

Final Report of
DR044 SWE Science Club
Programs C & D
Engineering Our Environment
A Tutorial Program for Girls Inc.

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Submitted by

The Society of Women Engineers
Central Indiana Section

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DR044 SWE Science Club
Programs C & D Final Report

I. SWE SCIENCE CLUB OVERVIEW

The SWE Science Club has conducted four hands-on tutorial programs (Programs A through D) at the Girls Incorporated of Indianapolis' Fountain Square Center. A report submitted on August 1, 2000, describes Programs A and B. This report documents Programs C and D. Program C began on September 13, 2000, and ended on December 14, 2000, and Program D began on January 2, 2001 and ended on May 16, 2001. Descriptions of all sessions are presented below and the schedules are included as Appendix 1.

II. SESSION DESCRIPTIONS

A. Program C, Session # 1 – Solid Waste Generation (September 13, 2000)
Attendance = 7 Participants

1. Objectives

The objectives were to increase the participants' awareness of the amount of solid waste generated in their homes and to learn how they can reduce solid waste.

2. Activity

After a quick overview of Program C, the SWE volunteer and participants discussed municipal solid waste (MSW) including the components, quantity generated in the U.S., where it goes and ways to reduce it in the home. The girls were then divided into two teams for a contest. Each team was given a garbage bag full of typical MSW. The object of the contest was to reduce the bag of MSW the most by recycling, composting or reusing the garbage. Both teams reduced their bags to virtually nothing!

3. Assignment

The homework assignment was to brainstorm ways to reduce the MSW leaving the participants' homes and to begin implementation of the best reduction method for their family.

B. Program C, Session # 2 – Solid Waste Disposal (September 27, 2000)
Attendance = 15 Participants

1. Objective

The objective was to learn about the construction and operation of solid waste landfills.

2. Activity

The session began with a discussion of landfill construction including a diagram illustrating the different layers. Then the participants, with help from two SWE volunteers, constructed a miniature municipal landfill. The model was built with a clear plastic storage box for the cell, potting soil for the subgrade, brown sugar for the compacted soil, a black plastic trash bag for the liner, straws for the leachate drainage pipes, small stones for the granular drainage layer, garbage from the Girls Inc. garbage can for the waste, and a layer of potting soil for the daily cover. The volunteers discussed the purpose of each layer as the girls took turns building the landfill.

3. Assignment

Homework was not assigned.

C. Program C, Session # 3 – Hazardous Waste Generation (October 11, 2000)
Attendance = 14 Participants

1. Objective

The objective was to learn about the characteristics of hazardous waste.

2. Activity

The SWE volunteer discussed ignitability, corrosivity, toxicity and reactivity with the participants. Corrosivity was demonstrated with litmus paper in vinegar, water and bleach. Toxicity was illustrated by a small container of gasoline. Reactivity was demonstrated with vinegar and baking soda.

3. Assignment

The participants were given three containers containing water, vinegar or bleach and small pieces of metal. The assignment was to observe any changes in the metal over time. In addition, litmus paper was given to all participants to take home to experiment with their families.

D. Program C, Session # 4 – South Side Landfill Field Trip (October 26, 2000)
Attendance = 8 Participants

1. Objective

The objective was to learn about the operation of a landfill by getting a first-hand look at an operating MSW landfill.

2. Activity

After arriving at the landfill, a 15-minute film was played about the products that are and are not accepted into the landfill, the components of the construction, and the reuse of the methane gas from the landfill that is used for heating and cooling system of the on-site greenhouse.

Then the group got into a van along with the landfill tour guide. They drove the route the garbage trucks take to the tipping floor, continued along the exterior road of the landfill to see the gas wells and the markers for the impermeable underground wall.

The Crossroads Greenhouse was toured next. The landfill-produced methane gas is mixed with water to heat or cool the greenhouse via plastic pipes in the walls and ceiling. This is a huge greenhouse that produces 400,000 poinsettias, bedding plants, and hanging baskets and 8 million starter plugs for shipping to other commercial greenhouses. The participants got to choose a cabbage plant to take home.

3. Assignment

Homework was not assigned.

E. Program C, Session # 5 – Hazardous Waste Disposal (November 8, 2000)
Attendance = 15 Participants

1. Objective

The objective was to teach the participants about hazardous waste disposal.

2. Activity

The two SWE volunteers began the session with a discussion of what hazardous waste is and how it differs from municipal waste. Hazardous waste disposal options (landfill, incineration and neutralization) were also discussed.

Seven household materials (bleach, baking soda, vinegar, cola, orange juice, mouthwash, and dish soap) were brought in for a neutralization experiment.

The pH scale was explained and each material was tested with pH paper and labeled. A glass of water was used as the control to demonstrate neutral. Then the participants mixed an acid with a base to try to get a neutral solution and all succeeded!

The second activity was dressing the participants in protective gear worn by workers on hazardous waste sites, including tyvek suits, saranex suits, hard hats, respirators and gloves. A Polaroid camera was used to take a picture of each of them to take home.

3. Assignment

The homework assignment was a hazardous waste word search.

F. Program C, Session # 6 – Air Pollution & Quality Control (November 15, 2000)

Attendance = 6 Participants

1. Objective

The objective was to teach the participants about air quality.

2. Activity

The two SWE volunteers explained what air pollution looks like and why clean air is important. The participants learned about the “Dirty Six” – Carbon Monoxide, Ozone, Particulate Matter, Nitrogen Oxides, Lead, and Sulfur Dioxide. The phrase “Good Up High, Bad Nearby” was used to explain when it’s good to have ozone and when it can be harmful.

The participants played “Air Quality Pictionary”. When the girls successfully identified the picture, we explained what that picture had to do with air quality. The game taught the participants about alternatives to creating pollution such as carpooling or riding a bike. The session concluded with additional air quality activities such as projects and puzzles.

3. Assignment

No homework was assigned.

G. Program C, Session # 7 – Contest Preparation (November 29, 2000)
Attendance = 9 Participants

1. Objective

The objective was to construct miniature solid waste landfills to be judged during the contest.

2. Activity

The SWE volunteer provided the materials and guidance so that the participants could construct miniature solid waste landfills. Just as in Session #2, the landfills were built with a clear plastic storage box for the cell, potting soil for the subgrade, brown sugar for the compacted soil, a black plastic trash bag for the liner, straws for the leachate drainage pipes, small stones for the granular drainage layer, garbage from the Girls Inc. garbage can for the waste, and a layer of potting soil for the daily cover.

3. Assignment

The miniature landfill construction continued until the contest on December 14, 2000.

H. Program C, Session # 8 – Contest Preparation (December 6, 2000)
Attendance = 9 Participants

1. Objective

The objective was to continue construction of miniature solid waste landfills to be judged during the contest.

2. Activity

The SWE volunteer provided guidance for the participants to continue with their landfills. During this session the girls added layers of soil and waste to the models.

3. Assignment

The miniature landfill construction continued until the contest on December 14, 2000.

I. Program C, Session # 9 – Contest (December 14, 2000)
Attendance = 3 Participants

The contest was originally scheduled for December 13, 2000. However, significant snowfall delayed the contest one day and resulted in a lower number of participants than anticipated.

1. Objective

The objective was to prepare miniature landfills for judging in a contest. The landfills were judged on specification performance, label quality, overall appearance and creativity.

2. Activity

The participants completed a SWE Science Club “report card” for Program C. Then the two SWE volunteers rated the three miniature landfills on the four characteristics listed in the above paragraph. First, second and third place winners were determined and prizes were awarded. Prizes included marker sets and stained glass window art kits.

3. Assignment

Homework was not assigned.

J. Program D, Session # 1 – Introduction to Wastewater & Stormwater (January 31, 2001)
Attendance = 8 Participants

1. Objective

The objective was to introduce sanitary wastewater and stormwater systems to the participants.

2. Activity

The SWE volunteer began the session by running water into the sink in the presentation room asking, “Where does this water go next?” From there the discussion followed the wastewater from the sink through the sanitary sewer collection system to the wastewater treatment plant and ended with disposal into the White River. Interceptor sewer drawings were brought in so the participants could see what sanitary engineers design before the sewer can be installed. The stormwater system was similarly discussed.

The girls were split into two teams for a game. The object of the game was to brainstorm the most things that contribute to wastewater. The participants

recorded their answers on huge post-it notes. The winning team came up with 46 items that contribute to wastewater!

3. Assignment

The homework assignment was to list ten items that contribute to wastewater from the participants' homes.

K. Program D, Session # 2 – Sanitary Wastewater Collection (February 7, 2001) Attendance = 10 Participants

1. Objective

The objective was to explain and demonstrate wastewater conveyance from homes to wastewater treatment plant and septic systems.

2. Activity

The SWE volunteers began the session with a discussion of wastewater pipes, gravity flow, pumps, treatment plants and septic tanks.

The volunteers assembled a polyvinyl chloride (PVC) pipes to simulate a wastewater collection system. The participants were given additional supplies to assemble and create their own wastewater collection system. Wastewater was generated with typical household products including coffee grounds, baby food, and soap. The wastewater was then poured into the collection system via a funnel.

The participants were then dressed up as sewer inspectors in personal protection equipment (PPE).

3. Homework

The homework assignment was to ask their parents if the wastewater from their home went to a wastewater treatment plant or into a septic system.

L. Program D, Session # 3 – Sanitary Wastewater Treatment (February 21, 2001) Attendance = 8 Participants

1. Objectives

The objectives were to explain what wastewater is, why and how it is treated, and how it can be reclaimed.

2. Activity

The homework from the previous session was discussed regarding where wastewater goes from their homes. Then the participants watched a video, "Popular Mechanics for Kids", about wastewater collection and treatment. A discussion of what wastewater is and why it is treated followed the video.

The SWE volunteers then explained the primary treatment processes by describing step-by-step what happens at each stage using a blown-up picture of a wastewater treatment plant (WWTP). The steps in the process included screening, pumping, aerating, removing sludge and scum, and killing bacteria. The participants had lots of questions about the WWTP picture, so the group was broken up into two separate discussions. After the questions were answered, the aeration tank demonstration began.

A half-full balloon was placed in a large bucket of water. A bike pump was used to pump water into each bucket, creating bubbles. The participants learned that the harder and faster the pump was used, the more bubbles that were created but the more energy was exuded, similar to real life equipment. It was challenging to maintain the right amount of air in the water to keep the balloon submerged in the bucket without touching the bottom.

3. Homework

A handout was distributed that summarized the session. The participants were asked to take the handout home and discuss with their parents how treated wastewater can be reused.

M. Program D, Session # 4 – Stormwater Field Trip (March 7, 2001)

Attendance = 8 Participants

1. Objective

The objective was to learn about stormwater by observing stormwater drainage facilities.

2. Activity

The field trip took place in Plainfield, Indiana. The tour started along Perimeter Parkway in the industrial warehouse section. Grading, storm pipes, and retention ponds were discussed and pointed out by the SWE volunteer. The group also visited a commercial area where plan reading, riprap and erosion control were discussed. Several more inlets, pipes, swales, and retention ponds were observed. Lastly, two residential subdivisions were visited - one that had a detention pond, and one that didn't need one.

3. Assignment

Homework was not assigned.

N. Program D, Session # 5 – Stormwater Collection and Disposal (March 21, 2001)

Attendance = 6 Participants

1. Objective

The objective was to learn about stormwater collection and disposal.

2. Activity

The participants played a game following a cartoon character through stormwater collection and disposal processes. Then a video was observed about stormwater problems in Indianapolis.

3. Assignment

Homework was not assigned.

O. Program D, Session # 6 – Waste Water Treatment Plant Field Trip (April 4, 2001)

Attendance = 9 Participants

1. Objective

The objective was to learn about sanitary wastewater treatment by observing the Danville, Indiana treatment plant.

2. Activity

The SWE volunteer discussed the wastewater treatment process using the blown-up picture of a WWTP from Session D3 before leaving for Danville. The tour began inside the laboratory for a discussion (by lab personnel) about what the water is tested and analyzed for before and after treatment. Several testing apparatuses were observed and discussed.

The tour continued outside by following the influent through the treatment steps including screening, settling tanks, oxidation ditch and filter bed press that makes “brownies”!

The group made a stop at Ellis Park in Danville on the return trip to enjoy a picnic lunch and some playtime before driving back to Girls Inc.

3. Assignment

Homework was not assigned.

P. Program D, Session # 7 – Contest Preparation (April 18, 2001) Attendance = 5 Participants

1. Objective

The objective was to help the participants construct miniature sanitary wastewater collection systems to be judged during the contest.

2. Activity

The SWE volunteers brought in three sets of collection system materials that the participants were asked to assemble into a gravity-fed collection system by looking at a design drawing. Materials included PVC pipes, tees, plugs, elbows, plastic milk jugs and funnels. Improvements and embellishments to the design were encouraged. The parameters to be judged were discussed including quality of design and connections, overall appearance, and creativity. A timed portion of the contest was also explained during which the participants would race to fill up the WWTP vessel.

Three teams began construction of their collection systems. The participants were asked what additional materials they wanted to embellish their systems. Glitter glue, construction paper and gravel were requested.

3. Homework

Homework was not assigned.

Q. Program D, Session # 8 – Contest Preparation (May 2, 2001) Attendance = 5 Participants

1. Objective

The objective was to continue helping the participants construct miniature sanitary wastewater collection systems to be judged during the contest.

2. Activity

The SWE volunteer brought in glitter glue, construction paper and gravel that had been requested during the first contest preparation session. The teams completed work on their collection systems and practiced collecting wastewater through the three taps in order to fill up the WWTP vessel.

3. Homework

Homework was not assigned.

R. Program D, Session # 9 – Contest (May 16, 2001) Attendance = 3 Participants

1. Objective

The objective was to judge the miniature sanitary wastewater collection systems.

2. Activity

The SWE volunteers then judged the collection systems for quality of design (gravity flow especially) and connections, overall appearance, and creativity. In addition, the teams were timed while they put approximately one gallon of “wastewater” into their systems via three taps (funnels) into the WWTP vessel.

Two of the three teams that prepared collection systems were present. Prizes, including beaded jewelry kits, were awarded to the first and second place teams. The third place prizes were left with Girls Inc. staff to distribute to the team member not present.

3. Homework

Homework was not assigned.

III. FINAL REPORT REQUIREMENTS

This section, presented in question (bold text) and answer format, presents the points to address as required by the implementation plan. The required financial data is presented in Appendix 2.

What did we originally hope to accomplish under the grant?

The *Engineering Our Environment* series was designed to support SWE’s strategic priorities of leadership, education and visibility. The project combined SWE Central Indiana’s human resources (heavily populated by civil/environmental engineers) and a need for science and math related programs at Girls’ Inc.

How did we go about realizing the project goals?

Leadership: SWE Central Indiana members have developed project management, program development, and facilitation skills with this program because they have had

opportunities to develop, plan, and implement a total of 35 tutorial sessions for Girls Inc. participants.

Education: Girls Inc.'s Operation SMART (Science, Math and Relevant Technology) program encourages girls' interests in math and science and has provided SWE Central Indiana members a framework for educating the participants in math- and science-related topics.

Visibility: Implementing Programs C and D of *Engineering Our Environment* has increased our visibility in the Indianapolis area by publishing articles in The Indy Innovator (SWE Central Indiana newsletter) and through word of mouth by SWE Central Indiana Section members that volunteered to present the sessions.

What were the principal outcomes of our program?

The tangible outcomes of the program included completed homework assignments, report cards completed by the participants on the Program C sessions, and miniature landfill and sanitary wastewater collection system projects. The intangible outcomes included increasing enthusiasm of the participants as the programs continued and increased visibility of SWE Central Indiana in the Indianapolis area.

Were these all the outcomes we anticipated?

The tangible outcomes were all anticipated but the growing enthusiasm of the participants was an added bonus!

What is the potential significance of the outcomes for SWE?

The outcomes prove that *SWE Science Club: Engineering Our Environment* is expanding the image of the engineering profession as a positive force in improving the quality of life (part of SWE's mission statement) because the girls are having fun completing the sessions!

What is the potential significance of the outcomes for non-SWE?

The participants are being exposed to the roles that engineers and scientists play in improving our society. It is our hope that this exposure will lead some of them down the engineering career path.

How have the outcomes been communicated to interested audiences?

The Indy Innovator (SWE Central Indiana newsletter), published four times annually, typically contains an article that describes the program highlights since the last newsletter.

Are there any recommendations to continue or build on the work accomplished under the grant?

Our original project initiation proposal included four 4-month programs. SWE Central Indiana members intend for the program to continue indefinitely. Additional funding is being applied for at this time and increased publicity is one of the goals for future programs.

Were the monies we received adequate for the project?

Yes, more than adequate. The project initiation proposal included funds for two 4-month programs. We have concluded four 4-month programs using approximately 66% of the total monies received.

Was the time allotted for our project adequate?

Yes.

Did we encounter any significant problems in carrying out our project?

No.

Has our project received any public attention to date?

No, Programs C and D did not receive any public attention other than the Indy Innovator.

APPENDIX 1

Schedules

**SWE Science Club Tutorial Program for Girls Inc.
 Program C Schedule - Fall 2000
 Wednesdays, 6 - 7 p.m.
 (Except Session # 4, as noted)**

Date	#	Session Topic	Presenters
9/13/00	1	Solid Waste Generation	Elizabeth White
9/27/00	2	Solid Waste Disposal	Angela Steiner
10/11/00	3	Hazardous Waste Generation	Shelley DeWys
10/26/00 Thursday	4	Field Trip to the South Side Landfill @ 3:30 p.m.	Angela Steiner
11/8/00	5	Hazardous Waste Disposal	Heather Cheslek Aimee Vessell
11/15/00	6	Air Pollution & Air Quality Control	Kim Cottrell Heidi Beyer
11/29/00	7	Contest Preparation	Melissa Moran
12/6/00	8	Contest Preparation	Catherine Pallotta
12/13/00	9	Contest	Elizabeth White

SchedC.xls

SWE Science Club Tutorial Program for Girls Inc.
Program D Schedule - Spring 2001
Wastewater & Stormwater
Wednesdays, 6 - 7 p.m.
(Except Field Trips)

Date	Session #	Session Topic	Presenters
1/31/01	1	Introduction to Wastewater & Stormwater	Elizabeth White
2/7/01	2	Sanitary Wastewater Collection	Heather Cheslek Wileatha Horton
2/21/01	3	Sanitary Wastewater Treatment	Amanda Grose Amy Lukazewski
3/7/01	4	Field Trip	
3/21/01	5	Stormwater Collection & Disposal	Catherine Pallotta
Week of 4/4/01	6	Field Trip	
4/18/01	7	Contest Preparation	Amanda Grose Julie Hanson
5/2/01	8	Contest Preparation	Melissa Moran
5/16/01	9	Contest	Elizabeth White Julie Grim

Schedd.xls

APPENDIX 2

Financial Data

DR044 SWE SCIENCE CLUB

**Engineering Our Environment
A SWE Tutorial Program for Girls Inc.**

Programs A - D Proposed Budget

Item	Unit Cost	Quantity	Unit	Extension
Girls Inc. Staff Administration	\$50.00	10	hours	\$500.00
Photocopies	\$0.10	1760	copies	\$176.00
Misc. Supplies	\$200.00	2	programs	\$400.00
Field Trips	\$200.00	2	trips	\$400.00
Mileage	\$0.35	640	miles	\$224.00
Models & Session Supplies	\$150.00	6	models	\$900.00
Prizes	\$200.00	2	programs	\$400.00
Handbook	\$100.00	2	books	\$200.00
TOTAL				\$3,200.00

**Programs A - D Actual Expenses
Revised May 31, 2001**

Item	Unit Cost	Quantity	Unit	Extension
Girls Inc. Staff Administration	\$50.00	10	hours	\$500.00
Photocopies	\$0.07	248	copies	\$17.36
Misc. Supplies	varies	NA	varies	\$94.75
Field Trips	varies	NA	varies	\$230.08
Mileage	\$0.35	736	miles	\$257.60
Models & Session Supplies	varies	NA	varies	\$677.63
Prizes	varies	NA	varies	\$347.33
Handbook	varies	NA	varies	\$0.00
TOTAL				\$2,124.75

NA = Not Applicable

Abudget.xls