

## Conclusions and Future Work

Based on the rich experience that was gained by the Hope students, high school students, and local teachers, we consider this innovative pilot a success. In the future, the goal is to make the course component of this program self-sustaining by attracting at least six Hope students to this course each summer, allowing the Education instructors to be supported by tuition revenue. All Hope students enrolled in the course will be encouraged to apply to become a lead instructor in the Hope Summer Science Camps or the STEM Academy program. If accepted, they will be paid to teach in the camp program as a lead camp instructor. The revenue from the Academy or Hope Summer Science Camps tuition will be used to fund equipment, materials, and camp instructor salary. Future STEM Scholars may also apply for HHMI support to carry out their education research project. This will allow them to have a reduced instructional load in camps or academies while they carry out their research.

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APS  
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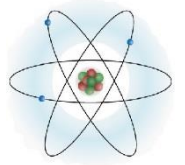


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## Center for STEM Inquiry: STEM Scholars Program

**Dr. Vicki-Lynn Holmes, Carrie Dummer, Susan Ipri Brown,**

**Dr. Cathy Mader**



 **Hope** COLLEGE

Pre-College Conference  
Innovation Exposition 2013

## Abstract

This project engages science or math education majors in education research projects via coursework and intensive field placements. A May term STEM methods course includes pedagogical and curriculum instruction. The Hope STEM scholars then implement inquiry-based, action research as co-leaders of two STEM Academies - summer inquiry experiences for high school students.

## Innovations

- New course offering that blends Science and Math secondary methods
- New requirement for Hope students to complete an intensive education action research project within the course framework
- Field placement for Education students is immersive and comprehensive. They are the leaders of the classroom.
- Expands offerings of Hope Science Camps to high school students
- Expands opportunities for teachers to attend STEM workshops at Hope College
- Expands the influence and presence of Hope College STEM in the K-12 community
- All curriculum is aligned to the Next Generation Science Standards, which emphasize holistic and in-depth STEM topics and goals

Quotes from STEM Scholars regarding the course and research experience:

“I have grown leaps and bounds this summer as a future educator through the STEM research. Applying strategies and various pedagogical approaches learned in the Methods course has taught me a lot of what it takes to be a teacher. I feel more prepared and a lot more confident now for my future field placements and teaching jobs in the future. This research has prepared me well for what is ahead of me in education.”

“This research has helped me find my passion. I enjoyed every second of it! From connecting with students to writing curricula, I really feel prepared for what's ahead of me as a future educator.”

“The hybrid course helped me in understanding the difference between research in education and research in the natural applied sciences. In the past three years, I have been involved with summer undergraduate research in biochemistry and had become very accustomed to a certain style of research that would be difficult to transfer to the classroom. With the experiences from this hybrid course I now know and understand the flexibility, the methods of collecting data, and the *Action Research* component that is so vital to research in education. In addition, I very much enjoyed the field placement because I saw my students every day for six hours for an entire week. I felt like I got to know them better than I ever have any of my other students from other field placements. “

## Results

Each STEM Scholar chose a project to do during the academy, such as the impact of computer simulations on learning in the science classroom, using project-based learning to keep high school students engaged in the science classroom, and how a summer academy learning environment affects student performance and attitude.

The STEM Scholars then compiled their results and research experience into a poster presentation that was shared at both the Central Michigan Universities SUMMR conference and the Michigan Council of Teachers of Mathematics Conference. The results will be further disseminated at various scholarly meetings and conferences throughout the 2013-2014 academic year. This project gave the STEM Scholars experience in authentic STEM education research and helped them to develop skills that will enable them to be STEM instructional leaders as they enter the teaching profession.

The high school students and teachers who attended the academies and workshops greatly appreciated the access to advanced instrumentation as well as subject level experts. Additionally, being on campus and experiencing parts of college life, such as eating in the dining halls and listening to college students, made a large impact on them. Hopefully, this experience for the high school students has significantly impacted their impressions of attending college and/or Hope in the future. The majority of the high school students would like to return next year and even attend for multiple weeks.

## Background

The traditional course offerings for secondary education majors include taking methods courses in the content areas of which they will be future teachers. Methods courses introduce multiple instructional strategies and pedagogy to the pre-service teachers. They then demonstrate their knowledge of these methods and their ability to apply them by teaching demonstration lessons to their classmates on campus as well as completing 12 hours, spread out over an entire semester, in a field placement in a local K-12 classroom. This approach has worked well in the past, but with the increasing emphasis on STEM initiatives and providing pre-service teachers with increased practicum experience, it was decided to develop a hybrid Math/Science or STEM methods course that immersed the Hope students more fully in to a classroom experience and challenged them to do action research – proactively trying different instructional methods to see how the achievement of students can be impacted. This project has the added benefit of expanding Hope’s well-respected summer science programs to more advanced K-12 students and to teachers.

## Methodology

Hope College is well known and respected for its undergraduate STEM research programs and for its summer science camps that appeal to K-8 students. The Center for STEM Inquiry, an initiative of the 2012 HHMI grant, provides a new home for K-12 STEM outreach and teacher professional development. In an effort to pique the interest of pre-college students and teachers in STEM research at Hope College, the Center for STEM Inquiry partnered with the Education Department to offer STEM academies (high school level science camps) and teacher workshops. These STEM academies and workshops were developed, refined, and led by the Hope College Education majors who concurrently took the hybrid STEM methods course. This innovative project benefits the Hope Education students by immersing them in real-world applications of STEM pedagogy and curriculum. In addition, it increases the STEM knowledge and awareness of resources and opportunities at Hope College for the high school students and teachers who participated. Three critical components of this project were:

Development of an Inquiry-based STEM Methods course which was offered as a May term course

- Co-developed and taught by Dr. Vicki-Lynn Holmes and Carrie Dummer
- Met the requirements of both the secondary education Science and Math methods courses
- Included an intensive action research project, which is not part of the academic year versions of the courses, that focused on a small area of pedagogy within the academies
- The Hope students fulfilled the field placement requirement by leading the high school academies and immersing themselves in the classroom experience by investigating the outcomes of various instructional strategies they learned during the preliminary course work

Recruitment of high school teachers and students to attend the workshops and academies

- CSI coordinated with the REACH program to include those students in the high school academies. The five REACH students started their summers in the academies, then began work in their host research labs
- Susan Ipri Brown contacted local public, private, and charter schools, as well as the Allegan, Kent, and Ottawa Intermediate School Districts to recruit high school students for the academies and teachers for the workshops
- A wide variety of students and teachers from the greater Grand Rapids / Holland/ Muskegon/ Lansing areas attended

Logistical preparation and running of the workshops and academies

- Two academies were offered in the summer of 2013: Nuclear Forensics Investigations and Watershed Investigations
- Hope STEM Scholars in the May term STEM methods course developed and refined curricular materials that were utilized in the Hope STEM Academies
- Both Susan Ipri Brown and Dr. Cathy Mader assisted the Hope Education students in preparing the materials and schedule for the STEM Academies.
- The Hope Education students led the high school academies alongside experienced teachers Drew Isola from Allegan HS and Jennifer Soukhome from Zeeland West HS