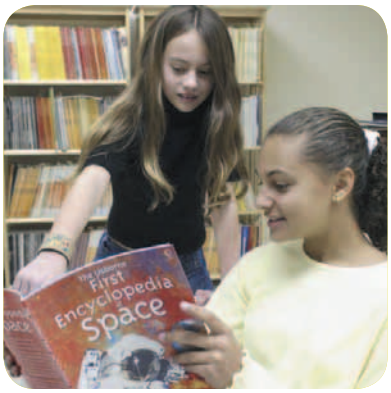
GIRL SCOUTS OF THE USA | MOTOROLA FOUNDATION

Girl Scouts®

Evaluating Promising Practices

in Informal Science, Technology, Engineering, and Mathematics (STEM) Education for Girls



RESEARCHERS Carrie Liston, Karen Peterson, Vicky Ragan
Evaluation & Research Associates
Puget Sound Center for Teaching, Learning and Technology

motorola foundation

EXECUTIVE SUMMARY

Evaluation and Research Associates (ERA) of the Puget Sound Center for Teaching, Learning and Technology contracted with the Girl Scouts of the USA to review informal science, technology, engineering and/or mathematics (STEM) education programs in order to identify promising and effective practices for girls. Findings of this project will add to the research data on what practices and structures are effective in informal education for increasing girls' interest and engagement in STEM, and hopefully improve girls' experiences in such programs.

The theory of change underlying this project is that informal education programs can influence the career choices of girls, and there are specific practices that are effective when used with girls in informal education programs in grades K – 12. Informal education programs that adopt these practices will be more successful in influencing girls' career choices.

Study components included creating a directory of informal STEM education programs for girls, conducting a literature review to establish a baseline of effective practices, developing and administrating a survey to program representatives, and developing a final report of findings identifying effective practices. Survey questions, derived from the literature review and input from the Girl Scouts of the USA, collected both quantitative and qualitative data from program respondents.

Program Demographics

The majority of the 123 programs responding to the survey incorporated multiple STEM content areas into their program curriculum, with aspects of science and technology the most common. Programs surveyed were located in 36 states of the United States, including 74% serving participants in urban areas and 60% serving suburban areas. The majority of the programs were created between 2000 and 2007, though a few have existed for more than 40 years. Sixty-one percent of the programs surveyed were non-profit or community-based programs. The frequency of program meetings varied, including one-time events (26%), programs meeting a few times a year (17%), or some other frequency (57%).

The majority of programs surveyed served girls only (60%). They most commonly reached youth in grades six through ten, and 35% of programs served over 101 participants at once. Ethnicity-wise, programs indicated a mean percentage of 61% Caucasian/European American participants, 24% Black/African American, and 12% Hispanic/Latino. Program respondents recruited participants using a variety of resources, with about 75% using print advertising, a Web site, and participants' word-of-mouth. Eighty-seven percent of programs indicated they specifically targeted participant groups, most commonly female middle school participants. A quarter of programs reported that 49% to 70% of participants who start their programs remain involved.

Funding came from a variety of sources, with the three main sources being the participants themselves (55%), corporations (54%), or private foundations (44%). Most programs charge $25.00 or less for participation and, of those who charge for their programs, only 15% indicated that fees covered the cost of the program. Programs frequently received in-kind support, most commonly in the form of staff or volunteer time (78%) facilities or office space (65%).

Promising Practices

Utilizing a list of practices generated from the literature review on effective elements for engaging participants in informal education programs, and more specifically for girls in STEM, 33 practices were organized into the following categories for the survey:

- Staff Practices
- Curriculum Practices
- Learning Experience Practices
- Career Information Practices
- Other Practices (Not categorized into the above categories)
- Additional Practices (Survey respondents wrote in their practices)

Respondents were asked to identify their level of agreement to the statement that each practice contributed to the success of their program, using a scale of 1 to 5, where 1 = Strongly Disagree and 5 = Strongly Agree. Respondents were also asked to select the five practices they felt were most critical in determining the success of their program.

The most highly rated practices from the survey contributing to a program's success were:

Practice	Mean
Hands-on experiences	4.87
Project-based learning opportunities (e.g. projects with real-world activities)	4.60
Opportunities to work together with other people	4.55
Making curriculum relevant, tying it to real-life issues	4.49
Program Director with strong leadership skills	4.47
Experienced Program Director	4.46
Experienced staff	4.46
Sufficient funding	4.46
Opportunities to use technology to be creative and explore	4.42
Small group sizes	4.37

The most frequently included "top five" practices by survey respondents were as follows:

Practice	Percentage of Respondents
Hands-on experiences	65%
Making curriculum relevant, tying it to real-life issues	47%
Project-based learning opportunities	28%
Experienced Program Director	27%
Experienced staff	27%
Girls-only environments	27%
Using curriculum materials that appeal to girls	24%
Sufficient funding	23%
Program Director with strong leadership skills	22%
Contact with mentors	19%

Many of the highest rated practices were related to the learning experiences of participants, or how they are engaged in activities. There was not a lot of variation between different types of programs on how they rated the practices, signifying that a common set of practices can be effective for a diverse set of programs. The next sections discuss in depth the responses under each category.

Staff Practices

Overall, staffing elements were considered to strongly contribute to a program's success. A program director with strong leadership skills was rated as among the most important staff element (mean = 4.47) along with experienced staff and an experienced program director (mean = 4.46). When asked to elaborate on successful staff practices, programs specified that a diverse staff with high energy and enthusiasm and skills working with youth were most effective.

Curriculum Practices

A number of the practices identified as highly contributing to a program's success were related to teaching or exposing participants to the nature of work in STEM. Project-based learning opportunities (mean = 4.60) and tying curriculum to real-life issues (mean = 4.49) were highly rated practices in curriculum and overall. Almost half of the respondents selected relevant curriculum as one of the most important practices. Program respondents believed participants became more engaged and learned content more easily when they were able to relate it to their lives. Interestingly, tying curriculum to participants' culture was one of the least valuable practices. Using curriculum materials that appeal to girls was rated significantly higher by girls-only programs compared to co-educational programs (independent samples t-test, $p<.05$, n = 69, n = 48, respectively).

Learning Experience Practices

Hands-on experiences received a mean of 4.87 and ranked first of all practices, with 65% of respondents selecting it as one of the five most important practices. While traditional school work often includes reading and writing about content, informal

education programs attempt to involve participants in interactive lessons where they learn by doing and working together.

According to program respondents, it is important for informal education programs to let the participants relax and enjoy themselves. This was believed to make content more interesting and learning more enjoyable. The program location may also contribute to a program's success. Holding events on a college campus sparked girls' imaginations of what it would be like to work or study there. In addition, many program staff appreciated higher-end or cutting-edge technology resources, but these were not necessary to make a program successful.

Career Information Practices

Contact with mentors had a mean of 4.33 and ranked 10th out of 33 practices, with 19% of respondents selecting it as one of the five most critical practices. Seventy-seven percent of programs completing this survey said they had a mentoring component. A third of the program respondents indicated participants interacted with mentors a few times a year, such as in visits to the program or via field trips. Through fun, hands-on activities and contact with mentors working in STEM fields, program respondents hoped participants would gain a more accurate understanding of the creative and collaborative nature of STEM work, who is employed in STEM, and provide them with role models. Many found it more effective to find mentors who were similar to the program participants, including those who were younger, ethnically diverse, and female.

Other Practices (not included in the above categories)

Sufficient funding had a mean of 4.46 and ranked eighth out of 33 practices, with 23% of respondents selecting it as one of the five most critical practices. However, a few program respondents stated they could make their program successful despite a lack of funding or resources. Setting clear program goals was stated as important to help organize activities and get staff on the same page regarding their efforts. Providing leadership opportunities to participants, including participants making curriculum and activity decisions, was seen as a method of increasing participant engagement and involvement. A large percentage of programs conducted evaluations (89%), and though it was rated as useful with a mean of 4.01, it was one of the lowest rated practices. Most evaluations were to inform program implementation and to report to funders or program staff. The large majority (88%) of programs conducting evaluations agreed that results were useful.

Additional Practices (Survey respondents shared their practices)

In this section, respondents shared practices that were not listed in the previous five categories. Frequent responses included utilizing slightly older girls as role models or mentors, establishing and leveraging partnerships with local organizations, businesses, and schools, and locating the program on a college or university campus.

Conclusions

Effective strategies toward meeting program goals included engaging girls in hands-on, relevant activities that allowed for collaboration. Programs also exposed girls to STEM-related careers through information or contacts with mentors. Informal education programs benefited from the relaxed environment that showed how STEM could be "fun."

There were similar findings between types of programs, such as frequency of meetings, ages served, participant gender, and what constitutes a promising practice for informal STEM education programs for girls. One difference was girls-only programs (n=69) rating girls-only environments and curriculum that appeals to girls as significantly ($p<.05$) more important to the success of their program, compared to co-educational programs (n=48). The high level of agreement overall shows that findings should be applicable across a wide range of programs. A number of additional questions for further research, including the ability to generalize results and participant outcomes specific to different practices, are discussed at the end of this report.

TABLE OF CONTENTS

INTRODUCTION

Project Background

Evaluation and Research Associates (ERA) of the Puget Sound Center for Teaching, Learning and Technology contracted with the Girl Scouts of the USA to review informal science, technology, engineering or mathematics (STEM) education programs and initiatives for Kindergarten through 12th grade girls in order to determine promising and effective practices.

The three objectives of the project were to: 1) identify promising practices for engaging girls in informal STEM education programs for K – 12 participants; 2) create a report based on the findings; and 3) create a program database. The three main project components were: 1) a literature review of articles and research studies related to girls in STEM and promising practices in informal education; 2) a directory of informal STEM education programs serving girls between grades K – 12; and 3) a survey sent to STEM programs to gather data to help determine promising practices.

A spreadsheet of STEM programs and a "stand-alone" literature review on STEM informal education practices were submitted to the funders prior to this final report. A goal of the literature review was to determine what experiences, specifically in informal education, are beneficial to maintain or increase girls' interest, involvement, and likeliness to pursue STEM careers. This final report contains the literature review, and detailed analysis and discussion of the quantitative and qualitative data gathered in this project.

Theory of Change

This project was borne out of concern from the partners regarding the low percentage of women working in STEM careers and the under representation of girls in the pipeline for those careers. The pipeline refers to those who are "on-track" to qualify for positions in STEM. Candidates are likely to have positive experiences with STEM fields in middle school, take relevant courses in high school, and earn undergraduate or graduate degrees. Gurer & Camp (1997) state, "the pipeline shrinkage problem for women in science is a well known and documented phenomenon."

A large number of programs in the United States aim to increase elementary, middle and high school girls' interest in STEM, providing them with positive experiences and exposing them to career possibilities in the hope that more girls will continue through the pipeline. There is an increasing amount of literature on what type of experiences lead females to jobs in STEM, a portion is presented in this review. A goal of this project is to add to the research data on what practices and structures are effective in informal education for increasing girls' interest and engagement in STEM.

The theory of change underlying this project is that informal education programs can influence the career choices of girls, and certain practices are effective when used with girls in informal education programs in grades K – 12. Informal education programs that adopt these practices will be more successful in influencing girls' career choices.

Background Literature

Research shows women to be underrepresented in science, technology, engineering, and mathematics (STEM). The inequities appear as early as secondary school and are more pronounced in graduate education and workforce participation. The number of women qualified to work in professional STEM positions is partially determined by the number of women in the "pipeline" toward such careers, referring to those that express an early interest, have positive experiences in education programs or courses in middle school or high school, and pursue a college or advanced degree in the field. At each of these points, women are underrepresented and a number of others "leak" out of the pipeline, deciding to pursue another field. Science, Gender and Afterschool: A Research Action Agenda (Froschl, Sprung, Archer & Fancsali, 2003) suggests studying the best STEM curricula, approaches, and strategies in terms of fostering girls' STEM interest, skills, and persistence, including what approaches and strategies help build and sustain girls' interest and persistence in STEM courses and careers.

A goal of this literature review is to determine what experiences, specifically in informal education, are beneficial to increase girls' interest, involvement, and likeliness to pursue STEM. Many projects in STEM aim to increase the number of girls in STEM and studies have shown how informal education programs influence education and career decisions. For example, Zales & Cronin (2005) conducted a summer residential program incorporating bioinformatics for high school girls. Observations, surveys, and interviews indicated that participants increased their mastery of science content and excitement about science careers, with three-fourths of the participants pursuing natural science majors in college.

STEM-related activities are used in many informal education programs. They lend themselves to experiential hands-on learning opportunities which engage young people and foster a constructivist approach to knowledge and life-long learning. The informal setting, flexibility in curriculum, close ties between staff and participants, and connections to the community of informal education programs are a strong fit for STEM projects and activities. A number of articles, research studies, and literature reviews have identified effective practices in informal education programs. First, we will look at statistics regarding girls' participation in STEM at different ages and other practices that are effective.

K–12 Years

In a 2000 study, by eighth grade, twice as many boys as girls (independent of race/ethnicity) show an interest in STEM careers. Also by eighth grade, girls' interest in mathematics and confidence in their mathematics abilities have eroded, even though they perform as well as boys in this subject (Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development, 2000).

In mathematics, the gap between males' and females' average scale scores has been quite small and fluctuated only slightly between 1990 and 2003. A study of high school students found that while boys have a higher level of perceived ability than girls in *required* math classes, girls have a higher level of perceived ability than boys in *elective* math classes (Greene, DeBacker, Ravindran & Krows, 1999).

On a standardized nation-wide science test, gender differences were small among fourth- and eighth-graders, males scored slightly higher than females on the 2000 science assessment, though not in the 1996 assessment. In 2000, sex differences occurred in the amount of females taking courses in science, but not in mathematics. Males completed physics and Advanced Placement / International Baccalaureate (AP/IB) physics courses at higher rates than females (National Center for Education Statistics, 2004). In 2002, males made up a higher proportion of students taking AP examinations in science and calculus (National Science Board, 2006). Among SAT-takers, over three-quarters of students wishing to major in engineering and computer science were boys. The only field attracting more girls than boys is the biological sciences (The College Board, 2006).

Females are particularly underrepresented in Information Technology (IT) fields. High school girls are less likely than boys to participate in computer labs, computer clubs and computer science courses (AAUW, 2000) and only 15% of students taking the AP exam in Computer Science were female in 2005 (The College Board, 2006).

College/Graduate School

Between 1995 and 2004, women received 21% of the bachelors degrees awarded in engineering, 27% in the computer sciences, and 43% in the physical sciences (National Science Foundation, 2006). The number of women enrolling in science and engineering graduate programs has continued to increase since 1983, except for a decline in computer sciences in 2003 (National Science Board, 2006). The number of science and engineering master's degrees earned by women increased since 2003 from 21,000 to 43,500, while the number that men earned increased only slightly, from 46,700 to 55,700. The resulting rise in the percentage of women earning master's degrees in science and engineering was from 31% in 1983 to 44% in 2002.

Women received 21% of master's degrees in engineering and 38% of those in the physical sciences such as physics, chemistry and astronomy between 1995 and 2004. Similar statistics follow for doctoral degrees, with women earning 18% of engineering degrees, 26% of degrees in physical science, and 28% of those in mathematics (National Science Foundation, 2006).

A greater proportion of women switch out of STEM majors than men. Reasons behind the higher attrition rate include women reporting poor quality of STEM teaching, an inflexible curriculum, lack of role models, stereotyping of science and engineering as "male" fields, experiences of gender bias, distaste for the current competitive nature of science and engineering education, psychological alienation, an inability to obtain adequate academic guidance or advice, and low faculty expectations (Catalyst, 1998,

as cited in Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development, 2000).

Workforce

Factors such as negative perceptions of careers, low confidence, and a lack of role models and career advice have been noted in the literature as contributing to the lack of females working in STEM (Bartol & Aspray, 2006). In the workforce, the numbers reflect the low number of women getting college degrees in STEM. Slightly fewer than 30% of computer and mathematical occupations and 27% of science and engineering occupations are occupied by women (National Science Foundation, 2006). The numbers have risen in a few areas over the years though. While women were 12% of those in science and engineering occupations in 1980, they comprised 25% in 2000 (National Science Board, 2006). According to the Bureau of Labor Statistics (2007), three of the top ten fastest growing occupations until 2014 are technology related.

A study by VanLeuvan (2000) investigated factors that led to females' persistence in pursuing a career in STEM and found that encouragement and support of significant others was an important influence. Fadigan & Hammrich's (2004) longitudinal study of urban, low-income students participating in a year-long high school informal education science program found they had increased rates of enrollment in college STEM programs. They found that having staff to talk to, learning job skills, and socialization with like-minded peers influenced their career and educational decisions. In a survey of women working in IT, the most frequently mentioned influential experience was taking a programming course and enjoying it, possibly indicating that participation in early education experiences can directly influence career choices (Turner, Bernt & Pecora, 2002).

Informal Education Experiences

A number of researchers and reports recommend increasing girls' exposure to STEM. AAUW (2004) proposes promoting the benefits of education in computer science, engineering, mathematics, and technology to women and girls, and creating opportunities and incentives for women and girls to pursue these fields. Crombie (1999) discusses the strategy of increasing positive learning experiences for girls in order to increase female interest and enrollment in academic courses related to STEM. She highlights a successful program which diminishes stereotypes and provides learning experiences to promote positive attitudes. Zarrett & Malanchuk (2005) conclude that since early factors either directly influence or are indirectly related to later STEM-related occupational decisions (specifically IT), then "interventions early in youths' development that address such factors may play a key role for getting young adolescents on track for the pursuit of an IT career" (p.76).

Showers & Farenga's (1999) survey of over 100 high-ability science students found they were more likely to be attracted to physical science if they had early histories of science-related experiences. Males in the sample were more likely to participate in those early physical science experiences. The findings also showed a correlation between early career interest in science and future participation in science.

Promising Practices

There is much research that identifies promising practices for engaging girls in STEM. A list of commonly identified practices and the authors who cite them as effective are shown in Table 1.

Practice	Articles citing as an Effective Practice (See References)
Real-life context/Relevance	Christie, 2005 Lichtman, 1998 Fancsali, 2002 Jones, Howe & Rua, 2000 Penuel & Kim, 2000 Sanders, 2005 Gürer & Camp, 1997 Thompson & Windschitl, 2005 National Science Foundation, Directorate of Engineering, 2005 Weisgram & Bigler, 2006 Wilkins, Gaskin, Hom & Andrews, 2005
Increasing confidence/ Providing positive feedback	U.S. Department of Education, 2007 Lichtman, 1998 Hanor, 1998 Lanius, 1997 Berenson, et al., 2000 Lanius, 1997 Fancsali, 2002 Crombie, 1999 Zeldin & Pajares, 2000 Britner & Pajares, 2001 Wilkins, et al., 2005
Contact with role models/ mentors	U.S. Department of Education, 2007 Christie, 2005 Lee, 2002 Lanius, 1997 Fancsali, 2002 Packard & Nguyen, 2003 Gürer & Camp, 1997 Sanders, 2005 Quimby & DeSantis, 2006 Wilkins, et al., 2005 Denner, Werner, Bean & Campe, 2005
Collaborative work	Lichtman, 1998 Hanor, 1998 Lanius, 1997 Penuel & Kim, 2000 Birmingham, et al., 2005 Fancsali, 2002 Sanders, 2005 Christie, 2005 Wilkins, et al., 2005 Denner, et al., 2005

Parent involvement/Influence	Birmingham, et al., 2005 Gürer & Camp, 1997 Lee, 2002 Fancsali, 2002 Baker & Leary, 1995 Turner, Bernt & Pecora, 2002
Experienced/Engaged staff	Miller, 2005 Penuel & Kim, 2000 Fancsali, 2002 Birmingham, et al., 2005 Gürer & Camp, 1997
Provide career information	Lanius, 1997 National Science Foundation, Directorate of Engineering, 2005 Yanowitz & Vanderpool, 2004 Denner, et al., 2005
Hands-on learning activities	Christie, 2005 Haury & Rillero, 1994 Fancsali, 2002 Wilkins, et al., 2005 Denner, et al., 2005
Girls-only environment	Christie, 2005 Lichtman, 1998 Crombie, 1999 Gürer & Camp, 1997
Array of learning activities	Miller, 2005 Birmingham, et al., 2005 Sanders, 2005 Baker & Leary, 1995
Avoid gender-biased materials/ Use gender-differentiated instruction	Christie, 2005 Crombie, 1999 Leonard & Derry, 2001
Physically comfortable	Miller, 2005 Birmingham, et al., 2005 Gürer & Camp, 1997
Providing choices/ Self-initiated tasks	Hanor, 1998 Berenson, et al., 2000
Frequent staff professional development	Miller, 2005 Birmingham, et al., 2005
Clear program goals	Fancsali, 2002 Birmingham, et al., 2005
Identity-forming activities	Denner, Werner, Bean & Campe, 2005
Program evaluation	Campbell & Branting, 2005

Table 1 shows the high level of correspondence from the literature concerning what practices are effective for engaging girls in STEM. In the following sections, practices that were frequently mentioned as effective are discussed in more detail.

Contact with Role Models/Mentors

Females' perceptions of STEM are mediated by their experience in the fields and influenced by those they interact with or see representing the STEM fields. Quimby & DeSantis's (2006) study of over 350 female undergraduates revealed that role model influence, slightly more than self-efficacy, significantly affected career choices. They cite work tying role model influence to career aspirations, career choice, and attitude towards non-traditional careers. Many women interested in STEM were influenced by their parents and see them as role models, especially those with parents in STEM-related occupations (Baker & Leary, 1995; Turner, Bernt & Pecora, 2002).

Lee (2002) concludes that emotionally satisfying relationships centered on science, math and engineering (SME) activities and discussions positively shape students' likelihood of thinking of themselves in SME terms and engaging in SME activities. Another study found that participants who were in programs that involved important mentoring relationships gave context in considering career-related plans (Packard & Nguyen, 2003). Simply, the people in women's lives affect their perceptions of STEM, the people who work in STEM-related jobs, and the abilities and skills needed for STEM-related careers.

Real Life Context/Relevant

Girls are motivated to conduct work that "makes a difference," or work they feel impacts the world in positive ways, and is rewarding (Jones, Howe & Rua, 2000). Those who believed in the altruistic value of scientific careers have a higher interest in science and feel more efficient in the subject (Weisgram & Bigler, 2006). Before engaging in STEM activities, girls usually have to confirm that they will fit in, both in terms of physical features and personal interests. However, their perceptions of STEM fields are often based on negative stereotypes such as STEM work is "geeky" and isolating. A study funded by the National Science Foundation in 2005 found that high school girls do not have an accurate real-life image of what work in engineering entails and they think of it as a "man's job". Teachers believed that very few of their students were interested in engineering as a profession and many thought this was due to a "fundamental lack of awareness" (National Science Foundation, Directorate of Engineering, 2005). Showing girls how they fit into STEM and how STEM ties into their lives has been identified as an effective practice to increase interest in the fields.

Thompson & Windschitl (2005) studied engagement in high school science activities for underachieving girls in the Pacific Northwest. They found that in order to engage girls in science, science projects need to relate to some aspect of their lives. The Women in Technology Project in Maui (Wilkins, et al., 2005) states the importance in culturally aligning programming in order to build self-efficacy and lift barriers of ethnicity and gender. The program exposes girls to science and technology in their community and links them with mentors who were also raised in Hawaii.

Increasing Confidence

People's perception of how well they can perform STEM-related tasks has a strong influence on whether they will pursue education or work in the field, especially for women. A report by the U.S. Department of Education (2007) on encouraging girls in math and science states, "One major way to encourage girls to choose careers in math and science is to foster the development of strong beliefs about their abilities in these subjects — beliefs that more accurately reflect their abilities — and more accurate beliefs about the participation of women in math- and science-related careers" (p.14).

Zeldin & Pajares (2000) studied women working in STEM to better understand their academic and career choices. They concluded that academic and relational self-efficacy was very important in women's career paths, motivating them to pursue IT, and helping them overcome obstacles. The importance of the women's perception of competence led the researchers to conclude that "educational programs should be geared to helping girls develop stronger self-efficacy beliefs during critical periods in their lives" (p.240).

Increased time interacting with STEM content or activities is linked with increased levels of confidence and opportunities to gain skills. Girls with positive attitudes toward science attributed their attitudes, in part, to extracurricular experiences such as doing science at home, reading about science, or watching science-related television shows (Baker & Leary, 1995).

Collaborative Work

A shared feature of successful after-school programs, as noted in Birmingham, et al. (2005), are youth-directed relationship-building activities that are collaborative, where youth work together or share materials to accomplish tasks, and are equal partners in the work. Similarly, one of Lanius's Ten Tips on getting girls interested in computers is to, "collaborate more; compete less." In general, girls respond better to collaborative projects rather than competitive. Christie's (2005) principles grounding her computer classroom include that learning is social and is fostered by collaboration. She suggests placing computers in homes and schools in central locations that encourage collaboration among classmates.

Jo Sanders (2005) reviewed literature on girls and information technology. She cites studies where girls chose to work collaboratively on the computer while boys chose to work individually (Ching, Kafait & Marshall, 2002). In another study, girls described their ideal computer use as one that permits collaboration and sharing, while boys fantasized about computers giving them power and speed (Brunner, 1992). Girls have been shown to prefer software requiring them to collaborate rather than compete (AAUW, 2000; Miller, Chaika & Groppe, 1996). Hanor (1998) found interpersonal relations to be a key factor in girls' enjoyment of computer activities.

Finally, Penuel & Kim (2000) cited the benefits of informal and formal peer support and collaboration opportunities when offering young people expanded opportunities for positive social development and for acquiring a sense of ownership within their programs.

Conclusion

The practices described above, and many of the other practices identified in the literature, are inter-related. For example, engineering graduate students link others' misconceptions about engineering to the lack of role models,

> "They do not understand how engineering helps people. They don't have any female role models so it does not seem natural for them to go into engineering. The women in their lives are probably not engineers nor are they knowledgeable about what type of work it involves." (National Science Foundation, Directorate of Engineering, 2005, p.11).

Increasing girls' confidence in STEM is often tied to opportunities to engage in hands-on activities, working with others, and girls-only environments. The practices identified as effective in engaging girls in informal education programs also address barriers to girls' participation in STEM such as lack of role models, lack of self-confidence, lack of support or encouragement from family, friends or teachers, gender role expectations, lack of access to STEM resources and a perception that the fields lack social relevance.

The experiences that girls have in informal education programs can be highly influential regarding their decisions in STEM, such as whether to take advanced coursework in secondary school, whether to pursue undergraduate or graduate degrees in a related field, and whether to work in STEM positions. Additionally, positive experiences in informal education programs can increase the likelihood of participants to persist in the STEM pipeline despite other barriers or obstacles. The flexibility of informal education programs in terms of curriculum, activities, environment, and instructors offers great opportunity to incorporate research-based practices to improve participants' experiences and increase the number of females engaged in STEM.

Methodology

The background literature review was conducted at the start of the project to gain an understanding of the current status of girls and women in STEM, existing knowledge on promising practices, and to learn common methodologies and tools used to investigate similar questions.

Deliverables resulting from this project are 1) a program directory including basic information of STEM programs located nationally, 2) a literature review, a stand-alone review of the literature pertaining to informal STEM education practices, specifically for girls, and 3) a final report based on the literature review and the survey data gathered from STEM education programs.

A STEM program directory was built. To do so, an online survey was administered to representatives who were most familiar with their STEM program's structure and goals in order to determine what practices they considered as contributing to their success. Statistical analysis of the quantitative data and content analysis coding of qualitative survey questions was conducted.

The survey was developed following a literature review of effective practices in informal education programs and effective practices for increasing girls' interest in STEM. Respondents were asked to rate the level to which different practices contributed to their program's success. They were also urged to fill in additional practices that they believed to be effective and provide evidence or examples on how practices affected the program goals. The survey collected demographic and basic information about the programs. A copy of the survey is included as Appendix B.

An initial survey email invitation (Appendix A) was sent on August 17, 2007 to contacts from relevant listservs and networks, including 265 programs in the National Girls Collaborative Project database, the Northwest Girls Coalition listserv, Women in Engineering Program Advocates Network (WEPAN), the National Science Foundation program list, the Information Technology Experiences for Students and Teachers (ITEST) program list, and the Science, Gender, and Afterschool list. Further contacts, including the Girl Scouts Online Council Network, were sent an invitation the week of September 10, 2007. Reminder emails were sent to the groups receiving the original invitation. The survey closed on October 8, 2007.

It was intended that the online survey reach a diverse set of respondents. The survey was "public" instead of "invitation-only," meaning that any program with the URL to the survey could access the survey, not only those on a pre-determined respondent list. This allowed the survey invitation to be e-mailed and forwarded along the multiple communication lines to relevant contacts, listservs, and professional networks.

The final number of programs responding to the survey was 123. It is impossible to calculate the response rate as we do not know how many programs the survey invitation actually reached after being forwarded.

DIRECTORY OF PROGRAMS

Programs in STEM

Evaluation & Research Associates compiled a list of 561 informal education programs focused on one or more aspects of science, technology, engineering and/or mathematics that included female participants in grades K to 12. Program directory data included 123 STEM programs responding to this survey as well as 438 programs from an earlier survey specifically targeting informal information technology programs.

On the online survey, respondents were asked to check a box approving their inclusion in the program directory. Program directory data was imported from survey questions asking for basic program information. Additionally, a large number of the programs in the directory came from a prior GSUSA project focused on information technology programs. Program directory fields included the following information.

- Program Name
- Organization Name
- Program Web site
- Brief Program Description
- Contact Name
- Contact E-mail

SURVEY FINDINGS

The 123 survey respondents included a variety of self-selected youth programs with a focus on one or more STEM content areas. A summary of the data analysis follows, beginning with the demographic data of the programs responding to the survey.

Demographics of Programs

Most programs responding to the survey indicated they use content from more than one STEM area. Respondents indicated the percentage of time their programs spent in science, technology, engineering and technology. Each content area was covered by a large percentage of programs, with science and technology most frequently included. The mean percentage of time spent on each of the four areas is also represented in Table 2. Most of the program time was dedicated to science, while the least amount of time was spent on mathematics.

Table 2. Time Spent in STEM Content Areas

Content Area	Percentage of Programs Indicating Content Used	Mean Percentage of Time Dedicated to Content Area
Science	93%	39%
Technology	92%	27%
Engineering	80%	23%
Mathematics	82%	16%

Sixty-percent of the programs responding to the survey were created between 2000 and 2007. Three percent indicated their programs were created prior to 1960. Programs were located in 36 states of the United States with 98% of the programs still active and 2% no longer active, but answering the survey retrospectively.

Most of the responding programs were located within urban or suburban areas. The percentages in Table 3 do not equal 100% because survey respondents were asked to check all that apply and some indicated their programs are offered in more than one type of location.

Table 3. Location of Program

Location	Percentage of Respondents
Urban	74%
Suburban	60%
Rural	48%

Sixty-one percent of programs were non-profit or community-based programs. Of the 27 "other" responses, 13% were university or college-based programs (4 respondents), and others included museums (1 respondent), science centers (2 respondents), school-based programs, GSUSA Councils (2 respondents), or a specific program, such as NASA sponsored or National Wildlife Refuge. A few were corporate-sponsored or for-profit education programs.

Table 4. Type of Program

Type of Program	Percentage of Respondents
Non-profit/Community program	61%
Other	22%
School-based program	12%
Corporate sponsored program	3%
For-profit education program	2%

Program Structure

The most frequent program length was "Once a year or a one time event" (26%). Eighteen percent of participants selected "other" when asked about frequency of meetings. "Other" respondents wrote the frequency of meetings varies depending on the program, group or participants, they do all of the choices given, or it was, "A part of the regular school schedule" or "throughout the year at scheduled events." Only 5% of programs met 4–7 times per week.

Table 5. Frequency of Participant Meetings

Meeting Frequency	Percentage of Respondents
4–7 times per week	5%
1–3 times per week	15%
1–2 times per month	6%
A few times per year	17%
Once a year for 1–7 days, e.g., camp	10%
Once a year for 8 days or more, e.g., camp	4%
Once a year or one-time event, e.g., conference	26%
Other	18%

The length of most program meetings was between three and six hours (48% of programs). Thirty-nine percent of programs indicated they met less than three hours. Only 14% of programs met longer than six hours.

Program Participants

Program respondents were asked to indicate all grade levels of the participants they serve and the number of youth attending programs at any one time. The largest percentage of programs indicated they served youth in grades 6 – 8, between the ages of 11 – 14. Sixty-seven percent of programs indicated they served youth in grades 11 – 12, compared with 45% indicating they served youth in kindergarten to third grades. Table 6 indicates all of the grade level options and the percentage of respondents they served. The percentages do not total 100% because the information was gathered from a choose-all question and many programs served multiple age groups.

Table 6. Grade Level of Participants

Grade Level	Percentage of Respondents
Kindergarten to 3rd grade (ages 5–8)	45%
4th to 5th grade (ages 9–10)	60%
6th to 8th grade (ages 11–14)	82%
9th to 10th grade (ages 14–15)	65%
11th to 12th grade (ages 15–16)	67%
None of the above (under age 5 or over age 18)	1%

Almost half of programs (47%) served 11 – 50 participants at any one time, and 35% of programs served over 100 participants simultaneously. Fifteen of the 43 programs serving over 100 participants held one time events.

Table 7. Number of Youth in Program at Any One Time

Number of Youth Involved	Percentage of Respondents
1–10	4%
11–25	23%
26–50	24%
51–75	7%
76–100	8%
101+	35%

Respondents were asked about the length of time most participants stayed involved in their programs. Sixty-nine percent of programs had lengths other than what is shown in the table (65 "Other" responses were unique — reporting 65 other configurations).

Table 8. Length of Participant Involvement

Length	Percentage of Respondents
1 day	9%
5 days	3%
1 year	3%
2 years	3%
3 years	6%
4 years	4%

In terms of participants' race, programs indicated a mean percentage of 61% Caucasian/European American participants and 24% Black/African American. A separate question specifically asked for an estimate of the percentage of participants who were Hispanic/Latino, with a mean response of 12%. Participation by other racial categories was lower. The percents in Table 9 are the mean percent of participants' race by all programs responding to the question.

Table 9. Mean Percent of Participant Race

Caucasian/ European American	Black/ African-American	Asian	Hawaiian or Pacific Islander	Native American or Alaskan Native	Multi-racial	Hispanic/ Latino
61%	24%	6%	1%	2%	6%	12%

Seventy-three respondents (60%) reported serving girls only, while 50 programs (40%) were co-educational. No programs responding indicated they served boys only.

Table 10. Program Participant Gender

Gender of Participants	Percentage of Respondents
Girls only	60%
Co-educational	40%
Boys only	0%

Program Funding

Funding for programs came from a variety of sources as indicated in Table 11. The three main funding sources reported by programs were corporate, private foundation, or from participant fees. Thirty-nine percent of responding programs indicated they received funding from individual donors as well. Twenty-five percent of programs received funding from sources other than those listed, including eight programs receiving college or university funding and five receiving Girl Scout Council funding.

Table 11. Program Funding Sources

Funding Sources	Percentage of Respondents
Funded by participants	55%
Corporate funding	54%
Private foundation grant	44%
Individual donors	39%
Other	25%
Federal government grant	23%
Local government grant	14%

Since 55% of programs indicated they received funding from participants, we can assume that 45% of programs did not charge participant fees. Most respondents indicated they charged $25.00 or less for participation. Of those who charged for their programs, 15% of those responding to the question indicated the fee covered the cost of the program while 85% indicated they needed additional funding.

Table 12. Participant Fees

Participant Charge	Percentage of Respondents*
$0–$25	78%
$26–$50	6%
$51–$100	2%
$101–$200	5%
$201–300	2%
More than $300	7%

* Percentages represent programs that indicated they charged participant fees

In terms of in-kind support, the choice most often selected was "staff/volunteer time" (78%). Sixty-five percent of respondents indicated they were provided facilities or office space, and 61% received donated materials or supplies (see Table 13). More than half of the programs received technical expertise or technical equipment, indicating STEM-specific support. Seven percent of programs did not receive any in-kind support.

Table 13. In-kind Support for Programs

In-kind Support Type	Percentage of Respondents
Staff/Volunteer time	78%
Facilities/Office space	65%
Materials/supplies	61%
Technical expertise (e.g. in science, technology, etc.)	57%
Technical equipment (e.g. hardware, software, or other infrastructure)	51%
Administrative support	48%
Information (e.g. list of contacts)	44%
Communication	42%
Project advising	35%
No in-kind support received	7%
Other	2%

Participant Recruitment

All programs reported using some type of recruitment strategy. Programs responding to the survey most commonly recruited participants using print advertising, a Web site, and past or current participants telling others about the program. Responses specified under "other" strategies included the use of schools (counselors, teachers, in-school programs, direct contact with schools, and having a school identify participants).

Table 14. Participant Recruitment

Mode of Recruitment	Percentage of Respondents
Advertising, Print (e.g. fliers, brochures, newspaper ads)	77%
Web site	75%
Participants who spread the word	73%
Through other organizations that work with youth	61%
Mailing brochures/fliers	57%
Outreach/Presentations (e.g. at schools, parent organizations)	52%
Listservs/E-mail	50%
Advertising, Non-print (e.g. radio)	21%
Other	9%

Eighty-seven percent of programs indicated they specifically target participant groups, most commonly female participants. Table 15 shows the different groups that programs indicated they target.

Table 15. Targeted Participant Groups

Participant Group	Percentage of Respondents
Female participants	73%
Middle school age participants	61%
High school age participants	48%
Urban participants	40%
Elementary age participants	38%
Hispanic/Latino participants	29%
Rural participants	28%
Black participants	26%
Asian participants	13%
Other	11%
Male participants	7%
My program does not target specific participant groups	1%

Examples of how programs reach out to specific groups include the following strategies.

> "For female participants, we advertise through Girl Scouts and other girl-serving organizations. For certain school groups (elementary, middle school) we email the counselors of local schools to advertise the program. For ethnic groups, we advertise in ethnic listservs or through ethnic organizations."

> "Girls completed an application as to why they wanted to be involved and that they were expected to participate completely."

"We targeted rural high schools in eastern [state name] which have large minority populations, so that by targeting these schools we automatically have a large minority pool with which to choose. In that pool, we gave preference to girls."

Other programs described how they work with school staff or schools in general to distribute information about their programs. One program offered workshops to elementary school teachers as a way to get the program started in schools.

Participant Retention

Forty-seven percent of programs indicated they do not retain participants, likely due to the type of program (44% of those programs were one-time events). Of those responding to the question, 25% reported that a majority (49–70%) of participants who start their programs remain involved. Table 16 shows the percentage of respondents retained in their programs.

Table 16. Program Participant Retention Rate

Retention Rate	Percentage of Respondents
Not applicable (e.g. one time event)	47%
Few (0–29%) participants who start the program remain involved	5%
Less than half (30–49%) of participants who start the program remain involved	7%
A majority (49–70%) of participants who start the program remain involved	25%
Most (71–85%) participants who start the program remain involved	8%
Almost all (86–100%) participants who start the program remain involved	9%

The following strategies were used by some programs to retain participants. It is notable that many of the recruiting strategies overlapped with the practices they believed made their programs successful overall.

"Make sure the activities are relevant and that staff are well trained and build a relationship with the students."

"The students and their parents have a great time and want to return the next year when they are in 5th grade. We also recruit students as an 'advisory group' who stay with us year after year."

"Our weekend robotics teams retain a core 75%. Convenient meeting time and location and building relationships with participants and parents are key to retention. Providing parents with information on university admissions requirements, etc. is key."

"We are located within an environment where it is close to home and where there are other free programs for them to participate in on a regular basis."

Other responses included concepts such as making the activities fun, challenging, interesting, hands-on, engaging and progressive. Having a quality program with good staff was also mentioned by more than one program.

Promising Practices

The majority of survey questions listed program practices or elements identified in the literature and research studies as effective for successful informal education programs, engaging youth or girls in STEM, or generally in programs working with girls. Respondents indicated on a five point scale, where "1" is strongly disagree and "5" is strongly agree, the level to which each practice contributed to the success of their program. They could also elaborate or describe evidence to support their response in an open-ended question. In another question, respondents were asked to indicate the top five practices they believed to be most critical in ensuring a program's success. Tables 17–21 indicate the percentage of respondents selecting each practice alongside the mean scale responses from each category: s*taff, curriculum, learning experiences, career information* and *other practices*, and clarifying quotes are included when relevant.

Over the five scales, the practices receiving the highest mean were hands-on experiences (4.87), project-based learning opportunities (4.60), and opportunities to work together with other people (4.55). The lowest mean scores were for staff similar to the students in terms of ethnicity (3.42), female (as opposed to male) staff (3.55), and curriculum relevant to participants' culture (3.57). These data correspond somewhat to the top five most critical practices where hands-on experiences (65%), making curriculum relevant (47%) and project-based learning opportunities (28%) were most frequently selected. In the following five sections, details from each category of practices are discussed.

Staff

This category included the program director, as well as other staff, such as instructors that typically worked directly with participants.

Table 17. Ratings of Practices Related to Staff

Practice	Mean	Selected as Top Five
Program Director with strong leadership skills	4.47	22%
Experienced Program Director	4.46	27%
Experienced staff	4.46	27%
Frequent staff professional development and training	3.91	7%
Female (as opposed to male) staff	3.55	9%
Staff that are similar to the students in terms of ethnicity	3.42	6%

In terms of staffing, survey respondents indicated that a program director with strong leadership skills and experience, and experienced staff received the three highest mean ratings regarding the level to which practices contributed to a program's success (see Table 17). Lower mean ratings included female staff and staff with similar ethnicity to

students. A low percentage of survey respondents chose those factors as fitting within the top five most crucial aspects or practices overall, whereas about 27% thought an experienced program director and experienced staff were crucial.

In the comments section, experienced leadership was described as valuable to a program's success especially when the leader was able to be flexible and continually adapt the program design to meet changing needs of participants.

> "Experienced staff have personal resources to draw on, as do those who receive professional development and training, when they have to solve problems and require less training. Strong leadership really helps transform/continually improve the program instead of maintaining status quo."

Though respondents did not rank staff with similar ethnicity to participants very highly compared to other elements, a number of respondents wrote they thought it was important to hire a diverse staff: nine specified they thought women on staff were important and eight specified they looked to hire an ethnically diverse staff. A diverse staff may show participants that STEM fields are open to all types of people, and it is not necessarily as important to match it with the ethnicity composition of the participant group, "We experience better results with a mixture of ethnicities and genders in the staff and adult volunteers, but it does not need to be similar to the students' mix." However, one respondent also commented she observed students being more involved when they were working with someone of similar ethnicity, "We have a shortage of minorities in our engineering program so our volunteers are usually Caucasian. One particular session I had a young African American woman and I saw the African American students be more vocal with her as a mentor and guide."

To further clarify their responses and elaborate on promising practices related to staffing, six respondents mentioned the importance of staff that were enthusiastic or passionate about the work and close in age to the participants. Staff who were excited about the STEM subject being taught were thought to be effective, "Staff who have high energy and an obvious passion for their subject matter really make the difference." Additionally, staff with enthusiasm and energy were able to inspire the participants, "What I find is the most important is passion. If the people giving the presentations or recruiting for a program or training mentors or adults or working with kids are very excited and passionate about what they are doing — then everyone gets on board." Staff characteristics such as creativity, high-energy and extraversion have a strong influence on participant experience in the program. As one respondent stated, "It is personality that drives the program."

In terms of age, four program respondents observed that participants more easily related to staff that were younger. Programs with college-aged staff members found the girls easily formed positive relationships with them, "We found 4th and 5th grade girls respond to the undergraduates better than adult women volunteers because they were closer in age and interests."

A similar idea mentioned by three respondents was that staff should be knowledgeable or skilled in working with youth.

> "In hiring staff to work with the kids, I look first for their abilities in working effectively with kids. Are they engaging? Do girls like to spend time with them? Can they effectively manage the group? I can teach the science skills they need, but good skills with youth are much harder to teach."

One respondent specified that it can be even more valuable if staff is experienced or familiar with the type of youth involved in the program. This idea implies that it is not necessarily staff with subject-matter expertise; it seems more important to have enthusiastic staff skilled at engaging youth.

Finally, for practices related to staff, one survey respondent mentioned it was important to have a clear program vision that is shared among all staff members. Allowing staff to share in creating the vision can further this practice, "Having a strategic plan that staff have worked together to develop promotes buy-in, an understanding of expectations, a clear vision of where the program needs to go, how to get there and who is responsible for each strategy." Communication, strong leadership and frequent professional development can strengthen programs.

Curriculum

Program curriculum refers to the content being taught through various activities or lessons within a program.

Table 18. Ratings of Practices Related to Curriculum

Practice	Mean	Selected as Top Five
Project-based learning opportunities (e.g. projects with real-world activities)	4.60	28%
Making curriculum relevant, tying it to real-life issues	4.49	47%
Opportunities to use technology to be creative and explore	4.42	16%
Broad array of enrichment activities	4.29	7%
Using curriculum materials that appeal to girls	4.23	24%
A challenging content level	4.22	11%
Opportunities to use technology to communicate/ social network	4.12	4%
Curriculum relevant to participants' culture	3.57	5%

Practices related to curriculum received fairly high means on a scale question regarding how the practices affect program success, ranging from 3.57 to 4.60. In particular, project-based learning opportunities and making curriculum relevant were highly ranked and also frequently selected as being within the top five most critical practices. Relevant curriculum was selected as critical by close to half of the survey respondents. Interestingly, curriculum relevant to participants' culture received the lowest mean rating of importance to program success.

In the open-ended responses, twelve respondents reiterated their belief in the importance of relating content to the participants' real-world experiences. They showed participants how science and technology played a part in their every day experiences,

> "Prior to the workshop, they thought plants could only grow in soil and they had no idea that technology could play such a big role in producing food. Furthermore, they did not realize technology could make it possible to grow plants almost anywhere."

Respondents believed participants would recall the information better if they were reminded of what they learned during their daily lives.

Relevant curriculum was effective at engaging participants in the activities, as specified by fourteen respondents. A few mentioned evaluation findings that showed participants appreciated the real-life connections, "Hands-on, real-life activities that are applicable to the girls are always more highly rated." and, "In evaluation forms, participants comment on using/seeing exciting new technology and on the applicability to "real world" issues." One respondent explained that after participants learn how technology is related to something familiar, it encourages them to explore further.

> "One of our Electric Circuitry projects is particularly successful with young people when they compare it to the popular game of Operation. Puts things in context. 'Oh, this is how Operation works!!' As they increase understanding of the technology involved in the workings of a familiar activity/game, they are encouraged to explore how other things 'work.'"

Other examples of effective relevant curriculum included GIS mapping of landmarks in their neighborhoods, measuring water quality in nearby streams and other issues that relate to them personally. They felt it effective to use problem-solving activities, and detailed projects, such as Mission to Mars, that were engaging to the girls.

Three respondents believed the content and the activities should be challenging to the participants, which prevented participants from getting bored. Additionally, two respondents believed providing opportunities for girls to be creative and build things were especially enjoyable.

Another curriculum strategy mentioned by three respondents was to distinguish the program curriculum from in-school or more formal curriculum by complementing or enhancing the curriculum. They tried to make it more fun, open-ended, and feature problem-solving. However, one respondent found their program had more registrants when they based the curriculum on the National Science Standards.

There were mixed responses to whether curriculum that appeals to girls was important to a program's success. While one respondent shared how the girls enjoyed using LegoRobotics to make music boxes instead of cars, another found a general

technology curriculum to appeal to girls without having to focus on any "girl-specific" interests. Note that 24% of the respondents included this in the top five most important elements.

Learning Experiences

While the curriculum is *what* is taught, learning experiences is *how* that content is taught.

Table 19. Ratings of Practices Related to Learning Experiences

Practice	Mean	Selected as Top Five
Hands-on experiences	4.87	65%
Opportunities to work together with other people	4.55	19%
Small group sizes	4.37	17%
Frequent affirmation and verbal support from instructors	4.30	6%
Utilizing a variety of teaching styles	4.27	6%
Comfortable physical learning environment	4.21	3%
Low student to staff ratio, e.g., 10 (or less) to 1	4.09	8%
Girls-only environments	4.05	27%
Positive interaction between girls is explicitly addressed	4.04	3%
High-end, up-to-date equipment and resources	3.76	7%

A few of the highest means across all five categories were for practices related to learning experiences, indicating that it may be influential in ensuring an effective program. Hands-on activities were the most highly rated contributor to program success and most frequently selected as being within the top five most critical practices. Haury & Rillero (1994) summarized that hands-on learning is related to any educational experiences that actively involve people in manipulating objects to gain understanding or knowledge. According to survey respondents, there were numerous effects from using interactive lessons, such as keeping the girls engaged and increasing excitement. "All students surveyed indicate that hands-on outdoor experience during camp contributes to the success of the program and makes it interesting to students." and, "Students enjoy themselves more and learn more when they are active and hands-on in the program." Seven respondents believed program participants were engaged and enjoyed learning when they were actively involved, "We work on computers every day as part of their activities and it's very important to keep them engaged and active, not passive and just listening, but doing."

While frequent affirmation and verbal support received a fairly high mean rating, one respondent stated it is important to make the praise meaningful. While it is important to challenge participants, it is also important to offer praise and support so they have a positive experience. "Typically these days, kids are over-praised and under-challenged. I find that if you do expectation setting and give meaningful praise when they do rise to the challenge, [they] accomplish so much." A low staff to participant ratio, specified by two respondents, can be an effective method to ensure each girl receives instructor

attention, "Girls are much more manageable and enjoy the attention they receive when there is a low student to volunteer ratio."

Participants working in small groups, mentioned by three respondents, was valuable in assisting the learning and increasing the enjoyment of the girls. However, it is important to monitor their interaction to ensure it remains positive, "We are still working on the negativity that is being brought to these events — girls treating each other badly — by training adults, giving them tools, etc. to keep the environment welcoming to every girl."

Three respondents offered support for an all-girl learning environment, though it received one of the lower means compared to the other learning environment practices. They mentioned it decreased distractions, "Girls do much better in STEM activities with an all-girl group — not so many distractions." In contrast, another respondent believed co-educational programs provided them with experience on how to learn together, "It is not necessary to separate the girls and boys. Co-ed programs help students learn to interact and work together at an early age."

Career Information

Career practices are any that integrate career education into program activities or curriculum, such as providing mentors for participants, information and statistics or exposure to possible careers.

Table 20. Ratings of Practices Related to Career Information

Practice	Mean	Selected as Top Five
Contact with mentors, e.g., communication with STEM professionals	4.33	19%
Career information	4.11	8%
Information on professionals in the field (not necessarily known personally)	4.01	4%

Among career information practices, staff were most likely to think that contact with mentors was an important practice for their program's success. Providing information on professionals working in the field was not very frequently selected as being in the top five most critical practices. Career practices were stated to be not as valuable for programs that serve younger participants, such as elementary school youth. However, many other program respondents commented on career education elements they found to be successful. Eleven programs wrote about exposing the girls to STEM professionals. Four programs arranged visits from women working in STEM, who gave a short presentation, led the girls in an activity, or participated in an interactive networking activity. Girls usually had opportunity to ask the women questions, and survey respondents believed this was valuable, "We had two very successful afternoon sessions with career speakers — the girls got to ask questions and interact with other people working in the field." and "They connect better if they can interact with professionals rather than hear about examples." Two thought it was especially worthwhile when discussions included information about both the women's work and their home

life or personal interests, "They unanimously loved the opportunity to discuss not only careers but also other life choices with the women." It showed them it was possible to study or work in STEM and still have a home life, "They liked knowing that a grad student was also pregnant, working and studying!"

Opportunity to interact with professionals also allowed the participants to ask content-specific questions in STEM, as two respondents commented, "By meeting actual engineers and working hands-on with engineering students, the girls could ask questions as they arose and could converse with someone with the intelligence to answer their questions down to the detail. They tended to ask more questions and it generated some awesome discussions." One program representative wrote how they assigned mentors for project-based assistance so girls could turn to an expert in the field for guidance, "Older girls benefit tremendously from a mentor, or someone they can 'check in with' while working on a long range project."

One respondent wrote that field trips allowed girls to interact with STEM professionals, while also providing them with other contextual information about what STEM work looks like, where STEM work takes place and who is doing the work. Seeing or meeting women as opposed to men was thought to be important by program respondents, especially since they wanted the girls to be able to picture themselves in STEM fields and realize a diverse set of workers is needed, "This is a huge part of the program and the interaction with STEM professionals (females in particular) was crucial" and "Meeting real, live women who work in STEM-related fields has a HUGE impact on girls' perceptions of who STEM careers are 'for.'" Much of the career information being shared in the programs aims to dispel common stereotypes about STEM work, such as that it is suited for males. Meeting women professionals may help participants re-evaluate their perceptions of STEM work, "Girls really make a connection when they meet a woman employed in the field that is being explored. It PROVES that a woman can do a job in that area."

Along similar lines, bringing in younger role models or mentors was also indicated by two respondents to be valuable for participants as they were able to identify with them more easily, "A Ph.D. in Optics came to the camp and did a presentation. Since she dressed like the girls, was in the 18–25 year old range, talked like them and brought the material to their level, the girls were fascinated as much by her as her teachings and therefore were much more open to her teachings." Another respondent also stated how important it was to have the professionals be easy to relate to and who are skilled at interacting with youth, "[It is] important to have 'guest speakers' who can relate to the age and interests of the girls — not talk to them as if they're much younger, talk over their intelligence, or be too stiff."

Forming a personal relationship between participants and a woman in STEM, such as a mentor-mentee relationship was especially valuable, according to four programs, "I think we do best when we make the relationship available between a girl and a female professional." One program embedded career information into fun activities because they felt youth can feel career information is not relevant to them, "When we point out

that we are trying to give the girls career options, they tune out. They need space to begin and grow their own personal interests that will lead to their career choice."

In order to provide girls with STEM education and career support outside of the programs, one program also offered parent or teacher sessions on how to support their child or student. They might cover information on what classes are required at different levels, the options available for STEM work, and how to spark and encourage a girl's interest and involvement is covered, "We also register the parents and have sessions on career planning, financial aid and what can be done to encourage their daughters to choose technology as a career. We seek out key notes from notable sources and obtain break outs from local businesses."

Career education components of informal STEM education programs aim to increase the participants' interest in the fields and encourage them to pursue further education or work. The evaluations of these programs often showed an increase in interest in pursuing STEM. However, one program found a few participants were dissuaded from STEM careers based on what they learned. The respondent believed that if these participants were making the decision based on a true understanding of the work, then being able to realize that it is not for them is a positive outcome, "After our events we ask girls if they are now considering a career in what we have done, and we always get some answers of yes, and some that say now they know they wouldn't want a career in this field. Both lessons are valuable, I think."

Other Practices

This category contains practices from the literature that did not fit within any of the other main categories.

Table 21. Ratings of Other Practices

Practice	Mean	Selected as Top Five
Sufficient funding	4.46	23%
Clear program goals	4.34	5%
Community support, e.g. in-kind resources, services, and/or recognition	4.23	7%
Parent support	4.16	11%
Opportunities for participants to take a leadership role	4.07	8%
Formal program evaluation	4.01	2%

Overall, sufficient funding was the most highly rated element in this category for contributing to program success, and fairly frequently rated as one of the five most important elements. However, it is important to note in the open-ended responses, four program respondents stated that they could make their program successful despite a lack of funding or resources, "I make the program successful with or without the outside resources." and "While funding is important, we can get the same results with less $$ and less high-tech." It forces program staff to be inventive in working around the barrier, "We can do anything regardless of funding because those are the times

we become most creative!" Insufficient funding can cause programs to be unable to execute their plans for the program, "We do not have sufficient funding so our ideas are greater than our ability to see them to fruition." Funding can allow programs to waive participant fees and provide additional resources, "Funding has allowed us to bring in technology that we could not afford when the camp was tuition-based."

Although program evaluation was not highly rated, seven survey respondents commented on the benefits of having their program evaluated. Identified benefits included increasing legitimacy, "We had a round of outcomes-based evaluation that increased our 'legitimacy' in the eyes of funders" and strengthened funding proposals, "The program was formally evaluated and that will be important for future funding." Additionally, one respondent stated evaluation allows them to identify program outcomes and helps others understand their program, "Continuous evaluation helps us to determine if what we are doing is effective and enhances transparency." and "We began formal program evaluation three years ago to confirm that students are getting information content and becoming more competent in science."

Setting clear program goals was mentioned by three programs to help organize activities and get staff on the same page regarding their efforts, "The clearer the goals of our program, the better able we are to design our activities to meet those goals in a focused manner." and "Clear Program Goals allow focus on STEM program curriculum and staff development." Program clarity focuses activities so parents and participants know what to expect, "Clear goals are essential when program planning. It provides a guide when determining activities and alleviates trying to be everything to everyone (unless that is your goal)."

Providing leadership opportunities to participants was specified by two respondents as a method of increasing participant engagement and involvement. Putting girls in a position where they are responsible for a program activity increases their feelings of ownership, "Girls seem to become more engaged in their experience when you give them a leadership role, no matter how small or short-lived, during their event." One respondent believed if girls were able to be a leader, more girls would remain in the program, "Girls are more likely to continue if they see themselves contributing to their community by taking on leadership roles."

Community involvement was mentioned in the open-ended responses by six respondents as helpful to programs receiving in-kind donations and resources, but also as beneficial when the program reached out to the community, for example, by involving the community in activities and events. Many programs depended on local organizations and businesses to contribute specific support, "We rely on community resources from museum discounts/passes to consulting services to interns to classroom space at public schools and universities to help us have a varied and successful program." They were able to use relationships with community partners to recruit participants and expand the type of STEM curricula and activities they were able to expose participants to. For example, relationships with local businesses were especially valuable if they could provide mentors for the participants.

Part of the outside community includes parents, and program respondents indicated they attempted to involve parents in their child's program. Parent support was identified by five respondents as a way to increase the participant's perception of the program's value and the sustainability of the program's goals, "Parents have to want their girls involved in STEM or it's not likely to go anywhere for the individual." Parent or community showcases of program successes allow girls to demonstrate their skills which is an opportunity for the participants to feel successful and the parents to realize the value of the program, "Parent participation and, in turn, recognition of parents, peers and community increase personal satisfaction and leads to greater participation." On the other hand, one respondent stated that while parent support leads to positive results, it is not critical to program success, "Parent involvement and support is always a plus, but doesn't necessarily indicate success. I've had plenty of student interns and program participants who have succeeded, not because of their parents, but despite the lack of parental support."

Additional Practices

In this section, respondents wrote in practices that were not listed in the previous five sections. Common responses coded iteratively are presented in Table 22.

Table 22. Additional Promising Practices

Practice	Number of Respondents
Slightly Older Girls involved as Role Models/Mentors	8
Partnerships/Collaboration with Local Organizations/Businesses	7
School Partnerships	7
Located on College/University Campuses	6
Utilizing Volunteers	5
Staff/Volunteer/Mentor Training	5
Girl-Driven Topics	4
Diversity of Staff	4
Utilizing Various Curricula: STEM and Other Subjects	4
Technology/Website	3
Parent Involvement	3
Low Cost	2
Encouraging Teamwork	2

The sections below highlight a few of the practices identified by multiple respondents.

Volunteers/Staff

A number of the response categories were related to staffing or volunteer practices. The most common practice that was indicated as important to a program's success not on previous lists was utilizing younger volunteers or staff. High school girls working with the younger girls, or bringing in college undergraduate students to work with the girls, "[It's] very beneficial to bring in the undergrad women as role models and to show that girls do go into this type of career; also provides undergrads with a chance to share their expertise with others."

Utilizing volunteers in addition to any paid staff members was identified by five program respondents as a valuable practice. They mentioned having a strong method for recruiting volunteers and getting dedicated volunteers. Additionally, volunteer and staff training help ensure program success. Professional development of activity implementation and communication skills, in particular, were named as important. Finally, a diverse staff in terms of language, ethnicity and area of expertise was also mentioned.

Partnerships

Six programs' staff mentioned involving the outside community in their program, which also included forming partnerships with other organizations. Partnerships with schools and with local organizations and businesses were each identified by seven different respondents. School coordination, such as working with guidance counselors, having teachers instruct at the program, or interacting with teachers to recruit program participants, helped programs. Other partnerships with similar organizations, such as girl-serving or STEM-related education programs, were thought to strengthen the program and extend their reach. Additionally, it brings in different areas of expertise to share with participants.

College/University

The value of holding the program on a university campus was also mentioned. It served a dual purpose: younger girls were able to become familiar with a university and feel more inspired to attend, and universities often offered in-kind resources and other types of support. "The event is held on a local community college campus. It gives the parents and students an opportunity to see the campus and sit in a classroom, visit the student center, etc. It seems to create more excitement."

Curriculum

Practices related to curriculum include asking girls to provide ideas of projects, activities and topics for exploration. This is one form of offering participants a leadership role in influencing the program. Two respondents stated that girls become engaged more easily when they chose the topic, "All our program evaluations ask girls, 'What do you want us to do?' and they tell us! When we offer something that girls request, there is a higher response than if 'we think they would like this.'"

A few programs try to attract girls who are not interested in STEM. They "sneak" the science lessons in and later discuss how it is related to the content area, or they use "hybrid" programs that incorporate other content areas, "Hybridized programming that can not specifically be labeled STEM, created by programmers with diverse backgrounds, attracts girls who would otherwise shy from 'science and math.'" and "Combining STEM with other fields — not limiting the program to girls who announce they are interested in STEM." One respondent believes that avoiding advertising the program as STEM-related will increase the number of participants and potentially reach girls who did not realize they liked STEM.

Other

Other responses on practices that influence a program's success are included in Table 23.

Table 23. Other Influential Practices

A participation patch is given to all participants
Ability to receive college credit and high school credit concurrently
Awareness of changing demographics both racial and socioeconomic
Building communication skills as an integral part of the curriculum is important
Capitalizing on the current TV/movie science craze and creating programs such as CSI
Cohort model intervention in and out of school time including summers
Giving out companion activity books that enhance the experience and provide hands-on programs for leaders to do in the troop that accentuate the same principles taught at the program; Leaders will use them since now they understand the science!
Grant writing expertise
Having a corporation create specific internship opportunities for our high school girls
Helping girls translate interest into career — I like chemistry but I don't think I want to work in a laboratory so I can't go into chemistry — open up their eyes to possibilities — what careers are out there and what do people really do in those jobs?
Instilling confidence
Kids empowered to succeed
Letting the girls have time to just play + explore
Marketing materials that appeal to girls
Membership in a nationally recognized STEM organization or club
Needs assessment
Outdoor component to experience
Participation in a nationally recognized student design competition
Partnering with professional societies to increase outreach, and the pool of volunteers
Presenting the program, a conference, as equivalent to an adult professional experience
Providing strong encouragement to all students. Give them a sense that they can succeed if they keep trying.
Question based learning (What do you think is...?)
Sharing clear steps to reach a goal or career — to be a vet, you must do x, y, z, etc.
Support from "higher-ups" (e.g., your boss)
The length of the program offered
Time of the year offered

Program Differences and Promising Practices

In this section, we will look at different types of programs and compare their perceptions of promising practices using the scale scores where respondents indicated the level to which each practice contributed to the success of the program.

Girls-only Versus Co-educational Programs

Sixty-percent of the programs served girls-only and the remainder of the programs were co-educational. An independent samples t-test revealed a number of significant differences between how important girls-only programs considered certain practices to be and what co-educational programs rated as important. Girls-only programs were more likely to agree that a girls-only environment, female staff, curriculum that appealed to girls, and positive interaction between girls strongly contributed to the success of their program. Co-educational programs were more likely to agree that hands-on experiences, opportunities to work with others, and mentors strongly contributed to their success. Table 24 shows means where $p<.05$ on a two-tailed independent samples t-test.

Table 24. Ratings of Practices: Girls-only versus Co-educational Programs

Practice	Girls-only programs (mean) n=69	Co-educational programs (mean) n=48
Girls-only environment	**4.56**	3.13
Using curriculum materials that appeal to girls	**4.46**	3.84
Positive interaction between girls is explicitly addressed	**4.28**	3.58
Female (as opposed to male) staff	**3.79**	3.17
Opportunities for participants to work with other people	4.45	**4.69**
Contact with mentors, e.g., communication with working professionals	3.90	**4.29**
Hands-on experiences	4.30	**4.96**

High-Minority versus Low-Minority Participants' Served

Thirty-two programs indicated that more than 50% of their participants were from racial minorities (non-Caucasian/European). Compared to other programs, the high-minority programs were less likely to indicate contact with mentors and utilizing a variety of teaching styles as important in ensuring their program's success. No other practice received significantly different ratings when comparing high-minority and low-minority serving programs.

Table 25. Ratings of Practices: High-Minority versus Low-Minority Programs

Practice	High-Minority (mean) n=32	Low-Minority (mean) n=72
Contact with mentors, e.g., communication with working professionals	4.00	**4.35**
Utilizing a variety of teaching styles	3.70	**4.21**

Elementary School versus Middle School and High School Programs

In order to compare how programs serving different age groups perceived the importance of practices, programs were coded for whether they served elementary school aged participants only (K–5th graders), middle school aged participants only (6th–8th grade) or high school aged participants only (9th–12th graders). However, because the majority of programs served multiple age groups, there were few programs that fit within each category. Six programs had only elementary aged participants, 14 served only middle-school participants, and 13 served high school participants. Because of the low numbers of programs in each category, it was not plausible to run a statistical analysis.

Frequent versus Infrequent Program Meetings

In order to make comparisons, frequent programs were defined as those meeting at least weekly (n=24) and infrequent programs met only once, such as for a one-day conference (n=30). A t-test showed just two significant differences between the means of the two groups: the importance of a broad array of enrichment activities and use of high-end equipment. Programs that met infrequently thought both of these elements to be more important compared to programs meeting frequently.

Table 26. Ratings of Practices: Frequent versus Infrequent Program Meetings

Practice	Programs meeting weekly (mean) n=24	Programs meeting as one-day events (mean) n=30
Broad array of enrichment activities	4.04	**4.50**
High-end, up-to-date equipment and resources	3.54	**4.10**

Urban versus Rural and/or Suburban Settings

There were 37 programs that operated only in urban settings and 33 in rural and/or suburban settings. No significant differences were identified between how these two groups rated the list of practices.

Summary of Promising Practices

Overall, practices that were rated as most important in ensuring a program's success were hands-on experiences, project-based learning opportunities, opportunities to work together with other people, and making curriculum relevant. Table 27 shows the ten most highly ranked practices from the scale questions.

Table 27. Top Ten Highly Rated Practices Overall

Practice	Mean
Hands-on experiences	4.87
Project-based learning opportunities (e.g. projects with real-world activities)	4.60
Opportunities to work together with other people	4.55
Making curriculum relevant, tying it to real-life issues	4.49
Program Director with strong leadership skills	4.47
Experienced Program Director	4.46
Experienced staff	4.46
Sufficient funding	4.46
Opportunities to use technology to be creative and explore	4.42
Small group sizes	4.37

In another question, respondents were asked to select the top five practices that they considered most crucial to the success of their program. The list of the ten most frequently selected elements overlaps with the highly rated elements, including hands-on experiences at the top of the list.

Table 28. Top Ten Most Frequently Selected Elements

Practice	Percentage of Respondents
Hands-on experiences	65%
Making curriculum relevant, tying it to real-life issues	47%
Project-based learning opportunities	28%
Experienced Program Director	27%
Experienced staff	27%
Girls-only environments	27%
Using curriculum materials that appeal to girls	24%
Sufficient funding	23%
Program Director with strong leadership skills	22%
Contact with mentors	19%

Few differences were seen when comparing responses of differing program structures, likely signifying that certain practices can be useful for a variety of programs. In an open-ended question, respondents specified that including slightly older girls, such as high-school, college-aged, or young professionals, as role models or mentors was a valuable practice since it allowed the girls to connect with them better. Additionally, forming partnerships with local organizations, businesses or schools was important for helping programs succeed.

Mentor Component

A mentor was defined in this survey as a person with knowledge or experience who provides personal guidance, advice or counsel. The literature offers much evidence on the importance of influential figures such as mentors in the lives of participants. Further investigation on how mentoring is used in informal education programs and

what program respondents believed to be the effects on participants was conducted. Seventy-seven percent of programs completing this survey indicated they had a mentoring component. A third of the program respondents indicated participants interacted with mentors a few times a year, such as in visits to the program or via field trips. Many others (28%) arranged for their participants to interact with STEM professionals once a year or less frequently. Seven percent of programs had mentors who they met four to seven times a week.

Table 29. Frequency of Interaction between Participants and Mentors

Frequency	Percentage of Respondents
Once a year or less frequently	28%
A few times per year	33%
1–2 times per month	15%
1–3 times per week	17%
4–7 times per week	7%

Most commonly, participants interacted with their mentors in person, either in groups (81%) or individually (60%), as shown in Table 30. About a third used e-mail to communicate with their mentors, and a lower percentage used the phone, online chats, or video conferencing.

Table 30. Method of Interaction Between Participants and Mentors

Interaction Method	Percentage of Respondents
In person, in groups	81%
In person, individually	60%
E-mail	32%
Phone	11%
Online chats	5%
Video conference	3%

Mentors were typically working professionals, volunteers, or college students. Programs also frequently included past program participants. Thirty percent of program respondents indicated they had an ethnically diverse set of mentors. In the "other" category, respondents specified their mentors were staff (3 respondents), K–12 teachers and professors (3 respondents), and retired teachers or parents (1 respondent).

Table 31. Description of Mentors

Mentor Description	Percentage of Respondents
Working professionals	79%
Volunteers	65%
College students	60%
Program alumni/past participants	32%
Ethnically diverse	30%
Older students, K–12	18%
Other	8%

As stated earlier, 66% of the programs serve girls-only. Every program with a mentoring component was asked how many of their mentors were female. The majority of programs had three-quarters to all of their mentors as female, while 6% had less than a quarter of female mentors.

Table 32. Percentage of Female Mentors

Percentage Female	Percentage of Respondents
0–25%	6%
26–50%	16%
51–75%	17%
76–100%	62%

In terms of how the mentoring component affected participants, respondents stated it changed their attitudes about STEM, provided them with guidance on how to succeed in STEM, and provided real-world examples of STEM work and workers.

Mentors were able to show girls the positive aspects of work in STEM-related fields. The girls were exposed to women that enjoy their work and are excited about STEM, and this was often contagious. "They see female engineering students enjoying what they are learning and helping them understand why it is fun." Anecdotal evidence has demonstrated to program respondents how mentors can change attitudes of the girls regarding STEM. "We've had both elementary as well as older girls return to our programs because of the mentors, and also have anecdotal evidence that they have changed their attitudes about science in a positive manner as a result of interaction with the mentors."

Participants typically have stereotyped images of who works in STEM, and introducing them to STEM professionals offered the opportunity to break those stereotypes, "Most girls leave feeling that the STEM project and personnel have changed their view point about being successful in those fields." Participants are exposed to successful women, "Mentors allow the female camp participants the opportunity to see professional women successful in their chosen fields of study." It can give them somebody to model themselves after, if they are interested in pursuing the same line of work, "Giving the younger girls positive female role models allows them to envision personal

success." and "[Mentors] allows them to relate to someone who may have had the same goal they have. It encourages girls to follow whatever dream they may have. Younger mentors, in particular, were believed to be effective in reaching the participants, "The girls generally like talking to older 'girls' — college-aged women. They're still students, but they're grown up and I think that's appealing."

A few programs had mentors provide guidance on a participant project. Through these content-specific interactions, participants were also exposed to career information, "The mentors not only provide guidance and direction for the students' work (design of human mission to Mars), but also important information about the many paths to take into STEM careers, and the variety of opportunities within STEM careers." It allowed them to take on more challenging projects, "Using mentors for the Gold and Silver award hopefuls gives the girls the courage to try a project that may have felt out of their reach. Knowing they have someone willing to guide them makes a big difference."

Respondents believed that encouraging role models makes an impact on participants. "Girls are surrounded by women who work in STEM-related fields, and who want to encourage girls in STEM fields. This makes an impact!" A few respondents wrote about participants continuing to contact women who came to visit the program.

Program Evaluation

Eighty-nine percent of respondents had an evaluation conducted of their program. Most had a dual purpose: 91% indicated it was to look at program implementation and make improvements, and 81% used the evaluation results to report to funders or others. Other programs used evaluation to measure program outcomes, especially on participants, to evaluate staff or volunteers, to solicit funders, to see if the results are supporting the mission and goals of the program, and to look at long-term effects.

Table 33. Evaluation Purpose

Evaluation Purpose	Percentage of Respondents
Look at program implementation, e.g., evaluation results are used to inform decision-making about program implementation	91%
Report to funders and/or program staff, e.g., evaluation results are used to inform funders or others	81%
Other	13%

A large majority of program respondents agreed (44%) or strongly agreed (44%) that evaluation results are useful for shaping program decisions.

DISCUSSION

A variety of programs completed this survey aimed to identify promising practices for informal girl-serving STEM educational programs. Despite the differing structures, there were high levels of agreement about what practices contributed significantly to a program's success. Additionally, findings closely parallel those found in a previous study funded by the National Center for Women in Information Technology (NCWIT) investigating promising practices in information technology (IT) informal programs. The results had a number of overlapping top five critical practices, including the same top two: hands-on activities (selected by 64% of IT respondents) and project-based learning opportunities (selected by 48% of IT respondents). Additionally, mean ratings were very similar, with the same practices in the top three (hands-on experiences, opportunities to work together with other people, and project-based learning opportunities) (Liston, Peterson & Ragan, 2006).

Program structures ranged from those with a small group of participants meeting regularly (9% met once per week or more frequently) to large one-day events (26%). Most of the programs focused on multiple content areas, including aspects of science, technology, engineering and mathematics. Science was most likely to be included, with 39% of programs focusing on science content. Sixty percent of responding programs were girls-only, and the remainder were co-educational. Programs served a range of participant age groups, from young elementary students (45%) to upper high school students (67%). Middle school students had the most programs available, with 82% of programs serving that age group. Programs were located in 36 states across the U.S., and though they most commonly served urban areas (74%), many were also involved in suburban (60%) or rural (48%) locations. They were mainly run through non-profit or community-based organizations (61%), and rarely through federal or local government grants (23% and 14%, respectively).

Promising Practices

Overall ratings of the practices were quite high. For reference, the lowest rating was 3.42 (in this case, for having a staff similar to the students' ethnicity). All other ratings are higher. This shows a high level of agreement between what has been specified in the research as promising and what program representatives believe to be effective.

The highest ratings of practices, and their means, to ensure a program's success were for:

- Hands-on experiences (4.87)
- Project-based learning opportunities (e.g. projects with real-world activities) (4.60)
- Opportunities to work together with other people (4.55)
- Making curriculum relevant, tying it to real-life issues (4.49)
- Program Director with strong leadership skills (4.47)
- Experienced Program Director (4.46)
- Experienced staff (4.46)
- Sufficient funding (4.46)

Additionally, practices most frequently selected as the top five most critical were:

- Hands-on experiences (65%)
- Making curriculum relevant, tying it to real-life issues (47%)
- Project-based learning opportunities (28%)
- Experienced Program Director (27%)
- Experienced staff (27%)
- Girls-only environment (27%)

There is high overlap between the two lists above, including hands-on activities at the top of each. Research supports the use of interactive lessons to keep students engaged and thinking critically (Christie, 2005, Fancsali, 2002). Programs believed girls became more engaged and learned more when they were doing hands-on activities. Additionally, it more accurately reflects work that is actually done in STEM, and often counterbalances the reading and writing exercises participants are doing in school. Opportunities to work with other people are often easily incorporated into hands-on activities.

In addition to being hands-on, using curriculum that is relevant and tied into the participants' lives was also seen as important. Project-based learning opportunities using real-world activities was very highly rated. Programs strived to show participants how STEM fields were part of their everyday experience. A common theme in the literature is that girls want to affect the world in positive ways and realize the larger impact of their work (Jones, Howe & Rua, 2000), though many program organizers did not tie that idea into relevant curriculum. A number of programs believed that allowing girls to decide the curriculum was effective in engaging them in STEM content.

Many programs wrote about the importance of making their program fun, and staff played a large role in setting the tone of the program and making girls feel comfortable and enjoy themselves. Practices related to staffing were fourth and fifth on the list of the most critical practices. An experienced program director that is good at communicating, flexible and able to problem-solve, and experienced, diverse staff with youth development skills influence a program's success. Additionally, in the open-ended sections, program respondents wrote about the importance of using volunteers, especially those working in STEM careers, to come in and work with the girls, and the value of staff and volunteer training.

The role of program structure and types of participants' served were analyzed for differences. Girls-only settings have received mixed-reviews in the literature (Froschl, et al., 2003), and that is also reflected in this data set. Many co-educational programs did not think that separating the sexes was a valuable practice, but the girls-only programs noted it as significantly more important to their success. Girls-only programs were also significantly more likely to agree that female staff, curriculum that appealed to girls, and explicitly addressing positive interaction between girls strongly contributed to the success of their program. Since the majority of the programs served multiple participant age groups, it was not possible to isolate differences between programs serving younger participants versus older participants.

Programs meeting once found it important to include a broad array of enrichment activities and high-end, up-to-date resources compared to programs meeting at least once a week. Perhaps the one-shot programs felt a need to be more flashy and inclusive since they typically need to recruit a large number of participants. No significant differences were found between programs serving participants in urban, rural or suburban locales.

Participant Recruitment and Retainment

Programs responding to the survey most commonly recruited participants using print advertising (77%), a Web site (75%), and past or current participants telling others about the program (73%). Almost 90% of programs target a specific participant group when they are recruiting, most commonly female participants, followed by middle school age participants. Often they work with the schools or teachers to reach potential participants.

The large majority of these programs did not have difficulty retaining participants: 12% retained less than half of their participants. To encourage their participants to remain in the program, program organizers ensure the activities were relevant and fun, build relationships with participants and parents, and decrease barriers such as cost and location.

Role of Funding and Resources

Most programs had a variety of funding sources. The three main funding sources reported by programs were participant fees (55%), corporate funding (54%) or private foundation grants (44%). It is important to note that even though more than half of programs charged participants, most indicated fees less than $25.00. Programs also received many forms of in-kind support, most commonly in the form of staff or volunteer time (78%), facilities (65%), or materials/supplies (61%). Only 7% of programs indicated they did not receive any in-kind support. A number of programs specified that forming partnerships or collaborations with local organizations, businesses or schools can help a program succeed, perhaps indicating they believed it to be important to work with others, sharing resources and receiving support. The majority (61%) of the programs surveyed were run by not-for-profit organizations.

High-end, up-to-date equipment and resources received a mean scale rating of 3.76, so it was fairly important to many programs. However, it was the lowest rating of learning experiences practices. Many program representatives wrote about "making-do" with resources they have and still feeling they can be successful. Sufficient funding was rated as much more important to a program's success (mean = 4.46). One possible explanation is that "sufficient" is not covering high-end resources, but more basic equipment or other general program needs. Many informal education programs, though, are often under-funded, so programs could be indicating that sufficient funding could make them more successful.

Role of Program Evaluation

All but 11 percent of programs responding to this survey were evaluated. Most had a dual purpose, 91% indicated it was to look at program implementation and make improvements, and 81% used the evaluation results to report to funders or others. A large majority of program representatives agreed (44%) or strongly agreed (44%) that evaluation results are useful for shaping program decisions.

Role of Mentors

For many programs, exposure to and understanding of the discipline is the main goal of their program. Additionally, they might address the negative stereotypes that girls have of those who work in the field or share stories of female role-models who have been successful. Quimby & DeSantis's (2006) study of over 350 female undergraduates revealed that role model influence significantly affected career choices. As a career piece, ratings for simply providing career information or information on professionals in the field were much lower than providing personal experiences where participants had opportunities to meet and interact with professionals.

Based on the survey definition of a mentor as a person with knowledge or experience who provides personal guidance, advice or counsel, 77% of programs completing this survey indicated they had a mentoring component regardless of the amount of contact or depth of exposure. Most commonly, participants interacted with their mentors a few times per year (33%), or once a year or less frequently (28%) in person, either in groups (81%) or individually (60%). The typical mentor was a female STEM professional and a volunteer. It was reported that many of these programs included visits from STEM professionals as mentoring opportunities, which is often termed as exposure to a "role model" rather than a "mentor." However, the way respondents interpreted the questions points out something important: Any type of in-person interaction where participants were able to observe, listen to, or ask questions of a woman working in STEM had a definite impact.

Contact with a mentor received fairly high ratings on the scale question, 4.33, and 19% of respondents indicated it was one of the top five most critical practices. Programs indicating that more than 50% of their participants were racial minorities (non-Caucasian/European) were significantly less likely to rate contact with mentors as an important practice. This could be partially due to the low numbers of racial minorities working in STEM fields as programs typically try to find mentors who are similar to their group of participants, whether in terms of age, gender, ethnicity, or other background characteristics.

In terms of age, a number of programs specified in an open-ended section that finding mentors or role models who were close in age to program participants was helpful in ensuring a program's success. Participants were more likely to view the mentor or role model as similar to themselves, or as somebody they aspired to be like. Girls' preference for younger mentors or role models were described in a report from Girl Scout Research Institute (Schoenberg, Doyle, Bynum, Mosatche, Conn & Pryor, 2002) based on data from over 3,000 girls, "Girls 11–17 are looking for a group advisor who

is closer to them in age and has experienced many of the same issues. Both in the focus groups and then in the on-line study, girls 11–17 indicated a definite preference to have as advisors young women ranging in age from 18 to 29 years old, from college students to young professionals." College-age females were most frequently selected as preferred advisors by 34% of Girl Scouts and 26% of non-Girl Scouts.

Program representatives in this survey believed their mentoring components to be effective because they showed girls the positive aspects of STEM, broke negative stereotypes, and changed participant attitudes. Clearly, the influence of role models and mentors—whether formally defined or loosely interpreted—has a significant impact on girls' judgment and impressions of STEM and STEM-related careers.

AREAS FOR FURTHER CONSIDERATION

Although this study compiles a data set from a diverse set of programs on a variety of promising practices, it also raises additional research questions.

Participant Learning Experience

This report was based on data collected from program representatives who inferred, using a variety of evidence, how effectual different practices were in making their program successful at engaging girls. It would be interesting to investigate what defines success for each program. Based on research, we expect that many programs aim to engage girls in STEM, show the true nature of work in STEM fields, and possibly to inspire more girls to pursue education or careers in STEM.

It would also be worthwhile to collect data from informal STEM education program participants to determine what practices they thought were successful. Studying participant outcomes based on the practices being utilized could also reveal the effects of specific practices.

Curriculum and Learning Activities

There is a fair amount of consensus concerning what type of curriculum and learning activities are worthwhile to use in informal education programs. Hands-on and project-based activities and real-world, relevant content are considered to strongly contribute to program success. This indicates that the development of shared curricular resources would be beneficial for many programs. This would require, though, the establishment of content that is relevant to a diverse group of participants.

It would be valuable to investigate how "relevant" curricula are generalized or even if they can be generalized. Our data show that curriculum relevant to participants' culture, as rated by the program representatives, is one of the lowest-rated curriculum practices with a mean of 3.57. What participant characteristics, including age, ethnicity, locale, etc, influence what types of curricula are relevant?

Contact with Mentors

Mentors were used by many programs to provide girls with personal contact with female professionals. This practice is supported by Lee's research (2002) which showed that girls' identity and self-concepts are more influenced by high-quality, supportive relationships in STEM than boys' identity. Additionally, the effect of exposing girls to different types of careers without actively encouraging them to pursue those careers should be further explored.

However, the majority of mentor-participant relationships in the surveyed programs are brief — only 7% meet more than 4 times per week, while one-third meet a few times per year. Are students actually gaining an understanding of different careers? What types of mentoring are most effective?

Generalizability

The correlation between practices used in programs and promising practices identified in literature suggest high practitioner familiarity with research. Survey respondents were able to indicate if they did not use the practice listed by marking "Not Applicable." The most frequent practices that were not used included opportunities for participants to take a leadership role (n=14), positive interaction between girls is explicitly addressed (n=12), curriculum relevant to participants' culture (n=12) and frequent staff development (n=11).

The survey responses overall showed little variation: only three practices rated on a five point scale had a standard deviation slightly over 1.0: female as opposed to male staff, SD = 1.09; High-end, up-to-date equipment and resources, SD = 1.04; and girls-only environments, SD = 1.03. This indicates a high level of agreement among these different programs on what practices are effective. It would be interesting, though, to further explore how certain program characteristics affect what practices are thought to be most successful. In this study, the project team was able to get a sense of a small number of characteristics such as girls-only programs, ages served, frequency of meetings, and program locale. More in-depth studies are warranted in order to get a better idea of which practices can be applied to all groups and settings and still bring positive results. These additional studies might also bring an understanding of what makes these practices effective.

This type of study would be especially valuable in comparing how these practices apply to classroom-based programs. This study showed that representatives from informal education programs thought a comfortable, relaxed and "fun" environment strongly contributed to their success. Do in-school programs set that atmosphere for their programs? Does the practice apply only to programs that aim to be content-rich?

Communication and Collaboration

The power of collaboration was noted by many respondents in open-ended portions of the survey. Programs reached out to the local community to attend youth presentations on their projects and worked with teachers to recruit participants. Survey responses also revealed the importance of communicating and working together with other like-organizations. The dialogue about promising practices needs to continue so there is an awareness of what has demonstrated effectiveness and what new, innovative practices are being tried. Improving evaluation would allow programs to show evidence of which practices lead to specific participant outcomes.

This report establishes many practices as effective within informal STEM education programs for girls, but there is more work that can strengthen and extend the findings into more generalizable and more specific practices.

Inquiries related to *Evaluating Promising Practices in Informal Science, Technology, Engineering, and Mathematics (STEM) Education for Girls* should be directed to Program Collaborations & Initiatives, Girl Scouts of the USA, 420 Fifth Ave., New York, NY 10018-2798.

REFERENCES

AAUW Educational Foundation (2000). *Tech savvy: Educating girls in the new computer age.* Washington, DC: American Association for University Women.

AAUW Educational Foundation (2004). *Under the microscope: A decade of gender equity projects in the sciences.* Washington, DC: American Association of University Women.

Berenson, B. S., Droujkova, M. A., Cavey, L. O., Smith, N. H., & Barnes, T. M. (2000, Winter). Girls on track with information technology. *Meridian: A Middle School Computer Technologies Journal.* Retrieved April 16, 2006 from http://www.ncsu.edu/meridian/2000wint/index.html

Bartol, K.M. & Aspray, W. (2006). The transition from the academic world to the IT workplace. In J.McGrath Cohoon & William Aspray (Eds.) *Women and information technology: Research on underrepresentation* (pp377–419). Cambridge, MA: The MIT Press.

Birmingham, J., Pechman, E. M., Russell, C. A., Mielke, M. (2005, November). *Shared features of high-performing after-school programs: A follow-up to the TASC evaluation.* The After-School Corporation and Southwest Educational Development Laboratory. Retrieved April 16, 2006 from http://www.sedl.org/pubs/fam107/fam107.pdf

Bureau of Labor Statistics, U.S. Department of Labor. (2007). *Occupational outlook handbook, 2006–07.* Retrieved October 1, 2007 from http://www.bls.gov/news.release/ooh.t01.htm

Britner, S. L., & Pajares, F. (2001). Self-efficacy beliefs, motivation, race, and gender in middle school science. *Journal of Women and Minorities in Science and Engineering, 7*, 1–23.

Campbell, P.B. & Branting, B. (2005). Making it better: Using data to improve projects and programs. *GE Foundation's Math Excellence Cross-Project Evaluation*.

Catalyst (1998). *Census of women corporate officers and top earners of the Fortune 500.* New York, NY: Catalyst, 1998. Retrieved December 13, 2007 from http://www.catalyst.org/knowledge/metrisarchives.shtml

Christie, A. A. (2005, Winter). How adolescent boys and girls view today's computer culture. *Meridian: A Middle School Computer Technologies Journal.* Retrieved April 16, 2006 from http://www.ncsu.edu/meridian/win2005/computer%20culture/computer_culture.pdf

The College Board (2006). *Advanced placement program: National summary report.* New York, NY: Author. Retrieved June 12, 2006 from http://www.collegeboard.com/prod_downloads/about/news_info/ap/2006/2006_ap-report-nation.pdf

Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development (2000, September). *Land of plenty: Diversity as America's competitive edge in science, engineering and technology.* Arlington, VA: National Science Foundation. Retrieved October 1, 2007 from http://www.nsf.gov/pubs/2000/cawmset0409/cawmset_0409.pdf

Crombie, G. (1999). *Research on young women in computer science: Promoting high technology for girls.* Presentation at the annual meeting of the Professional Engineers of Ontario, Women in Engineering Advisory Committee.

Denner, J. Werner, W. Bean, S. & Campe, S. (2005). The Girls Creating Games program: Strategies for engaging middle-school girls in information technology. *Frontiers*, 26(1), 90–98.

Fancsali, C. (2002). *What we know about girls, STEM, and afterschool programs.* New York City: Academy for Educational Development.

Froschl, M., Sprung, B., Archer, E., & Fancsali, C. (2003). *Science, gender, and afterschool: A research agenda*. Washington, DC: Educational Equity Concepts and Academy of Educational Development. Retrieved June 29, 2005 from http://www.aed.org/CentersandExperts/froschl.cfm

Greene, B. A., DeBacker, T.K., Ravindran, B. & Krows, A. J. (1999). Goals, values, and beliefs as predictors of achievement and effort in high school mathematics classes. *Sex Roles, 40*(5/6), 421–458.

Gürer, D. & Camp, T. (1997). *Investigating the incredible shrinking pipeline for women in computer science.* ACM Committee on Women in Computing. Retrieved October 11, 2006 from http://women.acm.org/documents/finalreport.pdf

Hanor, J. (1998, Winter). Concepts and strategies learned from girls' interactions with computers. *Theory into Practice*, 37(1), 64–72.

Haury, D. & Rillero, P. (1994). Perspectives of hands-on science teaching. *Pathways to School Improvement*, Retrieved December 5, 2006 from http://www.ncrel.org/sdrs/areas/issues/content/cntareas/science/eric/eric-1.htm

Jones, M. G., Howe, A., & Rua, M. J. (2000). Gender differences in students' experiences, interests, and attitudes toward science and scientists. *Science Education*, 84, 180–192.

Lanius, C. (1997) *Girltech: Getting girls interested in computer science.* Retrieved April 16, 2006 from http://math.rice.edu/~lanius/club/girls.html

Lee, J. D. (2002). More than ability: Gender and personal relationships influence science and technology involvement. *Sociology of Education*, 75, 349–73.

Leonard, M. J. & Derry, S. J. (2001). *Can gender-adapted instruction improve mathematics performance and attitudes?* Paper presented at the meeting of the American Educational Research Association, Seattle, WA.

Lichtman, J. (1998). The cyber sisters club: Using the Internet to bridge the technology gap with inner city girls. *T. H. E Journal (Technology Horizons in Education, 26*(5), 47.

Liston, C., Peterson, K. & Ragan, V. (2006). Evaluating promising practices in informal information technology education for girls. Paper presented at the annual meeting of the National Center for Women & Information Technology, Boulder, CO.

Miller, B.M. (2005, November). *Pathways to success for youth: What counts in after-school.* A report of the Massachusetts After-School Research Study (MARS). Retrieved April 16, 2006 from http://www.uwmb.org

National Center for Education Statistics (2004). *Trends in educational equity of girls & women.* Institute on Education Sciences. NCES 2005016. Retrieved November 21, 2006 from http://nces.ed.gov/pubs2005/equity/

National Science Board (2006). *Science and Engineering Indicators, Volume 1.* NSB 06-01. Arlington, VA: National Science Foundation. Retrieved April 17, 2006, from http://www.nsf.gov/statistics/seind06/

National Science Foundation (2006). *Women, minorities and persons with disabilities in science and engineering.* Division of Science Resource Statistics. Arlington, VA: Author. Retrieved June 12, 2006 from http://www.nsf.gov/statistics/wmpd/sex.htm

National Science Foundation, Directorate of Engineering (2005). Extraordinary women engineers: Final report. EEC-0438810. Retrieved November 21, 2006 from http://www.eweek.org/2002/News/Eweek/EWE_Needs_Asses.pdf

Packard, B. W-L. & Nguyen, D. (2003). Science career-related possible selves of adolescent girls: A longitudinal study. *Journal of Career Development*, 29(4), 251–263.

Pajares, F. (in press). Gender differences in mathematics self-efficacy beliefs. In A. Gallagher & J. Kaufman (Eds.), *Mind the gap: Gender differences in mathematics.* Boston, MA: Cambridge University Press.

Penuel, W., & Kim, D. (2000). *Promising practices and organizational challenges in Community Technology Centers.* Menlo Park, CA: VStreets Research Group, SRI International. Retrieved October 11, 2006 from http://www.sri.com/policy/ctl/assets/images/vStreets_Promising_Practices.pdf

Sanders, J. (2005). *Gender and technology in education: A research review.* Retrieved June 1, 2006, from http://www.josanders.com/pdf/gendertech0705.pdf

Schoenberg, J., Doyle, E., Bynum, R., Mosatche, H., Conn, M., & Pryor, D. (2002). *The ten emerging truths: New directions for girls 11–17.* New York: Girl Scouts of the USA. Retrieved December 13, 2007 from http://www.girlscouts.org/research/pdf/ten_truths.pdf

Thompson, J. J. & Windschitl, M. (2005). Failing girls: Understanding connections among identity negotiation, personal relevance, and engagement in science learning from underachieving girls. *Journal of Women and Minorities in Science and Engineering 11*(1), 1–26.

U.S. Department of Education (2007, September). Encouraging girls in math and science, IES practice guide. *Institute for Education Sciences.* Retrieved October 29, 2007 from http://ies.ed.gov/ncee/wwc/pdf/20072003.pdf

Weisgram, E.S. & Bigler, R.S. (2006). Girls and science careers: The role of altruistic values and attitudes about scientific tasks. *Journal of Applied Developmental Psychology, 27*, 326–348.

Wilkins, L., Gaskin, J., Hom, S. & Andrews, C.L. (2005). Engaging middle school girls by aligning culture and science. *Maui Economic Development Board/Women in Technology Project.* Paper presented at 2005 WEPAN/NAMEPA Joint Conference. Retrieved September 15, 2007 from http://www.womenintech.com/about_research/WEPAN05ExciteCampF.pdf

Yanowitz, K. L. & Vanderpool, S. S. (2004). Assessing girls' reactions to science workshops. *Journal of Science Education and Technology, 13*(3), 353–359.

Zales, C. R. and S. J. Cronin (2005). Embracing the future: Bioinformatics for high school women. *Journal of Women and Minorities in Science and Engineering, 11*(1), 27–44.

Zarrett, N. R., & Malanchuk, O. (2005). Who's computing? Gender and race differences in young adults' decisions to pursue an information technology career. *New Directions for Child and Adolescent Development*, 110, 65–84.

APPENDIX A

Survey Invitation

STEM Survey invitation

Do you run an informal education program that includes components of science, technology, engineering, and mathematics (STEM)?

If yes, we would like to invite you to participate in a study on promising practices in STEM informal education by completing an online survey. The survey is geared toward past and current informal education programs (such as after-school programs, conferences, or summer programs) that serve K–12 girls (including co-educational programs) in the U.S. and have aspects related to STEM.

The information you provide will help Evaluation & Research Associates (ERA) and Girl Scouts of the USA (GSUSA) create a resource with research-based tips for girls' informal education programs in STEM that will be disseminated nationally. Additionally, responses to a set of optional questions describing your program will be used in a national online directory of STEM programs. The survey will take approximately 20 – 30 minutes to complete. Your survey responses are confidential and only aggregate results will be shared in the final reporting documents.

Please forward this invitation to other contacts and programs involved in informal STEM education programs. In order to reach as many programs as possible, we are relying on formal and informal networks of those involved in work related to STEM education.

Thank you in advance for your help with this study. Please contact Carrie Liston at cliston@psctlt.org if you have any questions or need technical support related to the survey.

Evaluation & Research Associates
Puget Sound Center for Teaching, Learning and Technology

APPENDIX B

Survey to STEM Programs

Survey of Informal Education Programs in Science, Technology, Engineering and/or Mathematics (STEM)

Program Structure

Indicate the percentage of time in your program spent on the following content areas. Use 0 if the content area is not covered in your program.

Science _____
Technology _____
Engineering _____
Mathematics _____

What are the grade levels of your program's participants? Check all that apply.

- ☐ Kindergarten to 3rd grade (ages 5–8)
- ☐ 4th to 5th grade (ages 9–10)
- ☐ 6th to 8th grade (ages 11–14)
- ☐ 9th to 10th grade (ages 14–15)
- ☐ 10th to 12th grade (ages 15–16)
- ☐ None of the above (under age 5 or over age 18)

What year was your program created? _____

What state is your program in? _____

Is your program still active?

- ☐ Yes
- ☐ No

In what type of location do you run your program? Check all that apply.

- ☐ Urban
- ☐ Suburban
- ☐ Rural

What best describes your program?

- ☐ School-based program
- ☐ For-profit education program
- ☐ Non-profit/Community program
- ☐ Corporate sponsored program
- ☐ Other, please specify: _____

How is your program funded? Check all that apply.

- ☐ Corporate funding
- ☐ Local government grant
- ☐ Federal government grant
- ☐ Private foundation grant
- ☐ Funded by participants
- ☐ Individual donors
- ☐ Other(s), please specify: _____

What types of in-kind support has your program received? Check all that apply. _____

- ☐ Administrative support
- ☐ Communication
- ☐ Information (e.g. list of contacts)
- ☐ Facilities/Office space
- ☐ Materials/supplies
- ☐ Staff/Volunteer time
- ☐ Project advising
- ☐ Technical equipment (e.g. hardware, software, or other infrastructure)
- ☐ Technical expertise (e.g. in science, technology, etc.)
- ☐ Other(s), please specify: _____
- ☐ No in-kind support received

How much do you charge participants for your program, on average?

- ☐ $0–$25
- ☐ $26–$50
- ☐ $51–$100
- ☐ $101–$200
- ☐ $201–300
- ☐ More than $300

Do participant fees cover the cost of the program?

- ☐ Yes
- ☐ No, other funding is needed

How frequently do participants meet? Choose the best answer.

- ☐ Once a year or one-time event, e.g., conference
- ☐ Once a year for 1–7 days, e.g., camp
- ☐ Once a year for 8 days or more, e.g., camp
- ☐ A few times per year
- ☐ 1–2 times per month
- ☐ 1–3 times per week
- ☐ 4–7 times per week
- ☐ Other, please specify _____

What is the average duration of each program meeting?

- ☐ Less than 3 hours
- ☐ Between 3 and 6 hours
- ☐ Longer than 6 hours

Participants

Approximately how many youth participants are involved in your program at any one time?

- ☐ 1–10
- ☐ 11–25
- ☐ 26–50
- ☐ 51–75
- ☐ 76–100
- ☐ 101+

How long do most participants stay involved in your program? Indicate the average length in days, months, or years, e.g., 15 days. _____

Please describe the ethnicity of your participants. Estimate the percentage of each ethnicity (must total 100%).

Caucasian/European American _____
Black/African-American _____
Asian _____
Hawaiian or Pacific Islander _____
Native American or Alaskan Native _____
Multi-racial _____

Please estimate the percentage of participants who are Hispanic/Latino: _____

Is your program co-ed, girls only, or boys only?

- ☐ Co-ed
- ☐ Girls only
- ☐ Boys only

How do you recruit participants to your program? Check all that apply.

- ☐ Advertising, Print (e.g. fliers, brochures, newspaper ads)
- ☐ Advertising, Non-print (e.g. radio)
- ☐ Through other organizations that work with youth
- ☐ Mailing brochures/fliers
- ☐ Outreach/Presentations (e.g. at schools, parent organizations)
- ☐ Participants who spread the word
- ☐ Listservs/E-mail
- ☐ Web site
- ☐ Other(s), Please specify: _____
- ☐ My program does not recruit participants

Do you target specific participant groups (e.g. certain age groups, locations, ethnicities)?

- ☐ Yes, we target specific participant groups
- ☐ We do not target specific participant groups

If applicable, what specific participant groups do you target? Check all that apply.

- ☐ Female participants
- ☐ Male participants
- ☐ Elementary age participants
- ☐ Middle school age participants
- ☐ High school age participants
- ☐ Urban participants
- ☐ Rural participants
- ☐ Asian participants
- ☐ Black participants
- ☐ Hispanic/Latino participants
- ☐ Other(s), Please specify: _____
- ☐ My program does not target specific participant groups

If applicable, please explain how you reached out to (a) specific participant group(s).

_____

_____

_____

What is the retention rate of your program?

- ☐ Not applicable (e.g. one time event)
- ☐ Few (0–29%) participants who start the program remain involved
- ☐ Less than half (30–49%) of participants who start the program remain involved
- ☐ A majority (49–70%) of participants who start the program remain involved
- ☐ Most (71–85%) of participants who start the program remain involved
- ☐ Almost all (86–100%) participants who start the program remain involved

If applicable, what are the most effective strategies for retaining participants in your program?

_____

_____

_____

Program Staff

Please respond based on the following prompt:
This practice contributes to the success of my program.

	Not Appli-cable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Experienced Program Director	☐	☐	☐	☐	☐	☐
b) Program Director with strong leadership skills	☐	☐	☐	☐	☐	☐
c) Experienced staff	☐	☐	☐	☐	☐	☐
d) Frequent staff professional development and training	☐	☐	☐	☐	☐	☐
e) Female (as opposed to male) staff	☐	☐	☐	☐	☐	☐
f) Staff that are similar to the students in terms of ethnicity	☐	☐	☐	☐	☐	☐

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success related to staffing practices.

_____

_____

Curriculum

Please respond based on the following prompt:
This practice contributes to the success of my program.

	Not Appli-cable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Curriculum relevant to participants' culture	☐	☐	☐	☐	☐	☐
b) Making curriculum relevant, tying it to real-life issues	☐	☐	☐	☐	☐	☐
c) Project-based learning opportunities (e.g. projects with real-world activities)	☐	☐	☐	☐	☐	☐
d) Using curriculum materials that appeal to girls	☐	☐	☐	☐	☐	☐
e) A challenging content level	☐	☐	☐	☐	☐	☐
f) Broad array of enrichment activities	☐	☐	☐	☐	☐	☐
g) Opportunities to use technology to be creative and explore	☐	☐	☐	☐	☐	☐
h) Opportunities to use technology to communicate/ social network	☐	☐	☐	☐	☐	☐

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success related to curriculum practices.

Learning Experiences

Please respond based on the following prompt:
This practice contributes to the success of my program.

	Not Appli-cable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Hands-on experiences	☐	☐	☐	☐	☐	☐
b) Opportunities to work together with other people	☐	☐	☐	☐	☐	☐
c) Small group sizes	☐	☐	☐	☐	☐	☐
d) Girls-only environments	☐	☐	☐	☐	☐	☐
e) Frequent affirmation and verbal support from instructors	☐	☐	☐	☐	☐	☐
f) Low student to staff ratio, e.g., 10 (or less) to 1	☐	☐	☐	☐	☐	☐
g) Utilizing a variety of teaching styles	☐	☐	☐	☐	☐	☐
h) Comfortable physical learning environment	☐	☐	☐	☐	☐	☐
i) High-end, up-to-date equipment and resources	☐	☐	☐	☐	☐	☐
j) Positive interaction between girls is explicitly addressed	☐	☐	☐	☐	☐	☐

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success of practices related to learning experiences.

Career Information

Please respond based on the following prompt:
This practice contributes to the success of my program.

	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Contact with mentors, e.g., communication with STEM professionals	☐	☐	☐	☐	☐	☐
b) Information on professionals in the field (not necessarily known personally)	☐	☐	☐	☐	☐	☐
c) Career information	☐	☐	☐	☐	☐	☐

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success related to sharing career information.

_____

_____

Other Practices

Please respond based on the following prompt:
This practice contributes to the success of my program.

	Not Applicable	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
a) Opportunities for participants to take a leadership role	☐	☐	☐	☐	☐	☐
b) Community support, e.g. in-kind resources, services, and/or recognition	☐	☐	☐	☐	☐	☐
c) Parent support	☐	☐	☐	☐	☐	☐
d) Clear program goals	☐	☐	☐	☐	☐	☐
e) Sufficient funding	☐	☐	☐	☐	☐	☐
f) Formal program evaluation	☐	☐	☐	☐	☐	☐

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success of practices related to the above other practices.

_____

_____

_____

Additional Practices

Other 1 _____

a) This practice contributes to the success of my program.

- ☐ Not Applicable
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Other 2 _____

a) This practice contributes to the success of my program.

- ☐ Not Applicable
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Other 3 _____

a) This practice contributes to the success of my program.

- ☐ Not Applicable
- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Neutral
- ☐ Agree
- ☐ Strongly Agree

Please describe any evidence from your program (including anecdotal evidence from observation, communication with those in the program, informal or formal evaluation, etc.) that demonstrates success of practices related to the additional practices.

_____

_____

_____

Rank the Practices

Check the boxes next to the five practices you consider most important in determining the success of your program. There is space at the end to write in up to three other practices that are not included on the list.

- ☐ Experienced Program Director
- ☐ Program Director with strong leadership skills
- ☐ Experienced staff
- ☐ Frequent staff professional development and training
- ☐ Female (as opposed to male) staff
- ☐ Staff that are similar to the students in terms of ethnicity
- ☐ Curriculum that is relevant to participants' culture
- ☐ Making curriculum relevant, tying it to real-life issues
- ☐ Project-based learning opportunities
- ☐ Using curriculum materials that appeal to girls
- ☐ A challenging content level
- ☐ Broad array of enrichment activities
- ☐ Opportunities to use technology to be creative and explore
- ☐ Opportunities to use technology to communicate/social network
- ☐ Hands-on experiences
- ☐ Opportunities to work together with other people
- ☐ Small group sizes
- ☐ Girls-only environments
- ☐ Frequent affirmation and verbal support from instructors
- ☐ Low student to staff ratio
- ☐ Utilizing a variety of teaching styles
- ☐ Comfortable physical learning environment
- ☐ High-end, up-to-date equipment and resources
- ☐ Positive interaction between girls is explicitly addressed
- ☐ Contact with mentors
- ☐ Information on professionals in the field
- ☐ Career information
- ☐ Opportunities for participants to take a leadership role
- ☐ Community support
- ☐ Parent support
- ☐ Clear program goals
- ☐ Sufficient funding
- ☐ Formal program evaluation
- ☐ Other 1 _____
- ☐ Other 2 _____
- ☐ Other 3 _____

Mentors

A mentor is a person with knowledge or experience who provides personal guidance, advice or counsel. Does your program provide participants with the opportunity to interact with mentors?

- ☐ Yes
- ☐ No [Goto question Qeval]

In what ways do participants interact with mentors? Check all that apply:

- ☐ In person, individually
- ☐ In person, in groups
- ☐ E-mail
- ☐ Phone
- ☐ Online chats
- ☐ Video conference
- ☐ Other, Please specify: _____

How frequently do participants interact with mentors?

- ☐ Once a year or less frequently
- ☐ A few times per year
- ☐ 1–2 times per month
- ☐ 1–3 times per week
- ☐ 4–7 times per week

How many of the mentors for the girls in your program are female?

- ☐ 0–25%
- ☐ 26–50%
- ☐ 51–75%
- ☐ 76–100%

What describes the group who serves as mentors for your program? Check all that apply:

- ☐ Volunteers
- ☐ Older students, K–12
- ☐ College students
- ☐ Working professionals
- ☐ Program alumni/past participants
- ☐ Ethnically diverse
- ☐ Other, Please specify: _____

Briefly describe how the mentor component affects your participants.

_____

_____

_____

Program Evaluation

Is your program evaluated?

- ☐ Yes [Go to next question]
- ☐ No [Go to contact information]

What is the purpose of your evaluation? Check all that apply.

- ☐ Look at program implementation, e.g., evaluation results are used to inform decision-making about program implementation
- ☐ Report to funders and/or program staff, e.g., evaluation results are used to inform funders or others
- ☐ Other, Please specify _____

Evaluation results are useful for shaping program decisions.

- ☐ Strongly Disagree
- ☐ Disagree
- ☐ Agree
- ☐ Strongly Agree

Contact Information

In this section, responses are not confidential. We may include the program information in an online directory of informal STEM education programs across the U.S.

Would you like your program to be included in an online directory of STEM programs across the U.S.?

- ☐ Yes, include my program in the directory
- ☐ No thanks

Program Name (e.g. Girls are IT): _____

Organization Name, if applicable (e.g. Girl Scouts) _____

Contact Name: _____

Email Address: _____

Your Title: _____

Street Address: _____

City: _____ State: _____

Brief Program Description:

_____

_____

Comments?