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FEMALES EXCELLING MORE IN MATH, ENGINEERING, AND SCIENCE (FEMMES): AN AFTER-SCHOOL STEM PROGRAM FOR GIRLS THAT FOSTERS HANDS-ON LEARNING AND FEMALE-TO-FEMALE MENTORSHIP

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The gender disparities in science, technology, engineering, and mathematics (STEM) fields can be improved through the use of outreach programs. As early as middle school, girls begin to lose interest in science and math, reducing the likelihood of ever pursuing a career path in STEM fields. To address this problem, we developed an after-school outreach curriculum as part of the Females Excelling More in Math, Engineering, and Science (FEMMES) program at Duke University [see companion paper in this issue (Shuen et al., J. Women Minor. Sci. Eng., vol. 17, no. 4, p. 295–313, 2011)] . The goal of the FEMMES after-school program is to inspire 4th–6th grade girls in science, math, and engineering through hands-on activities with female undergraduate and graduate student volunteers. We examined the interest, knowledge, and confidence in STEM fields measured through pre- and post-test surveys given to 100 girls who participated in the FEMMES after-school program. A mixed ANOVA (analysis of variance between groups) revealed a significant increase in the girls' interest in science and engineering, knowledge in science, and confidence in math and science. Students (almost unanimously) gave high ratings to the seven STEM activities included in the after-school program. Although the study was small, the results are encouraging and we continue to assess the impact of this engaging program.

KEY WORDS: *education, outreach, underprivileged, gender disparity, role models, interest, confidence, knowledge, elementary school, middle school*

1. INTRODUCTION

Over the past several decades, women have begun to make strides in gaining educational equality with men. However, despite the enormous amount of progress that has been made, women are still less likely to feel confident in areas like science, technology, engineering, and math (STEM) (Fancsali and Froschl, 2006). Though girls often tend to perform at the same level as boys in these areas, as early as middle school they begin to veer off from these career paths due to a lack of educational

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support and a fear of failure. Oftentimes, girls lack role models who excel in math and engineering, thus formulating a misconception that they cannot pursue an interest in these paths (Heller and Martin, 1994). Reversal of these gender inequalities can take place through increased programming and mentorship for girls. In fact, collaborative learning, the presence of role models, and hands-on experimentation have all been shown to increase girls' confidence and interest in the STEM areas (Fancsali and Froschl, 2006). When girls are given the opportunity to learn in a single-sex environment, it has been shown that they are more likely to gain confidence and continue to pursue the sciences after their middle-school years (Fancsali and Froschl, 2006). Students often find science in the classroom to be "trivial and boring or difficult and confusing" (Lee and Anderson, 1993). As an alternative method of education, hands-on learning has been implicated as one of the key factors that can improve a girl's confidence in the STEM areas; this hands-on learning is particularly efficacious if done in an after-school program environment. After-school environments are those in which programs are repeated on a regular basis and provide a learning experience for the girls that is not just simply "another school day."

In a comparative study of after-school programs in areas of low income, "Middle-school students who regularly attended the high-quality after-school programs (alone or in combination with other activities) across two years demonstrated significant gains in standardized math test scores" (Vandell *et al.*, 2007). Moreover, middle-school girls who attended a two-week engineering program (Camp Reach) later had higher enrollment in STEM-related courses in high school and reported higher engineering self-efficacy at college entry (Hubelbank *et al.*, 2007). These significant findings demonstrate the increase in confidence and knowledge that can be achieved through high-quality, creative programs delivered to middle-school girls that promote education during out-of-school hours.

To address the gender disparities in the STEM fields in Durham, North Carolina, Females Excelling More in Math, Engineering and Science (FEMMES)—a student-led organization at Duke University—was founded. A compilation of 2008–2009 education data from the Durham area has shown that, starting in the 5th grade, only 48.9% of students performed at or above their grade level on the end-of-year science test for the No Child Left Behind program (Education First NC School Report Cards, 2009). This figure demonstrates the need to bolster science education in the Durham area. The FEMMES program hosts a variety of educational outreach programs related to math, science, and engineering for 4th–6th grade girls from underserved schools in the Durham area. Over the years, FEMMES has become multifaceted, including a one-day capstone event (see companion paper by Shuen *et al.*) as well as a six-week after-school program.

1.1 Overview of the FEMMES After-School Program

The FEMMES after-school program is an educational outreach program that invites 4th–6th grade girls to learn STEM concepts from Duke undergraduate and graduate students for six weeks per semester at select elementary schools in Durham, North Carolina. The program was created to engage elementary and middle-school girls in hands-on, inquiry, and problem-based learning activities that promote analytical and problem-solving skills, creativity, critical thinking, and teamwork.

Volunteers, who are selected based on demonstration of interest in mentoring girls and passion for STEM fields, travel to Durham schools throughout the week to lead activities that expose girls to more applications of science, engineering, and math. At the beginning of the school year, the volunteers participate in a mentor training session during which policies are reviewed, mentoring strategies and tips are explored, and objectives are discussed. The volunteers learn to provide constant encouragement and support and present the material in a manner designed to foster enthusiasm and to teach fundamental concepts in an engaging, hands-on approach. Activity training sessions are also held for the mentors to become familiar with each curriculum activity. To develop effective student–mentor relationships, program participants are randomly divided into smaller groups, and each group is assigned a mentor. Volunteers provide feedback each week to ensure that the activities are running smoothly.

The activities are developed by members of the FEMMES After-School Committee, all of whom serve as mentors in the program. The program curriculum covers a wide range of science topics, including biology, chemistry, physics, engineering, and earth science. A table describing the activities used by the FEMMES volunteers is shown in Table 1.

2. METHODS

2.1 Participants and Setting

For the 2009–2010 school year, five after-school programs consisting of six sessions each were offered to 4th–6th grade girls over the course of six weeks (one session per week). Four of these after-school programs were held at W.G. Pearson Elementary School, E.K. Powe Elementary School,

TABLE 1: FEMMES after-school curriculum (fall 2009)

	Activity	Subject	Description
1a	Ice Cream Making	Chemistry	Students make ice cream and learn how salt reduces the freezing point of water.
1b	Cell Cookies	Biology	Students create a plant or animal cell using cookies and candy as they review the different parts within a cell and their functions.
2	Balloon Lung Models	Biology	Students build models to explore how the lungs and diaphragm work and how the rib cage and intercostals muscles help out for breathing.
3	Bridge Building	Physics, Engineering	Students build bridges and learn bridge terminology, construction techniques, and some basic concepts in physics and structural engineering.
4	Hovercraft Racers	Physics, Engineering	Students build hovercrafts and discover how friction and Newton's laws of motion pertain to hovercrafts.
5	The Moon	Earth Science	This activity allows students to use models of Earth, the Sun, and the Moon to discover why moon phases occur.
6	Acids and Bases	Chemistry	This activity introduces and reinforces the basic principles of acids, bases, and the pH scale. Students will test common household items and identify them as acidic, basic, or neutral.

Club Boulevard Elementary School, and the Emily Krzyzewski (Emily K.) Center on weekdays. Various elementary schools in the Durham area were contacted about the possibility of providing the program at their respective schools, and faculty members from the aforementioned four locations showed interest and commitment to the after-school program. These faculty members served as liaisons between the schools and our program staff and helped supervise students during all program sessions. To reach out to girls who did not attend the schools listed above, we provided a fifth after-school program, held on Saturdays, that allowed 4th–6th graders from the Durham area to learn from the mentors on the Duke University campus. Although all after-school programs were meant to use the same curriculum, with six one-hour sessions each, the program at E.K. Powe Elementary School was shortened to five one-hour sessions due to a scheduling conflict.

Our teacher contacts at the four schools helped recruit participants by distributing registration forms to female students. For the Saturday program, registration forms were sent out to all parents on the FEMMES mailing list. Students were accepted into the program on a first-come, first-served basis. Each girl was allowed to participate in one after-school program only. Additionally, in order to register, each girl was required to commit to attending all sessions of the program. Class size was limited so that there was a student–mentor ratio of about 4:1. In the fall of 2009, a total of 100 students participated in the FEMMES after-school program.

Programs at the Emily K. Center, Club Boulevard Elementary School, and W.G. Pearson Elementary School used activities 1a, 2, 3, 4, 5, and 6 (Table 1). The Saturday program at Duke University used activities 1b, 2, 3, 4, 5, and 6. The program at E.K. Powe Elementary School (shortened to five weeks instead of six) used activities 1b, 2, 3, 4, and 5. Activity 1a was used at the Emily K. Center, Club Boulevard Elementary School, and W.G. Pearson Elementary because some girls who had attended a separate FEMMES program in the previous year had already done activity 1b and we wanted them to have the opportunity to do a different activity instead.

2.2 Evaluation Methodology

Several assessment instruments were used to evaluate the impact of the program on the girls' self-efficacy and knowledge in STEM areas. Surveys that were completed by the students were designed to examine primarily self-perceived interest, confidence, and knowledge before and after their participation (termed pre- and post-surveys, respectively) in the after-school program. The research protocol was approved by Duke University's Institutional Review Board (IRB) prior to starting the study. All students in the program returned consent forms to participate in the assessment of the program. The pre-survey was distributed to students during the registration process, and the post-survey was administered to students during the last day of the six-week program. All responses were confidential. Participants were each assigned an ID number upon registration and submission of the pre-survey. Post-surveys were assigned corresponding numbers so that each participant's surveys were matched together but were not identifiable to her name. The list of names and ID codes was then placed in a locked file cabinet, and only the study director had access.

Among the participants, 100 girls filled out a pre-survey ($N = 56$), post-survey ($N = 76$), or both ($N = 38$) for the 2009 after-school program. Of these 100 girls, 36 were 4th graders, 45 were 5th graders, and 18 were 6th graders; one student did not provide her grade level.

Each participant assessed her own interest, knowledge, and confidence in math, science, and engineering on a scale of 1–10 (1 = weakest, 10 = strongest) on the pre- and post-surveys (see Appendix). Sample questions are provided below:

Q1. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in math? Please circle one number.

Q2. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about math? Please circle one number.

Q3. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at math? Please circle one number.

For formative purposes and continued improvements to the program, the post-survey also included additional questions that assessed the students' opinions on the program's curriculum and how important various aspects were to the participant's positive experience.

Quantitative data were analyzed using the statistical software, SPSS. A mean score was calculated for each pre- and post-survey question. A mixed ANOVA model (analysis of variance between groups) was used to determine whether there were significant effects of time (pre- versus post-program) and grade level (4th–6th) on student self-reported ratings of knowledge, interest, and confidence in the three STEM areas. Students who did not complete both surveys were excluded from the mixed ANOVA model. When appropriate, significant main effects were subjected to a Scheffe's post hoc analysis to determine specific differences between groups.

3. RESULTS

3.1 Overview of Interest, Knowledge, and Confidence Ratings Before and After the After-School Experience

The mean ratings for the pre- and post-surveys of all participants are provided in Table 2. Only a fraction of the 79 respondents in the post-survey participated in the pre-survey as well ($N = 38$). Thus subsequent analyses by a mixed ANOVA used only the 38 pairs of pre- and post-outcomes. As can be seen from the overall data in Table 2, all post-survey ratings were higher than pre-survey ratings for each subject area and for each outcome measure.

3.2 Effects of the After-School Program on Interest, Knowledge, and Confidence, Depending on Grade Level

We determined whether the impact of the after-school program on girls' ratings of their interest, knowledge, and confidence in science, math, and engineering would depend on their grade in school. We performed a 2 × 3 mixed ANOVA with time (pre and post) as the within-subjects factor and grade level (4th, 5th, and 6th) as the between-subjects factor. Overall, significant models were found for the following categories: interest in science, interest in engineering, knowledge in science, confidence in math, and confidence in science (Table 3). Students rated their interest in science and engineering significantly higher after the after-school program compared to before the program [$F(1,35) = 6.705$, $p = 0.014$, and [$F(1,35) = 5.299$, $p = 0.027$], respectively. The only significant increase in knowledge was in science [$F(1,34) = 4.379$, $p = 0.044$]. In terms of confidence, significant increases were found in science [$F(1,34) = 4.379$, $p =0.044$] and math [$F(1,35) = 4.779$, $p = 0.036$]. There were no significant interactions with grade.

Significant main effects of grade were also evident (Table 4). Overall, 4th graders gave the lowest ratings in each of the outcome measures, and 6th graders provided the highest ratings. Both interest and confidence in science depended on the grade level of the respondent [$F(2,35) = 5.664$, $p = 0.007$ and $F(2,34) = 6.675$, $p = 0.004$, respectively]. For example, 4th graders reported the lowest interest in science—and interest in science increased significantly in 5th graders. There was a marginal increase in science knowledge [$F(2,35) = 3.153$, $p = 0.055$], with increasing scores from grade 4 to 6. In addition, students reported a significant increase in confidence in science as they approached grade 6.

TABLE 2: Pre- and post-survey ratings for interest, confidence, and knowledge in math, science, and engineering

Assessment Domain	Subject	Mean Rating (SD)	
		Pre	Post
		(*N* = 55–56)	(*N* = 76–79)
Interest	Math	7.70 (2.26)	8.37 (2.06)
	Science	8.38 (1.78)	9.05 (1.45)
	Engineering	7.45 (1.96)	8.34 (1.82)
Confidence	Math	8.14 (1.74)	8.90 (1.62)
	Science	7.95 (1.78)	8.43 (1.63)
	Engineering	5.85 (2.68)	6.97 (2.52)
Knowledge	Math	8.00 (1.78)	8.78 (1.51)
	Science	7.63 (1.99)	8.33 (1.56)
	Engineering	5.49 (2.52)	6.58 (2.38)

Ratings are based on a scale of 1 (worst) to 10 (best). Total respondents $N = 100$.

TABLE 3: Main effects of time and grade on interest, knowledge, and confidence in math, science, and engineering

Subject	Assessment	F values	
		Time (Pre and Post)	Grade (4,5,6)
Math	Interest	2.595	0.094
	Knowledge	0.462	1.169
	Confidence	4.779*	0.950
Science	Interest	6.705*	5.664**
	Knowledge	6.421*	3.153
	Confidence	4.379*	6.675**
Engineering	Interest	5.299*	0.396
	Knowledge	0.471	0.922
	Confidence	1.641	0.300

*$p < 0.05$, **$p < 0.01$, mixed ANOVA.

3.3 Activity Ratings

Overall, participants rated all of the after-school program activities very highly. The median score for five of the seven activities was 10, with the remaining two activities receiving median scores of 8 and 9.5 (Table 5). Based on these results, we concluded that the activities used for the after-school program were engaging and enjoyable and may have been effective in piquing student interest in engineering and science.

TABLE 4: Differences in interest, knowledge, and confidence in math, science, and engineering by grade

Subject	Assessment	Mean ratings			Significant comparisons
		Grade 4	Grade 5	Grade 6	
Math	Interest	8.38 (2.43)	8.10 (1.96)	8.32 (2.35)	NS
	Knowledge	7.88 (2.54)	8.35 (1.45)	9.01 (1.36)	NS
	Confidence	8.25 (1.71)	8.37 (1.19)	9.00 (1.20)	NS
Science	Interest	7.75 (1.22)	9.10 (1.02)	8.38 (1.13)	4th vs 5th*
	Knowledge	6.40 (2.45)	8.08 (1.41)	8.31 (1.29)	NS
	Confidence	6.13 (2.31)	8.34 (1.33)	8.50 (1.07)	4th vs 5th** vs 6th**
Engineering	Interest	8.63 (1.80)	7.81 (2.12)	7.94 (1.83)	NS
	Knowledge	4.63 (2.86)	5.69 (2.57)	6.32 (2.63)	NS
	Confidence	5.75 (3.47)	6.32 (2.85)	6.76 (2.63)	NS

Ratings are based on a scale of 1 (worst) to 10 (best). *$p < 0.05$, **$p < 0.01$ using Sheffe's post hoc analysis. NS = not significantly different.

TABLE 5: Ratings for after-school program activities

Week	Activity	Median rating	Number responding
1	Ice Cream Making	10	25
1	Cell Cookies	10	51
2 3	Balloon Lung Models Bridge Building	10 9.5	74 71
4	Hovercraft Racers	10	71
5	The Moon	8	71
6	Acids and Bases	10	53

Activities are shown for the fall 2009 cohort. Ratings are based on a scale of 1 (enjoyed least) to 10 (enjoyed most).

4. DISCUSSION

In this study we found that an after-school mentorship program (once a week for 6 weeks) can have a positive impact on girls' self-perceived interest, knowledge, and confidence in STEM areas. While significant changes were not detected in all domains for each field, every rating was higher on the post-surveys as compared to the pre-surveys. Students rated their interest in science and engineering significantly higher after completing the after-school program; they felt that they improved their knowledge in science, and they felt more confident in science and math. The girls participating in the FEMMES after-school program indicated that they enjoyed working on the activities with their mentors to a very high degree.

While we hoped to determine whether the pre-post measures varied by grade level, the small sample number of 4th- and 6th-grade girls (only four and eight with paired data, respectively) resulted in insignificant interactions. The only significant (main) effect of grade occurred in the science domains of interest and confidence, with 4th-grade students providing the lowest ratings.

Upon inspection of the students' ratings, there appears to be a slightly larger increase in interest in engineering compared to interest in science (although the statistical model did not include these comparisons). The basis for this difference, if significant, is unclear. However, it is possible that the more "hands-on" type of activities positively influenced girls' attitudes toward engineering. In addition, the novel nature of engineering exposure for elementary school students may have reflected a slightly lower pre-test score. In contrast, the slightly higher pre-survey ratings for interest in math and science may reflect that these subjects are traditionally taught in elementary schools. The absence of a significant change for interest in math may be attributed to the lack of math activities in the after-school curriculum during the 2009 program. However, students did report an increase in math confidence, which may have resulted from their experiences with the science and engineering activities.

The overall positive impact of FEMMES may be attributed to multiple aspects of the after-school program. In a program instituted by George Washington University in collaboration with the National Science Foundation, middle-school girls ranked the characteristics that they felt were most important to a successful science education program. This compiled list included aspects such as role models, mentoring, cooperative learning environments, open-ended activities, etc. (Heller and Martin, 1994). These characteristics are indeed vital to successful educational outreach programs, and all of them have been incorporated into the FEMMES after-school program. Similarly, a program called "Girls Creating Games," an after-school and summer program that teaches middle-school-age girls about technology through the designing of computer programs, found that girls benefit most from learning environments when they are able to collaborate with their peers while still becoming independent learners (Denner *et al.*, 2005). It is our hope that the hands-on STEM activities chosen for the FEMMES programs model these aspects as well. Another important aspect of the FEMMES after-school program is that it is conducted at each school once a week for six weeks. This allows the student volunteer mentors ample time to establish strong relationships with each of the girls, so that at the end of the program the girls can comfortably ask questions and participate throughout each of the activities. According to past research studies, presenting girls with female science role models allows them to have greater confidence in pursuing the field of science (Tindall and Hamil, 2004).

Previous educational outreach programs have demonstrated a differential degree of effectiveness in increasing interest and confidence depending on the participants' grade. For example, "Adventure Engineering," a mathematics and science outreach program designed to develop interests in engineering among middle-school students, found that while the majority of 7th and 8th graders still considered engineering as a future career, students in 9th grade had already decided that they would not participate in such a career (Mooney and Laubach, 2002). In other words, outreach programs that target students at a younger age are often more effective than those that focus on students of a higher grade level. As mentioned above, the small sample size in our study did not allow us to conclude whether the after-school program may have been more effective in any domain in one grade versus another. However, we have continued to collect data from subsequent after-school program cohorts, and a preliminary analysis in the current cohort indicates that overall, 4th graders appear to show greater pre-post survey rating differences compared to the 5th and 6th graders (unpublished finding). Accordingly, future studies will include all of the data to determine whether the impact of the FEMMES after-school program is greater for earlier grade levels.

Another limitation of this study is the self-selection factor. Because parents are asked to complete a registration packet, the families who are more interested and more willing to apply are more likely to have a child interested in a STEM field. In addition, there is some response bias on the surveys related in part to the survey process. The first is attrition. All participants who began the program at the start of the semester completed pre-surveys as part of their registration packet. However, only a fraction of these students completed the semester and submitted a post-survey. Furthermore, several girls joined the program in the middle of the semester and submitted a post-survey without a pre-survey.

A second problem lies in the way the survey was designed. Many girls who have a high interest in science score 10s for both the pre- and post-surveys. Since 10 was the highest number on the rating scale, even if a girl's interest increases after the event, she was unable to rate any higher than her original score of 10. Additionally, though we do state our selection process was first-come, first-served, participants may have circled 10s on the pre-survey, believing that doing so would increase the chances of selection for the program. For the post-survey, the girls were able to honestly rate each question. This discrepancy in adherence to true perception while taking the pre- and post-surveys would result in an artificial decrease or an increase of a smaller magnitude. One way to eliminate the "ceiling effect" is to deliver a survey that asks students to provide a retrospective opinion about their interest or confidence.

In the future we would like to investigate the long-term effects of the FEMMES after-school program by continuing to assess girls' interest in STEM fields as they progress through middle and high school. With consent from participating parents and daughters, we could carry out longitudinal studies accepting new participants each year while maintaining contact with previous participants.

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APPENDIX A: QUESTIONS FROM PRE-SURVEY AND POST-SURVEY

Pre-Survey

1. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

2. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you know in science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

3. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

4. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

5. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

6. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

7. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

8. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

9. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

Post-Survey

1. What did you like most about the FEMMES program?

2. What did you like least about it?

3. Would you participate again? YES _____ NO ______

If NO, why not?

4. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how would you rate your experience with the program? Please circle one number.

1 2 3 4 5 6 7 8 9 10

5. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

6. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

7. Overall, on a scale of 1–10 (10 being very interested, 1 being not interested at all), how interested are you in engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

8. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

9. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

10. Overall, on a scale of 1–10 (10 being you know a lot, 1 being you know nothing), how much do you know about engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

11. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at math? Please circle one number.

1 2 3 4 5 6 7 8 9 10

12. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at science? Please circle one number.

1 2 3 4 5 6 7 8 9 10

13. Overall, on a scale of 1–10 (10 being the best, 1 being the worst), how good are you at engineering? Please circle one number.

1 2 3 4 5 6 7 8 9 10

14. Is interest in math, science, and engineering higher, lower, or the same after the program (circle one)?

Better Worse The same

Why?

____

15. On a scale of 1–10 (10 being you enjoyed it a lot, 1 being you didn't enjoy it at all), how much did you enjoy the program's activities?

Activity 1:

1 2 3 4 5 6 7 8 9 10

Activity 2:

1 2 3 4 5 6 7 8 9 10

Activity 3:

1 2 3 4 5 6 7 8 9 10

Activity 4:

1 2 3 4 5 6 7 8 9 10

Activity 5:

1 2 3 4 5 6 7 8 9 10

16. On a scale of 1–10 (10 being very important, 1 being not important at all), how important do you think the following things were to how positive your experience with FEMMES was?

-You got to learn outside of school

1 2 3 4 5 6 7 8 9 10

-There were only girls

1 2 3 4 5 6 7 8 9 10

-You got to spend time with college students who like math, science, and engineering

1 2 3 4 5 6 7 8 9 10

-You liked the specific activities

1 2 3 4 5 6 7 8 9 10

-You were able to do hands-on learning

1 2 3 4 5 6 7 8 9 10

-The program was focused on math, science, and engineering

1 2 3 4 5 6 7 8 9 10

-You were able to spend time with your friends

1 2 3 4 5 6 7 8 9 10