

Summer Studies in Mathematics and Science

Amazing Science Evaluation

Christina Bruhn

August 28, 2011



This report is presented in several parts. The first part describes the history of the development of the summer studies units and the methodology employed for their evaluation. The second part describes results of pre-tests and post-tests of knowledge for the Aviation, Energy, Forensics, and Health units. The third part describes the comments made by the implementers of the units both as to their strengths and their needs for further development. The fourth describes the comments that students made about the program. The fifth includes observations of the evaluator. The final section offers a summary and describes recommendations and next steps.

I. History and Methodology

The development of the units of study for the summer studies program began formally in April of 2010. The Summer Studies Committee, as it was constituted at that time, met several times to determine such logistics as location, timing, transportation, ages of students served, funding and curriculum. Decisions were made quickly about many of the logistical arrangements necessary to host the program, and then the curriculum became the major topic of focus. The Committee sought a “cutting edge curriculum, utilizing real world applications of math and science as well as classroom and laboratory activities.” The Committee determined that the development of such a curriculum would require professionals in education and mathematics and science. Accordingly, the Committee developed job descriptions and applications. These were distributed widely through the broader Mathematics and Science Education Center collaboration. Applications were received and considered, and contracts were established with developers for four curricula. The curricula were developed, revised, and formatted in the following year. The curricula finalized prior the implementation of the first Summer Studies program included: Aviation, Energy, Forensics, and Health. Forensics and Health were the first two finished. These were the units piloted at the After-School Program in the spring of 2011. The units were pilot tested at two schools: Jefferson and Bednarcik. All units were implemented with 6th through 8th graders only. The full units were not implemented in the pilot tests, although many modules were. The Amazing Science program itself was delivered on the campus of Aurora University from Mondays through Thursdays from nine to noon from June 13 to July 21. The program generally included content delivery, hands-on/experiential activities, a break for a snack, and then another set of content and additional experiential activities. The units were delivered in a manner consistent with the ways in which the original curricula were designed, although minor modifications were made at times.

The evaluation of the process and outcomes associated with this implementation was conducted in three parts. The first part involved delivery of pre-tests and post-tests of knowledge. The second part involved feedback forms completed by program implementers to identify strengths of each unit and areas for future development. The third part took the form of observations of implementation by the evaluator along with focus groups with students involved in the pilot programs.

II. Pre-test and Post-tests

The pre-tests and post-test are criterion-referenced tests developed by the evaluator based on the unit contents. Originally, pre-tests and post-tests were developed for 4th and 5th grade students as well as for 6th through 8th grade students, as the original plan was to implement the pilot tests in after-school programming with younger students as well. However, given the limited availability of program staff interested in implementing and able to implement the pilot project, its eventual scope was limited to middle school-aged children only, and the final Amazing Science summer program also targeted middle school students. The tests that were written for the pilot program were checked with the original authors of the curricula prior to being utilized. These tests were later revised based on experience with the pilot evaluation. It was felt that the students scored too high on the initial pre-tests and that this did not allow for as comprehensive an assessment of their learning as possible. Thus, the pre-tests for the Forensics and Health units were made more difficult between the pilot test and the actual implementation of the Amazing Science summer program. The intent was to make the test more difficult with regard to content but not with regard to reading level for the Amazing Science summer program. In addition, tests were written for the two new units, Aviation and Energy. The new tests for Aviation and Energy were intended to be at a difficulty level congruent with the new Forensics and Health tests. Answer keys were developed for each test, and these were provided to the program managers to give to the staff members, so content included on the tests could be completely and accurately delivered in sessions.

Each of the units resulted in statistically significant gains in test scores. These results, along with statistical findings, are reflected in Table I.

Table I: Pretest and Posttest Means and Standard Deviations

Unit	Number	Pretest mean and standard deviation	Posttest mean and standard deviation	Statistical findings
Aviation	29	9.2 (2.9)	11.8 (3.8)	$t(28) = -5.25, p = .000$
Energy	32	9.9 (2.7)	13.8 (3.4)	$t(31) = -7.30, p = .000$
Health	37	13.5 (4.6)	16.9 (4.3)	$t(36) = -8.87, p = .000$
Forensics	37	10.9 (2.7)	14.6 (3.5)	$t(36) = -10.32, p = .000$

The findings represented in Table I indicate that scores went up from pretest to posttest for each of the four units. The rate of gain per unit (as analyzed by ANOVA) was not significantly different from one unit to the next. The pretest scores did differ significantly, suggesting that the Health test produced higher pretest scores than the other three tests did.

III. Comments of Student Team Leaders

Each program implementer was provided with a comment form for each day of study with the program. These forms were to be filled out in order to reflect what was covered, what went well, what went less well, and changes that could be made. The forms also requested activities participated in and number of minutes for each activity. The table below presents the most common responses in each category. Each category was responded to by three separate teams of trainers, each team being comprised of two trainers.

Unit	Session	What went well	What went less well	Recommendations
Aviation	Introduction, Air Pressure	<ol style="list-style-type: none"> 1) Ping pong “surprised and excited.” 2) Air squeeze went well. 3) Kids liked being able to decorate their own air balloons. 	<ol style="list-style-type: none"> 1) Power Points were “boring” and “overwhelming.” 2) Kids were uninterested in air squeeze. 3) Hot air balloons would not fly. 	More activities before Power Points to get kids engaged.
Aviation	Lift and Forces of Movement	<ol style="list-style-type: none"> 1) Inertia demos (penny and card) were exciting and helped kids understand the concept. 2) Loved the demonstration of Bernoulli’s principle with pop cans and straws. 3) Loved rotary motors. 	<ol style="list-style-type: none"> 1) Bernoulli’s stations were difficult to carry out – kids struggled with getting the ball from one cup to another and couldn’t get cans to come together. 2) Strip of paper lift and Power Points bored them – too “heavy” or “lengthy” – “too much material.” 3) Helicopter became out of control. 	Physical activity – Power Points are lengthy and kids grow antsy.

Aviation	Aerolab	<ol style="list-style-type: none"> 1) Dr. Hipp's management – externally imposed discipline. 2) Enjoyed building the planes and LOVED flying the planes. 3) Wind sock kept them busy and challenged them. Liked the step-by-step process and organization. 	<ol style="list-style-type: none"> 1) Plane worksheets are hard to read. 2) Aerolab didn't work because there were not enough pylons. 3) Didn't like to have to tie the airplane to the spool and did not want to try to get different measurements. 4) Compass made with nails and magnets did not work because the Styrofoam was sticking to the side of the dish. Bored with this quickly. 5) Need better instructions for the windsock. Took "forever." 	<p>More setup in the gym. Compass making activity "tanked," need a new activity.</p>
Aviation	Navigation	<ol style="list-style-type: none"> 1) Scavenger hunt was fun but needs to be longer. 2) Liked the phonetic alphabet, liked working with partners to plan their flight. 	<ol style="list-style-type: none"> 1) Scavenger hunt clues got moved. 2) Little bored with the GPS article/worksheet 	
Aviation	Paper airplanes/gliders	<ol style="list-style-type: none"> 1) Paper airplanes worked well. The kids worked together and helped each other. 	<ol style="list-style-type: none"> 1) Gliders did not have time to dry, fell apart easily. 2) Didn't like/easily understand control surfaces. 	<p>Outside or in the gym!</p>

Aviation	Aerolab competition	1) Liked tweaking their planes for the aerolab competition.	1) Disappointed when they didn't win the competition. 2) Disappointed when planes broke.	Have a plan for when planes break.
Energy	Introduction	1) Straw launchers were "a hit." Enjoyed making and discovering how high they shot depending on how far they pulled it. 2) Inclined plane went well.	1) Soaring straws worksheets were difficult to read. 2) Inclined plane did not get their interest and was confusing to some. 3) Kids were bored with energy detective.	Could not make it through all the activities in one day.
Energy	Exploring Energy and Electricity	1) Liked the stations – batteries, energy usage now, and electric car worked well and they liked the batteries and the bike activity.	1) Crunched for time.	Switch the LED lights around if they aren't lighting with the batteries.
Energy	Sources of Energy	1) Enjoyed and understood the chemical models. 2) Got into the energy game after awhile/Energy Enigma worked well, the kids were very interested. 3) Enjoyed renew-a-bean.	1) Coal didn't do much. 2) Confused by renew-a-bean. Renew-a-bean didn't work very well. 3) Were not excited about the magnet.	Too many activities in one day.

Energy	Renewable Energy	<ol style="list-style-type: none"> 1) Hot dog cooking was exciting for them. They liked the activeness of the relay and caught on quickly. Also enjoyed the oil burning activity once inside. 	<ol style="list-style-type: none"> 1) Windmills did not turn much. Doing the oils outside didn't work well. 	Maybe not do two food activities in one day.
Health	Nutrition	<ol style="list-style-type: none"> 1) Graphing went well for first 30 minutes and then lost focus. 2) NuVal Power Point was "a BIG hit!" They loved guessing the ratings. 3) They had fun with the game comparing the NuVal scores. 4) "Yay!" 	<ol style="list-style-type: none"> 1) For the lining up the product before introducing NuVal, we would like to be able to tell the students the correct order. 	
Health	Digestive System	<ol style="list-style-type: none"> 1) Hidden sugars worked well, the kids enjoyed it. 2) They liked the peanut butter experiment. 	<ol style="list-style-type: none"> 1) The flossing was extremely messy, we should have done it outside. 2) Use less food in test tubes. 3) Be sure to hold the hose with the oatmeal in it. 4) Kids were grossed out by the digestive system activity. 	

Health	Respiration	<ol style="list-style-type: none"> 1) Risk factor game was fun. 2) Really interested in the smoking/tar collector. 3) Enjoyed the lung model. 	<ol style="list-style-type: none"> 1) The risk factor game did not work well because they were shy. 2) Wish we had more time. 3) Balloons very distracting and broke easily. 	Explain everything before giving lung capacity materials.
Health	Factors Affecting Weight Loss and Gain	<ol style="list-style-type: none"> 1) They really liked researching and making their posters. 2) Visible pulse – they enjoyed moving around. 	<ol style="list-style-type: none"> 1) They were totally bored with the munching mice. 	
Forensics	Powder and Blood Spatter	<ol style="list-style-type: none"> 1) The powder analysis went well because the kids got the hang of it and could find the mystery powder. 2) The kids were very interested in the experiment. 	<ol style="list-style-type: none"> 1) The blood spatter didn't work well because the blood was thick/clumpy and there was not a big difference in diameter. 	Need to do more at the crime scene – kids who are not collecting evidence get bored.
Forensics	Teeth, Trash, and Finger Prints	<ol style="list-style-type: none"> 1) They liked guessing whose marks were on the chocolate. 2) None of the activities went wrong, they enjoyed all of them. 	<ol style="list-style-type: none"> 1) Finger prints need better materials. 2) We tried the trash activity outside, and their bags were blowing away in the wind. 3) A few of the chocolate pieces were breaking when they tried to leave an impression. 	

Forensics	Foot Prints and Tire Tracks	<ol style="list-style-type: none"> 1) They enjoyed casting the foot prints. 2) They enjoyed analyzing the tire tracks. 3) All activities worked well. 	<ol style="list-style-type: none"> 1) Foot prints were messy. 2) Measuring cups for the casting were different sizes so the plaster took some playing around with but it still went fine. 3) Found the foot/height ratio boring. 	
Forensics	Chromatography and Tool Marks	<ol style="list-style-type: none"> 1) Chromatography went well because they were able to guess almost all of the mystery pens. 	<ol style="list-style-type: none"> 1) Tool mark analysis didn't go as well because the kids weren't listening and did the wrong things/bored/confused. 2) Clay was oily and hard to get off of their hands. 	Try an invisible ink experiment.

Summary of comments:

Most of the comments provided by the team leaders about the curricula, their implementation, and student reactions were positive. The tone of the comments was much more favorable for the Amazing Science summer program than it had been for the pilot implementation, suggesting that the pilot improved the program. While some activities naturally posed unanticipated challenges (for example, trash archaeology materials blowing away in the wind outside), the team leaders were able to make accommodations (for example, bring the oil burning activity inside when it didn't work well outside), to keep kids focused, and to stay on schedule and continue to move through the modules. While some took slightly less or more time than expected, again, the comparison to the pilot test is favorable insofar as time management was much more optimal in the Amazing Science summer program.

The comments suggest that not every group perceived every activity in the same way. In some cases, one group would report that the activity was well received, and a different group would report that the kids perceived the same activity as boring or confusing. This may be due to factors associated with the students enrolled in the activities, the way they are presented, or

both. In the future, taking video of different presentations to determine association between style of presentation and student reaction may prove beneficial.

In general, the most favorably received activities are the ones that required the most physical activity and kept kids the busiest/presented the least “down time.” The presenters seemed to feel that the Power Points were only exciting to kids when they were interactive (e.g. guess the NuVal score) and not in any other circumstance. In most cases, the reporters indicated they spent short periods of time (20 to 30 minutes) per activity, although a few took up to one hour. This quick pace seems to have been largely effective in helping to keep kids engaged.

IV. Comments of Enrolled Students

The students were asked four, open-ended questions at the conclusion of the posttests. The questions were:

- What were your favorite things about the (Aviation, Energy, Health, Forensics) program and why?
- What did you like least about the (name) program and why?
- If you were the boss and could change anything you wanted about the (name) program, what would you change?
- What else would you like to tell us?

The answers were all transcribed into a single document and analyzed for common themes. The answers were analyzed by individual program initially, and then the most common themes throughout were considered in a summary.

A. Aviation

1. Positive comments

The most common “favorite things” by far were making planes. The students liked making planes of all types. Out of 29 positive comments, 16 were about making or flying airplanes. The students stated they liked this “because it is a hands-on activity” and “it was fun.” Other things students liked were, “experiments because they were fun,” “experiments because we learned about thrust and other things,” and “the activities, the teachers, and all the learning materials.” One student stated she liked “everything because I learned something new in a fun and interactive way.”

2. Negative comments

The students’ most common comment about what they did not like (of 27 comments) was “nothing.” This occurred 7 times. The second most common comment was “Power Points.” This occurred 4 times. The students also disliked the pretests and posttests. This occurred 3 times. Other comments were mixed. They included comments about individual sessions (such as the gps, because it involved a lot of reading, and the Pilot’s

Flight Plan, because it was too simple), “the writing because I hate writing,” cellular phones not working in Alumni Hall, waking up early, and not having enough materials for each person to have their own set.

3. Recommendations for change and other comments

The recommendations student had for program improvement were not consistent. Of 26 students who offered comments, 5 said they wanted either more “fun stuff” or more activities. A total of 3 asked for no tests, 2 wanted more snacks, and 1 wanted it to start later. One student wanted “to do a little less learning,” and one student wanted staff members to “more deeply explain why everyone got the results that they did.” This comment resonates with the observations made in the classroom about students enjoying the experiments and engaging well with the process but not always being able to explain “why” what they observed had occurred.

In terms of other comments, students stated, “I had fun,” “the counselors were very nice,” “I like the snacks and hands-on activities,” “Awesome job,” “I had a great time and learned new stuff,” and “Thank you!”

B. Energy

1. Positive comments

The comments in response to the Energy unit were very positive. Among 29 comments, the most frequent reference was to liking “experiments” (7), usually combined with “fun.” The second most frequent favorite thing mentioned was “learning” (6). After this, three categories were tied at three mentions each – games, stations, and “everything.” The comments were more detailed than they had been for the Aviation unit and conveyed a great deal of enthusiasm. Students stated, “My favorite part was the game where we had to guess the other group’s energy source. It was lots of fun and I learned about different types of energy.” “You learn things that you never knew about.” “We learn how to do fun stuff because I have the most awesome teacher!” “I learned lots of things and had lots of fun experimenting – I can’t wait til the next session!” “I love Energy, I love Science, basically everything.” “It taught that there was more than one kind of way you can make and store energy,” and “Everything because it was so much fun.”

2. Negative comments

The negative comments were also largely positive. Of a total of 26 comments, the most common comment about what was not liked was “nothing.” A total of 12 children said either that they disliked nothing or that they liked everything. Students stated: “I did not like... nothing. I honestly really enjoyed the program!” “Nothing. Everything was awesome!” and “2 good 2 be true.”

The negative comments that actually were negative were comments about snacks (being frozen, having to walk to another building to get them), tests, having to read, having to write, and it being too hot outside.

3. Recommendations for change and other comments

Some of the recommendations were also really positive comments – “I won’t change anything I love the energy program!” or “Nothing.” Those recommendations that were offered mostly related around even more experiments and hands-on activities (4), particularly building things. Several students asked to spend more time outside, at least early in the day before the day gets hot. They asked for no more frozen bagels and no more tests. A few asked for the session to be longer (more days).

Other comments included: “I loved the camp, I was really satisfied. The room was cold. I liked all the activities.” “I learned a lot about energy, I thought this was a good program and thank you for the opportunity to be here.” “I would like to say thank you for having this great organization.” “The class was sooo much fun and I’ll miss it. The teachers were great and my classmates were super nice (with a single exception) but overall I had a great time. P.S. snack was nummy.” “This is an amazing program. I highly recommend it!” “I can’t wait til the next session to see you!” “You guys are very nice,” and “The only thing is that I had fun.”

C. Health

1. Positive comments

Students made a number of session-specific positive comments about the health unit. Of 29 positive comments, many were general (12) – “The awesome experiments because they were fun and very interesting,” “All experiments – it made it easier to learn,” “I love hands-on experiments,” “The activities were hands-on and demonstrative.” In addition, 6 students specifically indicated they liked the sugars in foods experiment, 4 students liked the respiration session, 3 students liked the obesity session, and 2 students liked the dental health session. Examples of comments included, “Experiments with testing sugars in food, because it was fun and taught something,” “There were a lot of interesting facts and good information to know,” and “We got to do hands-on experiments to help us understand the topic.”

2. Negative comments

The most common negative comment (of 28) was about having to take tests (7). The second most common comment was “nothing,” and this was followed by comments about having to take notes or do extensive graphing (4) and about the munching mice experiment (3). The students felt that the simulation in the munching mice experiment was not as engaging as

the “real” experiments. One student disliked “the peanut butter hand thing (because it) was odd.”

3. Recommendations for change and other comments

The most common recommendation (of 25) was “nothing.” The second most common theme for this unit is that students wanted more experiments – they wanted this unit to be more interactive and to involve “more hands-on activities like instead of just graphing and something more interactive,” or “less writing more doing” (6). They were very favorable toward the experiment-based, hand-on aspects of the units. In addition, the number of students who requested that the units both start and end later started to escalate as the program went along. Students also requested “better snacks” and no tests.

In terms of other comments, students stated “You’re good teachers,” “The teachers... are nice and funny,” “The leaders were well educated with the topics we discussed,” “The teachers are great at explaining things,” “The health section was very fun, I loved the hands-on labs!” “Keep up the hard work,” “This is a wonderful program I love it!” and “Overall this is a really great camp and I would come back again.”

D. Forensics

1. Positive comments

Student respondents were extremely favorable about the Forensics unit. The total of 32 responses addressed a variety of topics. As one student said, forensics was “my favorite activity.” Some students stated they liked “everything” (4) – “Everything because in regular school we don’t get to do this awesome unit.” Very many students made specific allusion to using the crime scene (12). They stated, “The crime scene because it actually seemed real!” and “The crime scene investigation because it made me feel like C.I.S.” They also made specific mention of finger printing (6), stating “The finger printing was cool.” They indicated that the hands-on, experimental nature of the unit appealed to them (5). “I liked the fact that it was hands-on,” “My favorite thing about forensics is how there are so many activities and experiments,” and “My favorite thing about the forensic program are the experiments, because they are fun and cool.” They also identified the foot casts, blood spatter activity, and collecting evidence as their favorite aspects of the unit – “Everything! The shoe printing was so much fun, and the crime scene was Awesome!” “The blood spatter, it looked very real,” “We got to try firsthand how you collect evidence and how evidence is left at a crime scene.”

2. Negative comments

The most common “least like” comment was “nothing.” Of 32 respondents, 8 said they did not have anything they disliked. The second most common comment was tests (5), and the remaining comments were scattered and did not center around any common themes. Two

people did not like to walk to the crime scene because it was hot. Two people did not like to get up so early in the morning. Two people found the crime story “cheesy” or wanted a “real” investigation. One person said it was too short.

3. Recommendations for change and other comments

The most common recommendation for change was “nothing” (9 of 29). The second most common recommendation was fewer tests/less work/less writing (4). Three students wished the program started later, three students wished it ran longer, and three students wished for a “more serious crime” – something that would simulate real life crime scene investigations. One student requested more food options. One student recommended a field trip to a forensics lab.

Many students, in response to the “What else would you like to tell us?” question, indicated specifically that they had “fun” (5 of 19). In addition, they stated “The program is awesome, I wanna come next year,” “You are the best,” “It was awesome!” “Nice job with forensics,” “You two are really good teachers,” “I want to come back next year,” and “I really enjoyed this program and I will like to join next year.”

Summary

The student comments suggest that the program has met its objectives. The students were very positive about the hand-on, experiential nature of the program. They expressed many positive statements about liking “experiments” and finding them both fun and educational. They repeatedly asked for even more projects, building, activities, and experiments. They were not favorable about tests as they were delivered or about didactic content delivery (Power Points) and extensive writing requirements. They found the staff members “awesome” and, for the most part, enjoyed their peers as well. They frequently indicated that they hope to return to the science camp next year and wanted the organizers to know that they would like to say “thank you for having this great organization.”

V. Observations

The evaluator went to the camp to conduct observations on two occasions, 6/23/11 and 7/7/11. The first observation was of an energy module and the second was of a health module. The energy module was energy stations, and the health module involved hidden sugars (students were using Benedict’s solution to determine whether a variety of different types of foods contained sugars). At each observation, the evaluator engaged in conversations with the students about what they liked, did not like, and recommended about the camp. This section will be organized as two parts: the first is observations made, and the second is comments made by students.

Observations

Energy

The evaluator observed that the camp was very well organized. Each station included all the materials that were necessary. The materials were found in neatly labeled boxes. Printed lists of instructions were also present at each station. The kids clearly knew what to do and were proceeding from one station to the next in an orderly fashion, doing the activities presented at each station, and using their notebooks to keep notes about their findings. They were able to answer questions about what they were doing and what they were finding, although when questioned “why” or about what the findings meant, they often went to their team leader to find out the answer. The program appeared to be well structured insofar as the kids seemed comfortable in the room and to be willing and able to stay on task – more so than had been the case with the pilot test. The Amazing Science program appeared to be well thought out and prepared for.

Health

The kids were working on putting small pieces of food in test tubes of Benedicts’ solution to see if the solution would react, indicating presence of sugars in foods. The kids were making notes in their notebooks about their findings and posting them up on the board. The activity seemed to be very engaging to them insofar as they stayed focused, were able and willing to discuss the activity, and were even thinking of different kinds of foods to test. They seemed to feel important because they were handling laboratory tools and conducting laboratory-like experiments. The team leaders were careful to keep the kids’ focus on the activity and to require them to clean up the space (they had just finished the peanut butter and flossing experiment, and there was still a lot of peanut butter to clean up).

Comments Made by Students

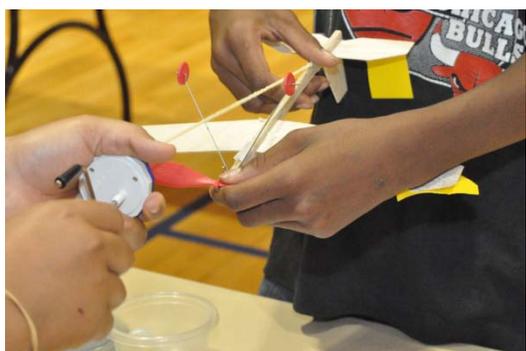
The students universally stated that they were enjoying the camp. They stated that they really valued the hands-on nature of the experiments and that they enjoyed the most active days the most. Their reaction to the Aviation unit was not as positive as I had expected – I had expected this to be their favorite unit. They did state that they liked the aerolab, paper airplanes, and gliders but that they were enjoying the Energy unit more as a whole because the level of activity was higher on an every-day basis. They stated they had liked everything about the Energy unit except the pretests and the Power Points. This was also the case with regard to the Health unit.

VI. Summary

The evaluation of the Amazing Science program produced evidence that students demonstrated statistically significant increases from pretest to posttest, that students stated that they enjoyed the camp, and that the camp was well planned-for, well structured, and safe.

The scores of students did remain lower than had been anticipated at the time of planning for the evaluation. At that time, it was anticipated that high-performing students with an interest in mathematics and science would be the primary audience. As is so happened, the majority of the students attending the program appeared to have or indicated they had a genuine interest in mathematics or science, but not all of the students were academically high-performing. Many of the students demonstrated literacy challenges. Thus, the topical and literacy-level difficulty of the tests as they were reconstructed between pilot test and final implementation during the summer may have been too great. Nonetheless, students did post statistically significant gains.

More importantly, students were very positive in their response to the camp. Their comments made clear that they valued the work of their team leaders, they enjoyed the activities, and that they felt that they learned important content and applications pertaining to mathematics and science. Their recommendations for change revolved primarily around adding even more hands-on, experiential, project-based activities. When we asked the students what else they would like to tell us, they said, "Thank you."



Appendix A

Report of Pilot Test Evaluation

The pilot evaluation was conducted in the spring of 2011 at the After-School program at two schools, Bednarcik and Jefferson. Jefferson implemented both the Health and Forensics units, and Bendarcik implemented only the Forensics unit.

The evaluation of the process and outcomes associated with this implementation was conducted in three parts. The first part involved delivery of pre-tests and post-tests of knowledge. The second part involved feedback forms completed by program implementers to identify strengths of each unit and areas for future development. The third part took the form of observations of implementation by the evaluator along with focus groups with students involved in the pilot programs.

I. Pre-tests and post-tests

A number of pre-tests and post-tests were delivered, but only few tests were acquired for the same children at both the pre-test and post-test points. This was due to the fluctuation in program membership across the time of the pilot test. Specifically, a total of 22 pre-tests and 10 post-tests were collected. However, only 9 tests were available at pre-test and post-test, and these are the tests on which the findings reported here are based. Of those tests collected, 7 were for Forensics and 2 were for Health. Based on the limited number of available matched tests, statistical analyses to test for differences in outcomes between these two units could not be conducted. Furthermore, tests of any differences between the two sites could not be conducted.

Despite the fact that analyses by site and unit could not be conducted, analyses of change from pre-test to post-test based on the pilot program as a whole could be conducted. These tests resulted in identification of statistically significant change in knowledge over the course of the program period. Specifically:

Table 1: Pre-test and Post-test results

Item	Mean	Standard Deviation
Pre-test	63.7%	.12
Post-test	82.2%	.07
Total change	18.4%	.09

These results are significant ($t(8) = -5.989, p < .01$) and indicate that the test score went up an average of approximately 20 percentage points between pre-test and post-test. Based on such a small sample size, the significance of these results is very promising. While the possibility of maturation or history (the idea that students would have learned this content anyway, even without the program) remains plausible, this possibility is considered unlikely.

While unit-specific change could not be statistically measured, the preliminary findings are promising. The average percentage gain on the Forensics test was 17.9%, and the average percentage gain on the Health test was 20.4%.

Despite the strong rate of change associated with the Health test, it was noted by the evaluator that the rate of correct response on the pre-test was higher than the rate of correct response on the Forensics test (it was 69.9%, relative to 62.1%). Thus the test was judged to represent too much content that had already been mastered by students and was adjusted for the purposes of the Summer Studies program to represent more difficult content.

II. Comments

Each program implementer was provided with a comment form for each week of study with the program. These forms were to be filled out in order to reflect what was covered, what went well, what went less well, and changes that could be made. A total of 19 forms were collected. Of these, only 2 were for Health.

The content of the forms is evaluated separately for Health and Forensics and separately by week, with summary comments provided at the end.

Table 2: Program Implementer Comments

Topic	Session	What went well	What went less well	Recommendations
Health	Respiratory system	Loved the lung model	Things went too quickly, need to expand on activities	- More information about lungs to promote learning - Soda bottles work better than juice bottles with wide necks
Health	Nutrition	Liked making graphs with real packages	Wrong food packages included	Needed to bring a greater variety of food packages to demonstrate relative nutritional value of different foods
Forensics	Introduction	Enjoyed conversation about solving the book crime	Student behavior – 3 students had to be asked to leave	Needed classroom control methods, turn taking and raising hands
Forensics	Powders	A lot of fun – KWL chart went well and game went well	Nothing	Add more materials/powders
Forensics	Liquid splatter	Enjoyed measuring blood splatters	Too quick	- Get big sheets of construction paper – it is heavier - Expand the lesson
Forensics	Tool mark analysis	Liked the entire activity except for difficulty identifying which tool was used	Could not identify which tool was used	Use clay to do impressions, the tools do not make very good impressions on styrofoam
Forensics	Hidden handwriting, ink chromatography	Cool	Did not have alcohol and the same types of pens	Provide different pens and alcohol
Forensics	Tire tracks	Liked rolling the cars in ink – discussions went well - creativity	Too short. Only took 10-15 minutes, students were bored within 5 minutes. Tracks all looked the same	Use bigger cars with more distinguishable tracks. Get better ink that will roll on better (ink was too dry)
Forensics	Height/foot ratio	Informative – children liked the idea.	Amount of time it took – they were finished within 10 minutes	Make it more challenging
Forensics	Trash archaeology	Not done	Trash was contaminated and not safe for children to use.	Use “clean” trash
Forensics	Teeth impressions	Everything	Nothing. By far the most fun activity.	

In summary, many of the lessons were well received. The most frequent comment was that the lessons were too short and could be expanded, possibly by adding additional materials. The second most frequent scenario related to difficulties with the specific materials provided – for example, the implementers requested different materials for the lung unit (soda bottles, not juice bottles), the nutrition unit (greater variety of packages), the powders unit (more powders), the blood splatter unit (big sheets of construction paper), the tool marks unit (clay instead of styrofoam plates), the chromatography unit (variety of pens, alcohol), the tire tracks unit (bigger cars and trucks, more diverse tracks), and the trash unit (“clean” trash).

III. Observations

The evaluator observed the Health unit and both Forensics units being implemented. The specific units observed were nutrition, tire tracks, and tool marks. The following is a summary of field notes made after these observations:

- The implementers appear to be diverse in terms of preparation and motivation for formal instruction. Some of the implementers were careful to demonstrate thoroughly, to check for student understanding, to differentiate their instruction to accommodate a variety of student needs, and to provide additional individual help where needed, but this is not always the case. In some cases the implementers rushed through a demonstration or did not attend to students who seemed not to understand the material. These observations suggest a need for specialized training in how to educate students in mathematics and science content coupled with ongoing supervision.
- The materials comments made by the implementers were reinforced by observations made by the evaluator. The tire tracks demonstration was not as effective as it could have been because the cars did not pick up the ink, and in any case their treads were all the same. The tools demonstration was not as effective as it could have been for several reasons. This included the fact that many of the tool marks looked the same and the fact that students were confused as to what forensic evidence they should compare the marks they had made to. The demonstration was not initially organized effectively, although the implementers worked hard to provide clarification, and the children clearly had fun.
- Students’ comments suggest that they enjoyed the units. They were clear that they liked building things the most. The lung model unit was very popular. They also liked the teeth mark impressions unit. They wanted “hand-on” activities, by which they meant activities where they constructed products. They did not have suggestions for improvement other than to add hand-on activities.

IV. Summary

The pilot test of the Summer Studies units did what it was intended to do, which is to demonstrate which aspects of each unit should be retained, where new content could be added, and where logistical considerations might affect implementation. In addition, the

pre-tests and post-tests were assessed, and modifications were made based on findings. Specific suggestions for units that might benefit from expansion and materials recommendations are made above. Despite initial challenges in delivering this content for the first time, however, students clearly indicated their enjoyment of the opportunity, and the pre-tests and post-tests indicated significant learning. For an increase of close to 20 percentage points to be demonstrated based on an abbreviated, introductory program is very promising and suggests that the strength of what has been developed during the course of this project thus far is considerable.

Appendix B Enrollment Summary

The original agreement distributed the 100 openings in the program accordingly:

West Aurora 129 (4 middle schools)	36
East Aurora 131 (3 middle schools)	27
Indian Prairie 204 (3 middle schools)	27
Oswego 308 (1 middle schools)	<u>9</u>
	99

During May and June, Dan Hipp was the AU coordinator who worked with school districts and families to finalize 50 students for session one and 50 students for session two, based on the applications submitted to CIS by the four districts. As a result, **the rosters** on day one of each session consisted of students from the schools and districts as follows:

Session One (Aviation and Energy, June 13-30)

129	18 students (Washington 10, Jefferson 5, Jewel 2, Herget 1)
131	14 students (Waldo 8, Cowherd 2, Magnet 4, Simmons 0)
204	15 students (Granger 10, Still 4, Fischer 1)
308	<u>3</u> students (Bednarcik 3)
	50

Session Two (Health and Forensics, July 5-21)

129	17 students (Washington 8, Jefferson 6, Jewel 2, Herget 1)
131	17 students (Waldo 3, Cowherd 0, Magnet 1, Simmons 13)
204	18 students (Granger 11, Still 2, Fischer 5)
308	<u>4</u> students (Bednarcik 4)
	56

Once session one was underway, it was clear there were several no-shows. As a result in planning for session two, I over-enrolled the program, anticipating that some students would not show but seeking to get the enrollment closer to our capacity of 50 students. Here is the breakdown of **the actual attendees** in each session by school and district:

Session One (Aviation and Energy, June 13-30)

129	12 students (Washington 7, Jefferson 4, Jewel 1, Herget 0)
131	9 students (Waldo 5, Cowherd 0, Magnet 4, Simmons 0)
204	10 students (Granger 6, Still 3, Fischer 1)
308	<u>3</u> students (Bednarcik 3)
	34

Session Two (Health and Forensics, July 5-21)

129	12 students (Washington 8, Jefferson 1, Jewel 2, Herget 1)
131	14 students (Waldo 1, Cowherd 0, Magnet 1, Simmons 12)
204	13 students (Granger 8, Still 2, Fischer 3)
308	<u>3</u> students (Bednarcik 3)
	42

