The Use of Quantitative and Qualitative Measures to Evaluate a Summer Camp for Elementary School Girls

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Abstract

In June 2000, Mercer University hosted Mercer MESSAGE, a summer camp for elementary school girls. Mercer MESSAGE is part of the Central South Summer Camp Program. The program consists of four essential elements: 1) Mercer MESSAGE, an all-girl summer math and science day camp, 2) Mercer TECH, a co-ed summer engineering day camp, 3) Central South Summer Camp reunions during the school year, and 4) continued communication with campers through e-mail or phone. The program targets 5th, 6th and 7th grade girls and features a tiered-mentoring process that is designed to match campers with high school students, college students, and college faculty who excel in science, mathematics and/or engineering. The mentors work in both camps and continue their mentoring activities throughout the following school year. The Central South Summer Camp evaluation plan, which includes qualitative and quantitative measures, will be used to assess program effectiveness and to help determine if girls who participate in this program have developed a sustained interest in math, science or engineering.

Introduction

It is commonly accepted that we need to attract more women and minorities to the fields of math, science, and engineering. Although women and minorities are increasing their presence in some areas of science and math, their overall representation is inadequate. The problem is especially evident in the field of engineering. In spite of the fact that women make up approximately half of the workforce, less than 10% of practicing engineers are women.[1,2] Clearly, we need to attract, and retain, more women in the scientific workforce.

There is some reason to believe that part of the problem can be traced to our school system. Even in the early school years, many teachers believe that boys are better at math and science than girls, even though the girls earn better grades in these subjects. [3] In fact, girls outperform boys on national tests in nearly every subject at the elementary school level. However, in middle school and high school years, the test scores of girls decline dramatically relative to test scores of boys, especially in math and science. [3,4] Targeting girls before the middle school decline may be an effective way to prevent this trend. [5]

A number of authors suggest that mentoring can help retain women in math, science and engineering. Successful mentoring has been demonstrated at the high school or college level. [6,7,8] Others have found mentoring to be an important factor in keeping women in the workforce.[9,10]

With the increasing availability of the Internet, mentoring through the use of e-mail is becoming more prevalent.[11,12] Another recognized way to enhance and reinforce math and science skills is through outreach programs or summer camps. Programs that have been implemented may be relatively short, perhaps one[2] or two days; other programs are one or two weeks long. [13,14] Some programs, especially those that involve undergraduate research, last for six weeks or more. Many of these programs report anecdotal success stories, but few have reported the use of quantitative measures to evaluate program effectiveness. Notable exceptions include Arizona State University for outreach programs[4] and MentorNet for e-mentoring .[12]

The Central South Summer Camp Program

Mercer University has received funding to deliver a program titled, *Central South Summer Math, Science, and Engineering Camps for Rising 5th, 6th, and 7th Graders*. The Central South community is adjacent to the campus of Mercer University, and the project directors, Linda Hensel (biology), Hope McIlwain (math) and Joan Burtner (engineering) are all faculty members at Mercer University. The 2000-2001 program sponsors are: the American Honda Foundation, the American Association of University Women, the Mercer Center for Community Development, and the Bibb County Public School System. The program has the following goals:

- establish annual summer math, science, and engineering day camps for girls and boys from the Central South neighborhood
- develop curricula that can be tested in the camp by teachers and then be integrated into the public school curriculum
- create tiered mentoring networks among the camp attendees, high school students, and college students that can be maintained throughout the school year
- expose college math, science, and engineering students with a possible interest in teaching to the camp format and teachers from the public school system
- expose the high school mentors to college math, science, and engineering students as a mechanism for informal mentoring

Beginning in June 2000, the project directors piloted two academically focused summer day camps for talented, minority children from the Central South neighborhood. One camp (Mercer MESSAGE) focuses on science and math skills and is offered to rising fifth and sixth grade girls. MESSAGE is an acronym for ***M***ath, ***E***ngineering, and ***S***cience ***S***ummer ***A***ll ***G***irl ***E***xperience. Linda Hensel and Hope McIlwain co-directed Mercer MESSAGE. The other camp (Mercer TECH) focuses on engineering and technology skills and is offered to rising sixth and seventh grade boys and girls as well as some of their teachers. TECH is an acronym for ***T***eachers ***E***ducating with ***C***omputers and ***H***ands-on Lessons. Joan Burtner directed Mercer TECH. The two camps include a number of common features:

- Emphasis on science, math, and technology
- Planned and directed by three women college faculty members (one each from science, math, and engineering)
- Focus on academically qualified public school students from underrepresented minorities
- Tiered mentoring through the use of talented minority high school and college students
- Goal to reinforce the idea that studying science, math, and engineering is fun and interesting
- Use of active pedagogy that includes field trips, oral presentations, and the use of computers in the classroom
- Curriculum planning that involves college faculty and public school teachers.

Program Features

Tiered Mentoring - The entire program depends on the active involvement of a tiered-mentoring team. One high school student and one college student are assigned to mentor a group of four campers. The high school mentors are scientifically talented female students at Southeast and Southwest High Schools. The college students are male or female science, math, and engineering majors from Mercer University. The college mentors were selected using the criteria that Mercer University uses to select orientation assistants for entering freshman. High school mentors were selected by similar criteria. Mentors received training prior to the first camp offering. In addition, mentors are expected to maintain periodic contact with camp participants (and each other) throughout the school year.

Camp Reunions - To facilitate this contact, three one-day-long camp reunions were scheduled. At the time of this writing, two of the three reunions have been held. The first reunion was held on the Mercer campus on September 30, 2000. The camp directors, campers, mentors and public school teachers all attended. The second reunion was held on November 18, 2000. For this reunion, the camp directors, campers, mentors, and public school teachers traveled to Chattanooga, Tennessee, to visit the Aquarium and the Children's Museum. The third reunion is scheduled for March 2001.

E-mail Contact - The use of e-mail as a means of communication between mentors and campers is encouraged. With funds provided by the Georgia Lottery System, each of the participating public schools is equipped with computers and e-mail capability. Campers, mentors, and public school teachers involved in the project receive training in the use of e-mail on an as-needed basis. Parents sign a release allowing their children to set up e-mail accounts. Of course, if the parents do not want to authorize the e-mail account, the

camper can still participate in the camp program; the only consequence is that the camper is excluded from the e-mail activities.

Evaluation Team - Most of the evaluation components are conducted by a three-person evaluation team. The evaluation team consists of Joan Burtner (Director of Mercer TECH), Theresa May (elementary school teacher) and Marcus Lee (engineering student). The program developers believe that the use of a three-person team enhances the potential for program improvement on a multi-perspective level.

Program Evaluation Plan

The program evaluation has been designed using guidelines developed especially for science, math, and engineering education. [15,16] Since the program is so new, much of the evaluation team's efforts during the first three years of the plan are focused on program improvement. The evaluation team is gathering information regarding the value of the instructional components of the program as well as the development of the mentoring program.

The formative evaluation can be divided into two separate areas.[15] The implementation evaluation will answer the question, "Is the program being delivered as planned?" The progress evaluation will answer the question, "What is the impact of the activities?" Throughout the formative evaluation phase, data will be analyzed and discussed and appropriate changes will be made to the Mercer MESSAGE and Mercer TECH programs.

The plan may be characterized as a mixed-mode evaluation.[16] Qualitative measures such as focus groups and journals comprise an essential part of the evaluation program. Although qualitative measures are more time-consuming and may be difficult to interpret, the evaluation designer felt that the potential richness of the data made the inclusion of qualitative measures essential. The primary quantitative measure is an attitude survey designed to measure changes in attitudes toward science, math, and engineering. The writer adapted the survey (with permission) from one that was used by Columbia College's 1996 Math is Women's Work program (Dr. Lucy Snead, director; Mr. Robert Stutts, evaluator). While the Columbia College instrument was restricted to math attitudes, the Central South Summer Camps evaluation instrument (See Appendix) measures attitudes toward math, science, and engineering. Through this adaptation, the evaluation team could use the same instrument for the Mercer MESSAGE and Mercer TECH camps, and thus make quantitative comparisons between the two programs.

The Mercer MESSAGE and Mercer TECH staff (faculty and student mentors) will use the evaluation data to identify successful practices as well as areas that need improvement. The high school and college mentors will keep records of post-camp contact with the campers. Through a cooperative relationship with the public school system, the campers' progress will be followed through middle and high school. School personnel will furnish information on the campers' enrollment in science and math courses as well as their involvement in science/math-related extra-curricular activities.

The evaluation plan is summarized in the Table 1.

Table 1

A Summary of Formative Evaluation Activities

What	*How*	*When*	*Who*
Career Choice	Questionnaire to campers	During camp	Evaluation Team
	Phone follow-up	Annually	Mentor
Course Choice	Data provided	Annually	Bibb County School personnel
Curriculum Effectiveness	Mentor journal, Camper journal	Each day of camp	Camp Director
	Focus group with staff	Last day of each week of camp	Member of Evaluation Team
	Focus group with students	Last day of each week of camp	Member of Evaluation Team
	Questionnaire to campers	First day of camp	Member of Evaluation Team
	Questionnaire to campers	Last day of camp	Member of Evaluation Team
	Questionnaire to campers	Third reunion	Member of Evaluation Team
Mentoring Process	Mentor journal, Camper journal	Each day of camp	Camp Director
	Focus group with mentors	Two Saturdays during school year	Evaluation Team

Camp Evaluation Results

Each day during the camp, the directors read the journal entries and modified the program accordingly. For example, our original camp design included a morning break and an afternoon break in which campers and mentors could go outside to have free time together. The camp directors felt that this break time would allow some informal mentoring to occur.

However, some mentors wrote in their journals that supervising energetic 4th and 5th graders was very tiring and that they needed a break sometime during the day. After brainstorming possible solutions, we developed a new method for the afternoon break. Mentors were given free time on a rotating basis during the afternoon session. In this way, there was still an opportunity for informal mentoring and each mentor got a break, too.

The public school teacher who was part of the evaluation team was selected to conduct the focus groups with Mercer MESSAGE campers and mentors. We believed that campers and mentors would respond best if the camp directors were not part of these focus groups. There is some data in the literature to support this belief.[17] Following standard qualitative assessment practice, each focus group was limited to eight participants to enhance communication. The public school teacher developed questions for the focus group sessions. The prescribed camper focus group questions were as follows:

- What happened during the last week of camp that was good?
- What happened during the last week of camp that was bad?
- Is there anything that happened at camp that surprised you?
- What have you learned about science?

The same four questions were asked of the mentors during their focus group. For both the mentor focus group and the camper focus groups, the public school teacher asked additional questions based on responses to the first four. Even though the camp directors were not part of the focus groups, the public school teacher discussed relevant issues with the directors the day after each focus group sessions.

Preliminary data indicate that TECH camp participants increased their interest in a career in engineering. On the other hand, Mercer MESSAGE participants increased their interest in a career in science. According to the survey results, participants in both camps increased their awareness that scientists discover things that help people. At a later date, analyses will be conducted to determine if these increases are statistically significant. The evaluation team is currently analyzing the qualitative components of the questionnaires as well as focus groups results. As noted in Table 1, additional evaluation data will be collected at the third reunion in March. At the end of the first full year of program implementation (May 2001) the evaluation team will compare quantitative and qualitative data collected throughout the year in an attempt to determine more lasting changes in students beliefs and attitudes.

Conclusion

The project directors hope that this program will enable the girls to succeed in a unique scientific endeavor and to be connected with tiered mentoring in the community. Additionally, it is hoped that the high school and college students who participate in the tiered mentoring program will continue their interest in science, math, and engineering throughout college and will eventually gain employment in a technical field. We believe that the use of both quantitative and qualitative measures gave us a richer set of data and will make it easier for us to improve the program for next year. The camp directors believe that the composition of the evaluation team (college professor, college student, and public school student) was essential to program

improvement on a multi-perspective level. The camper survey yielded quantitative data that will allow us to easily compare changes in attitude over time. Although qualitative data is more time-consuming to produce and interpret, it added valuable information to the overall evaluation.

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Appendix

Mercer MESSAGE 2000 Pre-Program Survey

We would like to ask you some questions about yourself, your feelings toward school, and your ideas about the Mercer MESSAGE program. Your answer sheets will be confidential—no one will see them except the camp staff who will only report how **all** of the campers answered. You are asked to put your first name and the **initial** of your last name on this form (for example, "Joan B.") so we can match up surveys you complete before and after the program. Results will help us evaluate the camp.

There are no right or wrong answers to the questions. What is important is that you tell us what you think and how you feel.

_____ _____
First Name Last Initial

I. Listed below are some statements about how students might think or feel. Read each statement and then circle **one** answer that best describes how often that statement describes **you**. For example, if you think the first statement describes how you feel most of the time you would circle the "4" for that statement.

	Mercer MESSAGE	Almost always	Most of the time	About half of the time	Sometimes	Almost never
1.	I enjoy school.	5	4	3	2	1
2.	I think of myself as being smart.	5	4	3	2	1
3.	I think that I am good at math.	5	4	3	2	1
4.	I like to figure out how things work.	5	4	3	2	1
5.	I am confident in my ability to become a good scientist.	5	4	3	2	1
6.	I get nervous when having to work on a challenging science or math project.	5	4	3	2	1
7.	I find math interesting.	5	4	3	2	1
8.	I think that a career in math might be a good choice for me.	5	4	3	2	1
9.	I enjoy the challenge of a math problem.	5	4	3	2	1
10.	I am somewhat afraid to ask teachers questions about math or science.	5	4	3	2	1
11.	I think that I am good at science.	5	4	3	2	1
12.	I enjoy working with other students on projects.	5	4	3	2	1
13.	I enjoy working with teachers on projects.	5	4	3	2	1
14.	I think that a career in engineering might be a good choice for me.	5	4	3	2	1
15.	Engineers make things that help people.	5	4	3	2	1
16.	I participate in class by asking questions or giving answers.	5	4	3	2	1
17.	I am somewhat afraid to get good grades because of what my friends might think or say.	5	4	3	2	1
18.	I am confident in my ability to become a good engineer.	5	4	3	2	1
19.	I enjoy building things.	5	4	3	2	1
20.	I enjoy planning projects.	5	4	3	2	1
21.	Boys are better at technology than girls.	5	4	3	2	1
22.	I enjoy solving problems.	5	4	3	2	1
23.	I am confident in my ability to become a good mathematician.	5	4	3	2	1
24.	I think that I am good at technology.	5	4	3	2	1
25.	I receive encouragement from my family to do well in math and science.	5	4	3	2	1
26.	I think that a career in science might be a good choice for me	5	4	3	2	1
27.	Girls are better than boys at math.	5	4	3	2	1
28.	Scientists discover things that help people.	5	4	3	2	1

Mercer MESSAGE 2000 Pre-Program Survey

II. What do you think will be the highest level of education that you will accomplish? (check one)

_____ a high school diploma

_____ a two year technical or community college degree

_____ a four-year degree from a college or university

_____ a master's degree

_____ a doctorate (for example, an MD., Ph.D. or similar professional degree)

What grade do you think you are most likely to receive in your next math class? (check one)

_____ A _____ B _____ C _____ D

III. Please answer each question below by filling in blanks.

1. My two favorite school subjects are: _____ and

_____.

2. My two worst school subjects are: _____ and

_____.

3. Two careers I might want to pursue when I get older are: _____ and

_____.