

KEYS TO EMPOWERING YOUTH: DEVELOPING A SCIENCE AND TECHNOLOGY MENTORING PROGRAM

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INTRODUCTION

In 1993, a group of students, staff, and faculty at the Massachusetts Institute of Technology recognized that between the ages of 11 and 13, many girls lose their enthusiasm for science. This phenomenon is the result of several factors including an educational bias that favors boys and social peer pressures that imply that science is for nerds, leaving girls with diminished self-esteem and a compromised educational foundation. In addition, there is lack of available networks connecting women in science and engineering to young women for guidance and inspiration as role models. In an attempt to address these issues, the Keys to Empowering Youth (or KEYS) program was formed. With the generous financial support of the Engineering Coalition of Schools for Excellence and Leadership (ECSEL) and the programmatic support of the MIT Public Service Center, the KEYS program was developed to be interactive and flexible. The KEYS program has been disseminated and is now hosted at The Catholic University of America and the University of Maryland at College Park.

The motivation behind KEYS is to encourage adolescent girls at a critical stage in their personal development. KEYS is designed to educate, excite, and empower girls ages 11 to 13 in the fields of science and engineering. Girls participating in the program spend a day on a university campus exploring many opportunities available in science and engineering. University students, staff, and faculty function as mentors and lab instructors throughout the day, exposing the girls to role models in various technical fields. The interactive nature of the program allows the girls to interact with women in science and engineering fields and build self-confidence. We hope to expose girls to all the possibilities available to them, and inspire them to fully develop their talent to achieve their personal goals.

KEYS ACTIVITIES

Icebreakers: Create a comfortable environment that will ease both girls and mentors into activities.

Stereotypes Activity: Recognize that there are certain stereotypes (good and bad) about men and women that can impose perceived restrictions or requirements on lifestyle and career choices. During the activity, the girls develop an awareness of such stereotypes and discrimination. Although the "Defining Stereotypes" discussion has not been rated as a favorite activity, many girls admit that they learned the most during this activity. Therefore, it remains a crucial component of the program.

Problem Solving Activity: Develop critical thinking, creativity and teamwork skills. In this activity, mentors informally introduce the engineering design process. By prompting the girls with questions and suggestions, the mentors are able to lead them through creative problem solving as a team.

Laboratory Sessions: Provide an opportunity to gain hands-on experience and familiarity with laboratory equipment and technology. Labs give the girls an opportunity to experience new and innovative research taking place at the university. The key to successful lab exercises lies in the hands-on, interactive experience for the girls. In participating in experiments and demonstrations, the girls build self-confidence and gain experience with technical devices. Relevant uses for the specific technology is articulated to show the practical applications of science and engineering.

Wrap Up: Bring closure to the day's activities. The Wrap Up remains as crucial to the success of the program as other components. During this time, the girls are asked to look ahead to the future and set goals for themselves. Mentors provide suggestions on how each girl can actively pursue these goals. A certificate of achievement is awarded to each girl to give her a sense of accomplishment.

EVALUATION

The evaluation component collects diverse information from participants before, during, and after the program. Surveys designed to encourage honest responses are used to evaluate the program. These instruments measure several different variables including subject matter interest levels, socio-demographic characteristics such as age, race, and family income, as well as participant feedback about the programmatic pedagogy. Furthermore, the evaluation

component incorporates follow-up questions to the participants at several future points to see if the program had lasting or fleeting effects. The pre- and post-evaluations provide critical information about the effectiveness of the program. By using recognized statistical models, the results of the evaluation component can guide the research team to create more effective programs, while providing critical data to support or reject current theories behind the attitudes of young girls toward science and engineering.

Evaluation Results

In 1998, a retrospective questionnaire was sent to past participants from MIT, The Catholic University of America and the University of Maryland. Out of approximately 900 girls who participated in the program between 1994 and 1998, one hundred and fifty-one responded to the survey. Almost all of the girls remembered the KEYS program (90%). The most popular component of the program for these girls was a "live action" activity called the Career Life Game, which allows girls to make decisions about money, education, and activities. When asked what they didn't like about the program, the girls tended to say either there were no negative aspects or they thought that the program was too short. Ninety percent of the girls rated the overall program as very good or moderately good. A good number of girls backed up this evaluation with comments indicating they liked the program because it was fun and interesting.

When asked to describe any changes in their interest in math, science, and engineering, over one third (37%) said that the program increased their interest in these fields. Some girls reported that they learned several new things (17%) and still others reported that after the program they had started taking more math/science/engineering courses or considered pursuing a degree in these fields (14%). When asked to report their favorite course this year, the most popular response (26%) was math. Over 80% of the girls reported achieving B averages or above in these classes. Ninety percent of the girls stated that they were good in math and science. A majority of the young women (over 90%) felt that math and science would be useful in their future. The same percentage felt that boys and girls were equally good in math and science. Over 50% agreed that a science or engineering job might be in their future.

University Specific Results

The University of Maryland

Since spring 1997, the University of Maryland's Women in Engineering Program in collaboration with the student chapter of SWE, successfully implemented 5 one-

day KEYs programs over 5 semesters. The programs were funded by the generous support of ECSEL and have been evaluated each semester to measure the quality and effect of the initiative. Out of a total of 150 middle school girls that participated in the 5 KEYs programs, 108 completed the survey distributed at the end of each program. The findings indicate that mentors had a very positive impact on the participants, as 97% of the respondents strongly agreed or agreed with the statement that they liked working with college engineering students. Ninety four percent strongly agreed or agreed with the statement that the college students they worked with were positive role models. In addition, the KEYs program met its goals of increasing the confidence, interest, and knowledge of the participants. Seventy seven percent of the girls surveyed strongly agreed or agreed with the statement that the program had increased their interest in science, math, and engineering. Seventy one percent strongly agreed or agreed that the program had increased their confidence in understanding science, math and engineering. Eighty percent strongly agreed or agreed that the program had increased their knowledge about educational and career opportunities in science, math and engineering. Finally, the participants were confident that both men and women could become successful engineers as 95% of the respondents strongly agreed or agreed with the statement.

The Catholic University of America

Fifty-two young women were involved in the two KEYs programs held at the Catholic University in the fall of 1998 and the winter of 1999. Forty percent of these young women strongly agreed with the statement that the program had increased their interest in math, science, and engineering. It is important to note that at this age there are far more girls already interested in math, science and engineering than in the later high school years. Thus 60% of them claimed - before the program - that math and science would be useful in their future and 73% had considered getting a college degree in math, science, or engineering before the program. Over half of the girls in the KEYs programs felt the program had increased their confidence in understanding math, science, and engineering (60% either strongly agreed or agreed with this statement). These young women were already quite confident in math in science before the program (83% had high confidence in math before the program and 91% had high confidence in science before the program). Thus, although the KEYs program further increased this confidence for over half of the girls, they came into the program with high confidence. Seventy seven percent of the KEYs youth reported that the program had helped them understand gender stereotypes (half of this group agreed and the rest expressed strong agreement with this statement). Prior to the program, there were some that disagreed with a statement that boys and girls are equally good in math and science (13%). Some of the girls expressed knowledge of biases against

women in science jobs in the pre-program surveys (16%) although most said that it would be as easy as for a woman as for a man to have a successful career in math, science, and engineering.

Massachusetts Institute of Technology

At MIT, the KEYS program is run by MIT students. Two student coordinators are responsible for program development, mentor and participant recruitment and lab participation. The Public Service Center staff supports the student coordinators in their efforts and provides guidance and encouragement. MIT has 4 one day programs throughout the academic year (two each semester) and an intensive 3 day program over the summer. The summer follow-up program invites participants, from the previous 4 programs, back to campus. This return visit is intended to broaden the experience of the one-day program. Several mentors return allowing them to build stronger, more fulfilling relationship with the girls. Many of the skills and ideas introduced in the one-day program are re-addressed and probed further. Also, given the additional time, laboratories have an opportunity to create more intense lab experiences for the group.

Although evaluation results for the three-day program have not been compiled, it is generally believed that the program has been successful. Previous participants' requests to return for the three-day program were high and could not all be accommodated. Mentors also report a satisfying experience given the additional time allowed for quality relationship building and stronger bonds with the girls. Lab mentors reported with great enthusiasm that they enjoyed the opportunity to more clearly expose the girls to a laboratory experience.

STARTING A PROGRAM: LESSONS LEARNED

Program Development: In developing your own program, make use of all available resources. The activities should ideally draw on the strengths of your school and turn cutting edge research into fun, interactive labs. Each activity should adhere to the following criteria:

- Be as interactive and hands-on as possible.
- Encourage mentor-participant interaction.
- Develop key skills such as teamwork and problem solving.
- Be FUN!

Mentor Recruiting: E-mail lists, flyers, announcements, and word of mouth are good approaches to advertise and draw students. Inform leaders of groups and organizations (i.e. professional societies, science clubs/organizations, campus ministry and/or service organizations) about the program and solicit their help in

recruiting mentors. In addition, a specific society like the student chapter of the Society of Women Engineers may be interested in partnering with you in the program and will ask their members to serve as mentors. Optimally, try to recruit one mentor for every two girls. Additional volunteers are needed to run the laboratory sessions in the afternoon. When recruiting laboratory instructors, try to find students already involved in the project that the laboratory session revolves around. The instructor should be able to articulate any background information and theory to the girls in clear, non-technical language that the girls can readily understand.

Mentor Training: A short mentor training session should be scheduled before each program to introduce new mentors to the program and inform returning mentors of any program schedule changes and new activities (before the first program, you may want to have a longer, more extensive training session). Here are a few topics you may want to address at a mentor training session:

- What is a mentor
- Specific responsibilities of each mentor
- What to do in emergency situations
- The structure and logistics of the program
- How to be an active mentor without taking over
- Information and instructions on each activity

Recruiting Participants: Begin recruiting girls to participate in the program 2 - 3 months before the program date. Having a diverse group of girls enhances the program by bringing different opinions, ideas, and perspectives to the group. Therefore, target girls from many different backgrounds. We found that no more than 5-10 girls should be taken from any one organization or school to prevent cliques from forming within the group. The KEYs program is specifically designed for girls between the ages of 11 and 13. Problems can arise when older girls (14-15 years) participate in the program. Often these girls become bored and disruptive. Younger girls (9-10 years) may benefit from the program, but they may be intimidated by the older girls.

Finally, one of the great aspects of KEYs lies in its flexibility. Virtually any enthusiastic group can run a workshop. The activities and interactive labs generally revolve around on-going research projects within the department or school. Your KEYs program may be very different from the sample program presented here. Even though each KEYs workshop is unique, the goals and aims remain the same. Please feel free to contact any of us for in depth information about creating a program.