

Reaching Teachers and Students: Stargazing on the Lake

*Julie Dowling, Illinois Mathematics and Science Academy
Jay Thomas, Ed.D., Aurora University*

Overview

With support from the Alfred P. Sloan Foundation, Siemens Foundation, and the Associated Colleges of Illinois (ACI), NCSSSMST hosted its third summer science program in June 2006 at Aurora (IL) University's Lake Geneva, Wisconsin, campus. This program followed the successful programs held at North Carolina Central University in 2003 and Princeton University in 2005. The mission of all three programs has been to increase the percentage of underrepresented populations enrolled and matriculating at NCSSSMST schools.

The Alfred P. Sloan Foundation, which has generously supported the summer science program in the past, continued its support for this third event with the express purpose of engaging underrepresented groups in careers in mathematics and science and encouraging them to apply for admission to NCSSSMST schools. A second goal of the 2006 program was to create opportunities for young, innovative, pre-service teachers of mathematics, science, and humanities. The juncture of new teachers, underrepresented students, and experienced NCSSSMST master teachers created a powerful opportunity for learning, reflection, and application in a science-rich context.

Student Program Design

The 2006 summer science program began with a goal of expanding knowledge through an exploration of astronomy but developed into much more than just stargazing. Thirteen students, three master teachers, and four pre-service teachers spent four days at Aurora University's lakeside campus in a context rich with opportunities for a deeper understanding of our physical universe and our place and responsibility in it.

For students and pre-service teachers, each day of the summer program began under the direction of Mr. Jeff Ortmann, an instructor of gifted students at Jonas Salk Elementary School and a very experienced outdoor education instructor. Mr. Ortmann had been conducting outdoor education experiences for a variety of students at the Lake Geneva campus for many years prior to the NCSSSMST program. Mr. Ortmann led students in team-building exercises and field-based science activities, including a trek to a Kishwaketo Wetlands preserve, and studies in water conservation and biology.

The University of Chicago's historic Yerkes Observatory provided the context for the astronomy-based afternoon lessons. On the first afternoon, students were provided an opportunity to begin thinking about space, distances, and possibilities for space travel through an integrative lesson in basic trigonometry led by Ms. Julie Dowling and science fiction writing led by Mr. Steve Williams. Both are Aurora University graduate students who will be teaching mathematics and English, respectively. Mr. Ed Moyer of the Proviso Mathematics and Science Academy engaged students in mathematical exercises that calculated relative distances between planets in our solar system. He concluded his lesson with recent images from the Hubble telescope depicting the birth and death of stars. Mr. Moyer involved the students in generating lists of things that they thought they knew and things they wished to know about the solar system, which directed the discussion toward common misconceptions about astronomy. On the third afternoon, Dr. Robert Kiely of the Illinois Mathematics and Science Academy (IMSA) challenged students' assumptions about science with a compelling session on the evolution of scientific thinking from Aristotle through Darwin. Dr. Kiely challenged the students

Julie Dowling is a resident counselor at the Illinois mathematics and Science Academy and is completing her master's degree in education at Aurora University.

Jay Thomas is an assistant professor of education at Aurora University and is currently NCSSSMST vice-president.

in discovering the origin of the scientific method and society's effect on and understanding of what is "acceptable" science.

On the third morning and into the final afternoon, Mr. Tim Staples, vice-principal at Urbana (IL) High School, introduced to students a classic problem-based learning scenario. With the assistance of the pre-service teachers, Mr. Staples challenged students to design their ideal high school for the study of astronomy and aquatic biology. The students were actively engaged in the deliberate process of designing a specialized school, from the architecture of the building and its facilities to the selection of students and staff. Dr. Joan Barber of the North Carolina School for Science and Mathematics and NCSSMST past president, concluded the session with a challenge to students to remain engaged in their passionate pursuit of science through educational opportunities.

Student Teacher Program Design

The distinguishing feature of the 2006 summer program was the opportunity for pre-service teachers to challenge themselves through direct interaction with students from high-needs schools, gifted middle school students, and experienced master teachers. While many, if not most, similar programs rely on younger staff to serve as mentors and counselors, the AU summer science program recognized the need and opportunity for developing young, innovative, and progressive teachers who will meet the needs of specialized student groups.

Pre-service teachers from Illinois applied to the program by responding to questions about their interest in teaching both gifted students and students from high needs schools. Candidates were required to be either juniors or seniors in college or graduate students in a teacher certification program. The pre-service teachers provided residential support and tutored students throughout the program in all areas of academic certification, from biology to mathematics.

Pre-service teachers were given the unique opportunity to enhance and refine their pedagogy throughout their observations and interactions with both

master teachers and students. After each afternoon session the pre-service teachers participated in seminars in which they had the opportunity to question the teaching methods and learn from experience and insights of the master teachers.

Discussions ranged from content, pedagogy, and classroom management to the nature of knowledge and teaching and surviving gifted adolescents.

Following the experience, each of the teachers reflected on three questions: In what ways did the experience enhance your understanding of teaching and learning among students from high needs schools? In what ways did the experience enhance your understanding of teaching and learning among students who have been identified as high achieving? In what ways did the experience enhance your understanding of teaching and learning in the areas of mathematics and science? The remainder of this article comprises the reflections of the program's four pre-service teachers. As you read them, try to recall your first encounters with such students.

Teacher and Teacher-Candidate Reflections **How did the summer science experience enhance your understanding of teaching and learning among students from high needs schools?**

The summer science experience introduced me to many difficulties that students from underprivileged/ high needs schools encounter. I had been previously unaware of some of the problems that these students encounter on a day-to-day basis. I think we were able to observe a discernable difference in the teaching and learning with these students. For example, when conducting the class in water study and working with the students observing specimens under microscopes, I discovered that [some] had never used microscopes before; as a result, I was impressed by their excitement and enthusiasm in discovering this new "microscopic world". They were disappointed when the lab ended saying they could have stayed and observed these amazing microorganisms for hours.

I began to understand how the interactions and situations that some students encounter make it difficult to excel and prosper in the environment in which they live.

[Several female students] demonstrated enthusiasm, stating that their experiences in most classes involved paper/pencil/book learning and very little “hands-on” experience.

Working with both the students and the NCSSMST scholars provided me with insight on how to deal with such situations as gang influence, poverty, and disinterest in specified subjects. I realize now that the best way to relate to high needs students and any students, for that matter, is to be honest with both yourself and them. By letting these students know that I was interested in their accomplishments they were more willing to attempt tasks and assignments that at first appeared difficult.

Although this was a rewarding experience I was able to realize some frustrations I might experience as a teacher. I found I did not like watching students struggle for answers, along with students having negative attitudes and looking for negative attention. I think it is good I was able to find out what frustration I might experience in the classroom so I will know what to expect and be prepared to handle what happens.

In general, I think I learned more about differences in teaching and learning of girls compared to boys as opposed to the high needs schools students.

During the program we spent two days, instead of the typical one morning, doing the team building activity because the students were so discouraged and disorganized. The students demonstrated lack of teamwork, inability to listen, inability to stand back and let someone else take the lead, as well as being easily discouraged. This translated easily into the classroom experience at camp. For many of the students if they didn't get the concept the first time around they were likely to give up on it entirely. These students also demonstrated that in their classical classroom setting they worked independently and had very little, if any, exposure to group work.

How did the experience enhance your understanding of teaching and learning among students who have been identified as high achieving?

The summer science experience enhanced my understanding of teaching and learning among high achieving students by first hand observation of how these students behave, communicate, and interact in both a learning environment and a leisure environment.

It became apparent that such students thrive in situations that “test” their intelligence and permit them to express their opinions and ideas. However, this experience also emphasized the weakness of gifted students in group activities. It became evident to me that high achieving students may have difficulty working as a group to accomplish specific activities.

Gifted students become adjusted to succeeding and they had difficulty coping with an activity that was difficult for them. A shortcoming of the group included the students' unwillingness to work together, the propensity to give up, and the struggle to respect others ideas regarding the task.

Throughout the years, they have been the mentors to average students and it seemed that they had difficulty relying on each other to complete a given task.

While it was evident that most of the students were either high achieving or exceptionally bright, there were obvious discrepancies among the students regarding their abilities and/or desires to learn, their cooperation and listening skills, and their seriousness, dedication, and perseverance to learn.

How did the experience enhance your understanding of teaching and learning in the areas of mathematics and science?

I was able to observe different scholars and how they successfully teach their subject matter. It became apparent that there is not one particular way to conduct a classroom.

I was pleasantly surprised and impressed with some genuine *lah hai* moments and enthusiasm

demonstrated during such times as actual newly found “love of nature” and being outdoors in generally unfamiliar situations, interesting observations and connections being made during the wetlands and lake study activities.

Many different methods were used during the summer science experience, and I believe that they were all effective. One commonality between all the lessons was the level of the enthusiasm for the material by the scholar. Each teacher had a passion for his/her subject that was expressed throughout the lessons. I believe that educators can make any subject interesting and enlightening by showing excitement and relating the material to their students. After observing the different educators I began to realize that these teachers were capable of monitoring the class for opportunities to involve students in activities that are interesting and also enhanced the students’ understanding and comprehension.

[Students demonstrated] real interest and knowledge in astronomy, and [I noted] some very profound connections, revelations, and understanding of some of the principles and mechanisms of evolution during Dr. Rob Kiely’s dynamic lecture and visual history of science, which extracted a very rapid and surprising comprehension of sophisticated scientific thought from Aristotle to Darwin.

The first day was a struggle for the counselors and aspiring teachers. We discovered during that first morning where our personal levels of tolerance and patience were. Many of us realized how frustrating it was to us to see the students frustrated and not getting the answer that many times we just wanted to give them the answer so that we could move on. I think this is typical for many aspiring teachers because we have high expectations for all of our students and we don’t always have all the tools we need to take a step back and guide the students through the process.

This experience was not only one of the most rewarding experiences of my life but also an affirmation of my desire to be an educator.

There is no better way to make sure teaching is right for you but by experiencing and spending almost all of your time with children for five days.

The 2006 summer science program proved to be a very successful program for students, pre-service teachers, and master teachers as well. In fact, several faculty asked to be more deeply involved in the design and delivery of future NCSSMST summer science programs. After three such programs, NCSSMST has demonstrated that this opportunity is an effective and replicable model for reaching under-served student groups. What we found to be especially powerful, as evidenced in the preceding comments, was the change in perspective that this program caused among our pre-service teachers. They were challenged by the divergent thinking of the middle school students, they were surprised by the varying academic backgrounds that these students brought with them, and they were certainly rewarded by the intellectual engagement with students and master teachers. It is our hope, then, that as NCSSMST explores new ways to engage talented young students, we also should look to cultivate the talents of young and talented teachers.

