AN EVALUATION OF THE EFFECTIVENESS OF THE SUMMER TECHNOLOGY AND ENGINEERING PREVIEW AT STOUT (STEPS) ON THE PERCEPTIONS OF FEMALES IN TECHNOLOGY OF SEVENTH GRADE GIRLS

By:

Ryan Timothy McKinney

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Dr. Richard Tafalla
Investigation Advisor

The Graduate College
University of Wisconsin-Stout
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The Graduate School
University of Wisconsin-Stout
Menomonie, WI 54751

ABSTRACT

McKinney Ryan T
(Writer) (Last Name) (First) (Initial)

An Evaluation of the Effectiveness of the Summer Technology and Engineering Preview (STEPS) on the Perceptions of Females in Technology of Seventh Grade Girls
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The purpose of this evaluation was to examine the effectiveness of participation in the Summer Technology Engineering Preview at Stout (STEPS) camps for short-term change of seventh grade girls' perceptions toward themselves and females in general working in technological fields. Analyses also included the identification of predictor variables that may affect these perceptions. In order to gather the necessary information, a survey was administered to campers who had received parental consent. The survey was given to the campers prior to, and following the week long camp. The survey contained questions designed to evaluate the girls' perceptions, attitudes, self-esteem, and social support structures. In addition to these, the girls were asked questions about the technical, developmental, and recreational activities they completed during the camp.

The seventh grade STEPS camps were held at the University of Wisconsin-Stout, University of St. Thomas, and Alexandria Technical College. In total, 335 girls participated in the evaluation. The mean age of the participating campers was 11.9 years.

Paired samples t-tests showed significant differences between the pre- and post-test survey responses of the campers. Also, multiple regression analysis revealed predictors of girls' perceptions to females in technological fields and their success in the STEPS camp.

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Chapter I

Introduction

STEPS Evaluation

The purpose of the evaluation of the Summer Technology and Engineering Preview (STEPS) camp was to determine the effectiveness of the camp to positively impact girls' perceptions concerning themselves in science, math, technology, and engineering. By providing girls with exposure to the aforementioned areas, it is hopeful that they will focus their education and career interests in this direction. A separate longitudinal study is in progress to assess these areas while the present study was designed to judge the short-term effectiveness of the STEPS camp. The evaluation component of the camp is designed to judge which areas are effective in influencing the girls' attitudes concerning technological careers. The evaluation also included a process element to determine camp activities that the girls are most pleased with, and conversely, areas that are not felt to be beneficial.

Gender Bias in Engineering

National statistics show that women now receive more then half of all bachelors degrees, yet more than twice as many men as women major in some field of mathematics, computer science, life or physical science, or engineering (Change, 1994). A number of issues may be seen as barriers for pursuing technological careers such as: classroom behavior, self-perception, and role models (Schiff, 1997). Women scientists are discouraged from an early age; even Barbie dolls have been manufactured to say, 'math

class is tough.' A girl who is having trouble in math is often told that her difficulties are normal, rather than being challenged to improve (Bruner, 1998).

As many adversities may challenge young girls in developing an interest to pursue a career in a technological field, foreclosure usually occurs at an early age. A crucial age for the formation of interests occurs before high school. During the critical attitude forming middle school years, girls blamed themselves for their challenges in science, while teachers discourage them from pursuing science through subtle forms of gender bias. This, together with existing stereotypes, lead girls to develop negative attitudes about science and to pursue other interests (Bojesen, 2000). Studies show to carve out more diverse career paths for women, changes must occur early on in education. Most girls lose interest in engineering fields before enrolling in college. Encouraging female students to take math and science courses throughout high school is crucial (Higgins & Koucky, 2000).

STEPS Experience

The STEPS camps are held the summer before the girls' seventh grade year. The reason for this is to counter the aforementioned finding that if girls are not encouraged during this pivotal period, they may never develop interest in technological careers (Bojesen, 2000). The curriculum of the seventh grade STEPS camp actively seeks to alleviate the other barriers faced by young females as well.

The activities during the week are broken down into three categories: technical, developmental, and recreational. During all of the activities the girls are surrounded by female counselors and professionals in order to portray to them positive female role models for technological careers.

The technical activities that the girls take part in during the week are designed to educate the girls in various aspects of science, math, engineering, and technology. During the week they have classroom lectures followed by hands-on time to show the practical applications of what they had learned. During the week the campers work together in teams to build a functional model airplane. The culminating activity at the end of the week is to actually fly the airplanes that they had built.

The developmental activities are designed to enhance social skills between the campers. These activities are planned to help the girls encourage each other in teamwork exercises. Finally, the recreational activities are designed to give girls some relaxation time. Recreational activities may include things like bicycling and playing arcade games. During all three kinds of activities the girls are supported and encouraged to facilitate the development of higher self-esteem.

The seventh grade STEPS camp was originally developed at the University of Wisconsin-Stout. Since its inception, the seventh grade camp has been replicated at St. Thomas University and Alexandria Technical College in Minnesota. A tenth grade STEPS camp has also been developed and takes place at the University of Minnesota. The evaluation of the STEPS camps is essential to the continued development and replication of the camp.

Problem Statement

The purpose of this study is to determine if participation in the STEPS camp plays a significant role in changing girls' attitudes and perceptions about females and themselves in technological careers. Constructs measured are the girls' perceptions of themselves and females in general, science and math interests, self-efficacy, and self-

esteem. These constructs were chosen for their applicability to the STEPS camp. The purpose of the STEPS camp is to influence the girls in all of these areas. Another component of the evaluation deals with the identification of variables that could predict a successful camp experience. It is hypothesized that the STEPS camp experience would lead to more positive views of oneself and more positive views of females in technological careers.

Chapter Two

Review of Literature

Traditionally, technological fields have been male dominated. The essentially patriarchal nature of science and technology was formed during the Enlightenment and Industrial Revolution (Kilbourne & Weeks, 1997). This same trend has continued in present day technologically advanced societies. Whereas women and closing the gap in various higher level careers, they are not doing so in technology related careers. The U.S. Bureau of Labor Statistics reports that in 1999, women made up 24.5 percent of doctors compared with 6.1 percent in 1950. In that same period, women went from 6.1 percent of engineers in 1950 to 10.6 percent in 1999. With the same basic educational requirements for both careers and federal laws, guidelines, and incentives in place to hire more women in previously male careers, women are not entering the field of engineering as they are the practice of medicine (Wolcott, 2001). High school boys are three times more likely to choose careers in engineering, mathematics, or science then girls (Schiff, 1997).

Engineering is not the only technologically advanced field in which women are underrepresented. With the rapid influx of computer technology into today's society it should be of concern that women are not actively pursuing careers in this field. In mathematics and computer science, almost twice as many men as women obtained degrees, largely because of a lack of women in computer science. Despite rising demand for software developers and information technologists, only 6,000 women, as compared with 15,000 men, graduated with degrees in those fields (Change, 1994)

One area that presents a possible explanation of this gender discrepancy has to deal with perception. Technology fields traditionally give the perception of being male dominated. Kleinman (2000) discusses how the social identity approach outlines how individuals conceptualize themselves and others as members of particular social groups. If this approach holds true, women would be more likely to steer away from traditionally male dominated careers as they could represent an "old boys" network that is hard to break into (Abrams, 2000). Technology professionals also often fall victim to the old but pervasive stereotype of the awkward IT worker sporting a pocket protector which can be a discouraging force for young women in their most impressionable years (Abrams, 2000).

The acknowledgement of the need for more women in technological fields is nationwide. The congressionally created Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology (CAWMSET) finds in most scientific pursuits a dramatic and persistent under representation of women (Garelik, 2000). In order to bridge the gender gap in technology related careers, classroom gender bias needs to be diminished, girls need to be exposed early on to the idea of such careers, and they need to be given positive female role models.

Although Title IX of the education amendments outlawed sex discrimination in the classroom, subtle forms of gender favoring behavior still exist (Bojesen, 2000). It's a fact that many teachers, parents and guidance counselors unfortunately discourage young women from pursuing careers in math, science and engineering (Abrams, 2000). Though teachers may not show overt discrimination against girls in science class even faintly favoring the male students may have an impact upon a young girls desire to

pursue an interest in science or technology. A recent report found that while teachers gave boys detailed instructions on how to do things, they completed the tasks for girls. Girls learn to attribute failure to lack of ability rather than lack of effort (Higgins et al., 2000). Placing the blame internally will inevitably cause girls to be less confident in technological areas.

Teachers may also tend to direct more technically advanced questions only to boys to aid in keeping a civil classroom environment. Koch (1994) discussed that this may be a main factor in girls being turned away from technologic fields; more specifically ones related to computers. She found that teachers only ask the boys technical questions, and boys mock girls' ignorance of technical terms. With the lack of a fostering educational experience, girls may feel more comfortable pursuing more traditional female careers.

Some recommendations are posed by Johnson (1999) to help reduce gender bias in the classroom. It is encouraged that parents become educated about the propensity for gender bias in science courses. It is dually noted by Costlow (2001) that a girls-only environment can be more effective way to reach female students than a mixed group, partly because boys tend to ask more questions and take over the sessions. Kleinfeld (1999) also notes that women succeed better in positive hands on environments.

A truly disparaging fact with the occurrence of gender bias in the classroom is that the pivotal age in which girls need to have positive exposures to science, math, and technology happens early on in their education. Koch (1994) found that girls need more exposure to technology, particularly during the critical middle-school years, when they often turn away from science, math, and technology. Unfortunately Bojesen (2000)

states that during the critical attitude-forming middle-school years, girls blamed themselves for the challenges in science, while teachers discouraged them from pursuing science. It is essential that girls receive positive experiences during these years to develop a continued interest in technology.

The middle school years offer a starting point of which to build a continued interest and exposure to science, math, and engineering. Some research findings by Armstrong (1985) suggest that the period from the 8th grade to the 12th grade is especially important, because it is during this transitional period that male students appear to catch up with and overtake female students in math. If girls loose interest during the early middle school years, they may easily fall soon behind their male counterparts. Change (1994) examines this critical period of exposure and encouragement in engineering. They state that girls are discouraged about their abilities in these disciplines even before they start college, while boys are encouraged to persevere even in the face of initial difficulties. Because of this structured nature, there is usually a window of introductory opportunity that, once missed, can never be revisited.

Of primary importance during the critical middle school years in the availability of role models. Availability of role models, among peers as well as among teachers and professionals, is essential to progress for young women in science and technology (Thom, 2002). It is necessary for young girls to be exposed to, and encouraged by, successful females in technological fields in order to foster possible future career choices. In both middle school and high school, girls need to meet and talk with successful women who work in technological fields (Silverman & Pritchare, 1996).

In order to reduce the gender gap and combat the fact that female students are underrepresented in high-technology learning environments (Crombie, Abarbanel, & Anderson, 2001), funding is being put forth to offer young girls opportunities to gain interest in technological fields. According to Computer Dealer News (2001), IBM corporation sponsors a week long camp called Exploring Interest in Technology Engineering (EXITE) which targets seventh and eighth grade girls in order to increase the number of female students taking information technology courses. The Society of Manufacturing Engineers (SME) sponsors the Summer Technology and Engineering Preview at Stout (STEPS). STEPS is a hands-on, tuition-free, residential camp targeting girls and minorities as they enter seventh grade. STEPS works through local colleges and universities and is funded by manufactures and private foundations (King, 2000). Through technical, developmental, and recreational activities, STEPS attempts to offer girls exposure to various technological career choices. Many of the counselors and directors of the STEPS camp are females which can offer the girls positive role models in technological fields.

STEPS was initially developed at the University of Wisconsin-Stout and in the year 2000, the seventh grade camp was replicated at the University of St. Thomas and Alexandria Technical College. An advanced STEPS camp for tenth grade girls has been developed at the University of Minnesota.

The program evaluation of STEPS is multi-faceted. First, there is a longitudinal study that is attempting to judge whether participation in the STEPS camp influences girls to enroll in technological courses in high school, and eventually choose college majors in science, math, engineering, or technology.

The present study examines the second area of the evaluation. It is intended to assess the short-term outcomes of the STEPS camp. This component reviews whether or not the camp is effective in altering girls' perceptions about females in technological fields, increasing their self esteem, and increasing their self-efficacy in technological areas.

Chapter Three

Methodology

Subjects

The 2001 STEPS camps took place at three universities. Each university had a total of four camps with 40 campers per week. This resulted in approximately 480 girls attending the 2001 seventh grade STEPS camps. All participants were invited to participate in the evaluation. When the campers were invited to participate in the STEPS camp, a letter explaining the evaluation and an accompanying consent form was sent to each camper's parent or guardian. Consent forms were returned to the researcher. Campers that did not return a consent form were again invited to participate in the evaluation during camp check-in. In order to agree to participate, a parent or guardian needed to be present to sign the appropriate consent form.

Of the possible 480 evaluation participants, 335 gave consent to take part in the evaluation yielding a consent rate of 69.8 percent. The mean age of the participants was 11.9 years of age.

Measures

The previous years evaluation team developed the surveys utilized in this evaluation. A copy of the survey instrument can be found in appendix A. The same survey instrument was employed for the 2001 evaluation due to a separate longitudinal evaluation. The survey was designed to measure demographic information, science math and computer exposure, perceptions, self-esteem, self-efficacy, science and math interests, social support, outcome and role expectations, occupational interests, and perceptions of the technical, developmental, and recreational activities.

The demographic questionnaire contained a number of questions designed to evaluate the campers' background. Areas addressed were: mothers and fathers occupation, number of siblings and siblings ages, siblings exposure to science and math courses, mothers and fathers educational level, parents income, and race or nationality. The items on this questionnaire were used as predictor variables for STEPS success.

The science, math, and computer exposure survey was designed to assess the number of activities that the girls' had participated in prior to attending the STEPS camp. The areas included: field trips, science camps, special science classes, math camps, special math classes, computer classes, special computer classes, science fairs, workshops, and seminars.

The perception survey included six questions about the girls perceptions about themselves and females in general working in the fields of science, math, and engineering. The perception survey was given before and after the camp. Since a goal of the STEPS camp is to change perceptions about females in science, math, and engineering, these questions were asked to assess any difference as a result of the camp.

In order to evaluate the campers self-esteem and self-efficacy, campers were asked to rate two questions concerning their confidence in science and math: I am good in math, and I am good in science. These questions were used in order to assess whether participation in the STEPS camp had an effect on girls self-esteem in science and math.

The self-efficacy section involved two components. The first component assesses the confidence of the girls in technical areas such as using calculators and utilizing laboratory equipment. The second component looked at the confidence levels of the girls in earning a "B" or better in science, math, and computer classes. These areas are of

critical importance due to the fact that early abandonment of technical careers can be due to low confidence in technical areas. The self-esteem/self-efficacy questions were asked prior to, and after completion of the camp.

The science and math interest survey addressed the girls' interest in participating in technological activities. Areas included science classes, math classes, computer classes, entering science fairs, and future camps like STEPS. Science and math interests are an important area to examine for the evaluation since interest in these kinds of activities may have a direct impact on the girls desire to pursue a career in a technology related field.

The social support survey utilizes 16 questions designed to evaluate the kind of support the girls receive from their family, friends, and teachers. This survey is also used to determine possible role models the girls may have. Since social support, especially from teachers can be a salient predictor when looking at foreclosure it is an important area to be evaluated.

The outcome and role expectations survey is concerned with the girls' expectations of taking technology courses and their expectations for the future. This measure helps to determine how worthwhile and accepted it is to take technology related courses. It also help to determine what early gender role expectations the girls have developed.

The occupational interest questionnaire was used to assess the camper's future occupational goals. Questions concerned what they would be doing when they were 25 years old and whether or not their career choices would require a college education. Along with the outcome and role expectations survey, the occupational interest survey

can be used to see if the girls have an early interest in pursuing a career in a technology related field.

Finally, the technical, developmental, and recreational activity surveys are designed to improve the camps process. These questionnaires dealt with how satisfied the girls were with the activities that they participated in during the camp. Seeing that STEPS is a fairly new camp, the information gained from these questionnaires will be very important in order to better tailor the camps for future girls.

Procedure

When girls for each site were invited to participate in the STEPS camp, an introductory letter explaining the evaluation, a consent form, and the demographic and exposure surveys were sent to each camper. Participation in the evaluation was voluntary. Because the campers were under the age of 18, a parent (or guardian)'s signature was required for participation in the evaluation. The consent form, demographic, and exposure surveys were then returned to the evaluator. When the materials were received, identification numbers were assigned to each camper. The identification numbers were to be used on all subsequent questionnaires as to ensure confidentiality.

Two weeks prior to the start of each camp, the camp director was sent evaluation instructions (appendix D) and the evaluation measures. At camp check in, consenting campers were given their identification number and the pre-test questionnaires(Appendix B). Campers that had not returned a consent form were invited to participate at that time. Those that consented were given the demographic, exposure (Appendix A), and pre-test

measures. The completed pre-test measures were placed in an envelope and returned to the evaluator.

At the conclusion of the camp, the campers were asked to fill out the post-test measures (appendix C). The post-test measures were collected by the camp director and returned to the evaluator. When all of the materials were received by the evaluator, the data was entered into a database using the Statistical Package for the Social Sciences (SPSS) for analysis.

Chapter Four

Results

In order to judge the short-term effectiveness of the STEPS camp, the data was analyzed on various levels. Individual variables were created into scales and from those scales, inferential analyses were used to examine pre-post differences. The pre-post differences were sought to determine how STEPS influenced girls' attitudes toward science, math, engineering, and technology.

Questions relating to a single construct were reduced to scales using coefficients derived from internal reliability testing. Crombach's Alpha was used to determine the internal reliability. Scales were developed for the following areas: Perception (.86), Science and Math interests (.88), Self Esteem/Self Efficacy (.79), Technical Activities (.90), and Developmental Activities (.74). Each scale was then converted into a composite score for each camper.

The technical activity and developmental activity composite scores measured the camper's opinions concerning the various activities that they participated in during the week. Correlational matrices were developed to show the associations between the technical and developmental activity composite scores and the composite scores of post-perception, science and math interests, and self-esteem/self-efficacy. Examination of these correlations was exploratory in nature and was used to determine how and if the aforementioned scales related to the campers feelings toward the technical and developmental activities.

In order to determine the short-term effectiveness of the STEPS camp in influencing girls' attitudes toward science, math, engineering, and technology, paired samples t-tests were used in comparing the pre and post-test responses on the perception, science and math interests, and self-esteem/self-efficacy.

Finally, in order to better understand which variables may predict success in the STEPS camp, multiple regression analysis was employed. The regression analyses focused on various demographic variables and examined their relationship to three separate criterion variables. The three criterion variables that were examined were post-perception, science and math interests, self-esteem/self-efficacy. The following regression equation was used in each analysis was as:

$$Y_1 = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$$

Y_1 = Post-perception in first analyses, science and math interests in second analysis, self esteem/self-efficacy in the third analysis. The predictor variables remained constant throughout each analysis with: X_1 = parents income, X_2 = mothers educational level, X_3 = fathers educational level, X_4 = technical activity composite score, and X_5 = developmental activity composite score and X_6 = each criterion variable's corresponding pre-test composite score

Short-term STEPS effectiveness was evaluated using a paired samples t-test. Significant differences were found between pre and post perception ($t= -3.5$, $p= .001$), pre and post science and math interests ($t= -5.1$, $p= .001$), and pre and post self- esteem/self-efficacy ($t= -4.5$, $p= .000$). A detailed description of the findings can be seen in table 1

Table 1
Paired Samples Statistics

		Pre-test	Post-test	t	df	p
Perception	Mean	4.5	4.6	-3.5	312	.001
	SD	.62	.54			
	N	313	313			
Science/Math Interests	Mean	6.3	6.7	-5.1	303	.000
	SD	1.5	1.5			
	N	304	304			
Self-esteem/ Self-efficacy	Mean	7.2	7.5	-4.5	297	.000
	SD	1.2	1.3			
	N	298	298			

Correlational relationships were calculated between the technical and developmental composite scores and the post-perception, science and math interests, and the self-esteem/self-efficacy constructs. Pearson correlations showed significant relationships between all constructs. Correlational coefficients are examined in table 2.

Table 2
Composite score correlations

	Technical Activity	Developmental Activity	Post-Perception	Post-Science/Math Interests	Post-Self-esteem/ Self-efficacy
Technical Activity	1.0	.69**	.36**	.55**	.39**
Developmental Activity	--	1.0	.29**	.44**	.29**

** p<.01

Three multiple regression equations were employed to examine six independent variables in predicting one criterion variable. A stepwise regression was used in each instance to examine which variable(s) had the most predictive power. The first

regression equation used was: $Y_1 = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$, with post-perception as the dependent variable and parents income, mothers education, fathers education, technical activity composite score, developmental activity composite score, and pre-perception as the independent variables. This analysis extruded two models. The first model included only the pre-perception composite score (t= 14.55, p<.01). All other variables were excluded. The second model included the pre-perception composite score (t= 13.7, p<.01) and the technical activity composite score (t= 4.96, p<.01). A detailed explanation can be seen in table 3.

Table 3
Post-perception regression results

Model	Standardized #	t	Sig.	R^2
1. Pre-perception	.69	14.55	.00	.48
2. Pre-perception	.64	13.7	.00	.53
Technical activity	.23	4.96	.00	

The second regression equation used was: $Y_1 = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_6$, with science and math interests as the dependent variable and parents income, mothers education, fathers education, technical activity composite score, developmental activity composite score, and pre-science and math interests as the independent variables. This analysis extruded two models. The first model included only the pre-science and math interests composite score (t= 15.66, p<.00) with all other variables excluded. The second model included the pre-science and math composite score (t= 12.07, p<.00) and the technical activity composite score (t= 4.31, p<.00) with all other variables excluded. A detailed explanation can be seen in table 4.1.

Table 4
Post-science and math interests regression results

Model	Standardized #	t	Sig.	R^2
1. Pre S/M interest	.72	15.66	.00	.53
2. Pre S/M interest	.62	12.07	.00	.57
Technical activity	.22	4.31	.00	

The third regression equation used was: $Y_1= b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + b_5X_5 + b_6X_{6,}$ with self-esteem/self-efficacy as the dependent variable and parents income, mothers education, fathers education, technical activity composite score, developmental activity composite score, and pre self-esteem/self-efficacy composite score as the independent variables. This analysis extruded two models. The first model included only the pre self-esteem/self-efficacy composite score (t= 19.15, p<.00) with all other variables excluded. The second model included the pre self-esteem/self-efficacy composite score (t= .17.61, p<.00), technical activity composite score (t= 2.87, p<.00), with all other variables excluded. A detailed explanation can be seen in tables 5.

Table 5
Post self-esteem/self-efficacy regression results

Model	Standardized #	t	Sig.	R^2
1. Pre Se/Se	.79	19.15	.00	.63
2. Pre Se/Se	.75	17.60	.00	.64
Technical activity	.12	2.87	.00	

Chapter Five

Discussion

The primary purpose of this study was to examine the short-term effectiveness of participation in the STEPS camp. Research has plainly shown the large gender differences in technology related fields (Gaston, 2001), and the STEPS camp is an effort to encourage females to enter more technologically related fields. The evaluation consisted of various components, each designed to measure a specific area related to girls early foreclosure in math and science. Many of these components can be analyzed to add understanding to why girls may choose not to pursue careers in science, math, technology, and engineering. However, for the purpose of this evaluation, of primary importance is to assess whether STEPS is actually altering girls attitudes toward technologically related fields.

Pre-Post differences

The perception scale was designed to measure girls' perceptions of themselves and females in general in science, math, and engineering. The effectiveness of the STEPS camp can be seen in the pre and post differences to this questionnaire. The significant pre-post difference suggests that the STEPS camp does in fact have a positive effect on girls' perceptions of themselves and females in the fields of science, math, and engineering.

The science and math interest scale was designed to measure girls' interest in science and math related activities. Again, pre-post analysis showed a significant increase in interest in these areas. This finding suggests that as a result of participation in

the STEPS camp, these girls may be more likely to participate in science and math related activities.

The self-esteem/self-efficacy scale was designed to measure the girls self reported competence levels in various areas associated to science, math, engineering and technology. The significant pre-post difference suggests that after participation in the STEPS camp, the girls have gained more confidence to perform better in these areas.

Correlations

The primary goal of the correlational analyses was to determine the strength of the relationships between the various composite scores. The campers experiences as measured by the technical and developmental activity scores are an indicator of their personal feelings about the processes of the camp. Correlating these scores with their perception, science and math interests, and self-esteem/self-efficacy scores can help to determine whether or not the camp is effective in cultivating and maintaining interest in science, math, engineering, and technology.

Overall, statistically significant relationships were identified between all of the constructs. These findings suggest that the successful completion of the technical and developmental activities that the girls participated in during the week were directly related to how they perceive themselves, their interests in science and math, and how confident they are in these areas.

Regression analysis

Multiple regression equations were utilized to examine predictor variables in predicting one criterion variable. The three criterion variables: post-perception, post-science and math interests, and post-self-esteem/self efficacy all extruded similar

predictor variables. In each equation, the corresponding pre-test was the first model to be removed. In all three instances, the second model removed consisted of the corresponding pre-test score accompanied by the technical activity composite score.

This finding can be interpreted in two ways. First, because of the strength of each criterion variables pre-test score, it can be argued that the STEPS camp had no real effect on the camper's perceptions, interests, and self-esteem/self-efficacy. However, when the second model is interpreted, the STEPS intervention reveals a positive change. The pre-test scores act as a control of the variance and the technical activity composite score (which represents the intervention of the camp) becomes a significant predictor variable.

The second model for each criterion variable included the technical activity score. When combined with the corresponding pre-test in each analysis, the R^2 values showed that the variance accounted for rose to 53 percent for post-perception, 56 percent for science and math interests, and 64 percent for self-esteem/self-efficacy. The technical activity score is a direct measure of the extent the girls' enjoyment of the weeks technical activities. These analyses show that the girls' enjoyment of the camp is a significant predictor of their overall camp success. This finding also shows that STEPS is more effective for girls that already have higher perceptions, science and math interests, and self-esteem/self-efficacy before the beginning of camp.

The excluded variables show that they had no significant value when predicting post camp perception, science and math interests, and self-esteem/self-efficacy. It is interesting to note that the demographic variables such as parents income and parents educational level were not predictive of the campers overall success.

Practical Applications

As previously mentioned, the purpose of this evaluation was to judge the effectiveness of the STEPS camp in affecting the attitudes of seventh grade girls. The findings show that the camp is indeed effective on two levels. First, the pre and post testing shows that the camp does have an impact on the way that the girls perceive themselves and females in technologically related fields. Secondly, the high correlations of the technical and developmental activities show that the process of the camp is effective. Also, the girls success in the camp, judged by the technical activity score, predicts, and is related to, their perceptions, interests, and confidence. Overall, the findings suggest that the STEPS camp is effective.

Limitations and Recommendations

The main limitation in this study is the primacy of when the post-test administration. Further research should be conducted to evaluate whether the girls still show high perceptions, interests, and confidence levels in the future. As the girls will be making elective course enrollment choices in high school, it would be interesting to periodically follow-up with them at that point, and again in college to see if their responses have differed.

As a separate component of the STEPS evaluation is a longitudinal piece, this limitation may be met. However, the present longitudinal evaluation does not include the same pre-test survey. The questions regarding perceptions, science and math interests, and self-esteem/self-efficacy should be included with all follow-up questionnaires.

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Appendix A

Demographic and Exposure Measures

Please fill in the blanks to best answer the following questions. **D**

If you need help, ask your parent(s) or guardian.

ID#: _____ Age: _____

Date: _____

Mother's Current Occupation: _____ Mother's Past Occupation: _____

Father's Current Occupation: _____ Father's Past Occupation: _____

Please list the number of brothers and sisters you have.

Number of Siblings: _____

If you have brothers or sisters, please list their age. If they are older than you, list the number of math and science courses they have completed. If you're not sure, ask your parent(s) or guardian.

Siblings' Age: _____
Number of Math Courses: _____
Number of Science Courses: _____

Siblings' Age: _____
Number of Math Courses: _____
Number of Science Courses: _____

Siblings' Age: _____
Number of Math Courses: _____
Number of Science Courses: _____

Siblings' Age: _____
Number of Math Courses: _____
Number of Science Courses: _____

Please check the items that apply.

Mother's Education Level

____ Less than 8th Grade
____ Some High School
____ High School Graduate/GED Completion
____ Some Technical School/Community College
____ Technical School/Community College Graduate
____ Some College
____ College Graduate
____ Some Graduate School
____ Graduate School Degree

Father's Education Level

____ Less than 8th Grade
____ Some High School
____ High School Graduate/GED Completion
____ Some Technical School/Community College
____ Technical School/Community College Graduate
____ Some College
____ College Graduate
____ Some Graduate School
____ Graduate School Degree

Parent (s) Income Level

____ < $14,999
____ $15,000 to $29,999
____ $30,000 to $44,999
____ $45,000 to $59,999
____ $60,000 to $74,999
____ $75,000 to $89,999
____ $90,000 or More

Race

___ White _____ African American _____ Asian _____ Hispanic _____ Native American

E

ID#: _____

Please state the number of Science, Math or Computer activities you have participated in and completed. If you do not know the exact number, ask your parent(s) or guardian.

If you have not participated in an activity, put a 0.

Field Trips: _____

Science Camps: _____

Special Science Classes: _____

Math Camps: _____

Special Math Classes: _____

Computer Camps: _____

Special Computer Classes: _____

Science Fairs: _____

Workshops: _____

Seminars: _____

"Take Your Daughter to Work Day" *(reflecting Science, Math and Engineering*)
_____

Other:
_____

Appendix B
Pre-test measures

OI

ID#: _____

1. What do you think you will be doing when you are 25 years old (i.e. single or married, any children, career, etc…)?

2. In what jobs/careers are you interested? Please list all that you are interested in.

3. Do the jobs/careers you are interested in require a college education?

Yes No Unsure

4. If yes, please list the college(s) you are interested in attending.

In your future job/career, do you want…

5. to be the boss? Yes No

6. to make important decisions? Yes No

P

ID#: _____

Please circle the number that best describes your present feelings regarding each statement.

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	2	3	4	5

It is okay for…

1. a female to work in Science	1	2	3	4	5
2. a female to work in Math	1	2	3	4	5
3. a female to work in Engineering	1	2	3	4	5
4. me to work in the field of Science	1	2	3	4	5
5. me to work in the field of Math	1	2	3	4	5
6. me to work in the field of Engineering	1	2	3	4	5

A2

ID#: _____

Draw a Picture of an Engineer:

What does an Engineer do?

ID#_____ SM Interests

Please circle how interested you are in taking each of the classes or activities listed below.

YUCK! VERY!
Zero Interest Interested

1 2 3 4 5 6 7 8 9

1. Taking Science classes in school 0 1 2 3 4 5 6 7 8 9
2. Taking math classes in school 0 1 2 3 4 5 6 7 8 9
3. Taking computer classes in school 0 1 2 3 4 5 6 7 8 9
4. Future camps like STEPS 0 1 2 3 4 5 6 7 8 9
5. Joining science or computer clubs 0 1 2 3 4 5 6 7 8 9
6. Reading science magazines 0 1 2 3 4 5 6 7 8 9
7. Entering science fairs 0 1 2 3 4 5 6 7 8 9
8. Writing computer programs 0 1 2 3 4 5 6 7 8 9

ID#_____ MS SEFF & SEST

Circle the number that fits how confident you are in successfully doing each task.
(Confidence means how well you think you can do something)

No Confidence at all Complete Confidence

0 1 2 3 4 5 6 7 8 9

1. Solving math problems without a calculator 0 1 2 3 4 5 6 7 8 9
2. Solving math problems with a calculator 0 1 2 3 4 5 6 7 8 9
3. Completing science projects 0 1 2 3 4 5 6 7 8 9
4. Using science laboratory equipment 0 1 2 3 4 5 6 7 8 9
5. Writing computer programs 0 1 2 3 4 5 6 7 8 9

Circle the amount of confidence you have in earning a "B" or better in each class

No Confidence at all Complete Confidence

0 1 2 3 4 5 6 7 8 9

1. Regular math classes 0 1 2 3 4 5 6 7 8 9
2. Advanced math classes 0 1 2 3 4 5 6 7 8 9
3. Regular science classes 0 1 2 3 4 5 6 7 8 9
4. Advanced science classes 0 1 2 3 4 5 6 7 8 9
5. Regular computer classes 0 1 2 3 4 5 6 7 8 9
6. Advanced computer classes 0 1 2 3 4 5 6 7 8 9

Circle the number that fits how you feel about each of the following statements

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9

1. I am good in math 0 1 2 3 4 5 6 7 8 9
2. I am good in science 0 1 2 3 4 5 6 7 8 9

Appendix C
Post-test measures

OI

ID#: _____

2. What do you think you will be doing when you are 25 years old (i.e. single or married, any children, career, etc…)?

2. In what jobs/careers are you interested? Please list all that you are interested in.

3. Do the jobs/careers you are interested in require a college education?

Yes No Unsure

4. If yes, please list the college(s) you are interested in attending.

In your future job/career, do you want…

5. to be the boss? Yes No

6. to make important decisions? Yes No

P

ID#: _____

Please circle the number that best describes your present feelings regarding each statement.

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	2	3	4	5

It is okay for…

1. a female to work in Science	1	2	3	4	5
2. a female to work in Math	1	2	3	4	5
3. a female to work in Engineering	1	2	3	4	5
4. me to work in the field of Science	1	2	3	4	5
5. me to work in the field of Math	1	2	3	4	5
6. me to work in the field of Engineering	1	2	3	4	5

A2

ID#: _____

Draw a Picture of an Engineer:

What does an Engineer do?

Rate your overall STEPS experience.
One is the worst and Ten is the best.
Circle the number that represents your STEPS experience.

0 2 3 4 5 6 7 8 9 10

ID#_____ SM Interests

Please circle how interested you are in taking each of the classes or activities listed below.

YUCK! Zero Interest — VERY! Interested

1 2 3 4 5 6 7 8 9

1. Taking Science classes in school 0 1 2 3 4 5 6 7 8 9
2. Taking math classes in school 0 1 2 3 4 5 6 7 8 9
3. Taking computer classes in school 0 1 2 3 4 5 6 7 8 9
4. Future camps like STEPS 0 1 2 3 4 5 6 7 8 9
5. Joining science or computer clubs 0 1 2 3 4 5 6 7 8 9
6. Reading science magazines 0 1 2 3 4 5 6 7 8 9
7. Entering science fairs 0 1 2 3 4 5 6 7 8 9
8. Writing computer programs 0 1 2 3 4 5 6 7 8 9

ID#_____ MS SEFF & SEST

Circle the number that fits how confident you are in successfully doing each task.
(Confidence means how well you think you can do something)

No Confidence at all Complete Confidence

0 1 2 3 4 5 6 7 8 9

1. Solving math problems without a calculator 0 1 2 3 4 5 6 7 8 9
2. Solving math problems with a calculator 0 1 2 3 4 5 6 7 8 9
3. Completing science projects 0 1 2 3 4 5 6 7 8 9
4. Using science laboratory equipment 0 1 2 3 4 5 6 7 8 9
5. Writing computer programs 0 1 2 3 4 5 6 7 8 9

Circle the amount of confidence you have in earning a "B" or better in each class

No Confidence at all Complete Confidence

0 1 2 3 4 5 6 7 8 9

1. Regular math classes 0 1 2 3 4 5 6 7 8 9
2. Advanced math classes 0 1 2 3 4 5 6 7 8 9
3. Regular science classes 0 1 2 3 4 5 6 7 8 9
4. Advanced science classes 0 1 2 3 4 5 6 7 8 9
5. Regular computer classes 0 1 2 3 4 5 6 7 8 9
6. Advanced computer classes 0 1 2 3 4 5 6 7 8 9

Circle the number that fits how you feel about each of the following statements

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9

1. I am good in math 0 1 2 3 4 5 6 7 8 9
2. I am good in science 0 1 2 3 4 5 6 7 8 9

SS

Circle the number that best fits how you feel about each of the following statements.

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9

1. My friends want “A”s in science and math classes.	0	1	2	3	4	5	6	7	8	9
2. My friends are bad in science and math classes.	0	1	2	3	4	5	6	7	8	9
3. My friends help me to do my best in science and math classes.	0	1	2	3	4	5	6	7	8	9
4. My friends encourage me in science and math activities.	0	1	2	3	4	5	6	7	8	9
5. People good in science and math are cool.	0	1	2	3	4	5	6	7	8	9
6. My teachers help me do my best in science and math classes.	0	1	2	3	4	5	6	7	8	9
7. My science and math teachers are cool.	0	1	2	3	4	5	6	7	8	9
8. My science and math teachers like me.	0	1	2	3	4	5	6	7	8	9
9. My teachers encourage me in science and math.	0	1	2	3	4	5	6	7	8	9
10. My parents tell me I am good in science and math.	0	1	2	3	4	5	6	7	8	9
11. My parents help me to do my best in science and math.	0	1	2	3	4	5	6	7	8	9
12. My mom is good in science and math.	0	1	2	3	4	5	6	7	8	9
13. My dad is good in science and math.	0	1	2	3	4	5	6	7	8	9
14. My brothers and sisters give me a hard time for taking science and math classes.	0	1	2	3	4	5	6	7	8	9
14. My parents encourage me in science and math	0	1	2	3	4	5	6	7	8	9
15. My guidance counselor at school encourages me to take science and math activities.	0	1	2	3	4	5	6	7	8	9

ID #:_____ OE

For each statement below, please circle the number that best fits your thoughts.

Strongly Disagree Strongly Agree

0 1 2 3 4 5 6 7 8 9

1. My friends will respect me if I take math, science or computer classes. 0 1 2 3 4 5 6 7 8 9

2. Taking math, science or technology classes are a waste of time. 0 1 2 3 4 5 6 7 8 9

3. When I'm an adult, I will get a better job if I take math, science or computer classes. 0 1 2 3 4 5 6 7 8 9

4. I will be ready for college if I take math, science or computer classes. 0 1 2 3 4 5 6 7 8 9

When I am an adult, I want to….. RE

1. Get married 0 1 2 3 4 5 6 7 8 9

2. Have Children 0 1 2 3 4 5 6 7 8 9

3. Stay home full time with children while they are young 0 1 2 3 4 5 6 7 8 9

4. Stay home part time with children while they are young 0 1 2 3 4 5 6 7 8 9

5. Have a full-time career 0 1 2 3 4 5 6 7 8 9

6. Have a part-time career 0 1 2 3 4 5 6 7 8 9

ID#: _____

TA

During the week you participated in many science, math, and technology activities.
(*Please ask your counselor if you are not sure which activities those were).*
Circle the number that best fits how you felt about the activities.

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

1. Were fun	1	2	3	4	5
2. Involved teamwork	1	2	3	4	5
3. Were competitive	1	2	3	4	5
4. Were challenging	1	2	3	4	5
5. Increased my interest in science	1	2	3	4	5
6. Increased my interest in math	1	2	3	4	5
7. Increased my interest in engineering	1	2	3	4	5
8. Made me nervous	1	2	3	4	5
9. Relates to my life	1	2	3	4	5
10. Will relate to my future life	1	2	3	4	5
11. Were frustrating to me when I started	1	2	3	4	5
12. Were frustrating to me upon completion	1	2	3	4	5
13. Made me feel better about myself	1	2	3	4	5
14. Could be repeated with no instruction	1	2	3	4	5
15. Were easy to understand	1	2	3	4	5

I received support from…

16. Other campers, the instructors & assistants	1	2	3	4	5

Please answer the following.

17. How many people did you admire during these activities: Male_____ Female_____

18. How much time did YOU spend with hands-on control of the activities? (Do not include the time your group spent on the activities) _____

DA

ID#: _____

During the week you participated in activities that helped you to be a better person.

***If you cant remember what activities those were, just ask your counselor*.**

Circle the number that best fits how you felt about the activities

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	2	3	4	5

The activities…

1.	Were fun	1	2	3	4	5
2.	Made me nervous	1	2	3	4	5
3.	Increased my problem solving skills	1	2	3	4	5
4.	Made me frustrated	1	2	3	4	5
5.	Helped me learn more about myself	1	2	3	4	5
6.	Made me feel more comfortable about myself	1	2	3	4	5
7.	Made me like myself more	1	2	3	4	5
8.	Increased my ability to complete challenging tasks	1	2	3	4	5
9.	Will make my future better	1	2	3	4	5
10.	Made me feel like a leader	1	2	3	4	5

During the activities I received support from…

11.	Other campers & STEPS staff	1	2	3	4	5

My favorite personal development activity was:

_____

_____

My least favorite personal development activity was:

_____

_____

RA

ID#: _____

During the week you participated in many activities that were just for fun. Please circle the number that best describes your feelings toward those activities

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	2	3	4	5

During the Recreational Activities…

1. I had fun	1	2	3	4	5
2. I felt good about myself	1	2	3	4	5
3. I interacted with others	1	2	3	4	5
4. I felt alone	1	2	3	4	5
5. I felt frustrated	1	2	3	4	5

I received support during the recreational activity from…

6. STEPS staff and other campers	1	2	3	4	5

My favorite just for fun activity was:

_____

_____

My least favorite just for fun activity was:

_____

_____

Appendix D
STEPS evaluation instructions

Evaluation Protocol

Summer Technology and Engineering Preview
2001

Two weeks prior to the four weeks of camps, the evaluation team will be sending the STEPS director the following information:

- A list of names of **consenting** campers
- A list of names of **non-consenting** campers
- A list of names of campers who have **not replied** to the initial mailing
- A sealed envelope for each consenting camper containing her identification number

Sunday Check in Directions

- Greet and introduce yourself to each camper and her parents if they are accompanying her to camp
- Explain that you need a few minutes of her and her parents'(if appropriate) time to discuss the program evaluation research project.
- Ask the camper her name
- Look for the camper's name on the list and see if they are:
  - Consenting
  - Not consenting
  - No reply

Consenting Campers

Step 1- Ask camper and parent(if present) the following questions:
a- What is the purpose of the evaluation?
b- What is the evaluation asking you to do?
c- *What are the risks and benefits of participating*?
Step 2- If the camper is unable to answer any of these questions, inform them of the correct answer
Step 3- Go to section on **Administering Pre-STEPS Questionnaires**.

Not Consenting Campers

Step 1- Inform the camper that if she would like, she can see the surveys but she is NOT to complete them.

No Reply Campers

Step 1- Determine if parent or guardian is present
- If parent or guardian is not present, refer to instructions for Non Consenting campers
- If parent or guardian is present, go to step 2

Step 2- Give parent and camper a copy of Informational letter & Consent form and ask them to carefully read both.
- If consenting, Obtain signatures on the consent form from both the parent and the camper. Go to step 3.
- If not consenting, refer to instructions for not consenting campers.

Step 3- Continue with same process as outlined for Consenting Campers then go to step 4.
Step 4- Give camper a blank copy of the Demographic and Exposure Surveys. Instruct her To complete them with the additional surveys to be administered as discussed in the Section for **Administering Pre-STEPS Questionnaires**.

Administering Pre-STEPS Questionnaires

Step1- Give the camper the sealed envelope with her name on it

Inform the camper that the envelope contains her evaluation study ID number.

Instruct the camper to use this number and not her name on all questionnaires to be completed.

Instruct her to leave an item blank if she does not want to answer it.

Remind camper that she will be asked to complete questionnaires again at the end of the week.

Step 2- Give each camper a Pre-STEPS packet of questionnaires (blue packet)

Inform the camper that the questionnaires will take approximately 20-30 minutes of her time.

Instruct the camper to return the completed packet (and Demographics and Exposure Survey if appropriate) to designated drop off box.

Inform the camper that the packet should be completed during check-in or after the completion of wrap-up that evening.

Step 3- Completed packets should be given to the STEPS director on Sunday evening.

Done with Sunday Directions

Friday Directions

Prior to the graduation ceremony, the campers will complete the second (pink) packet.

Two boxes should be placed in the graduation hall, one containing the packets and one empty box in which the campers are to place the completed packets.

Campers will be instructed to fill out the packet and place it in the correct box.

Remind campers to use their ID number when completing the packet

After all campers have completed the packets, the box will be given to the STEPS coordinator for that site.

The evaluation team will pick up the completed packets from the STEPS coordinator.

It is extremely important that the campers use their identification number when filling out the questionnaires. Please remind them to do so at the beginning and end of the week and instruct them to keep their identification number in a safe place to ensure that it is not lost. Remind them Friday morning to bring their identification number with them to the graduation ceremony.

If you have any questions during the weeks, contact Richard Tafalla 715-232-1662, or Ryan McKinney 715-235-4542.

Thank you