

## CINSAM & KCM at NKU

Presented to CPE STEM Task Force, December 19, 2006

The Colleges of Arts and Sciences and Education and Human Resources work to provide the teachers needed for the classrooms of Northern Kentucky. Some highlights of this preparation include:

- Special math class for elementary teachers in probability & statistics, number theory & algebraic reasoning, and geometry & measurement.
- For middle grades teachers, a class in geometry has been reconfigured and one in algebra is under consideration
- Preservice teachers are placed for practicum classes with teachers who have participated in grant classes and workshops.
- MAT students in math and science previously had careers in fields such as engineering and computer science.

The two units that coordinate much of the STEM related activity on the NKU campus and beyond are the Center for Integrative Natural Science and Mathematics (CINSAM) and the Kentucky Center for Mathematics (KCM).

The mission of CINSAM is to enhance the teaching, learning, and applying of Science and Mathematics at NKU and in the schools of the Northern Kentucky region through interdisciplinary collaboration. Established by the Council on Post-Secondary Education in 1999 as the Program of Distinction at NKU. CINSAM works to prepare learners for transitions at all levels – to pass from elementary to middle grades; to high school; to college, to advanced studies and/or work. CINSAM works to coordinate activities among faculty in the sciences and mathematics from the Colleges of Arts and Sciences, or Education and Human Resources, and of Informatics.

We'll first discuss some of the means by which we prepare students for success in science and mathematics. I'll give some examples where our faculty and students take programs out to local schools. Next I'll describe programs where we bring students to campus for the day and I'll talk about some of the camps that bring students to campus for longer stays. Finally I'll describe our work with local teachers.

CINSAM works with NKU faculty and students to coordinate a variety of programs offered to our local schools. One good example is the Tour De Force program offered by Matthew Zacate of our Physics department in collaboration with Lenore Kinne of our College of Education. They developed a series of demonstrations for middle grades students, demonstrations designed to force students to reconsider their understanding of forces and their effects. After beginning this program with CINSAM funds and support, they received funding from the American Physical Society to expand the scope of the program.

**This aspect of our work reaches over 1900 students and more than 90 teachers; involving the collaboration of nearly 30 NKU faculty and students.**

Several programs bring students to campus for a day of science or math activity. Middle School Math Day brings more than 200 eighth graders and their teachers to campus. The students work in large groups with faculty on topics like probability or mathematical magic tricks. They also work in small groups with education students who have developed interactive projects that engage the students in activities related to the KY core curriculum in Math at the 8<sup>th</sup> grade level. Why 8<sup>th</sup> Grade? Because CATS tests mathematics in that grade.

We also host several other day-on-campus visits by schools such as the WEB Dubois Academy, Withrow University H.S., and Cincinnati Christian School some that are predominantly African-American.

**All together, we bring more than 1000 students and 40 teachers to campus with the help of many NKU faculty and students.**

Summer Camps provide for longer and deeper interactions between students and NKU faculty and facilities. A few examples of camps that reach across the disciplines and grade levels are Robotics camps for students from elementary through middle grades, Math Mystery Camp, Engineering Technology camp, and JAVA programming camp. Other Camps such as Fun with Science or Sports Plus reach out to traditionally underserved groups of students; Hispanic high school students in the first case; inner city youth in the case of the second camp.

CSI Camps based on the Crime Scene Investigator theme have been extremely successful. We offer 3 camps to students at grades 6-12, reaching well over 100 students. One group of experienced 9<sup>th</sup> graders in the CSI II camp had to work with police dogs to locate a buried “body” (lab skeleton seeded with decayed chicken meat). They had to take the body into the lab and use physical characteristics to identify the sex and age of the victim. They learned about Forensic Entomology and used the characteristics of the maggots identified with the body to estimate the time of death.

**Approximately 1600 student days are spent in summer camps run with the assistance of 45 NKU faculty and local teachers.**

PREPARING TEACHERS: We work to help teachers by training our own students who are prospective teachers as well as offering a variety of activities for teachers in the field. We offer Integrative Natural Science and other natural science courses that are offered to prospective teachers using best practices in science education. I'm also going to describe our South Counties Project where we are working collaboratively with a number of districts.

ALLIANCES: Science and Mathematics alliances are groups of school teachers and University faculty who are focused either on a disciplinary topic or at a particular grade level. Each alliance has a teacher leader and University colleague who organize the group. All alliances gather in the fall for CINSAM night where they hear an invited speaker (last year a NASA Scientist who leads the Astrobiology Initiative) and plan for the coming year.

Each alliance is expected to host at least two activities each fall and spring. They are provided a modest budget for program expenses plus a stipend for the teacher leader.

**We foster interactions between over 440 teachers and 46 University (and even TMC) faculty.**

TEACHER WORKSHOPS: Many topics have arisen out of the Alliance meetings. For example, teachers requested assistance with the new Core curricula in science and mathematics, so CINSAM brought in experts who helped teachers address their concern.

We also offer workshops in topics like Forensic Science and afterwards engage the teachers as leaders in our CSI camps. This gives them the opportunity to practice what they have learned under the supervision of university staff.

**Through these workshops, 21 presenters (both from NKU and from outside the University) have interacted with more than 500 teachers.**

SOUTH COUNTIES SCIENCE: Using funds from a congressional award received with Sen. McConnell's assistance, CINSAM developed a program to work with several counties in the south of our service area.

Working closely with school leaders from these districts, we developed a program that was primarily staffed by Reeda Hart, a CINSAM instructor.

In the first year she did professional development on hands-on science instruction for the 4<sup>th</sup> grade teachers. She demonstrated best practices in their classes then worked with the teachers as they gained confidence in implementing them. The schools took this to the point where they each developed a "Science Day" program for their schools. The elementary students split their time between learning some science from NKU faculty and students and sharing in presentations by the 4<sup>th</sup> grade students on topics they had studied during the year.

OUTCOMES: The outcomes can be seen in the increase in 4<sup>th</sup> grade CATS scores over three years at the schools that fully implemented the program. This marked increase has been sustained without extensive continued intervention by Reeda.

This program has been featured in a Kentucky Department of Education DVD production on the teaching of science using inquiry-based methods as well as in a statewide television presentation on the same topic. That DVD and related materials are in circulation throughout the state as well as outside the state.

**COMMUNITY ENGAGEMENT:** Measuring interactions with teachers and students is an indication of effort and these numbers show the work that is being done by Math/Science and education faculty in collaboration with CINSAM.

CINSAM work with the South Counties schools produced more than 900 teacher contacts and over 8000 contacts with students.

In 2005-06 we worked with nearly 2000 teachers and almost 13,000 students.

CINSAM is also working to recruit students to STEM disciplines in general, and not just to NKU. Over the last two years, we have developed the SPIN program, that is offered in one form or another to rising high school juniors, their parents, teachers and counselors. The goal is broad but reasonably simple: Expose the students, parent, teachers, and counselors to the needed preparation STEM discipline study and to the remarkable career opportunities that study in a STEM discipline will offer these students. Underlying this is the clear delivery of what the student needs to complete in the last two years (three years in the case of freshman students being invited) in high school in order to be well prepared to succeed in the college environment.

**PREPARING SCIENCE & MATH STUDENTS:** Finally let us consider the preparation of our NKU science and mathematics students. I'll discuss some of the ways we are preparing our students for success.

**FACILITIES:** Another key element in the development of our students is the excellent facilities of the Dorothy Hermann Science Center. The building fosters the kind of interdisciplinary interaction that is critical to our student success. Faculty from different disciplines are intermixed in a way that

enables them and their students to interact. Labs and equipment are available for sharing and a spirit of cooperation pervades the Science Center.

The equipment is truly cutting-edge and compares favorably to that found at research institutions.

In addition the space lends itself very well not only to teaching and research but also to outreach. It is because of the cooperative nature of our departments that we are able to have access to so much of the best equipment and teaching spaces for work with school kids.

**UNDERGRADUATE RESEARCH:** One of the ways we engage our students in our disciplines beyond the classroom is through undergraduate research. Undergraduate research was alive at NKU before 2000 but with the inception of CINSAM to support research and the Science Center to house it, research has grown at a phenomenal rate.

Faculty apply for and receive grants from CINSAM to work with undergraduate students on research (an average of \$130,000/yr. over the last 5 years)

Faculty are also provided with start-up funds, especially in the natural sciences where equipment costs are very high.

There has been more than 3-fold growth in research activity by undergraduates in the sciences over the last 5 years. (since the establishment of CINSAM & Science Center) This does not show the whole picture since it does not include mathematics, computer science, or education where growth has also occurred.

**EXTERNSHIPS:** Another way we involve our students in experiential learning is through applied work on externships, i.e. business or industry projects brought into the University. Our mathematics and statistics students are engaged in analysis of projects both internal and external to the University in the Burkhart Consulting Center.

Science students work on projects of value to local industry in our labs using some of our advanced equipment. Just this summer some physics students worked on physical characteristics of potential products in the “household odors” business while biology students did some molecular biology analysis related to the equine industry. Both of these are for new firms that are looking to create products and potentially manufacturing jobs in our region.

CINSAM assists in this activity by providing training funds for students as they “learn the ropes.” We also work with the departments to fund positions for technicians to operate, maintain, and provide instruction on equipment such as our SEM/X-ray diffraction devices or our high-end chemical analysis equipment.

**EXTERNAL:** Research funding has grown at a high rate over the last 5 years. CINSAM-related departments were bringing in about \$100,000 per year before 2001. With the influx of new faculty, many with start-up funds and programs of research that could involve undergraduates, our annual funding has grown to around \$3.5M in the last couple of years.

More than 75% of this funding is attributable to faculty who have received “seed-money” support in one way or another from CINSAM.

**KCM:** Established by **House Bill 93:** The Kentucky Center for Mathematics has been charged to make available professional development for teachers in reliable, research-based diagnostic assessment and intervention

strategies, coaching and mentoring models, and other programs in mathematics.

Responding to strategies set by the statewide Committee on Mathematics Achievement, the Center has achieved a great deal in its first year, including:

- Developing a clearinghouse including the website: <http://www.kentuckymathematics.org> with resources from around the world for parents, teachers and students in addition to the mathematics coaches and mathematics intervention teachers served by the Center;
- Coordinating training and ongoing mentoring for 45 Mathematics Intervention Teachers (MITs), who are currently serving nearly 2000 primary students; KDE will choose 40 additional MITs for 2007 – 08
- Training and mentoring 67 mathematics coaches currently serving nearly 800 teachers; we hope to add an additional 120 coaches for next year.
- **Research on the efficacy of the programs of Intervention and diagnosis as well as coaching and mentoring**
- **Faculty Research** - Three faculty members at three of the public universities are currently conducting research through KCM Faculty Research Grants.  
Five faculty members at four of the public universities have applied for KCM Faculty Research Grants for Spring - Summer 2007. The KCM has funded four of these proposals.

KCM collaborates with numerous statewide agencies and boards in its work and is working on developing programs to assist Adult Education unit of CPE.