**1996 Department of Energy
Pre/Freshman Enrichment Program
At GMI Engineering and Management Institute
Flint MI, 48504**

DOE/TE/00015--71

Project Report

The four week summer program for 1996 was almost identical to that proposed to the Department of Energy.

The principal investigator visited several schools to deliver lectures and demonstrations to recruit students from the Genesee County area. The workshop was publicized through a local newspaper. Other sources of publicity such as television and radio were also used to inform the general population. As a result, we received over seventy applications from gifted ninth graders from more than twenty public and private schools. Based upon the selection criteria involving student grades, teachers recommendation, parents recommendation, and the essay written by the students, we selected thirty two students on the program. All the applicants, including the ones not selected for the program, were informed that they would be invited to attend the nine monthly follow up activities during the following academic year.

On Saturday, June 17, 1996 the thirty two participants and there parents attend an orientation. The workshop staff was introduced. The staff explained various activities of the workshop. The goals and the operating rules were also explained. Finally, a tour of all the GMI facilities was given. The workshop started at nine A.M. on Monday, June 19, 1996 and ended at 5.P.M. on July 14, 1996. To provide personal attention and a better student to teacher ratio, the thirty-two participants were divided into two sections, section 1 and 2. Each section was further divided into four groups. In the morning, for example, 1A, 1B, 1C, and 1D went to the four science classes (two physics and two chemistry), half of the section 2 went to the computer class and the other half went to communication class. In the afternoon these sections were alternated. This rotation ensured a small class size and guaranteed that all the participants had the same experience. (For detailed description of the workshop schedule, please see Appendix A)

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On most of the days, except the days of the field trip, the outside speakers were invited to talk to the participants. They discussed topics ranging from their educational background to ethics in science and technology. The science and mathematics activities performed are listed in Appendix B.

During the workshop, the participants were involved in attending sessions related with career choices, communications, and ethics in science. Most of these sessions were conducted by Mr. Fredrick Fischer with some assistance from Dr. Prem Vaishnava. The following is a list of the speakers:

1. Professor Reginald Bell, Professor of Environmental Chemistry, GMI, Engineering & management Institute, Flint, MI 48504
2. Professor Charles White, Professor of Mechanical Engineering Department, GMI Engineering & Management Institute, Flint, MI, 48504
3. Norma Hall, Weather specialist, WJRTV-12, Flint, MI 48504
4. Mr. Tom Auito, Engineer, Chrysler Corp. Auburn Hill, MI
5. Mrs. Marci Collings, Environmental Engineer, and Mr. John Collings, Communications Director at GMI.
6. Mrs Cora Kokosa, Material Scientist, GM Corp. Flint, MI 48502

Research Projects and Student's Presentation:

One of the highlights of the workshop was performing a research project with one of the faculty member of the science group. The entire third week was devoted to these projects. Out of the several topics listed under the names of the science faculty, the students were asked to give their preferences. Most of the students received the topic they had either as the first or the second choice. On Thursday afternoon and Friday morning of the third week, each student made presentation of his/her research project. During the fourth week, the students learned the problem solving techniques in mathematics and build their own personal computer.

Field Trips:

On each Friday of the workshop, the participants visited different institutions. The main philosophy of these trips was to see various scientists and engineers performing various duties and to introduce career options to the students. Following is the a list of the institutions participants visited:

1. The university of Michigan, Electrical and Computer Science Department, Ann Arbor, Michigan
2. Hands-On Museum, Ann Arbor, Michigan
3. Consumer Power Plant, Essexville, Michigan
4. Hall of Ideas, Midland, Michigan
5. Dow Chemical Plant, Midland, Michigan
6. Genessee County Waste water Treatment, Plant, Montrose, Michigan.
7. EDS, Auburn Hills, Michigan.

Banquet:

To honor the participants a banquet was organized on July 8, 1996. Dr. Jim John, the President of GMI was the keynote speaker. All the participants gave an oral presentation of his or her experiences of the workshop. A selected group of students ran the entire proceedings of the workshop. They introduced the speakers and guests to the audience and did an excellent job.

Follow-up Activities:

During the academic year 1996-97 nine monthly follow-up activities were planned. The applicants who were not selected for the workshop, teachers, and parents, were invited to attend. These activities took place on Saturdays and were two hours of duration. The first four activities involved the LEGO educational system and were supervised by Mr. Tim Meno of Alternative Education, Port Huron, Michigan. The next two activities involved bridge building and were conducted by Mr. Kim Hunter. The next two activities involved battery recycling and were conducted by Dr. Andrezej Prazyzany. The participants collected batteries from their schools and brought them to the follow-up activity for recycling.

Appendix A
Schedule

Monday June 19th	9-10 AM Safety Film - All Groups	10-12 B1 B2 Communications Rick Fischer	10-12 B3 B4 Computers Petros Gheresus	1-4 A1 A2 Communications Rick Fischer	1-4 A3 A4 Computers Petros Gheresus	1-4 B1 - Physics, (PV) B2 - Physics, (GH) B3 - Chemistry, (AP) B4 - Chemistry, (BW)
Tuesday June 20th	9-12 A4 - Physics, Prem Vaishnava A1 - Physics, Greg Hassold A2 - Chemistry, Andrzej Przyjazny A3 - Chemistry, Bill Welch	9-12 B1 B2 Computers Petros Gheresus	9-12 B3 B4 Communications	2-4 A3 A4 Communications Rick Fischer	2-4 A1 A2 Computers Petros Gheresus	2-4 B4 - Physics, (PV) B1 - Physics, (GH) B2 - Chemistry, (AP) B3 - Chemistry, (BW)
Wednesday June 21st	9-11 A3 - Physics, Prem Vaishnava A4 - Physics, Greg Hassold A1 - Chemistry, Andrzej Przyjazny A2 - Chemistry, Bill Welch	9-11 B1 B2 Communications Rick Fischer	9-11 B3 B4 Computers Petros Gheresus	1-4 A1 A2 Communications Rick Fischer	1-4 A3 A4 Computers Petros Gheresus	1-4 B3 - Physics, (PV) B4 - Physics, (GH) B1 - Chemistry, (AP) B2 - Chemistry, (BW)
Thursday June 22nd	11-12 Presentation by Sue Henderschott of MPHD					
Thursday June 22nd	9-11 A2 - Physics, Prem Vaishnava A3 - Physics, Greg Hassold A4 - Chemistry, Andrzej Przyjazny A1 - Chemistry, Bill Welch	9-11 B1 B2 Computers Petros Gheresus	9-11 B3 B4 Communications Rick Fisher	1-4 A3 A4 Communications Rick Fischer &	1-4 A1 A2 Computers Petros Gheresus	1-4 B2 - Physics, (PV) B3 - Physics, (GH) B4 - Chemistry, (AP) B1 - Chemistry, (BW)
Friday June 23rd	11-12 Presentation by Rhonda Sanders					
Friday June 23rd	U of M-Ann Arbor 8:30 a.m. to 3:00 p.m. Buses will leave Campus Center at 7:30 a.m. sharp					
Monday June 26th	9-12 A1 - Physics, Prem Vaishnava A2 - Physics, Greg Hassold A3 - Chemistry, Andrzej Przyjazny A4 - Chemistry, Bill Welch	9-12 B1 B2 Communications Rick Fischer	9-12 B3 B4 Computers Petros Gheresus	2-4 A1 A2 Communications Rick Fischer	2-4 A3 A4 Computers Petros Gheresus	2-4 B1 - Physics, (PV) B2 - Physics, (GH) B3 - Chemistry, (AP) B4 - Chemistry, (BW)

Tuesday June 27th	Dow Chemical 9:30 a.m. - 12 noon Hall of Ideas Midland 1:30 p.m. - 3:00 p.m. Buses will leave at 8:15 a.m.					
Wednesday June 28th	9-12 { <ul style="list-style-type: none"> A4 - Physics, PremVaishnava A1 - Physics, GregHassold A2 - Chemistry, AndrzejPrzyjazny A3 - Chemistry, BillWelch 	9-12 B1 B2 Computers Petros Gheresus 11-12 Presentation	9-12 B3 B4 Communications	1-4 A3 A4 Communications Rick Fischer	1-4 A1 A2 Computers Petros Gheresus	1-4 { <ul style="list-style-type: none"> B4 - Physics, (PV) B1 - Physics, (GH) B2 - Chemistry, (AP) B3 - Chemistry, (BW)
Thursday June 29th	9-11 { <ul style="list-style-type: none"> A3 - Physics, PremVaishnava A4 - Physics, GregHassold A1 - Chemistry, AndrzejPrzyjazny A2 - Chemistry, BillWelch 	9-11 B1 B2 Communications Rick Fischer	9-11 B3 B4 Computers Petros Gheresus	1-4 A1 A2 Communications Rick Fischer	1-4 A3 A4 Computers Petros Gheresus	1-4 { <ul style="list-style-type: none"> B3 - Physics, (PV) B4 - Physics, (GH) B1 - Chemistry, (AP) B2 - Chemistry, (BW)
Friday June 30th	9-12 { <ul style="list-style-type: none"> A2 - Physics, PremVaishnava A3 - Physics, GregHassold A4 - Chemistry, AndrzejPrzyjazny A1 - Chemistry, BillWelch 	9-12 B1 B2 Computers Petros Gheresus	9-12 B3 B4 Communications Rick Fischer	1-4 A3 A4 Communications Rick Fischer	1-4 A1 A2 Computers Petros Gheresus	1-4 { <ul style="list-style-type: none"> B2 - Physics, (PV) B3 - Physics, (GH) B4 - Chemistry, (AP) B1 - Chemistry, (BW)
Monday July 3rd	9-12 { <ul style="list-style-type: none"> RA1 - Physics, PremVaishnava RA2 - Physics, GregHassold RA3 - Chemistry, AndrzejPrzyjazny RA4 - Chemistry, BillWelch 		9-12 RB3 RB4 Computers Petros Gheresus Presentation	2-4 RA1 RA2 Communications Rick Fischer 1-2 Presentation by Professor Reggie Bell	2-4 RA3 RA4 Computers Petros Gheresus	2-4 { <ul style="list-style-type: none"> RB1 - Physics, (PV) RB2 - Physics, (GH) RB3 - Chemistry, (AP) RB4 - Chemistry, (BW)
Wednesday July 5th	9-11 { <ul style="list-style-type: none"> RA1 - Physics, PremVaishnava RA2 - Physics, GregHassold RA3 - Chemistry, AndrzejPrzyjazny RA4 - Chemistry, BillWelch 	9-11 RB1 RB2 Computers Petros Gheresus	9-11 RB3 RB4 Communications Rick Fischer	1-4 RA3 RA4 Communications Rick Fischer	1-4 RA1 RA2 Computers Petros Gheresus	1-4 { <ul style="list-style-type: none"> RB1 - Physics, (PV) RB2 - Physics, (GH) RB3 - Chemistry, (AP) RB4 - Chemistry, (BW)
	11-12 Presentation by Marci & John Colling					

Thursday July 6th	9-12 Preparation for presentation 1-4 Student presentation					
Friday July 7th	10-12 noon Consumer Power Plant			1:30-3:30 Water Treatment Plant Buses will leave at 9:30 a.m.		
Saturday July 8th	Students arrive at 1 pm, projects setup in the Great Court area 1-4 p.m.			Exhibits open from 5-6 p.m. 6-8 p.m. Banquet and presentation by students and keynote speaker		
Monday July 10th	10:00 a.m. - 12:00 noon Chrysler Research Center, 2:30 - 4:00 p.m. EDS Bus will leave at 9:00 a.m.					
Tuesday July 11th		9-12 A2 Computers - JM	9-12 A2 Computers - GT	1-4 B1 Math - KJ	1-4 B2 Math - CA	
Wednesday July 12th		9-12 B2 Computers - JM	9-12 B2 Computers - GT	1-4 A1 Math - KJ	1-4 A2 Math - CA	
Thursday July 13th		9-12 A1 Computers - JM	9-12 A1 Computers - GT	1-4 B2 Math - KJ	1-4 B1 Math - CA	
Friday July 14th		9-12 B1 Computers - JM	9-12 B1 Computers - GT	1-4 A2 Math - KJ	1-4 A1 Math - CA	

Appendix B
Course Description

Chemistry Module Outline
Dr. Bill Welch

Week 1:

- 1) Learn about the uniqueness and importance of water as a solvent
- 2) Learn the importance of concentration in chemical reactions
- 3) Explore the relationship between dilution and pollution
- 4) Experience parts per million (ppm)
- 5) Is dilution the answer to pollution?
- 6) Can quality of drinking water be determined by taste or smell?
- 7) How do we measure the amount of a potentially harmful substance present in various water samples?
- 8) What is the proper method of disposing of a potentially harmful substance?
- 9) How are toxicity levels for potentially toxic substances determined?
- 10) Prepare samples of solidified copper chloride using different proportions

Week 2:

- 1) Observe evidence of conductivity in solutions
- 2) Investigate electroplating of copper as a potential industrial pollutant
- 3) Reclaiming copper metal from an electroplating solution by metal replacement
- 4) Investigate the ability of various metals to replace copper ions in solution
- 5) Perform precipitation reactions and filter precipitates
- 6) Determine the stability of copper precipitates in weak acids, an acid rain simulation
- 7) What is the possible environmental impact of preparation of polymers
- 8) Illustrate polymers through modeling and current examples
- 9) Prepare several polymers: polyvinyl alcohol, nylon, latex

Week 3 and 4:

Students will conduct individual projects from the following suggestions or other approved projects:

- 1) Building batteries
- 2) Testing batteries for toxicity; mercury, lead and silver
- 3) Testing air quality
- 4) Testing for ozone in the air
- 5) Testing water for mercury contamination
- 6) Coal analysis - for moisture and sulfur content

Chemistry Module Outline
Dr. Andrzej Przyjazny

The main theme of chemical investigations will be **"Color in Chemistry"**. The workshop will trace the role of color in the development of modern chemistry and how color, in turn, helps chemists study the molecular world and the environment. The emphasis will be placed on the environmental aspects of using color.

The program, in addition to discussions and carefully designed laboratory experiments, will include a set of excellent video tapes from the World of Chemistry series

The following topics will be covered in laboratory experiments and a research project:

1. Color in emission and absorption spectroscopy - quantitative aspects of environmental analytical chemistry; this topic will be illustrated by the determination of water hardness using atomic absorption spectroscopy;
2. pH measurements - an important parameter of water quality (e.g., acid rain);
3. Chemical test to assess important parameters of water quality, including alkalinity, dissolved oxygen, chlorides, total hardness, and iron;
4. Chromatography - learning the principles and separating environmental samples;
5. Study of equilibrium and kinetics of chemical reactions - application of color measurements in physical chemistry.

Concepts of Solar Energy

Prem Vaishnava

Week 1:

- 1) Discuss various sources of energy
- 2) Advantages and disadvantages of the sources of energy
- 3) Solar energy's production and applications
- 4) Optics - reflection, refraction, interference, diffraction, polarization, lenses, and mirrors (experiments and theory)

Week 2:

- 1) Concepts of current, voltage, and resistance
- 2) Measurement of resistance by Ohm's Law, series and parallel combination of resistors
- 3) Power of color by measuring the current and voltage produced by light falling on a solar cell
- 4) Construction of holograms

Week 3 and 4:

Research Topics:

- 1) Fabrication of a solar car
- 2) Fabrication of a paper clock
- 3) Fabrication of a receiving and transmitting station including fiber-optic materials
- 4) Fabrication of a computer controlled Lego washing machine/robot
- 5) Preparation of a white light hologram and a diffraction gratin

Computer Science
Petros Gheresus

Week 1:

- 1) E-mail
- 2) Chatting over the terminal
- 3) Internet (accessing remote resources)

Week 2:

- 1) Introduction to PC
- 2) Novel network
- 3) Telnet to Nova

Week 3 and 4:

- 1) Introduction to Quick Basic Programming
- 2) Solving some mathematical problems
- 3) Building your own PC

Artificial Life

Greg Hassold

Artificial life is a research program combining computer science and biology which tries to simulate some of the aspects of life on a computer. The hope is that by understanding the behavior of simple model systems (on a computer), we may better understand the workings of complex biological systems.

Computer are able to mimic some properties of living things:

- change/evolution/adaptation
- replication of information which governs from/function
- self-organization

Agenda

First week: Use the computer to investigate the relationship between

- Rule/instructions/genes
- and
- Patterns/behavior

Second week: Use the computer to investigate

- how an "organism" responds and adapts to its environment
- how some "organisms" may be better suited to their environment
- the dynamics of population

Research: Either

- in-depth study of previous programs
- OR
- TIERRA: a sophisticated model system where each "organism" is a program