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# The importance of engaging girls in science and engineering

A study of Actua's all-girls camps

2003



Research support from:



## Introduction

Actua is a national charitable organization that supports a network of 27 member organizations across Canada. The mandate of the organization is to increase the scientific and technical awareness, excitement and literacy of young Canadians. Actua members reach over 225,000 youth, ages 6-17, each year through summer day camps, in-school workshops, community outreach activities and specialized programs for under-represented audiences (Aboriginal youth, girls, and underprivileged youth) which are delivered in over 325 communities annually.

Actua's work to engage more girls in science, engineering and technology was formalized when we noticed the declining enrolment of girls in our summer camp programs over a period of five years (1993-1997). To counter this decreasing enrolment, we developed our National Girls Program as a series of specialized resources, training and initiatives designed to help our members increase female participation in their programs. At the local level, members deliver all-girl camps, all-girl workshops, girls clubs, and mentoring programs for girls. To date, we have engaged over 15,000 girls in these specialized initiatives and provide gender training to over 4,000 staff and volunteers. The success of the National Girls Program has enabled Actua to not only reverse the trend of decreasing female enrolment, but to increase the overall percentage of girls in our programs.

Starting in 2000, Actua has conducted a series of research studies to assess the impact of our camp experience on participants' attitudes and future intentions related to science, engineering and technology. Through this work, using both perception of change data and pre-post change data, we have gained valuable insight into the positive impact that Actua camp programs are having on campers.

In 2003, with support from the Canadian Engineering Memorial Foundation, we expanded our research to include a survey on our all-girls camps. The survey included additional questions concerning the girls' ideas related to careers in science and engineering and their perceptions/experiences of an all-girls environment.

In designing the surveys, Actua and the research committee of CEMF were interested in finding out more about:

- How girls view career opportunities in science and engineering
- What influence girls' parents have on career decisions
- What attracted camp participants to the gender specific (all-girls) camp
- The effectiveness of Actua's all-girls camps in encouraging young girls to consider engineering as a career.

## Methodology

At the core of all of our evaluation work is a commitment to collecting and analyzing data that is useful for future program improvements and growth. As such, our surveys are developed specifically for our programs and our particular areas of interest. Prior to having campers complete surveys, local staff and/or volunteers receive training which provides additional information on the evaluations and specific procedures to follow when having campers complete the surveys. Information is collected in an anonymous way to protect the privacy and security of participants.

The all-girls survey was delivered to 252 girls at Actua all-girls camps across Canada. The girls completed pre camp surveys on the first day of camp and post camp surveys on their last day. Surveys were completed online through our secure system, or when this was not possible (for lack of computer time) using a hardcopy format. Following a pre/post matching process 176 matches were made from which data were analyzed including categorizing text-based (written) responses and tabulating percentages and means. For all calculations, the respondent's first answers were used. The girls in this study were between the ages 8 to 14, with the average age being 11. The following findings are drawn from our work with the 2003 all-girls survey results.

## Results and Discussion

### Importance of Enjoyment of Science for Girls

Enjoyment of science appears to be an important factor leading girls to a career in science. For some girls it is more important than being good at science, re-enforcing the importance of providing fun, hands-on programs that excite and inspire youth about science such as those offered by Actua.

When asked if they thought a job as a scientist would be good for them, almost one third of girls (32%) thought the choice of pursuing a job as a scientist would be a very good choice.

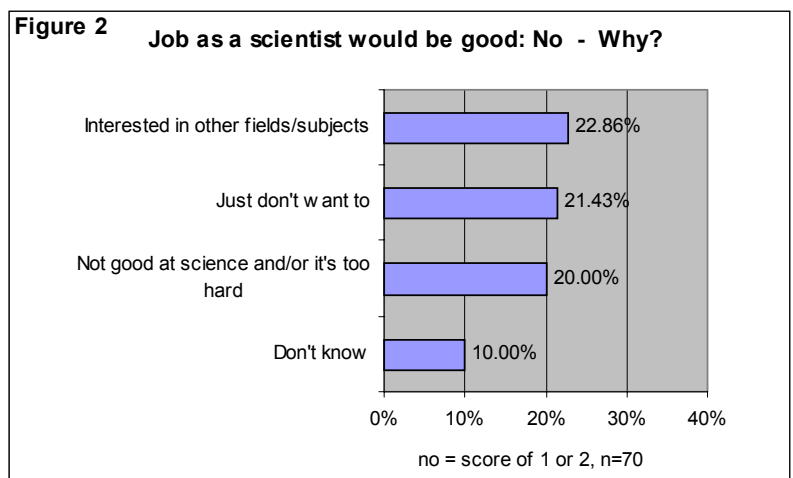
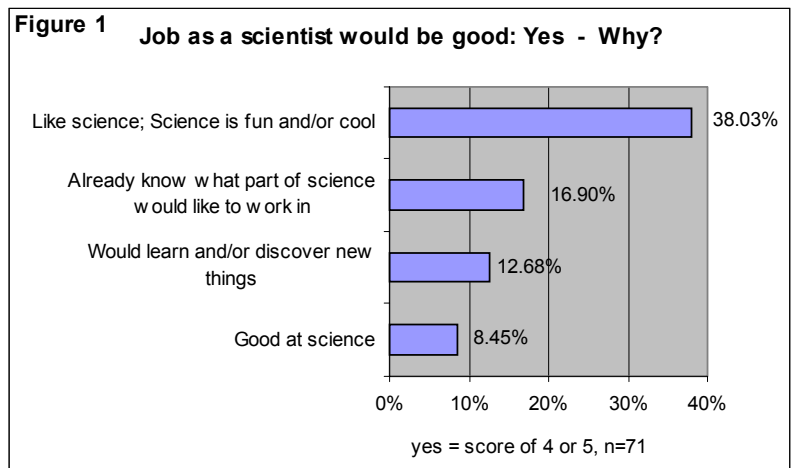
Of the girls who indicated that a job as a scientist would be good for them, more girls identified "liking science" than "being good at science" as the reason for their choice (see Figure 1).

Girls, who did **not** see themselves as a scientist (32%), indicated that they were interested in other things (44%, combination of "interested in other fields" 23% and "just don't want to" 21%) and that they were "not good at science" (20%) (see Figure 2).

### Girls Need Opportunities to Invent and Build

Research has shown that girls are not provided with the same opportunities as boys are to invent and build things as part of their play in the childhood years.

Of the girls who indicated that a job as an engineer would be good for them (15%), the most common reason for this choice was that they liked to build, design and/or invent



things (24%) (see Figure 3). This was followed by having a relative who is an engineer (15%). This reinforces the importance of the need for girls to experience building, designing and inventing things in order to encourage their participation in an engineering career in the future.

### Girls Career Interests Identified at a Young Age (sample average age 11)

Ideas related to career aspirations of campers appear to be formed at an early age; for instance many girls already had a notion of their career aspirations by the time they attended an Actua camp. This was made evident through the answers to questions asking the girls if they thought a job as an engineer or scientist would be good for them.

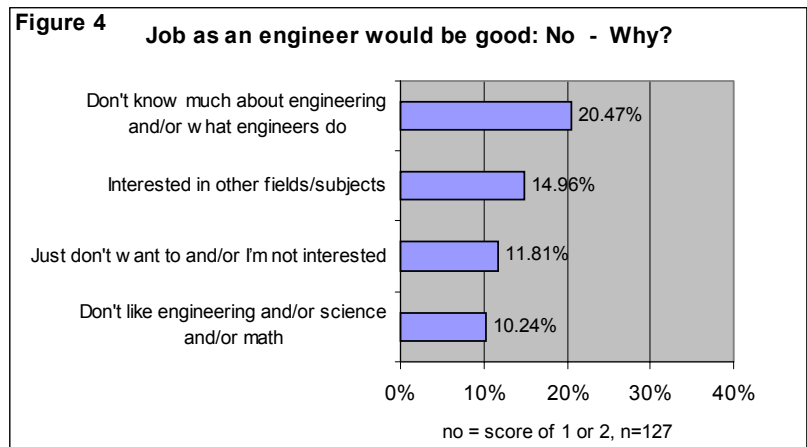
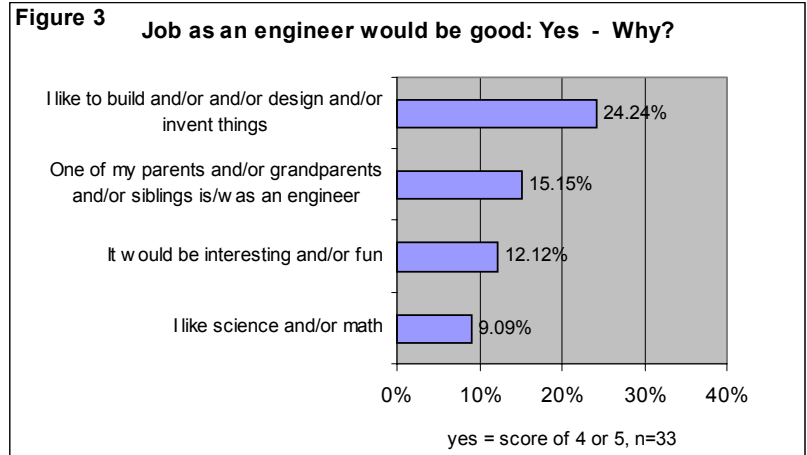
For those **not** interested in science or engineering careers, interest in other fields was given as either the highest or second highest response (see Figure 2 and 4).

Furthermore for those girls **not** interested in engineering, “not knowing about engineering or what engineers do” was the highest response (see Figure 4). This reinforces the importance of increasing girls’ knowledge about careers in engineering in this age group.

Two additional questions about career issues were also examined. When responding to the questions “What would **prevent you** from becoming a scientist”, and “What would prevent you from becoming an engineer”, a wide variety of responses were provided. The most prevalent response for both questions (25-28% of responses) was that the girls were interested in another job/career/subject. This provides further support indicating the early career-oriented decisions of girls at this young age. Thus supporting the importance of engaging youth in science and engineering programs at a young age.

### Impact of Parents’ Occupation on All-Girl Campers

Additional analyses were conducted to compare girls whose parents are engineers to those whose parents are not. Girls whose parents are engineers appear to know more about engineering. When asked, “do you think a job as an engineer would be good for you”, 100% of the girls who responded “don’t know much about engineering and/or what engineers do” (see Figure 4) were girls who did **not** have a parent in engineering.



### **What is Needed for Girls to Consider a Career in Engineering?**

Research into the factors contributing to the career interests and choices of girls has resulted in the identification of several characteristics that girls look for when choosing a career path. Specifically, girls have indicated that they want (1) a career that they are good at it, (2) a career in which they can help people, and (3) a career that enables them to balance work and family life.

In our study, we found that the girls identified these exact reasons for being interested in a career in engineering and provided a fourth reason particular to engineering. When the girls (pre camp) were asked to rank items that would be important in order for them to “consider a career in engineering”, the top 4 reasons for being attracted to a career in engineering were:

- You do well in science and math at school
- You know that your work will help people
- You can have time for both a family and a career in engineering
- Learn more about different kinds of engineering

This reinforces the importance of promoting how engineering careers encompass these factors, for example, demonstrating clearly to the girls how engineering improves people’s lives and how other women balance their work and their families successfully. It is also important to include information about different types of engineering in our programs.

### **Girls Camp Experience Resulted in an Increase of Knowledge of Engineering**

In the total sample of girls, there was a significant increase in the all-girl campers’ ratings of their knowledge of what engineers do from pre- ( $M=2.58$ ) to post-camp ( $M=3.14$ ),  $F(1, 216) = 34.55$ ,  $p < .01$ .

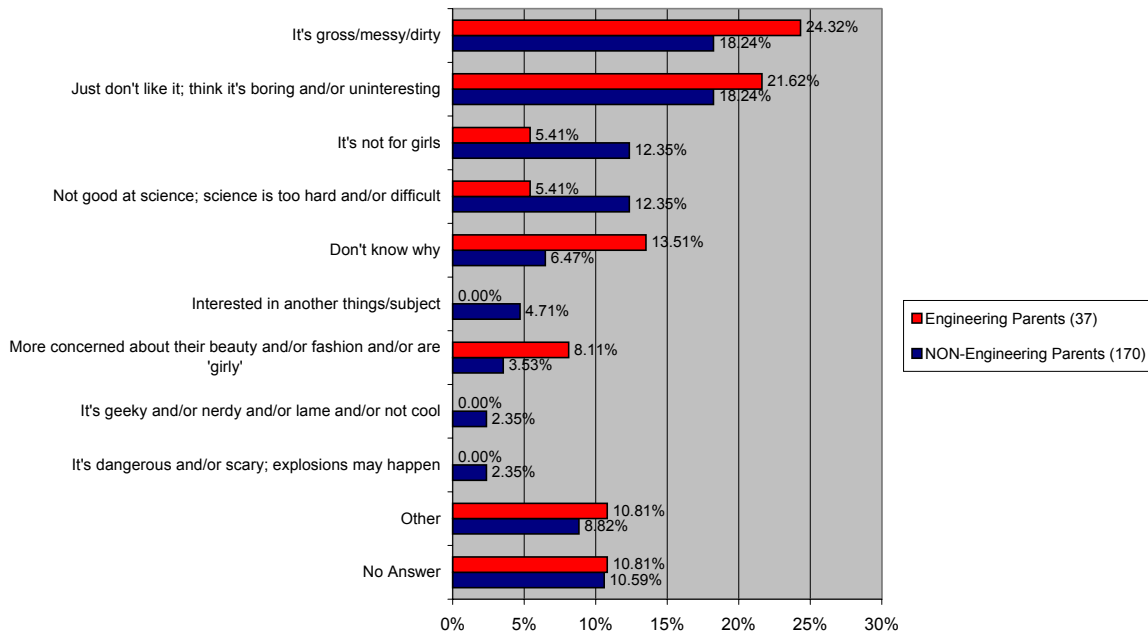
This increased knowledge about engineering was also reflected in the girls’ responses to the question “do you think a job as an engineer would be good for you”. For girls whose parents are **not** in engineering, the percentage of girls who indicated that “they did not know much about engineering and/or what engineers do” decreased from pre camp to post camp (15.3% to 5.9%). This further supports our finding that Actua is increasing participants knowledge of engineering through the camp experience.

### **Why do Some Girls Not Like Science?**

When asked why they thought some girls did not like science, Figure 5, represents the wide variety of reasons given for not liking science. From these we can see that “gross/messy/dirty” and “just don’t like it, think it’s boring and/or uninteresting” were the two most frequent responses for both girls whose parents are **not** in engineering and those whose are. This emphasizes the importance of making science experiences for girls fun and reinforces that there is still work to be done to dispel stereotypes about science, most importantly that science is not always, gross/messy, dirty or unsafe.

Figure 5

Why do you think that some girls don't like science?



**All-Girl Camps – More Comfortable for Girls**

Girls were attracted to the all-girls camp because they thought that they would be more comfortable and it would be easier to participate. In the post camp survey girls indicated that they had found the camp more enjoyable and that it was easier to ask questions and participate in the all-girl setting.

When asked what attracted the participants to the all-girls camp we found that prior to camp girls ranked the following to be the three most important reasons for choosing to come to an all-girl camp:

- feeling more comfortable with just girls ( $M=3.12$ ),
- feeling that it would be easier to ask questions and to participate ( $M=2.87$ ), and
- having no boys at camp ( $M=2.85$ )

In the post-camp survey, girls rated whether these same factors were present in the all-girl camp format. They rated their experience with the all-girl camp format, relative to a co-ed format, to be:

- more enjoyable ( $M=3.76$ ),
- more comfortable ( $M=3.54$ ),
- one in which it was easier to ask questions and to participate ( $M=3.52$ ), and
- better because there were no boys ( $M=3.48$ ).

Girls choose to attend the all-girls camps for a variety of reasons. When looking at the pre-camp confidence levels of the girls attending the all-girls camps, we thought that we might find more low confidence girls in the girls only program. However the distribution of low, medium and high confidence female campers did not differ between the all-girls and co-ed camps. It would be informative to examine additional possible differences between the girls

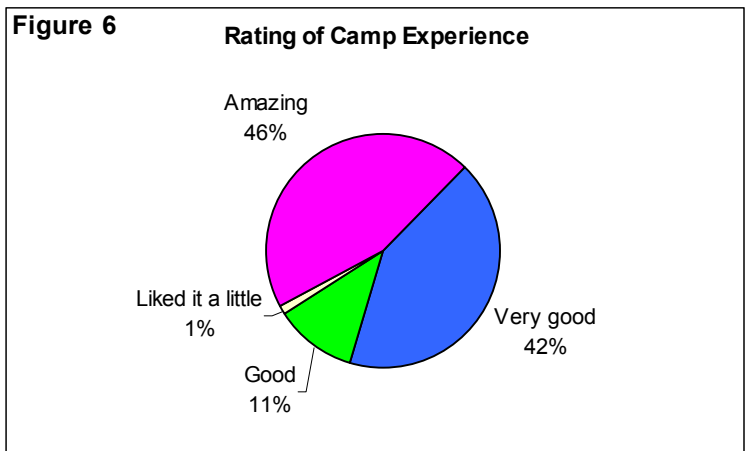
in the all-girls camp and those in the co-ed camp. Further understanding could help us build upon the current success of our all-girls programs. With the all-girls programs we have been able to reverse the trend of decreasing female enrolment in our programs (the trend that inspired the National Girls Program). Our overall female participation in camps has increased by 32% from 1999 to 2003 (compared to an overall increase in campers of 28%).

### Camp Experience, Confidence, Values, and Future Intentions

When the standard survey questions (those also completed by Actua co-ed campers) were analysed, there was not a significant difference between the all-girls and the co-ed samples. Generally the findings for both groups were as follows.

For the all-girls camp participants, camp was a very positive experience (see Figure 6), as it was for the co-ed campers.

As in the co-ed camp, the camp experience seems to be having a more significant effect on the girls with low confidence. The low confidence group had positive changes on confidence and the two values of importance and enjoyment. However they did not improve on the three future intentions that we examined. It is encouraging to note that changes in attitude are generally considered to be precursors to changes in future intentions.



### Conclusion

This study of Actua's all-girls camps has provided valuable information on the impact of our programs and the benefits of all-girl environments. Through this study, we have gained additional understanding of the attitudes of girls toward science and engineering careers, support for the benefits of providing an all-girls environment, as well as affirmation of the positive impact of attending an Actua camp.

Key findings from the study include the following:

- *Girls' career interest is linked to enjoyment of science*, with "liking science" being the girls' most frequent reason for considering a career in science. This pattern continued with the girls interested in an engineering career indicating that they enjoyed building, designing and/or inventing.
- *Girls whose parents are engineers* are more knowledgeable about engineering, with none of the girls in this group reporting that they "did not know much about engineering and/or what engineers do".
- *Attending camp increased the girls' knowledge of engineering*. There was a significant increase in the girls' pre to post camp ratings of their knowledge of engineering. This was further supported by the decrease (pre to post camp) in the number of girls indicating that "they did not know much about engineering", when

asked if they thought a job as an engineer would be good for them.

- *The all-girls environment is key to the positive experience of the girls.* Girls indicated that they selected the all-girls camp because they thought they would be more comfortable and it would be easier to participate. These expectations were met, with the girls reporting after camp that they felt more comfortable and found it easier to participate in the all-girls environment.
- Girls reported that they were looking for careers in which they were good at, through which they could help people, and which would allow them to balance work and family life. This is very consistent with other research into what influences girls' career choices.
- Girls require knowledge of engineering before career interest is possible. When asked what would be important for them to consider a career in engineering, they indicated the need to know more about engineering.
- Misconceptions around science still exist. When asked why some girls did not like science many girls responded that science is gross/messy or dirty.

These findings provide us with strong support for our continued work to engage girls in early positive experiences in science, engineering and technology. The findings further stress the importance of the continued provision of all-girl environments and the development of resources for parents.

For more detailed research reports please visit [www.actua.ca](http://www.actua.ca).

### **Acknowledgements**

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