

# Using Western Kentucky University SWE Members in the Recruitment of Middle School Girls

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## Abstract

For the past three years, the Ogden College of Science and Engineering has hosted a Girls in Science Day. This program is a day long event in which middle school girls are invited on campus to participate in a variety of hands-on engineering and science activities. Typically, the classes are taught by WKU faculty using WKU students as assistants. This past year the WKU SWE members taught two different engineering classes for the middle school students. This paper will describe the classes presented by the SWE members and their impact on WKU Girls in Science Day. Also, the format of the GIS day will be discussed and assessment of the past two years will be presented in this paper.

## Girls in Science Day

Girls in Science (GIS) Day was developed as an outreach activity by the faculty in the Ogden College of Science and Engineering at WKU as a way to increase awareness of young women of scientific careers.<sup>1</sup> The event has been held for the past three years on the WKU campus. Many young girls are not aware of potential careers in science and engineering. The program gives the girls opportunities to do fun hands-on projects with WKU science and engineering faculty in hopes of creating interest in the science field. The first year 49 girls attended, 81 girls attended the second year and 108 girls attended last year.

GIS Day consists of morning and afternoon sessions. During the morning session, the girls attend three forty-five minutes classes that they chose from a list of seven to ten classes. These classes cover a broad spectrum of scientific and engineering interests. The classes have included: Learn How to Make a Polymers; Emergency Fish Kill; Sport Psychology; Dirt Can Take Care of Your Dirty Work; Books, Stars, and Geometric Connections; the Art and Math of Tessellations; Scientific *Cellebration*; Exploring LEGO Robots; Crime Scene Investigation; Electricity and Magnetism; Race Car Construction; Bottle Your Own Genes; and Physics of Musical Instruments. Each class has ten to fifteen girls. The afternoon session is a team competition. The girls are put on two to three person teams and given an engineering problem to solve with limited resources. Each participant was charged a nominal fee of \$5.00 for the entire GIS experience. Scholarships were available for any interested girl who could not afford the fee.

## Using SWE Members as GIS Instructors

This year, WKU Society of Women Engineer members were recruited to teach two classes at GIS. It was hoped that the SWE members would be excellent role models for the middle school girls. The SWE members taught two classes described below.

### Electricity and Magnetism

Students were lead by the SWE members through a series of experiments involving simple electricity and magnetism principles<sup>2</sup>. These experiments included series and parallel current flow, insulators and conductors, using a lemon as a battery, magnetic forces, magnetic forces, and building your own magnet from a paper clip.

### Building a miniature car

The SWE members lead the girls in the construction of a miniature car<sup>3</sup> constructed of dc motors and simple household materials such as clothespins, popsicle sticks, and plastic film containers. When the girls finished this project, they were able to race their cars to see which was the fastest and most durable. Through this activity, the students were exposed to engineering techniques while learning about simple electrical principles.

Some comments from participants concerning the electricity and magnetism class were:

- I liked powering the light bulbs
- Learning about electricity

Comments from participants concerning the building a miniature car class were:

- I learned about engineering
- Race car construction

Overall, the SWE members had a positive impact on the Girls in Science Day activities. The SWE members had the experience of leading younger girls through hands on engineering activities while serving as mentors to the girls.

### GIS 2004 Assessment

GIS Day 2004 involved 108 girls from fifth to eighth grade from the Warren County/Bowling Green area (note: GIS also included one fourth grader). Three instruments were used to assess the perceptions of the girls and their parents about GIS Day. Students responded to a Pre-class Questionnaire and an End-of-day Questionnaire. Parents responded to the Parent Questionnaire. The instruments were developed by Dr. Betsy Shoenfelt based on input from Dr. Stacy Wilson.

Table 1. Grade in School of Those Attending GIS

<b>Grade</b>	<b>Percentage</b>	<b>N</b>
4	1.0	1
5	32.7	34
6	33.7	35
7	14.4	15
8	18.3	19

Of the 108 girls that filled out questionnaires, 73 (70.2%) were participating in Girls in Science Day for the first time, 24 (23.1%) were participating for the second time, 7 (6.7%) were participating for the third time, and 4 did not answer this item (3.7%). Girls participating

represented grades 4 through 8, with one fourth grader, 34 fifth graders, 35 sixth graders, 15 seventh graders, and 19 eighth graders (See Table 1).

The Pre-class Questionnaire was given at registration to assess attitudes toward science. The last four digits of the home phone number were used as an ID number so that the End-of-Day and Parent Questionnaires could be matched with the Pre-class Questionnaire while ensuring the student's anonymity. Participants indicated their grade in school and how many times they had participated in GIS Day. In addition, 14 Likert-type items tapped whether girls were interested in science and math classes at school, whether they were shy in asking questions concerning science and math, whether they would like to learn science outside class, whether they knew someone, especially a woman, who had a job in science, whether they intended to be a scientist, and whether science and math, in general, are fun. Responses were made on a scale, which ranged from 1 – Strongly Disagree to 5 – Strongly Agree.

At the end of GIS Day, the End-of-day Questionnaire was handed out to all participants. The first 14 Likert-type items used were the same as those in the Pre-class Questionnaire; two more Likert-type item asked participants' opinion on whether GIS Day was a good experience and whether they will recommend GIS Day to their friends. In addition, two open-ended questions were added, asking the girls' opinion on the strengths of GIS Day and what should be improved in GIS Day.

Generally, the items indicated favorable attitudes toward science and math. The items indicating the most agreement were that participants have worked on activities or projects in science, believe science is fun, and know a woman who has a job in science. The girls also agreed that they feel they are better in math and science compared to boys in their class. The girls slightly agreed that math is fun, that math and science classes at their school are interesting, that they have a member of their family or an adult friend in science, that they like to watch a TV show or videotape about science, and would like to take more classes in math or science. The girls were more neutral toward liking a job as a scientist, and liking to read a book or magazine about science. Participants disagreed that they are hesitant or shy about asking questions in science or math.

#### Comparison Between GIS 2003 and GIS 2004

The questionnaire used in the year 2004 was essentially the same as the instrument use to evaluate GIS Day in 2003. Two additional items were added in 2004 to the Pre-Class Questionnaire and four additional items to the End-of-Day Questionnaire. Hence, a meaningful comparison could be made between participants' responses from GIS 2003 and GIS 2004. The results of the one-sample t-tests indicated that there were no significant differences between participants' responses to the questionnaire items from the year 2003 and 2004, with only one exception. Girls in 2004 were more likely to agree that they have a family member/adult friend who works in science than were girls in GIS 2003. The means for questionnaire items for 2003 and 2004 may be found in Table 2.

Table 2. Comparison of Questionnaire Responses Between GIS 2003 and GIS 2004

	Year	N	Mean	SD
PRE-CLASS Science classes are interesting	2003	79	3.75	.85
	2004	98	3.70	.99
Math classes are interesting	2003	79	3.71	1.13
	2004	97	3.39	1.22
I am better at science than boys	2003	79	4.08	.92
	2004	97	3.79	.99
I am better at math than boys	2003	79	3.76	1.04
	2004	98	3.74	1.18
Sometimes hesitating to ask Qs	2003	78	2.42	1.42
	2004	98	2.65	1.33
Worked on activities in science	2003	79	4.54	.66
	2004	98	4.42	.75
Like to take more science classes	2003	79	3.34	1.22
	2004	98	3.51	1.19
Like to read a science book	2003	77	3.27	1.07
	2004	98	3.00	1.13
Like to watch TV show about science	2003	77	3.62	1.09
	2004	98	3.54	1.06
Know a woman who has a job in science	2003	77	3.88	1.39
	2004	98	3.80	1.41
Having a family member/adult friend who works in science	2003	77	3.14	1.64
	2004	97	3.31	1.51
Would like to have a job as a scientist	2003	77	2.90	1.11
	2004	98	3.01	1.16
END-OF-DAY Science classes are interesting	2003	77	3.79	.99
	2004	96	3.71	1.18
Math classes are interesting	2003	78	3.83	.99
	2004	96	3.49	1.17
I am better at science than boys	2003	78	4.00	.99
	2004	96	3.74	1.10
I am better at math than boys	2003	78	3.974	1.03
	2004	96	3.661	1.25

	Year	N	Mean	SD
Sometimes hesitating to ask Qs	2003	78	2.27	1.26
	2004	96	2.64	1.41
Worked on activities in science	2003	78	4.62	.78
	2004	96	4.31	.91
Like to take more science classes	2003	78	3.46	1.27
	2004	96	3.41	1.25
Like to read a science book	2003	76	3.38	1.22
	2004	96	3.00	1.24
Like to watch TV show about science	2003	78	3.50	1.28
	2004	96	3.31	1.26
Know a woman who has a job in science	2003	78	3.72	1.38
	2004	95	3.74	1.40
Having a family member/adult friend who works in science	2003	77	3.14	1.74
	2004	95	3.47	1.45
Would like to have a job as a scientist	2003	78	2.97	1.25
	2004	96	3.05	1.24

### Assessment Results

The Girls in Science Day Program received a very favorable evaluation from both the participants and their parents. The girls had a good time while learning in science classes. The Pre-Class Questionnaire responses suggest that the participants had relatively favorable attitudes toward math and science before attending GIS Day. Hopefully the GIS Day experience reinforces these attitudes and encourages these young ladies to seriously consider pursuing careers in math and science. Except for one item, there were no differences between girls' responses to questionnaire items in 2003 and 2004. It might be worthwhile to recruit to Girls in Science Day some of the young women who may be losing interest in math and science. The positive impact of Girls in Science Day may be even more beneficial in boosting the interest of these students. Finally, a larger variety of classes, or activities and projects within each class may also increase the appeal of Girls in Science Day.

## Conclusion

The Girls in Science Day program at WKU has been a highly successful event which introduces middle school girls to science and engineering. Typically, faculty from the Ogden College of Science and Engineering teach the classes with undergraduate or graduate student assistants. Last year, the SWE student members taught two classes at GIS. This proved to be a highly successful model which will continue to be implemented in the future.

Also, the girls participating in the Girls in Science Day really enjoyed the activities and classes and appeared to benefit a great deal from the program. The girls came into the program with generally favorable attitudes and confidence toward math and science. However, the girls enjoyed the exposure to new, different areas in math and science and especially the hands-on activities. Most importantly, the girls learned a lot in the classes. Many stated that the interactive activities help them learn and understand the math and science concepts. Last, the girls had a lot of fun, not only with the math and science aspect, but also with the opportunity to work together with other girls their own age with similar interests. Some of the girls offered very practical suggestions for improvement. They would like to be exposed to other areas of math and science; for example, several girls suggested a class or a project to explain Newton's Laws of Motion/Force. In addition to adding more classes and activities, it appears the girls would like to have a more time to work on the group project, and also would like to have a prize for all the girls to award their hard work. Overall, the girls felt the Girls in Science Day was successful and a worthwhile experience.

## Bibliographic Information

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<sup>3</sup> Barthlomew, Alan. *Electric Gadgets and Gizmos*, Kids Can Press, Buffalo, NY, 1998.

<sup>4</sup> Shoenfelt, Elizabeth L. and Xiaoquian Wang. *Report on the Evaluation of the Girls in Science Day Program*, Department of Psychology, Western Kentucky University, 2004.

## Biographical Information

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Stacy S. Wilson, Ph.D., P.E., an Associate Professor of Electrical Engineering at Western Kentucky University. Dr. Wilson is one of the primary organizers of the WKU Girls in Science Day program and the branch counselor for the WKU SWE branch. Dr. Wilson is the coordinator of the Electrical Engineering program at WKU and is a licensed professional engineer in the state of Kentucky.

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Elizabeth L. Shoenfelt, Ph.D., a Professor of Psychology at Western Kentucky University, is the director of the WKU Industrial/Organizational Psychology Graduate Program. Dr. Shoenfelt has over 20 years of experience developing and implementing programs to improve performance in business, industry, education, government, and sports. Dr. Shoenfelt is a licensed psychologist in the Commonwealth of Kentucky.