An Electrical Engineering Summer Academy for Middle School and High School Students

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***Abstract*—An Electrical Engineering Summer Academy for Pre-College Students was held at the University of Tulsa, Tulsa, OK, during the summers of 2007 and 2008. The Academy participants included students having just completed 7th to 11th grade and teachers from middle school through high school. The students and teachers participated in team-building, professional development, and technical activities designed to teach them about the engineering profession and the field of electrical engineering. Activities included laboratories in electrical circuits, designing an electric car, soldering, a field trip, and discussion about ethics. Students worked in two- and four-person teams and made presentations on their experiences. The Academy was evaluated using formal assessment instruments and faculty observations. Both individual activities and the overall program were evaluated. The evaluation of the 2007 Academy revealed ratings of 4.5 or greater out of 5 on most aspects of the Academy, though some areas indicated a need for improvement, such as clarity of written materials and the availability of additional material for advanced students who finished early. Improvement in knowledge was demonstrated on over 50% of the questions on a survey administered at the beginning and again at the end of the Academy. Changes were proposed and implemented for the 2008 Academy in response to the assessment data. The impact of these changes and the lessons learned in the process are also presented.**

***Index Terms*—Communication skills, electrical engineering, high school, middle school, summer programs, teachers.**

I. Introduction

EMPLOYMENT opportunities in science and engineering occupations are expected to increase through the end of the decade. However, there has been a declining trend in enrollment in undergraduate science and engineering majors at U.S. universities [1]. In fact, the U.S. trails many other industrialized nations in the percentage of Bachelor's degrees awarded in science and engineering [2]. A contributing factor to this problem is that engineering lacks a formal presence in K-12 education. As a result, many qualified students are unaware of career opportunities in science and engineering and thus fail to pursue technical majors in college [3].

To address the need to expose students to the career of engineering, particularly electrical engineering, an Electrical Engineering Summer Academy program was developed at the University of Tulsa, Tulsa, OK. This development was based on the recommendation described in [4] to implement summer science, mathematics, engineering, and technology (SMET) camps for K-12 teachers and students. The objective of the program is to make students aware of engineering career opportunities through hands-on design projects, seminars, and tours of local companies. In addition, high school teachers receive training and assist the program directors with the Academy's classroom activities. The program is designed to encourage and support the teachers in implementing Academy exercises within their classrooms during the regular school year. The overall goal is to attract more students into engineering study to help meet technical employer needs. By exposing students to engineering through hands-on experience and projects, the Academy helps to illustrate the need for students to develop math and science skills to tackle challenging and interesting engineering problems.

In this paper, a description is presented of the activities developed to achieve the goals of the program, and results are provided from formal and informal evaluations on the effectiveness of the program in meeting its goals for the sessions held in June 2007 and July 2008. The results are analyzed to determine how changes made to the program in response to the first evaluations impacted the subsequent summer session. Further recommendations for changes to the program and for implementing similar programs are presented.

II. Description of the Program and Activities

A. Overview

The Electrical Engineering Summer Academy is a five-day commuter program designed to serve local junior high and high school students. The structure of this program is based on reports of successful summer engineering academies at other universities [5]–[9]. A review of these programs revealed several key ingredients for successfully engaging and teaching high school students. These ingredients include an emphasis on hands-on activities and team projects with minimal lectures, as well as field trips to local industries to illustrate applications of concepts learned in the program. In addition to developing technical skills, it is important for prospective engineers to develop professional skills. The Accreditation Board for Engineering and Technology (ABET) has identified required professional skills for engineering graduates [10]. These include the ability to function on multidisciplinary teams, an understanding of professional and ethical responsibility, and the ability to communicate effectively. Therefore, to properly educate students about the engineering field, the program incorporates both technical and professional skills.

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	Monday	Tuesday	Wednesday	Thursday	Friday
9 AM to 12 PM	Intro Engineering Principles	Circuits Project	Integration Project	Field trip	Professional skills workshop
12 PM – 1 PM	Lunch Free Explore	Lunch Free Explore	Lunch Free Explore	Lunch Free Explore	Event (Banquet)
1PM to 4 PM	Speaker Circuits Lab	Speaker Digital logic lab & project	Speaker Integration Project	Engineering careers/ethics workshop	Adjourn
4 PM	Adjourn	Adjourn	Adjourn	Adjourn	

Fig. 1. Summer Academy schedule.

B. Implementation

The general schedule of the Academy is shown in Fig. 1. The first part of the week includes background activities designed to familiarize the students with basic concepts relevant to all engineering disciplines as well as those concepts specific to electrical engineering. The opening activities focus on the basic principles of team-building, communication, and engineering design. These activities also allow the students to introduce themselves to each other and find people with whom they would like to work. The next group of activities provides the students with basic skills and knowledge in electrical engineering, including constructing a circuit, basic measurements, digital logic, logic gates, soldering, and basic circuit components such as capacitors, resistors, batteries, and switches. The middle of the week focuses on integrating knowledge and information gained in the initial activities with a little new knowledge, which enables students to design and construct a more sophisticated circuit with a more practical application. In addition to these activities, speakers from industry and education meet with the students and talk about their own careers, the preparation needed to become an engineer, and career opportunities for engineers. The end of the week again focuses on more general engineering aspects and includes activities in engineering ethics, career development, a field trip to an active engineering site, and the development of a presentation on one aspect of the Academy. The presentation is made to the faculty and parents at the ending banquet.

For each topic, the scientific background and the basics are introduced by a brief lecture and significant hands-on exploration. The hands-on laboratory experience is used to reinforce and apply the concepts while making the material more exciting and relevant, as the students become active participants. For each topic, the instructor presents basic information for the first concept, then students perform a lab exercise based on this information. This process is repeated for each topic concept to provide hands-on experience with minimal lecturing. Each exercise builds on the previous one, leading to the completion of a more complex electrical circuit by the end of the week. To increase student interest in the projects, design competitions related to the topics are held that expose students to engineering decision-making based on criteria such as cost, environment, and reliability. All participants receive material to support the concepts taught and build items that they can keep. All of the exercises reinforce the mathematics and physics concepts that appear in the core high school curriculum.

All students work in teams of at least two students. These teams emphasize the importance of interpersonal skills and the improved output achieved when people combine their talents and strengths. Each student is assigned specific responsibilities within the team. The roles may be rotated. This team structure ensures that all students participate in activities and increases the level of organization both in and out of the classroom.

To break up the day, students also participate in free exploration activities. Examples of these include a game or contest with a science orientation (such as a scavenger hunt within the engineering building for engineering-related information), further exploration of an activity or topic presented earlier, and a brief educational activity following up on a class session.

Three or four pre-college science and math teachers participate in and assist with the program. The teachers are expected to attend an information and training session the week prior to the Academy to obtain basic instruction on the concepts and activities comprising the Academy. The teachers assist the Academy directors with methods that ensure student involvement and attention during activities. After the Academy concludes, the directors meet with the teachers to evaluate the program and discuss changes for the following year. The directors work with the teachers to introduce elements of the Academy into their classes during the school year. The involvement of teachers in the Academy provides them with an enrichment and sabbatical-type experience, which is a supplementary bonus to the Academy's primary benefit of giving the university a way to reach more precollege students.

C. Examples of Specific Activities

In this section, brief descriptions of some of the activities implemented in one or both Academies are presented. The examples cover team-building, professional development, and technical aspects of the Academy program. The two technical activities were chosen to demonstrate how activities were designed to build upon each other so as to reinforce the idea of building on basic concepts to construct more complicated systems for real applications. All of the activities were selected due to their inherent hands-on nature, the fact that they could be simplified to be accessible to students with limited prior experience, and prior experience using the activities in the Electrical Engineering program, which provided information on how well they held student interest.

1) Communication and Team Building: The purpose of this activity was to explore the various ways that groups of people communicate and work together to arrive at a common goal. The

Fig. 2. Challenge 2, with constructor blindfolded.

first part of the exercise involved an ice-breaking game where the students were each given colored "dollars," a subset of the game rules, and basic instructions, and they then had to put together the highest value set of "dollars" they could. The students had to exchange information and communicate with peers, decipher conflicting rules, and plan and carry out a strategy in order to be successful.

For the second part of the exercise, students were randomly placed into teams of four students. Each team had to build four objects selected by the instructor using a set of K'Nex. The K'Nex building system is a set of colored rods that connect between a variety of hub pieces, including wheels and motors, in a manner akin to Tinker Toys. Each construction project was accompanied by conditions that challenged the students to find different ways to communicate information effectively. In the first and second projects, the builder faced away from a model of the item to be built, and the other members of the group had to provide instruction on how to build it. The only other rule was that the instructing members could not hand parts to the builder or construct part of the object for the builder. In the second project, the builder was blindfolded, so that the visual information path was not available for giving instructions, as shown in Fig. 2. This challenged the students to devise other ways to convey spatial information and to select the appropriate piece. In the third project, a black and white photo of the object was provided to the group, thereby eliminating color information critical to building with K'Nex. In the fourth project, there was only one instructor who had to coordinate multiple builders to complete the construction. The builders in this case could not see the object under construction. This challenged several students to manage resources and people, and the strategies used were discussed with the students at the conclusion of the activity.

2) Electrical Circuits: The students worked through some basic concepts of circuits that were fundamental to many of the later activities. The students learned the basic laws of current, voltage, resistance, and power through experimentation and some lectures. Ohm's law was taught using a voltmeter, resistor, and power supply. Power ratings were investigated by finding the point where a component overheated (i.e., caught on fire for full dramatic effect). The students also learned the

Fig. 3. Distance contest in progress. The student is holding the capacitor in her top hand.

resistor color code, how to wire a light-emitting diode (LED) correctly, and how to construct circuits on a breadboard.

3) Electric Car: The students explored the concept of resistor-capacitor (*RC*) circuits in the context of the application of powering an electric car. This activity directly applied much of the knowledge from the electrical circuits activity and asked the students to build upon that knowledge. Each team built a small K'Nex car for testing purposes. The students then studied how quickly the capacitor charged through a circuit and a power supply. Each group connected a 1-F, 5.5-V capacitor (Kanthal Globar MaxCap) to a charging station that consisted of a resistor, a power supply set to 7 V, and a digital voltmeter. Using a stopwatch, the students measured the time required to charge the capacitor to 5 V. The students attached the charged capacitor to their cars and used the stopwatch to time the discharging of the capacitor. The measurements were repeated three to four times to allow for errors in the measurement process, at which point some basic statistical issues were discussed with the students. The results were used to address concepts of series and parallel capacitors and resistors by having the students relate the experimental measurements to the theoretical concept of a time constant. Then, the student either changed the resistance in the charging station or the capacitance by adding another like element in series or parallel (the exact process changed between years). By noting the change in the charging time, the students inferred how resistors or capacitors combine. The students then competed to see whose car would travel the farthest on a single charge, an example of which is shown in Fig. 3.

4) Ethics Challenge: The students participated in a discussion of professional ethics and how the practice of engineering is responsible to the general welfare. The students reviewed the professional engineering code of ethics and applied ethical concepts through a board game featuring the Dilbert comic characters (Lockheed Martin, "The Ethics Challenge"). Students competed to be the most ethical in their behavior.

5) Field Trips: In 2007, the students traveled to a local engineering company that manufactures flight simulators for customers worldwide. In 2008, the students traveled to a local steel mill that converts scrap steel into new steel products. Each tour emphasized the multidisciplinary nature of engineering projects, the business side of engineering, and the responsibilities of engineers in the workplace and the community.

6) Optical Remote Control: The students explored the basic principles of encoding information on light, sending it to a receiver, and recovering the information at the receiver. The students discovered properties of LEDs, photodetectors, and comparators and explored the idea of a reference measurement for sensing. An LED at the receiver indicated whether or not the signal was received correctly. Students then used knowledge gained in earlier exercises to construct more advanced systems, such as alarms, laser transmitters, and a garage door opener.

7) Professional Presentations: Each of the two-person groups from the other activities was required to create a 5-min talk about one project or theme of the Academy using PowerPoint. The students were given guidelines on good presentation practices and were allowed to proceed under the guidance of the instructors and high school teachers. The students presented their talks at the closing banquet with their families and friends as an audience.

III. Program Evaluation

A. Evaluation Methods

The Academy has four primary objectives, and evaluations were carried out during and after the Academy to determine whether or not these objectives were met.

1) Objective 1: Students can describe the basic principles of the engineering process.

For this objective, the goal was to provide the student with sufficient information about what engineers do, the process of engineering design, and the relationship of the engineer to both the public and the corporate world. To address this goal, the directors endeavored to include design activities in as many of the main activities as possible, address specific aspects of the design process in the activities, expose students to practicing engineers, and include a specific activity addressing engineering ethics. Some of this information was included in the laboratory notebooks provided to each student, and some was built into the activity itself.

2) Objective 2: Describe specific electrical engineering problems and applications.

For this objective, the goal was to introduce the students to basic problems and concepts in electrical engineering and build upon them throughout the Academy to a point where the students could understand the real-world applications. The laboratory activities were structured to build upon one another to develop more sophisticated electrical systems and tie those systems to real applications. The electrical circuits activity was the foundation for all of the electrical laboratories. The digital logic and electric car laboratories extended the concepts, and the optical communication laboratory was intended to integrate all of the prior experiences.

3) Objective 3: Learning about teamwork principles.

For this objective, the goal was to learn about the process of working with someone else, particularly on an engineering design project. The main efforts made in attaining this objective were to employ team-building activities, have the students work in teams for a variety of different challenges, and have faculty and teachers facilitate cooperative efforts.

4) Objective 4: Complete projects and presentation for demonstration to others.

There were two primary goals for attaining this objective. First, the students would have physical end-products that could be shown to others outside the Academy. The most successful of these was the programmable light sign, which each student received. Students were also allowed to take electrical components and circuitry home with them. Second, the student had to give a presentation at the closing event, which all of the students successfully completed.

To assess the project's effectiveness in meeting the first two objectives, a questionnaire was given at both the beginning and end of the Academy. The questionnaire consisted of two parts. The first part made several statements about the practice of engineering and asked the student to rate the accuracy of the statement on a scale from 1 to 4, with 1 representing a totally inaccurate statement and 4 representing a statement that was entirely accurate. The second part asked a series of multiple-choice questions on the practice of engineering. The same questions were asked at both the beginning and the end of the Academy, and the desired result was an increase in the number of students who marked the correct answer to each item.

Evaluation of Objective 3 was performed primarily by observation and by conversations with the students during breaks. The team-building activity on Monday evoked the most comments from the students, all of which were highly positive. The students openly discussed their solutions for overcoming the communications challenges among the groups, and good strategies were adopted in later stages of the activity. Faculty observation of activities repeatedly found that the students were capable of sharing responsibilities and allowing partners to work through problems before moving on, with only a few exceptions.

In addition to evaluating the objectives, individual activities were evaluated, along with the overall program. In these evaluations, the students responded to a statement on a scale from 1 (strongly disagree) to 5 (strongly agree). For each activity, the students were asked four questions: 1) Was the activity's purpose clear, and was it relevant to engineering? 2) Was the material clear and well presented by the instructors? 3) Was the activity of an appropriate length and level of difficulty? 4) Would you include the activity in the next Academy?

B. Evaluation Results

Examples of the results of the questionnaire used to evaluate Objectives 1 and 2 are shown in Tables I and II for both the 2007 and 2008 Academies, showing the percent correct.

Sample results from activities and the overall evaluation are given in Tables III–V.

The data presented in Tables I–V contain the responses from all student participants in the Academy, with no adjustments for differences in educational level or background. For anonymity

TABLE I
OBJECTIVE 1 EVALUATION RESULTS FOR 2007 AND 2008. VALUES REPRESENT THE PERCENTAGE OF CORRECT ANSWERS

Question	Mon 2007	Fri 2007	Mon 2008	Fri 2008
Part One				
An engineer must know how to communicate effectively.	100.0	100.0	90.1	95.2
Good design practice is to build the entire system and then test	42.0	64.0	40.9	63.6
An engineer is ethically responsible to the general public first	32.0	95.0	9.1	71.4
A new design can be built from existing designs	47.0	68.0	50.0	70.0
Engineering design is limited by specifications and regulations	56.0	59.0	77.2	90.4
Part Two				
Which of the following is not part of an engineer's job?	58.0	64.0	61.9	75.0
In order to solve a typical engineering problem, you must…	47.0	73.0	54.5	60.0
Which of the following steps is not part of the design process?	44.0	61.0	76.2	95.0

TABLE II
OBJECTIVE 2 EVALUATION RESULTS FOR 2007 AND 2008. VALUES REPRESENT THE PERCENTAGE OF CORRECT ANSWERS

Question	Mon 2007	Fri 2007	Mon 2008	Fri 2008
Part One				
A complex circuit is a combination of simple circuits	68.0	73.0	45.5	71.4
A digital system is used to control complex systems	32.0	32.0	33.3	65.0
An comparator decides which signal is bigger	63.0	86.0	33.3	57.1
Part Two				
The relationship between voltage, current and resistance is:	45.0	77.0	50.0	85.0
What tools are used to solve a digital logic problem?	27.0	73.0	19.0	55.0
The purpose of the detector circuit in a remote control is:	9.0	14.0	19.0	20.0
What areas of electrical engineering apply to artificial vision?	68.0	82.0	66.7	78.9

TABLE III
AVERAGE RESULTS FOR EVALUATION QUESTIONS FOR SELECTED ACTIVITIES, 2008 ACADEMY

Question	Circuits	Electric Car	Robot Design	Remote Control
1	4.565	4.810	4.882	4.783
2	4.435	4.857	4.941	4.565
3	4.435	4.809	4.941	4.455
4	4.545	4.904	5.000	4.609

TABLE IV
AVERAGE RESULTS FOR EVALUATION QUESTIONS FOR SELECTED ACTIVITIES, 2007 ACADEMY

Question	Circuits	Electric Car	Digital Logic	Remote Control
1	4.435	4.909	4.762	4.571
2	4.130	4.500	4.238	4.381
3	3.782	4.455	4.571	4.476
4	4.130	4.818	4.810	4.524

purposes, the surveys did not contain any information about the students, including names, so it is impossible, especially one to two years later, to break down the results into demographic categories with the information at hand. For reference purposes, the demographic breakdown of the participants for each year are given in Table VI.

IV. DISCUSSION

A. Questionnaire Results

In both parts of the questionnaire, there were many questions where an increase in correct answers was observed and some questions where no improvement was seen. It must be noted,

TABLE V
RESULTS OF OVERALL PROGRAM ASSESSMENT FOR 2007 AND 2008

Question	Average 2007	Average 2008
The faculty and staff were able to answer questions in ways I understood.	4.727	4.650
The faculty and staff were respectful in their treatment of the students.	4.955	4.800
There was a good balance of lecture and project work.	4.682	4.850
The faculty lectures were clear and understandable.	4.500	4.350
The written material for the laboratories was clear and helpful.	4.217	4.650
There was plenty of lab material available to complete each project.	4.773	4.800
If I finished an activity early, there was additional material to work on.	3.909	4.450
I would recommend this Academy to a friend or classmate.	4.636	4.850

TABLE VI
DEMOGRAPHIC BREAKDOWN OF STUDENT PARTICIPANTS BY PROGRAM YEAR

Year	Female	Male	Middle School	High School	Rural District	Metro District	Private/ Homeschool	Public School
2007	3	17	5	15	3	17	4	16
2008	6	17	14	9	9	14	5	18

however, that there were several questions that most ($> 90\%$) of the students answered correctly on Monday, and so no improvement in these questions was expected. The greatest increases in the number of correct answers occurred on questions that were directly and repeatedly addressed during the course of the Academy. The least improvement was observed on questions that, in reviewing the events of the week, were not as clearly addressed. Many of these topics were not addressed well in 2007 because of changes in the schedule and planned activities or imperfect timing of some of the activities. It was noted by the teachers after the 2007 Academy that some of the questions were too broad and allowed for misinterpretation by the students even if the topics were covered well.

The most significant change for 2008 was the refinement of the majority of the questions to be more specific and basic enough that the material will be covered in spite of planning or schedule changes during the Academy. For part two of the questionnaire, there was a trend of improvement in both the initial and final percentage of correct answers, with only a few exceptions. The results of changes to part-one questions was mixed. Therefore, the changes made to the question format were more effective, in general, for the questions that were narrower in scope. Questions covering a broader scope were still difficult for the students to analyze correctly.

In 2008, there were fewer questions (only three) that showed little or no improvement, when starting from a low initial score, compared to 11 in 2007. The improvement is primarily attributed to the programming changes that were made better to address the instructor's objectives as reflected in the assessment questions. Changing both the questions and the contents simultaneously makes it difficult to attribute the improvement completely to the content changes, as the students may have simply better understood the question and were therefore able properly to apply the knowledge obtained from the program.

B. *Overall Evaluation*

After the assessment of the 2007 Academy, the staff identified three areas that needed improvement.

The first area was the clarity and helpfulness of the written lab materials. Efforts were made to remove sections that did not directly apply to what the student was doing in the physical laboratory, particularly in the Circuits and Optical Communications/Optical Remote Control materials. In all labs, pictures were added that showed how the components should be placed on the breadboards if connected correctly. This addition served to mitigate student frustrations, reinforce some of the breadboard training in the Circuits session, and allow the students more time to explore the lab materials and attempt some additional experiments. An improvement in the assessment score of 0.44 was observed from 2007 to 2008, and the 2008 score was above the target score of 4.5, so the efforts to address this issue were deemed successful.

The second area was the need for additional or advanced work for students who finish an activity early. This occurred particularly in the earlier part of the week, as there were a few students who had taken circuits-related material in a high school course prior to the Academy. These students gave the activity poor reviews, both numerically and in comments made to the staff and on the review sheets. For the 2008 Academy, all of the activities were rewritten to add next-step material for students to explore once the original material is completed. An improvement of 0.5 was observed in the assessment of this aspect of the Academy after the 2008 session. However, the average score is still below 4.5, indicating a need for further improvement. Student comments indicated that some of the material intended for further exploration was either too much of a stretch for some students or did not match what interested the students most about the activity.

The third area of concern was provided by the comments from the teachers assisting with the Academy, and it concerned the need for a better teacher training session so that the teachers were better able to help the students and the staff during the activities. This shortcoming was in large part due to a problem with teacher recruitment, as many of the teachers were not added to the 2007 program until two weeks before it started, and this made scheduling difficult. In 2008, a full-day training session was scheduled and implemented during the week prior to the Academy. The training session was organized to allow the teachers to work through the initial parts of the technical activities so that they could familiarize themselves with the material, ask questions in a supportive environment, and address concerns with the material content and presentation. Comments received from the teachers after the 2008 Academy indicated that they were far more comfortable assisting the students than the teachers were during the 2007 Academy and that they were more satisfied with their experiences during the Academy.

C. Additional Comments

In addition to the numerical assessment tools, the written comments provided by both the teachers and students provided added insight into the strengths and weaknesses of the current program. Some of the most significant comments included the following.

1) The teachers in particular commented that there was no difference in the way female and male students were treated in the program. The Academy sets the same standards of participation, exploration, and academics for all of the students, and the faculty members strive to help all students be successful. The students and teachers have responded positively to this approach.
2) The students often commented positively on how the activities allowed them to do hands-on activities quickly and often, instead of extended listening and note-taking. All of the activities distribute the discussion or lecture components throughout the activity, so lectures are short and the students get to explore a concept right after it is introduced. This approach has been employed successfully in several of the laboratory-related classes in the college-level curriculum and does appear to translate well to the level of student participating in our Academy.
3) Partnering of students continues to be a challenge. The admissions process for the Academy does not allow for interviewing the students, so the personalities and interests of the students are not known prior to their arrival on the first day of the program. Since the program is open to students having a large range of academic training (7th through 11th grades, rural and urban school systems), the directors guide students of similar age and training toward partnering for the session. In 2007, despite this guidance, there were cases where partners split after a day or two due to personality differences. In 2008, the ice-breaking game was added to allow students to mix more naturally at the beginning of the program and to allow the faculty to know the students a little better before partnering occurred. While there was still some partner friction occurring in the 2008 session, it was relatively mild, and all of the groups remained intact throughout the program.

V. Conclusion

After two years operating the Electrical Engineering Summer Academy at the University of Tulsa for students entering grades 8–11, there have been many lessons learned about how to increase the students' awareness of the engineering discipline and to provide an engaging experience for the students. A focus on hands-on and participatory activities, including competitions, with short and effective lecture components has been well received by the students and teachers alike. Students respond very positively when the program sets the same standards of participation, exploration, and academic success for all of the students. Providing an independent training session for the teachers assisting with the program has increased the comfort and knowledge levels of the teachers when working with the material and improved their ability to interact with and guide the students when the program begins. An introductory ice-breaking activity is a useful tool for the students to learn about and become familiar with each other and for the instructors to learn about student personalities. This preliminary can lead to better pairing of students and less friction between students within the program, leading to an overall better experience for everyone. While most of the changes implemented in response to the 2007 evaluation resulted in measurable improvements in the 2008 evaluations, there are still areas in which the program can improve.

The next installment of the program, to be held in July 2009, will implement further refinements. To assess the effectiveness of the questionnaire portion of the evaluation process accurately, the next assessment process will use the same questions but implement further refinements to the program content. Assessment results from this upcoming session will hopefully show continued improvement in the number of questions for which the percentage of correct answers increased as well as a larger gain in the percentage of correct answers overall. The extra activities for advanced students will continue to be refined in the future to match the capabilities of the participants better. Addressing what most interests the students is expected to be more difficult since interests will change from session to session depending on the particular group of students enrolled in the program.

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