating students were compared with those of a matched control group of non-participating students.

Results of cost analysis over the past four Summer Academy sessions indicated that per-pupil expenditures from budget allocations were within ACPS guidelines for Summer School programs. The program's objectives with its targeted student population are unique to the ACPS system, and it does not unnecessarily duplicate other, pre-existing services. Moreover, there is sufficient evidence of student performance gains to suggest the program's overall effectiveness in promoting academic achievement, and increasing engagement in the areas of science, mathematics and engineering, in a population of students for whom opportunities in these fields have been scarce.

Justification for the program's mission can also be found in the well-known achievement gap seen in the ACPS and nationwide on standardized tests of achievement in mathematics and science. The Standards of Learning results for the 2000-2002 school year may serve to illustrate the disparity in academic performance between minority and non-minority students within the ACPS. In light of the No Child Left Behind statewide accountability system which mandates that all subgroups of students (including minorities, those with limited English proficiency, and Special Education students) meet 58.4% passing rates for mathematics, the need to develop new strategies to boost mathematics achievement is a high priority for the ACPS system.

On the ACPS Grade 8 mathematics SOL results, the passing percentage for white students was 85% in 2002, while only 46% of black students and 54% of Hispanic students passed the Grade 8 mathematics SOLs. For students taking high school mathematics SOLs, 2002 results showed a similar achievement gap for minority students. On the 2002 EOC Algebra I SOL, 89% of white students passed while only 60% of black students and 61% of Hispanic students did so. Results for EOC Geometry SOLs indicated that 84% of white students, but only 56% of black students, and 58% of Hispanic students passed the test.

In the area of science performance, the unadjusted passing percentage for white students on the Grade 8 science test was over 93 percent in 2002, while the passing percentages for black and Hispanic students were 70% and 64%, respectively. The EOC Earth Science results for 2002 indicated that 76% of white students 41% of black students, and 36% of Hispanic students earned passing scores in order to receive verified credit for the high school courses taken in these subjects.

The unadjusted passing percentages for minority students on the ACPS Grade 8 Computer/ Technology SOL results[4] indicate that, while over 91% of white students passed these tests during the 00, 01, and 02 administrations, only 64% of black students and 57% of Hispanic students did so.

The TEMS Summer Academy seeks to ensure that all students are mathematically and scientifically literate so that each will be able to function in an increasingly technological world. It seeks to ensure that students can use vocabulary of science to gather data, apply and use scientific methods toward the solution of complex problems. The curriculum is designed to familiarize students with the basic instruments of technology and their application as labor-enhancing tools.

The Career Counseling program ensures that all students understand the process of college applications and the avenues to pursue in the financing of a college education. In the spirit of education reminiscent of John Dewey's vision for American youth, the TEMS program shifts education in the mathematics and sciences from a 'transmission' to a 'participation' approach in which the student is less of a spectator and more of a participant in concrete educational activities. The TEMS Summer Academy aims to accomplish this objective by successfully involving the local university, city government and business communities in the ACPS student's summer experience.

The TEMS program has been an enrichment program developed with the vision to successfully implement alternative approaches to advancement in the sciences and technical fields for students traditionally under-represented in these careers. In 2004, the first group of TEMS participants will graduate from high school. It is recommended that a local program evaluation be conducted to follow the career and higher educational choices made by TEMS participants at this time. While the initial evaluation of student achievement indicates students are making progress in the direction of program objectives, it is expected that the TEMS Summer Academy will achieve long term gains in college attendance and employment areas. Pending the results of follow up research, the TEMS Summer Academy program may well serve as a model to other school divisions in providing a novel approach to the effort to boost minority achievement in mathematics and sciences.

[4] The Computer/Technology SOL test has since been discontinued.

SUMMARY OF RECOMMENDATIONS

1. There is a need for a part-time administrative assistant for assistance in the management of program administration, recruitment, record-keeping, and follow-up assessment of student outcomes.

2. Student selection and recruitment strategies must be revised to occur in a central location (middle school auditorium) in late fall or early winter, with follow-up recruitment efforts (posters, pamphlets) in the spring. Recruitment must be optimally implemented to ensure equal access to the program by all targeted students who might be interested in and advantaged by the program.

3. The relative loss of female to male membership since the first year of the program merits scrutiny, as female participation is an important goal of program implementation. Should changes in the recruitment methods fail to balance the male:female ratio in the future, an analysis of curricular strategies by gender may serve to clarify potential strategies for encouraging female participation.

4. Because system-wide awareness of the program has been limited, it is suggested that the TEMS staff make a special effort to present an overview of the TEMS Summer Academy in an early Fall Secondary Principal's meeting, in addition to inviting principals to the school-based recruitment presentations in order to familiarize them with the opportunities the program affords to ACPS students.

5. It is suggested that TEMS Summer Academy teachers organize a planning consultation with ACPS Curriculum Specialists in Mathematics, Science, Computer Technology and Vocational and Technical Education in late fall for the purpose of developing new hands-on, SOL-aligned activities well in advance of each summer academy session. Such early planning sessions will allow optimal time for ordering of materials.

6. New TEMS teaching staff would benefit from access to curricular planning and materials of prior staff. Thus it is recommended that an archival book of lesson plans and resources be developed at the conclusion of the Summer Academy programs on a yearly basis, and that these records be maintained by the Program Director.

7. A plan for yearly local evaluations should be developed in consultation with the Office of Monitoring and Evaluation in order to verify that program goals are attained. A student participant database should be maintained and updated on a yearly basis to track the progress of graduates of the program through the completion of high school programs. At the time of matriculation or withdrawal, a follow-up survey of student outcome should be conducted to determine the student's status in terms of high school graduation, college acceptance rate, and employment status. It is suggested that follow-

up be conducted both by means of telephone interview as well as by review of student graduation and guidance records.

8. The program must also demonstrate the success of its long-term mission: to increase the numbers of its participants entering post-secondary training programs in the science engineering and technical fields. It is suggested that a brief yearly report summarizing student outcomes be produced for the purpose of providing the ACPS and funding sources with an assessment of the program's effectiveness in fulfilling its mission.

9. The maintenance of existing community and business liaisons, and the development of new funding sources must remain an integral part of the program's implementation plan, as many of the unique enrichment opportunities afforded by this program (e.g., student travel to conventions, science supply kits, instruments and technical equipment) are made available primarily through fund-raising efforts. Program resources must be allocated toward this objective.

10. It is recommended that staff and selected participants of the ACPS TEMS Summer Academy develop a multimedia program presentation for the purpose of public relations both within and without the ACPS community. The program should be developed and promoted by the ACPS as a model to other school districts in providing a novel approach to the effort to boost minority achievement in mathematics and sciences.

11. It is recommended that, in light of recent projections for job growth in the heath care, pharmaceutical, and related health-technology fields that the TEMS curriculum be expanded to promote interest in and preparedness for the advanced academic training required for such occupations.

Appendix A
Program Evaluation Template

Program Goal	Expected Outcomes and Activities	Indicators	Data Sources
1. Program Implementation Is the implementation of program meeting stipulated objectives?	Appropriate staffing to meet program requirements?	1.Assess available number of staff by content area needs. 2. Assess credentials/certification or other suitability of instructional staff. 3. Assess instructional/student ratio.	1. Human resources assignments 2. Budget Report 3. Interview with Program Director 4. Program Prospectus and documentation, grant proposals.
	Equitable student selection process?	1. Assess accessability to all students in relevant age/academic/ demographic classifications. 2. Assess awareness of parents and students of program and selection process, and that they are given sufficient time to be involved. 3. Assess that selection process is applied in a systematic, approved manner.	1. ACPS/School newsletters, leaflets, interest surveys, other dissemination medium. 2. Public Relations Office information.
	Physical environs suitable for meeting program requirements (including reasonable growth)?	1. Assess whether facilities meet approved building and safety standards. 2. Assess number of instructional areas needed by the program.	1. Facilities report. 2. Program management report/interview.

	Are there identifiable program characteristics which make it distinct from other school programs?	1. Can all staff articulate distinguishing program indicators? 2. Are students and parents, system-wide, aware of the program particulars?	1. Staff survey
	Is the curriculum consistent with program needs, and does it meet ACPS, VADOE standards?	1. What materials are available in instructional settings? 2. Are the materials used appropriately per program needs?	1. Curriculum and instruction monitoring report
	Is a local program evaluation conducted on a regular basis?	1. Are specific staff meetings for program evaluation planned and conducted? 2. Do all instructional staff participate in decision-making?	1. Meeting notes, program reports and records. 2. Interview with Program Director.
	Is there a staff training program? How is it implemented?	1. Do staff meet experience/training requirements for their positions? 2. Are staff given opportunities to supplement experience and training as appropriate to meet current and expected program needs?	1.Interview with Program Director 2. Staff interviews
2. Community and Business Involvement	Community, parent, and business involvement meets program stipulations?	1. Is there an increase in community partnerships/funding associated with the program?	1. Program management reports 2. Budget report

3. Student Participation and Achievement	Increased student attendance?	1. Minimum 94% attendance rate for students? 2. Dropout rate below ACPS average? Controls? 3. Reduced disciplinary actions and out-of-school suspensions? 4. Reduced mobility rate?	1. Student performance reports (student attendance report, Monitoring and Evaluation).
	Improved student achievement?	Do students differ from controls on the following:1. number of higher level math and science courses taken during post-program year 2. Overall GPA 3. GPA in math and science.	1. Student performance reports. 2. Monitoring and Evaluation program evaluation.
	Increased proportion of students advancing to higher education or grade levels?	1. Proportion of students advancing to post-secondary education grater than ACPS average, above average %, above yoked-control average?	1. Yoked control group ex post facto analysis.
4. Cost Analysis	Are cost guidelines for program implementation specified? Are established costs within guidelines?	1. What have the budget appropriations for the program been to date? 2. Are the implementation expenditures within these appropriations?	1.Program Budget Report from Program Director.
	Does program operate within budget specifications?	1.Are there New funding allocation requests? 2. Are there funding reallocation requests? 3. Are there budget overruns? 4. Is there effective use of resources?	1. Program budget report from budget office for past four years.

Appendix B

TEMS Program Staff Interview Schedule

TEMS Staff Member:_____

Date:_____

I. Implementation

Staffing:

Is the optimum number of program staff needed to meet the program requirements for the summer session? Explain.

What credentials, certifications are needed for these positions? Explain.

What is the optimum instructional/student ratio?

Student Selection:

Is the program accessible to <u>all</u> minority students in the 7th and 8th grades?

How do students become aware of the program and selection process?

What is the optimum instructional/student ratio?

How much time are they given to be involved?

What is the selection process of students?

Is student selection applied in a systematic manner? Explain.

What number of instructional areas are needed by the program?

Program Distinctiveness:

What distinguishes this program from other after school enrichment programs offered to summer students?

Are all eligible students and parents, system-wide, aware of the program particulars?

Curriculum:

What materials are needed for your use in instructional components?

Are the materials available per program needs? If more materials are needed, explain.

Program Evaluation:

Is any local program evaluation conducted after each session is completed? How is this carried out.?

Are specific staff meetings planned and conducted?

Do all instructional-staff participate in decision-making?

Is there any staff training? Explain.

Do staff meet experience/training requirements deemed necessary for their positions?

Community and Business Involvement:

Are non-staff parents and community or business members involved in the program implementation?

Is there an increase in community partnerships/funding associated with the program? Explain.

Are parent and community groups informed of relevant activities and decisions affecting students/parents? Explain.

Are 85% of parents and students satisfied with the program as implemented?

Cost Analysis:

Are cost guidelines for program implementation specified?

Are program costs within these guidelines?

Does program operate within budget specifications?

Are there new funding requests over last year? Explain

Are there any budget overruns?

How are these costs met?

Appendix C
Principal's Survey

Principal Name and School
(Circle one):
School principal Asst Principal

Please rate the statements below:
SD=Strongly Disagree, D=Disagree, DK=Don't Know, A=Agree, SA=Strongly Agree

1). I am familiar with the Technology Engineering Math and Science (TEMS) Summer Academy available to rising 7th-10th grade ACPS students. (Circle one)

1	2	3	4	5
SD	D	DK	A	SA

2). All of my students are provided with an overview of the TEMS Summer Academy in spring, and have an opportunity to fill out an interest survey.

1	2	3	4	5
SD	D	DK	A	SA

3). The TEMS Summer Academy motivates minority students to consider pursuing post-secondary technical or science-related careers.

1	2	3	4	5
SD	D	DK	A	SA

4). Students who participate in the TEMS Summer Academy become more engaged in the learning process.

1	2	3	4	5
SD	D	DK	A	SA

5). How many students have you recommended to the TEMS summer program?_____

6). What best characterizes the students you have recommended to the TEMS summer program? Rank the following in order of importance 1= most, 4=least. (If you have not yet recommended a student to this program, skip this question and proceed to #7).

_____1. Student demonstrates an interest in science or mathematics.
_____2. Student expresses interest in the TEMS program specifically.
_____3. Student with aptitude is at risk of becoming disengaged from the learning process.
_____4. Student is from a group under-represented in the science and technology field.

7).What features of the TEMS program is the administrator aware of? Check ALL that apply:

___Enrichment Program emphasizing Math/Science/Computer Technology skills
___Exploration of Career Opportunities in engineering, math, science, computer technology.
___Program targets under-served youth
___Corporate Partnerships including job shadowing and visiting professionals in career settings
___Field trips to area colleges, universities, businesses
___Conference attendance (NSBE Convention, MESA Conference, College-Workshops)
___Student-production of careers video
___Hands-on approach to science and mathematics (robotics,design of roller-coaster, web page, etc)

Appendix D
Participant Questionnaire
TEMS Program

Name_____ Grade _____

Birth Date_____ School_____

Address:_____

City_____ Zip Code_____

Parent/Guardian:_____

Phone_____ Email_____

Please briefly answer the following questions:

1. How did you hear about the program?

2. What do you know about the program?

3. Why did you choose to participate in the program?

4. What do you want to get out of the program?

5. What are your career interests?

6. How many years have you been in the program?