NWO
COSMOS
Center Of excellence in Science and Mathematics education: Opportunities for Success
SciMaTEC
Science, Mathematics, and Technology Education Center

Northwest Ohio Center of Excellence in Science and Mathematics Education

coordinating partners
BGSU. OWENS COMMUNITY COLLEGE THE UNIVERSITY OF TOLEDO 1872

NORTHWEST OHIO CENTER OF EXCELLENCE IN SCIENCE AND MATHEMATICS EDUCATION (NWO)

2007 ANNUAL REPORT

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Table of Contents

NWO Mission

The Center's unified mission is to advance science, technology, engineering, and mathematics (STEM) education for people of all ages.

NWO Vision

The Northwest Ohio Center of Excellence purpose is to work with community partners to (a) generate new knowledge about the science of teaching and learning, (b) apply this knowledge by developing the expertise of K-12 educators and higher education faculty, (c) increase public support for, and understanding of, the STEM subject areas, and (d) to stimulate the interest of young people, especially those in underrepresented groups, in these rewarding fields of study and career opportunities.

Acknowledgments

We would like to acknowledge the critical support we have received from the Ohio Board of Regents, the Ohio Department of Education, and our partnering higher education institutions, business and community organizations, and local school districts. We would especially like to acknowledge the contributions of the many active members of our NWO team. The dedication, passion, competence, and subsequent contributions of this team are far reaching.

NWO 2007 Annual Report ~ An Introduction

In this report, we provide both quantitative and qualitative measures documenting the effectiveness of our collective activities and accomplishments to unfold the evolving storyline of NWO during the 2007 fiscal year. This year, we again organized and enacted an intense public relations campaign, investing both time and financial resources to design, develop, and disseminate the NWO concept (rather than university/college-specific), public relations, and advertising materials to further demonstrate our commitment to a unified center approach. The new identity is taking hold, as more and more individuals throughout the region and state now understand that NWO, COSMOS, and SciMaTEC are partner organizations.

In addition, the NWO Executive Board now meets semi-annually (September and May) with approved bylaws that guide the regional efforts. As a result, Owens Community College (OCC), Lourdes College (LC), The University of Findlay (UF), and a number of community and business organizations such as the Toledo Zoo and COSI-Toledo have become active and passionate NWO collaborative partners.

An important and unfortunate turn of events occurred during the year. The SciMaTEC Director left the University of Toledo. A search for a new SciMaTEC Director has been unsuccessful. This leaves the University of Toledo's role in the Center uncertain, as no other active NWO faculty members from the University of Toledo have emerged to take on the roles and responsibilities assumed by the outgoing Director. As such, the NWO Executive Board recommended that the University of Toledo subcontract award for FY 2008 be opened up to the entire region so that the work performed under the outgoing SciMaTEC Director could still be accomplished using regional resources. The NWO Symposium and the Future Teachers Conference are the two primary activities that were in jeopardy of being abandoned. As such, the NWO Regional Grants to Partners program was established and will be in effect during FY 2008 (Appendix A) so that faculty and

education leaders across the region can apply for funds to carry out these two annual NWO activities and other new NWO collaborative activities. We anticipate that this change in funding structure will enhance the accountability of scope of work completion and will facilitate a regional approach to NWO funding opportunities.

The Center has continued to work hard to gain and maintain the respect and collaboration from our partner schools, including four high-needs districts (Fremont City, Fostoria Community, Lima City, and Toledo Public) as well as smaller districts and county educational service centers (ESCs) including Bowling Green City, Maumee City, Perrysburg, Springfield Local, Hancock County ESC, and Wood County ESC, among others. During 2007, we established the COSMOS Collaborative Council (CCC) bringing together our school partners (teachers, principals, curriculum directors, and superintendents) once a month for regular planning and dissemination opportunities. We believe the CCC has become an integral component of the Center and has helped us ensure true school-university-community partnership arrangements.

NWO has a clear and specific focus on providing K-16+ professional development in science and mathematics, both in content and pedagogy, and developing new knowledge in the teaching and learning of science and mathematics. As a regional center, we aim to provide services appropriate and meaningful for all individuals and groups interested in joining our professional community. Often, non "high-needs" districts or individual teachers get left out of state-level professional development plans, yet our regional needs assessment indicated a strong desire and need for high-quality professional development in science and mathematics across the 19 county area, especially in rural communities. As such, NWO hosts meetings and events that are open to all pre-service and in-service teachers, higher education faculty, and other community partners across the region. In total, 897 pre-service teachers, in-service teachers, and higher education faculty actively participated in at least one Center activity during the 2006-07 academic year.

We are equally committed to identifying high-needs partners (defined by low student pass rates on Ohio achievement tests, high poverty level, or lower percentages of employed highly qualified teachers within the district) that desire high-quality, rigorous, and sustained professional development. Our approach then is two-tiered: to provide high-quality professional development opportunities for interested individuals and smaller non-high-needs school groups, and also to provide systemic professional development opportunities to a few targeted high-needs groups through both NWO activities and through our affiliated sponsored projects (COSMOS DREAMS, NWO TEAMS, REAL, Improving Teacher Quality Grants, etc.) that will result in changes at the institutional level (school, district, college, university).

Our diverse efforts, described in detail below, fall into four categories:

- In-service professional development
- Pre-service professional development
- Faculty development and collaborative research
- Affiliated projects

These efforts help us attain the vision, mission, and goals of the Center. The goals for 2008 are slightly restructured, placing more emphasis on recruitment into STEM and STEM education disciplines and in conducting collaborative research in science and mathematics education than in years past. This alteration is possible because the professional development and collaborative alliance goals require much less time and fewer human resources now that they are well underway and beyond the initial time and resource-intensive development phase.

NWO Goals for FY 2007

Goal 1: Increase the capacity of urban and other at-risk districts to enhance student achievement in science and mathematics through partnerships among universities, K-12 schools, and the Ohio Resource Center.

Goal 2: Increase the recruitment of pre-service and retention of in-service teachers of science and mathematics.

Goal 3: Improve in-service teacher preparation and faculty development in science and mathematics education.

Goal 4 Strengthen coordination/communication among college faculties (teacher education, sciences, and mathematics) and with funding agencies to improve the sustainability of the Center.

Goal 5: Establish ongoing collaboration among institutions of higher education, school districts, professional development centers, and the Ohio Resource Center to identify and solve root barriers to science and mathematics achievement.

NWO Activities and Accomplishments

NWO attained the stated goals through the following aligned activities:

In-Service Teacher Professional Development

Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching

For the last four years, the Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching (NWO Symposium) has brought together hundreds of participants to exchange effective strategies for teaching science and mathematics. This popular event has provided the Center with huge visibility in the community, attracting teachers to our long-term professional development opportunities, and giving all participants resources and ideas they can use in their classroom or setting. Because of our growing success, the 2006 Symposium continued in its two-day format, allowing us to increase the number of sessions available for higher education and K-12 instructors. This NWO Symposium was attended by 325 participants (pre-service and in-service teachers, faculty, and NWO staff). Participants noted the impressive variety of the sessions and vendors, were pleased with more content, and had an overall positive experience. NWO will continue to expand this showcase event and adapt it to reflect emerging needs of our partners. In addition, as the profile of this event continues to grow, we continue to attract more prospective presenters; we can be increasingly selective in our presentations and offer a symposium that highlights the best in science and mathematics professional development. The 2006 NWO Symposium program is included in Appendix B.

NWO/COSMOS Inquiry in Science and Mathematics Education Series

Sustained professional development is also offered by NWO through its academic year NWO/COSMOS Inquiry Series. The Inquiry Series continues to be a highly popular professional development opportunity in the region. The Inquiry Series is also a monthly platform for the affiliated NWO projects to bring together their project participants for project-specific professional development (action groups) or general professional development (feature presentations). Monthly Inquiry Series meeting and action groups were attended by an average of 133 participants/month during the 2006-07 academic year–an increase of almost 80%. The Inquiry Series is open to any teacher, faculty member, or school community partner in the region, and participants can opt to attend only one or all Inquiry Series events. Tuition scholarships are available through a cost share of the BGSU Graduate College. During the 2006-07 academic year, 15 actively participated in the entire series for two hours of graduate credit.

The theme for the 2006-07 series was Investigative Science and Mathematics (see Inquiry Series brochure, Appendix C). The series started with a Blast-Off in the fall during which we featured a nationally recognized speaker in science/mathematics teaching, Lawrence Lowry. Participants then chose a breakout session presented by COSMOS faculty and partners showcasing high-quality

investigative mathematics or science. Subsequent monthly Inquiry Series meetings featured interactive presentations and content- and grade-specific learning communities (COSMOS action groups) facilitated by K-12 teacher leaders. The series concluded with a Summit in late spring during which NWO partners shared lessons they developed during the year and action research they conducted on student learning in science and mathematics. Participants, including pre-service teachers, in-service teachers, MAT graduate students, NWO TEAMS participants, COSMOS DREAMS participants, school administrators, and higher education faculty, rated sessions highly. Feedback focused on the opportunities to develop a great support network, get assistance in developing lesson/curriculum plans, learn how to go about inquiry in the classroom, and gain awareness and preparedness to help students reach the Ohio standards and succeed on OGT/achievement testing. NWO/COSMOS will continue to expand this sustained professional development and adapt it to reflect emerging needs of our partners.

MAT Programs

Currently, COSMOS offers tuition scholarships to study both content and pedagogy through BGSU's Master of Arts in Teaching (MAT) programs. The coursework for these programs has been developed in part by COSMOS faculty to blend content consistent with the Ohio Standards with research-based pedagogical techniques. The physics MAT program offers a three-year-long professional development experience and has successfully created communities of teachers that persist even after they complete the program. In 2006-07, 14 students received full tuition MAT scholarships (four mathematics, eight physics, and two biology education). A total of 158 graduate credit hours were completed by MAT students, subsidized by COSMOS and the BGSU Graduate College at an expense of $74,400. Due to the COSMOS DREAMS grant program, many efforts are underway to expand and enhance the MAT offerings at BGSU including revised coursework in the sciences and

mathematics and a new interdisciplinary science MAT program geared towards middle-grades teachers (approximately 35 teachers are projected to be enrolled in this program). Five teachers received their MAT degrees this summer, including this physics MAT participant:

I want you (and all those who run COSMOS) to know how much I appreciated everything (classroom resources, teacher to teacher interaction, scholarships, etc) I received during my MAT program. I still plan on attending COSMOS events even though I am finished and if there is any way I can help out let me know. COSMOS has given me a lot, I'd like to give back if I can!

NWO K-12 Larabee Mini-Grants and K-16 Professional Development Grants

NWO sponsors $2,000 mini-grants for school/university partnerships that aim to promote the NWO vision and goals. The grants are named after a master science and mathematics teacher in the region who tragically lost his life in 2005. The NWO Larabee grant application process information and documents are found at the NWO website (http://www.nwocenter.org). All grant recipients disseminate their project information at an NWO event, such as the Blast-Off, Symposium, and/or Summit.

In spring 2007, a K-12 mini-grant was awarded to a local physics teacher to run a professional development workshop entitled The Physics of Cell Phones and Wireless Communications. The application form for participants is included in Appendix D. The final project report is available upon request.

Pre-Service Teacher Preparation and Recruiting

Ohio Junior Science and Humanities Symposium

The Ohio Junior Science and Humanities Symposium brings the best and brightest talents from Ohio high schools together for a competition to highlight and judge the quality of their research projects in the sciences and humanities. We believe this event is an excellent opportunity for the recruitment of the next generation of teachers. The overall evaluation rating of the 2007 OJSHS by the participants was 4.8 on a 5-point scale. Participants remarked on the organization of the event, professional working atmosphere, and recreation/ entertainment. Some of the comments were:

Fostering respect and congeniality of participants was wonderful this year

The OJSHS was an interesting way to enjoy the study of science. Very fun!

We will continue to expand the organizations involved in this event and use it to recruit students into the fields of STEM and science and mathematics education. This event is co-sponsored by NWO and a grant from the United States Army, Navy, and Air Force.

BG-UT SECO and CTM

BG-UT Science Education Council of Ohio / BG-UT Council of Teachers of Mathematics undergraduate professional organizations hosted monthly activities to promote active involvement in the profession prior to graduation. These organizations showed growth from 85 participants in 2006 to 190 undergraduate students attending events this school year. We will continue to expand this organization and use it to recruit and retain students into the fields of science and mathematics education.

Praxis II Preparation Workshop

A total of 17 students attended the Life Science Praxis II Preparation Workshop and 12 students attended the Integrated Mathematics Praxis II Preparation Workshop on Saturday, February 24, 2007, from 12:00 noon until 5:30pm. Two teachers from the Akron area presented the mathematics workshop. Dr. Eileen Underwood, Associate Professor in the Biology Department at BGSU, presented the life science Workshop. Students paid $25 each to attend the workshop with the remaining costs subsidized by various stakeholders: COSMOS, BGSU College of Arts & Sciences, BGSU School of Teaching and Learning, and BGSU College of Education & Human Development. Students continue to ask for workshops at other times of the year and for the other science areas. In the future we will consider these requests and also how to address the needs of students who attend our other partner institutions.

Faculty Development and Involvement

Teacher Education Course Redesign/Development

A critical component of pre-service and in-service teachers' professional development is their content and pedagogy coursework. Center funds are earmarked for the development and modification of teacher preparation coursework. At BGSU five new university courses, whose development was supported by NWO funding, are currently offered (two in mathematics and three in the sciences). We will continue to infuse best practices into these courses so that teachers do not face a mismatch between the teaching advocated in their education courses and the teaching methods employed in their science and mathematics content courses. The titles and descriptions of courses developed to date are included in Appendix E. Developed syllabi and supporting documents for these new courses are available upon request.

Research Learning Community

In the COSMOS Research Learning Community, faculty read and discuss top-tier research on science and mathematics education and present their own research, (design and develop new collaborative projects, discuss work in progress, or share the findings from a completed study). Importantly, presenters receive feedback from their peers and discuss new potential collaborative research project ideas. An average of 30 higher education faculty and center staff representing 16 departments and three colleges participated in the COSMOS Research Learning Community during the 2006-07 academic year. As a result, approximately 13 new collaborative research projects were launched during this time. This Research Learning Community was highly rated by faculty participants for establishing a sense of community among other researchers and teachers across the university, developing new research methodologies and refining research designs, gaining a background in science education, and enriching interdisciplinary awareness.

Research in Science and Mathematics Education Learning Community ~ Fall 2006 Schedule

Meeting Date	Presenter – Title of Presentation	Discussant
1. August 31	N/A	**Thurs: Jodi Haney** Goswami, U. (2006). Neuroscience and education: From research to practice? *Nature Reviews Neuroscience* 7, 406-413.
2. September 13 / 14	N/A	**Wed & Thurs: Mandy Heddle** Slotta, J., & Chi, M. (2006). Helping students understand challenging topics in science through ontology training. *Cognition and Instruction*, 24(2), 261-289.
3. September 27 / 28	**Wed: Dale Klopfer** *Peaks and Valleys in Geoscience Education Research* **Thurs: Chris Keil** *Preparation of Science Teachers to Do Scientific Inquiry*	**Wed: Tracy Huziak-Clark** Brown, B. (2005). "It isn't no slang that can be said about this stuff." *Journal of Research in Science Teaching*, 43(1), 96-126. **Thurs: Eileen Underwood** Slish, D. (2005). Assessment of the use of the jigsaw method and active learning in non-majors, introductory biology. *Bioscene*, 31(4), 4-10.
4. October 11 / 12	**Wed: Matt Partin** *A Potential Study of Student's Attitudes* **Thurs: Karen Sirum** *Design and Implementation of an Inquiry-Based Science Course*	**Wed: Jude Edminster** Kelly, G., Chen, C., & Prothero, W. (2000). The epistemological framing of a discipline: *Writing science in university oceanography. Journal of Research in Science Teaching*, 37(7), 691-718. **Thurs: Karen Sirum** Facione P. A., Facione N. C., and Giancarlo, C.A. (2000). The disposition toward critical thinking: Its character, measurement, and relationship to critical thinking skill. *Informal Logic*, 20(1), 61-84.

Research in Science and Mathematics Education Learning Community ~ Fall 2006 Schedule cont.

Meeting Date	Presenter – Title of Presentation	Discussant
5. October 25 / 26	**Wed: Jude Edminster** *Remediating Scientific Writing* **Thurs: Rick Worch** *Lesson Study in Preservice Science Teachers*	**Wed: Holly Myers** Arvai, J. J., Victoria, E. A., Baird, A., & Rivers, L. (2004). Teaching students to make better decisions about the environment: Lessons from the decision sciences. *The Journal of Environmental Education*, 36(1), 33-44. **Thurs: David Meel** Habre, S., & Abboud, M. (2006). Students' conceptual understanding of a function and its derivative in an experimental calculus course. *Journal of Mathematical Behavior*, 25, 57-72.
6. November 8 / 9	**Wed: Amy Scheuermann** *Explicit Inquiry: A Combination of Explicit Instruction and Inquiry Learning* **Thurs: David Meel** *Interplay of Geometry and Calculus: A Look at a Pythagorean-Based Related Rate Problem*	**Wed: Barbara Moses** Hill, H. C., Rowan, B., & Ball, D. L. (2005). Effects of teachers' mathematical knowledge for teaching on student achievement. *American Educational Research Journal*, 42(2), 371-406. **Thurs: Chris Keil** Bilgin, I. (2006). The effects of hands-on activities incorporating a cooperative learning approach on eighth grade students' science process skills and attitudes toward science. *Journal of Baltic Science Education*, 1(9), 27-37.
7. November 29 / 30	**Wed: Tracy Huziak-Clark** *I Already Know What Inquiry Is! Teacher/ Scientist Changing Attitudes and Practices Using Inquiry in the Science Classroom* **Thurs: Bob Midden** *A Scientific Basis for Deciding What Students Should Know and Be Able to Do*	**Wed: Dale Klopfer** Slotta, J., Chi, M., & Joram, E. (1995). Assessing students' misclassifications of physics concepts. *Cognition and Instruction*, 13(3), 373-400. **Thurs: Bob Midden** Laugksch, R. (2000). Scientific literacy: A conceptual overview. *Science Education*, 84(1), 71-94.
8. December 13 / 14	**Wed: Holly Myers** *Engaging Lake Wobegon Men in the Science Classroom* **Thurs: Steve Van Hook** *Researching Elementary Students' Understanding of Motions*	**Wed: Amy Scheuermann** Kroesbergen, E., Van Luit, J., & Maas, C. (2004). Effectiveness of explicit and constructivist mathematics instruction for low-achieving students in the Netherlands. *Elementary School Journal*, 104(3), 233-253. **Thurs: Steve Van Hook** Heron, P. R., Loverude, M. E., Shaffer, P. S., & McDermott, L. C. (2003). Helping students develop an understanding of Archimedes' principle: Development of research-based instructional materials. *American Journal of Physics*, 71(11), 1178-1187. **AND** Loverude, M. E., Kautz, C. H., & Heron, P. R. (2003). Helping students develop an understanding of Archimedes' principle: Research on student understanding. *American Journal of Physics*, 71(11), 1188-1185.

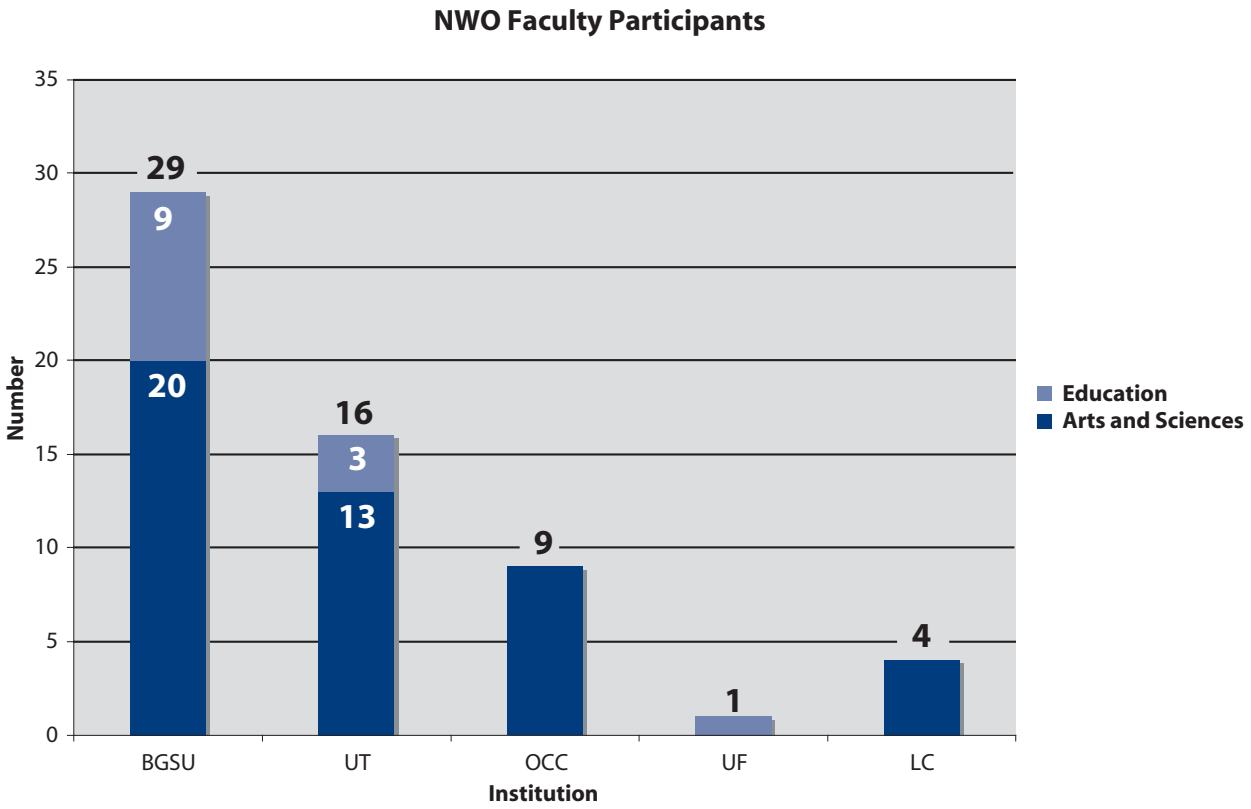
Research in Science and Mathematics Education Learning Community ~ Spring 2007 Schedule Mondays 1:30-3:00 ~ Thursdays 12:30-3:00		
Meeting Date	**Presenter – Title of Presentation**	**Discussant**
1. Jan 8/11	Mon: *Discussion of Change Forces by Michael Fullan* Thurs: *Discussion of Change Forces by Michael Fullan*	Mon: N/A Thurs: N/A
2. Jan 22/25	**Mon: Rich Oldrieve** *Teaching Literacy Is a Staircase: Metaphors as a Third-Space for Discussing Beliefs About Teaching* **Thurs: Steve Langendorfer** *Assessing Inquiry Developmentally: Hypothesized Rubrics*	**Mon: Rich Oldrieve** Mahlios, M., & Maxson, M. (1998). Metaphors as structures for elementary and secondary preservice teachers' thinking. *International Journal of Educational Researc*h, 29, 227-240. **Thurs: Steve Langendorfer** Roberton, M. A., Williams, K., & Langendorfer, S. (1980). Pre-longitudinal screening of motor development sequences. *Research Quarterly for Exercise and Sport*, 51(4), 724-731.
3. Feb 5/8	**Mon: Karen Sirum** *Bringing Critical Thinking Skills and Dispositions to the Introductory Biology Classroom* **Thurs: Yu Zhou** *Some Thoughts on Geographic Education*	**Mon: Karen Sirum** Facione, P. A., Giancarlo, C. A., Facione, N. C., & Gainen, J. (1995). The disposition toward critical thinking. *Journal of General Education*, 44(1), 1-25. **Thurs: Yu Zhou** Raento, P., & Hottola, P. (2005). Where on earth is New York? Pedagogical lessons from Finnish geography students' knowledge of the United States. *International Research in Geographical and Environmental* Education, 14(1), 5-27.
4. Feb 19/22	**Mon: Jude Edminster** *Pandora's Hope: Essays on the Reality of Science Studies* **Thurs: Bob Midden** *Assessing Student Ability to Evaluate the Scientific Validity of Scientific and Pseudoscientific Claims*	**Mon: Jude Edminster** Latour, B. (1999). Chapter two. Circulating reference: Sampling the soil in the Amazon forest. In Pandora's hope: *Essays on the reality of science studies* (pp. 24-79). Cambridge, MA: Harvard University Press. **Thurs: Bob Midden** Johnson, M., & Pigliucci, M. (2004). Is knowledge of science associated with higher skepticism of pseudoscientific claims? *The American Biology Teacher*, 66(8), 536-548.
5. Mar 19/22	**Mon: Dale Klopfer** *Spatial Ability and Success in Math and Science* **Thurs: Jodi Haney** *Developmental Sequencing of Teacher Beliefs*	**Mon: Dale Klopfer** Hegarty, M., & Kozhevnikov, M. (1999). Types of visual-spatial representations and mathematical problem solving. *Journal of Educational Psychology*, 91, 684-689. **Thurs: Jodi Haney** Guskey, T. R. (1986). Staff development and the process of teacher change. *Educational Researcher*, 15(5), 5-12.

Research in Science and Mathematics Education Learning Community ~ Spring 2007 Schedule Mondays 1:30-3:00 ~ Thursdays 12:30-3:00 cont.		
Meeting Date	**Presenter – Title of Presentation**	**Discussant**
6. Apr. 2/5	**Mon: Neocles Leontis** *Trying to Figure Out How Students Think About the Material World* **Thurs: Ann Cutler,** Field Editor of *Journal of College Science Teaching*	**Mon: Neocles Leontis** Hunt, E., & Pellegrino, J. W. (2002). Issues, examples, and challenges in formative assessment. In D. Halpern & M. Hakel (Eds.), *Applying the science of learning to university teaching and beyond* (New Directions for Teaching and Learning Series, No. 89, pp. 73-85). San Francisco: Jossey-Bass. **Thurs: Articles from Cutler's Journal** O'Neal, C., Wright, M., Cook, C., Perorazio, T., & Purkiss, J. (2007). The impact of teaching assistants on student retention in the sciences. *Journal of College Science Teaching*, 36(5), 24-29. **AND** Lord, T., & Baviskar, S. (2007). Moving students from information recitation to information understanding: Exploiting Bloom's taxonomy in creating science questions. *Journal of College Science Teaching*, 36(5), 40-44.
7. Apr. 16/19	**Mon: Julie Nurnberger-Haag** *What Do Children Have the Opportunity to Learn from Books about Shape?* **Thurs: Matt Partin** *Motivation and Constructivism*	**Mon: Julie Nurnberger-Haag** Clements, D., Swaminathan, S., Hannibal, M.A.Z., Sarama, J. (1999). Young children's concepts of shape. *Journal for Research in Mathematics Education*, 30(2), 192-212. **Thurs: Matt Partin** Palmer, D. (2005). A motivational view of constructivist-informed teaching. *International Journal of Science Education*, 27(15), 1853-1881.

Because of the overt excitement emerging from this group, a Research and Statistics Seminar was also sponsored during the spring semester of 2007. A faculty member in educational research led bi-monthly seminars focusing on various topics related to quantitative analysis. Approximately 16 faculty members were regular attendees at this forum.

Learning Sciences PhD Program

BGSU is developing a proposal for a Learning Sciences PhD program. The interdisciplinary program brings together faculty from multiple departments/units in the Colleges of Education and Arts and Sciences providing expertise in education, science and mathematics content, and learning. The PhD program focuses on preparing new faculty with a research focus on how people learn science and mathematics in a post-secondary setting. This unique program is timely, as faculty positions in science and mathematics education exist, both in the College of Education and the College of Arts and Sciences, and often these positions go unfilled as the demand has far exceeded the supply. The LSC program is designed to meet the needs of this projected shortfall by preparing faculty who can work across disciplines to meet the new challenges of the 21st century. COSMOS faculty are highly involved in the development of this new program and the current COSMOS Director is leading the process. The preliminary document was reviewed by nine Ohio institutions and was modified slightly in light of the recommendations and questions raised. The full proposal is currently in review in various units throughout the university and will be submitted to the Chancellor and the Ohio Board of Regents once university approval is attained. We foresee high levels of collaboration between this doctoral program and COSMOS.



This chart demonstrates the number of arts and sciences and education faculty associated with NWO from our five partner higher education institutions.

Many faculty from BGSU, UT, OCC, UF, and LC have been involved in some capacity, including COSMOS Inquiry Series, Action Groups, Research Learning Community, and Research Statistics Seminar; NWO Symposium; Ohio Junior Science and Humanities Symposium; NWO Executive Board; COSMOS Collaborative Council; and Learning Sciences PhD program committee.

Key Arts and Sciences faculty include:

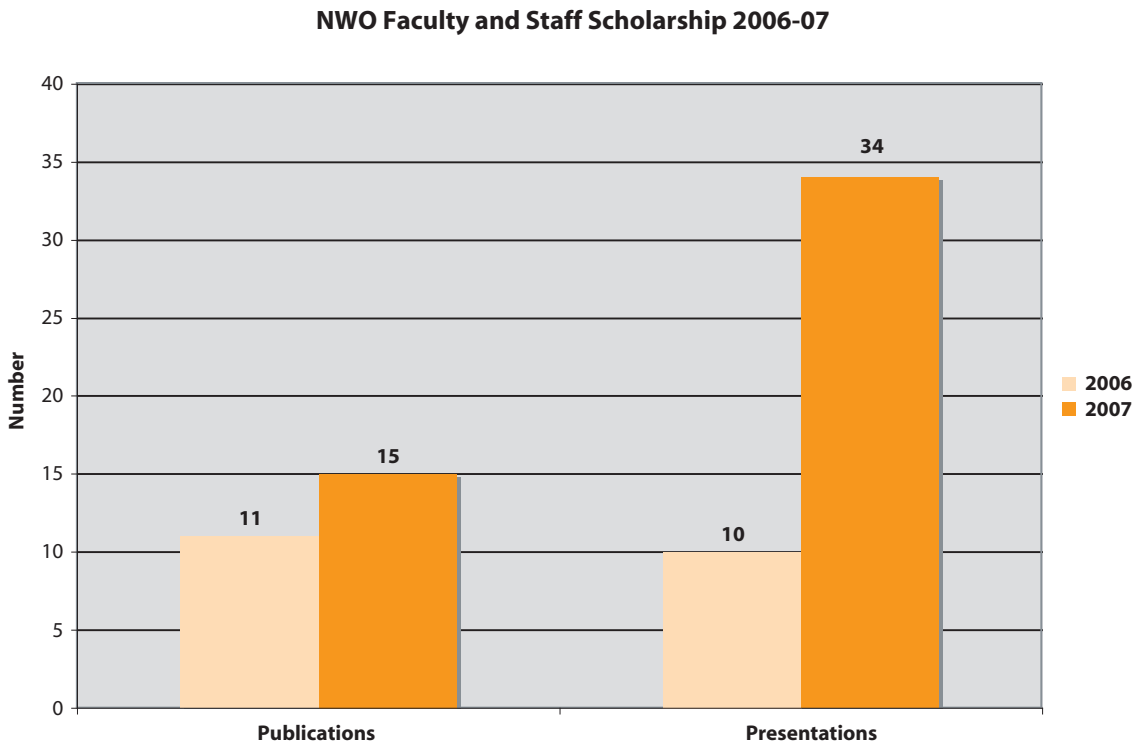
Van Hook, Laird	BGSU - Physics & Astronomy
Edminster	BGSU - English
Myers	BGSU - Environmental Programs
Klopfer	BGSU - Psychology
Moses, Carothers, Meel, Nguyen, Zhou, Filoppova	BGSU - Mathematics
Langendorfer	BGSU - School of HMSLS
Panter, Elkins	BGSU - Geology
Midden, Leontis	BGSU - Chemistry
Partin, Underwood, Sirum	BGSU - Biological Sciences
Gromko	BGSU - Vice Provost
Bullerjahn, Krompak, Roehrs, Schmoekel, Salahat	OCC - A & S faculty
Busby, Perry, Bazer, Way	OCC - Biology/ A & S administrators
Duran, Leady, Creutz, Leaman	UT - Biological Sciences
Spongberg	UT - EEES
Coleman, Escobar, Berhan	UT - Engineering
Funk, Jorgensen	UT - Chemistry
White	UT - Mathematics
Williams, Sarver	UT - Pharmacy
Czarcinski, Molitor, Wise, Gray	LC - A & S faculty

College of Education faculty include:

Haney	BGSU - School of Teaching and Learning and The Center for Environmental Programs, Science and Environmental Education (Joint Appointment).
Ballone-Duran, Huziak-Clark, Worch	BGSU - School of Teaching and Learning, Science Education
Brahier, Emerine, Gallagher	BGSU - School of Teaching and Learning, Mathematics Education
Mertler	BGSU - School of Leadership and Policy Studies
Scheuermann	BGSU - School of Intervention Services
Macintosh	UF - AYA and Multi-Age Program Director
Pindiprolu	UT - College of Education, Dept of Early Childhood, Physical and Special Education
Beltyukova, Fox	UT - College of Education, Dept of Research and Measurement

BGSU - Bowling Green State University **UF - University of Findlay**
LC - Lourdes College **UT - University of Toledo**
OCC- Owens Community College

NWO Faculty and Staff Scholarship



This chart demonstrates the growth of NWO/COSMOS faculty and staff scholarship during the period FY 2006 through FY 2007. Appendix F contains a bibliography of FY 2007 publications and presentations. Appendices G-L contain copies of publications by NWO/COSMOS faculty and local newspaper articles about NWO/COSMOS and affiliated programs.

Affiliated Projects

COSMOS DREAMS (Developing Regional Excellence for Achievement in Mathematics and Science Education)

DREAMS is a collaborative partnership between three high-needs school districts (Toledo Public Schools, Lima City Schools, and Fostoria Community Schools), suburban and rural school districts, and the Colleges of Arts and Sciences and Education at BGSU. This Math and Science Partnership (MSP) grant aims to increase pK-12 teacher content knowledge and leadership skills in math and science by providing teachers with the opportunity and skills to become leaders in math and/or science for their school district. Participants have the option to complete a Master of Arts in Teaching in one of four areas (biology, mathematics, physics, or interdisciplinary math and science) or a Specialist Endorsement in mathematics or science. DREAMS serves over 75 teachers from across the state of Ohio by funding tuition for 9 graduate credit hours per year. Participants will remain with the program for the next three years as they take classes at BGSU to complete their graduate program. The recruiting brochure is available in Appendix M. Dr. Mandy Heddle, COSMOS Research Assistant Professor, is the Principal Investigator for the DREAMS program. The program provides a total number of 135 contact hours /year, with a cost of $25/contact hour.

REAL (Regents Environment Academy for Learning)

REAL provided an opportunity for high school students entering 11th and 12th grades to receive college credit that may also fulfill high school requirements. This three-week residential summer academy at Bowling Green State University provided 54 students the opportunity to study environmental health science, biology, and chemistry concepts through a problem-based learning framework that focused on real-world local issues. Upon successful completion of the academy courses, students were eligible to earn an additional scholarship to take general education distance-learning course in the fall of 2007. The recruiting brochure is included in Appendix N. Dr. Chris Keil, Environmental Health Program at BGSU, is the Principal Investigator for the REAL program. NWO/COSMOS played a significant role in grant development, building a collaborative partnerships, among BGSU, OCC, and participating Ohio high schools. The program provided over 500 contact hours, with a cost of $12/contact hour.

RIPE (Research-based Inquiry Physics Experiences)

RIPE provided pk-3 teachers in northwest Ohio with training to transform early childhood education by (a) researching early childhood student conceptual understanding of physics concepts, (b) developing engaging and highly effective teaching models and instructional materials, (c) disseminating these models and materials, and (d) providing intense and sustained professional development to pre- and in-service teachers in effective physics teaching. The recruiting brochure is included in Appendix O. Dr. Steven Van Hook, Physics Department at BGSU, is the Principal Investigator and Dr. Tracy Huziak-Clark, School of Teaching and Learning at BGSU, is the co-Principal Investigator for the RIPE program. COSMOS partnered with RIPE to provide release time for Dr. Tracy Huziak-Clark and helped establish collaborative partners for this project. The program provided a total of 60 contact hours/year, with a cost of $59/contact hour.

NWO TEAMS (Teachers Enhancing Achievement in Mathematics and Science)

NWO TEAMS is a collaborative partnership between three high-needs school districts (Toledo Public Schools, Lima City Schools, and Fostoria Community Schools), suburban and rural school districts, the Colleges of Arts and Sciences and Education at BGSU and UT. This Math and Science Partnership (MSP) grant aims to increase the academic achievement of students of science and mathematics by enhancing the content knowledge and teaching skills of classroom teachers. In its second year of funding, NWO TEAMS served over 100 3-6 grade in-service teachers from around northwest Ohio and over 45 pre-service teachers. Over 40 teachers in Cohort I of the program completed a four-day follow-up held at BGSU from June 18-21, 2007, and 60 teachers began the program as part of Cohort II by participating in an eight-day Summer Institute held June 25-July 3, 2007. Twenty teachers from Cohort I and over 60 teachers from Cohort II will participate in the 2007-08 Academic Year Content Study Groups as a part of the aforementioned Inquiry Series. The quarterly

evaluation reports are available upon request. The recruiting brochure is included in Appendix P. Dr. Emilio Duran, Biological Sciences at UT is the Principal Investigator for the TEAMS program. NWO/COSMOS played a significant role in grant development, building a collaborative partnerships in all aspects of project implementation. The program provides a total number of 80 contact hours/year, with a cost of $43/contact hour.

NWO TeachOhio

NWO TeachOhio was an initiative aimed at recruitment of teachers into mathematics and science, involving grant funds from the Ohio Department of Education. The purpose of the TeachOhio grant was to increase the pool of highly qualified 7th–12th grade science and mathematics teachers in Ohio through alternative licensure. The recruiting brochure is included in Appendix Q. It was a collaborative partnership between BGSU, UT, OCC, and regional school districts. In particular for the 2006–07 school year, four high-needs districts were key partners (Toledo Public Schools, Lima City Schools, Fostoria Community Schools, and Fremont City Schools). BGSU took the lead on this project with UT and OCC contributing to this project by leading monthly cohort meetings, serving on the advisory board, and assisting in planning recruitment of science and mathematics teachers. The NWO TeachOhio program sought to deepen this goal by having the cohort not only obtain licensure, but also earn a master's degree in curriculum and teaching and receive on-going support and professional development via academic year participation in the NWO Inquiry Series and cohort meetings. The recruitment for this program began in 2006 with more than 1,000 people with science and/or mathematics backgrounds receiving brochures and many others reading about this opportunity through newspaper advertisements and an announcement in a teachers' union newsletter.

The NWO TeachOhio program prepared 14 new people to be eligible for Alternative Educator Licenses (12 science and 2 mathematics) to teach 7th-12th grade science or mathematics. Thirteen of the cohort members pursued jobs for the 2007-2008 school year and are teaching in 5 Northwest Ohio school districts (Corey-Rawson Schools, Fostoria Community Schools, Lima City Schools, Springfield Local Schools, and Toledo Public Schools). Twelve of these teachers are new to teaching as a result of our recruitment efforts, while two other 1st-8th grade licensed teachers are using the program to obtain a 7th-12th license. All 14 people are on target to earn their master's degrees by August 2008, with some choosing to finish in December 2007 or May 2008. The final report is available upon request. Dr. Jodi Haney, NWO Director, is the Principal Investigator for the TeachOhio program. NWO/COSMOS played a significant role in all aspects of this program. The program provides a total number of 575 contact hours/year, with a $29/contact hour.

NWO Evaluation

This year has seen considerable growth for NWO, both with regard to the number of individuals served by the Center and the degree of collaboration within and among NWO partners. In FY 2007, the Center served on an ongoing basis almost 900 pre-service and in-service teachers and higher education faculty. The increase in participation has had a synergistic effect on collaboration resulting in exciting and new partnerships among and between partners and participants.

The success of NWO in serving northwest Ohio educators is evidenced by the FY 2007 evaluation conducted by MetriKs Amérique (Appendix T). The Center's collaboration with MetriKs led to the development of slightly revised goals to better match with the Center's activities, evaluation questions, and data sources.

The revised goals are to (a) enhance the preparation of pre-service and in-service teachers though research-based professional development focusing on investigative mathematics and science teaching and learning; (b) recruit and retain students into STEM and STEM education disciplines; (c) conduct and communicate collaborative research on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts; (d) develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues; and (e) increase the leadership capacity for mathematics and science education in northwest Ohio. These goals will be used in FY 2008 to again guide the NWO activities and evaluation plan.

In order to determine progress towards these goals, the Center worked with MetriKs to align the Center's activities with each goal, formulate specific evaluation/research questions for each goal, and identify multiple instruments and data sources that could be triangulated to enhance the validity of the findings.

Example: Goal 1: Effective Professional Development

Evaluation of the effectiveness of the NWO professional development was accomplished by thematically analyzing and summarizing data gathered from six different sources:

1. Teacher Beliefs and Practices Instrument (TBI survey).
2. Session evaluation data (e.g., written evaluations of the professional development sessions).
3. Faculty interview data.
4. Teacher participant interview data.
5. Professional development session observation data (ratings using Horizons Research PD Observation Protocol) provided by external observers.
6. Other statistics collected by the Center about different activities (e.g., course and program modification documents, PD attendance data, MAT credit hour completion data, and Symposium participant involvement data).

Further details on the evaluation methods can be found in the evaluation report (see Appendix T).

Highlights of Findings

Self-Efficacy and Participant Beliefs about Classroom Practices

NWO programs have facilitated a significant increase in participant self-efficacy and participant beliefs about research-based classroom practices. Survey instruments, session evaluations, and interviews revealed that participants experienced greater confidence their ability to be effective leaders of inquiry-based and student-centered learning.

I'm definitely a more inquiry-based teacher. I feel that my questioning skills have increased greatly and I have become more of a facilitator and not so much a giver of knowledge.
– NWO Inquiry Series Teacher Participant

[The students] have to write their own lab procedure, they have to come up with it and of course it's great because they all come up with a perfect solution and it doesn't work, so then they have to go back and do the problem solving and it's a double period, so they have enough time to problem solve this. So it's fun to do this.
– NWO Inquiry Series Teacher Participant

Science and Mathematics Education Research

The COSMOS research community aims to encourage collaboration for research efforts on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts. Based on the evaluations provided by 20 Research Community participants, the overall usefulness of the Research Community was rated very high—4.75 on a 5-point Likert scale. In their open-ended evaluations and faculty interviews, the participants spoke highly about the utility of the Research Community in enhancing research on mathematics and science education. As a result of being part of the Research Community meetings, some participants collaborated on grants together or with others in their field.

The community inspired me to…submit an ITQ grant. I will probably try again next year, making use of further discussions about grant writing process held with this community.

– COSMOS Research Community Faculty Participant

…meeting new faculty with similar interests and sharing research ideas and projects across colleges. A better understanding of scientific research in education. A better understanding of the views and attitudes regarding effective science teaching and learning from our scientists/mathematicians….

– COSMOS Research Community Faculty Participant

Regional Collaborative Alliance

The collaborative alliance among the university, school, and community partners was sustained by conducting regular COSMOS Collaborative Council (CCC) and NWO Executive Board meetings. The concepts and ideas that were discussed and communicated at these meetings are indicative of the visionary approach taken by the Center in tackling current STEM education issues.

Teachers' Leadership

NWO participants showed considerable leadership in their region. Thirty-five participants gave presentations to their peers at various NWO events, and six NWO participants submitted and won grants for the A+ Energy Program from BP. A new grant program, DREAMS, was funded in early 2007, which aims to increase leadership skills in math and science educators through increased content knowledge and leadership workshops.

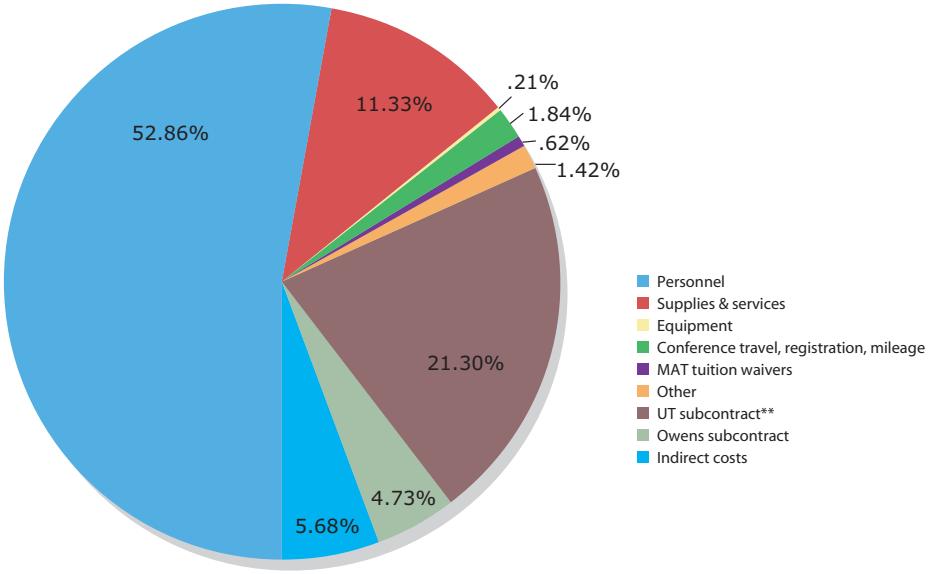
The complete evaluation report is included in Appendix T and includes recommendations for future efforts of NWO with regard to meeting goals as well as recommendations for furthering efforts to systematically collect and measure the outcomes of these goals.

In sum, we are both proud of our FY 2007 accomplishments and determined to make even deeper impact on the challenges that lie before us. The COSMOS name was derived from the term defined as "an organized harmonious whole." We believe the evaluation of NWO/COSMOS provides evidence of our success in attempting to establish a regional united force ready and able to tackle current issues in education through our goals: providing effective professional development for teachers and faculty, recruiting and retaining students into STEM, conducting and communicating timely research on science and mathematics education, establishing and growing the alliance, and enhancing the leadership capabilities to sustain our efforts. During FY 2008, we will continue these efforts with specific focus on recruiting and retaining students in STEM and STEM education disciplines. We will also step up our collaborative research efforts using the COSMOS research community forum.

FY 2007 NWO Budget

FY Expenditures for July 1, 2006 - June 30, 2007

Personnel		$111,696
Supplies & services		$23,950
Equipment		$450
Conference travel, registration, mileage		$3,886
MAT tuition waivers		$1,329
Other		$3000
UT subcontract**		$45,000
Owens subcontract		$10,000
	Total direct costs	$199,311
Indirect costs		$12,000
	TOTAL	**$211,311**



***UT Subcontract is the sum of $20,000 actual billed for services amount and $25,000 for Symposium*

The tables below show amounts spent in each category for 2004-05, 2005-06, and 2006-07.

2004-2005		
Personnel		$68,804
Supplies & services		$7,994
Equipment		$2,767
Conference travel, registration, mileage		$2,844
MAT tuition waivers		$40,639
Other		$20,710
UT subcontract		$108,468
Owens subcontract		$2,019
	Total direct costs	$254,245
Indirect costs		$9,288
	TOTAL	**$263,533**

2005-2006		
Personnel		$119,301
Supplies & services		$24,904
Equipment		$2,456
Conference travel, registration, mileage		$8,573
MAT tuition waivers		$19,237
Other		$11,031
UT subcontract		$121,389
Owens subcontract		$10,000
	Total direct costs	$358,845
Indirect costs		$13,574
	TOTAL	**$372,419**

2006-2007		
Personnel		$111,696
Supplies & services		$23,950
Equipment		$450
Conference travel, registration, mileage		$3,886
MAT tuition waivers		$1,329
Other		$30,001
UT subcontract		$45,000
Owens subcontract		$10,000
	Total direct costs	$199,311
Indirect costs		$12,000
	TOTAL	**$211,311**

Other NWO Accomplishments

Strengthening of Relationships

- NWO Executive Board: Minutes for May 21, 2007, are attached as Appendix R.
- NWO Executive Board Bylaws: Approved on June 12, 2007, are attached as Appendix S.

Anne Bullerjahn	Professor, Math/Science Department	Owens Community College
Julie Campbell	Science and Mathematics Support Teacher	Toledo Public Schools
Emilio Duran	NWO Co-Director, SciMaTEC Director	University of Toledo
Anjali D. Gray	Asso. Professor & Chair of Bio & Health Science	Lourdes College
Jodi J. Haney	Director, COSMOS/NWO Co-Director	BGSU
Carla Johnson	Asst. Professor/ Curr & Instruction	University of Toledo
Michelle Leow Klinger	Dir., Project ISIS Teacher Programs and Resources	COSI Toledo
Linda Lower	Customer Service Manager	Perstorp Polyols, Inc.
Mitch Magdich	Curator of Education	Toledo Zoo
Jane McCleary	Curriculum Director	Hancock County ESC
Julie McIntosh	Assistant Professor, AYA and Multi-Age Program Director	The University of Findlay
Mary Richter	Professional Development Director	Northwest RSIT
Stephen Van Hook	Assistant Professor, Physics & Astronomy	BGSU

COSMOS Collaborative Council (CCC)

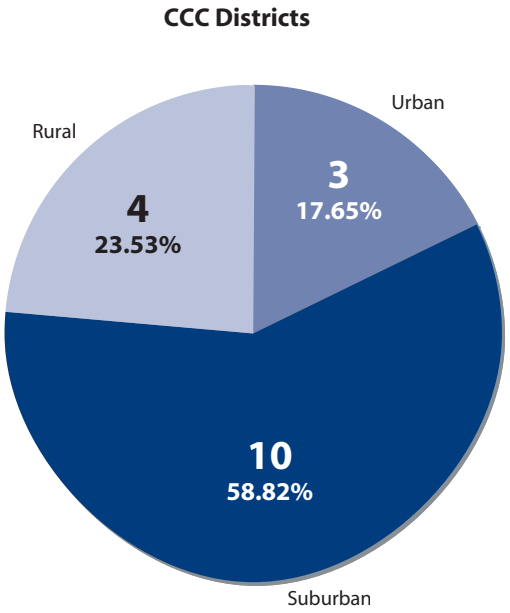
To increase the involvement of key stakeholders, COSMOS developed a forum for STEM regional support and collaboration. The CCC is composed of K-12 administrators, local teachers, BGSU faculty, and COSMOS staff who meet monthly to communicate needs, share opportunities and research, and determine mutual goals, objectives, and strategies to advance STEM education for people of all ages. Minutes of the CCC meetings are included (Appendix S). A breakdown of CCC member information follows:

Participant Information

Administrators	21
COSMOS Staff	5
K-12 Teachers	2
BGSU faculty	5
Community Partners	1
ESC staff	9

Collaborating District/ESC Info.

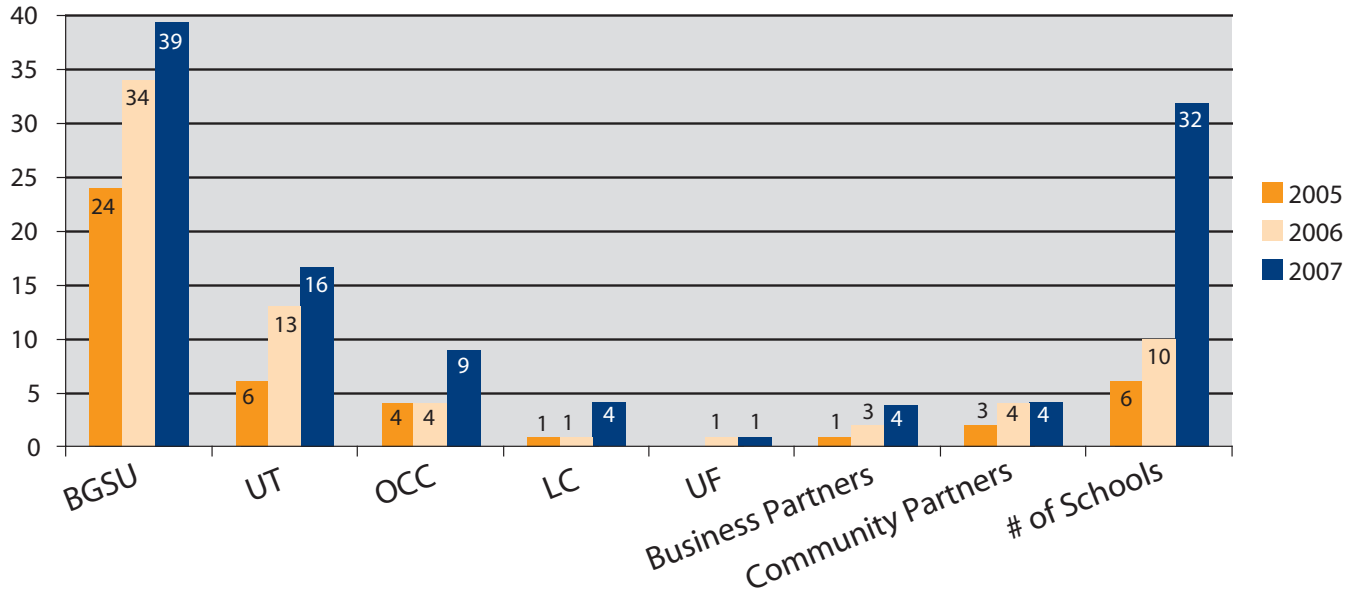
Urban	3
Suburban	10
RURAL	4
Counties Represented	**9**



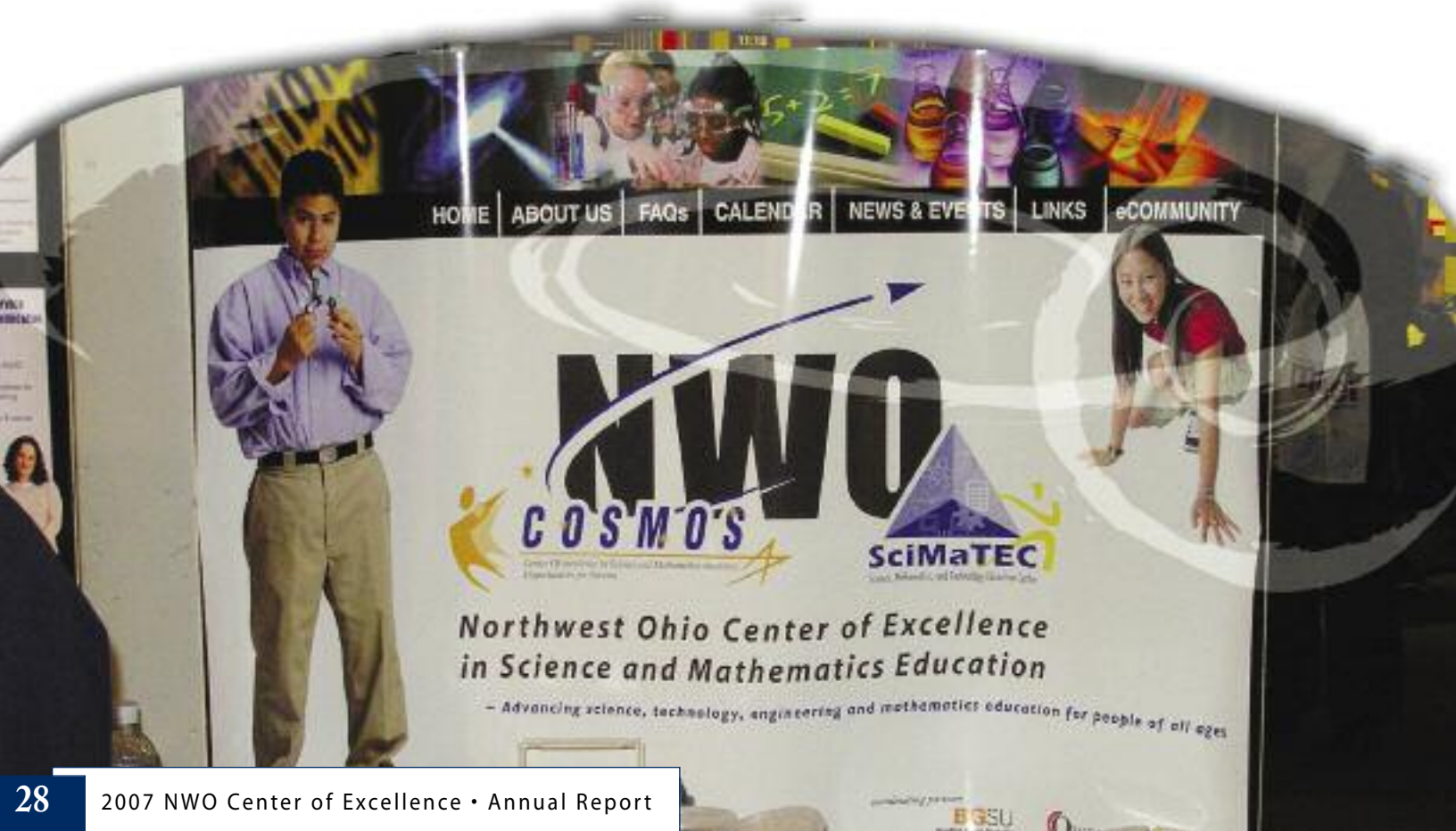
The CCC membership is representative of the district demographics of northwest Ohio schools. The involved districts cover a nine-county area.

As is evident, NWO partnerships have been expanding and our active membership now includes the following groups:

- Faculty from Colleges of Education and Arts & Sciences (BGSU, UF, LC, OCC, UT)
- Pre-service teachers
- In-service teachers, including master's degree-seeking students (20+ counties, 40+ school districts)
- Public school administrators
- Educational service centers
- Business partners - BP, Ball Corporation, Perstorp Polyols, Inc.
- Community agencies - Toledo Zoo, COSI Toledo, metro & county parks, botanical societies, technology agencies, soil and water districts



This chart depicts the NWO partners by institution/organization and year of participation. See CCC minutes (Appendix S) for school breakdown.



NWO Projected Goals and Activities - FY 2008

NWO Vision:

The Northwest Ohio Center of Excellence aims to advance science, technology, engineering, and mathematics (STEM) education for people of all ages. Our purpose is to work with community partners to (a) generate new knowledge about the science of teaching and learning, (b) apply this knowledge by developing the expertise of K-12 educators and higher education faculty, (c) increase public support for, and understanding of, the STEM subject areas, and (d) to stimulate the interest of young people, especially those in underrepresented groups, in these rewarding fields of study and career opportunities. The following NWO goals guide this vision.

NWO Goals and Scope of Work: NWO will attain the above goals through the following goal-aligned activities:

Goal 1: Develop the expertise of pre-service and in-service teachers and higher education faculty through research-based professional development framed by investigative science and mathematics teaching and learning.

Center Activities:

a. Conduct monthly regional professional development meetings (NWO Inquiry Series for K-12 science and mathematics pre-service and in-service teachers). Continue in the FY 2008 scope of work.

b. Host the annual one-day regional conference for pre-service and in-service teachers and higher education faculty (NWO Symposium). Continue in the FY 2008 scope of work, but reduce to a one-day event.

c. Host and co-sponsor Praxis II Preparation Workshops for AYA science and mathematics pre-service teachers. Continue in the FY08 scope of work.

d. Co-sponsor undergraduate professional organizations (NWO-SECO and NWO-CTM). Continue in the FY 2008 scope of work.

e. Co-sponsor learning communities and/or seminars for higher education faculty focused on improving science and mathematics teaching. New in the FY 2008 scope of work.

Affiliated Activities:

a. Continue to develop MAT graduate programs, adding a biology MAT for AYA science teachers and interdisciplinary MAT for middle grades science and mathematics teachers. New in the FY 2008 scope of work, will use ODE-MSP DREAMS grant funds for this work, but Center faculty and staff very much involved in this work.

b. Conduct an annual Summer Inquiry Institute and AY follow-up sessions for elementary science and mathematics teachers using funds provided by ODE-MSP program (NWO TEAMS). New in the FY 2008 scope of work, will use ODE-MSP TEAMS grant funds for this work, but Center faculty and staff very much involved in this work.

Goal 2: Recruit and retain students into STEM and STEM education disciplines.

Center Activities:

a. Host the annual NWO Future Teachers Conference. Continue in the FY 2008 scope of work.

b. Launch a collaborative STEM recruitment campaign aiming at increasing student interest and participation in STEM disciplines. We will seek additional state and/or federal funds to further develop these recruitment activities. New in the FY 2008 scope of work.

Affiliated Activity:

a. Ohio Junior Science and Humanities Symposium (OJSHS) for high-achieving Ohio students to present research. Outstanding projects receive various monetary awards. Continue in the FY 2008 scope of work.

Goal 3: Conduct and communicate collaborative research on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts.

Center Activity:

a. Host and co-sponsor the COSMOS research community for higher education faculty, graduate students, and support staff. Continue in the FY 2008 scope of work, but research action teams will be an addition to the regular research community. The action teams (consisting of 3-5 members) will conduct a research study focused on how people best teach and learn science and mathematics or on the barriers and enablers related to current reform efforts. We anticipate a minimum of three new collaborative research projects launched this year. Nearly half of the funding needed for this activity comes from the BGSU Center for Teaching and Learning.

Goal 4: Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues.

Center Activities:

a. Host monthly COSMOS Collaborative Council (CCC) meetings with regional school partners to plan new collaborative projects and sustain on-going projects. Continue in the FY 2008 scope of work (this idea was launched mid-year 2006-07).

b. Maintain semi-annual meetings of the Center's Executive Board to focus on building a collaborative alliance and shared decision-making body to guide and coordinate regional activities aimed at improving science and mathematics teaching and learning across the region using equitable and shared-responsibility approaches. Continue in the FY 2008 scope of work, but this year we now have approved bylaws to guide this board.

c. Reconstruct the current NWO/COSMOS websites to be more user-friendly and inclusive of the NWO/COSMOS activities. New in the FY 2008 scope of work.

d. Develop new business and community partnerships. New in the FY 2008 scope of work.

Goal 5: Increase the leadership capacity for science and mathematics education in northwest Ohio.

Center Activities:

a. Increase the number of teacher and faculty professional presentations of classroom best practices at the NWO Inquiry Series meetings, the NWO Symposium, and the Future Teachers Conference and at other local, regional, state, and national forums. Provide mentorship to these emerging leaders. Continue in the FY 2008 scope of work, but more explicit efforts on mentorship.

b. Collaborate with the Ohio Resource Center to develop additional teacher- and faculty-developed resources. Discontinued in FY 2008 scope of work, as we've tried to work with ORC in getting the lessons our teachers and faculty have generated to be reviewed and added (linked) to the ORC, yet it appears this is not the goal or current undertaking of the ORC. We will continue to collaborate with the ORC in all of our professional development programs by showing regional teachers and faculty the useful materials found at the ORC.

Affiliated Activity:

a. Develop a cadre of regional teacher-leaders for Northwest Ohio through the DREAMS Summer Leadership Institutes, newly developed academic year content courses, and pedagogical-content study (Curriculum Topic Study or Lesson lab). Teachers will have opportunities to earn an MAT and/or a science or mathematics Specialist Endorsement as 0a result of this experience. This activity will be supported by ODE – MSP funding (DREAMS project), yet Center faculty and staff will work very closely with this project. New in the FY 2008 scope of work.

NWO Resource Development and Sustainability

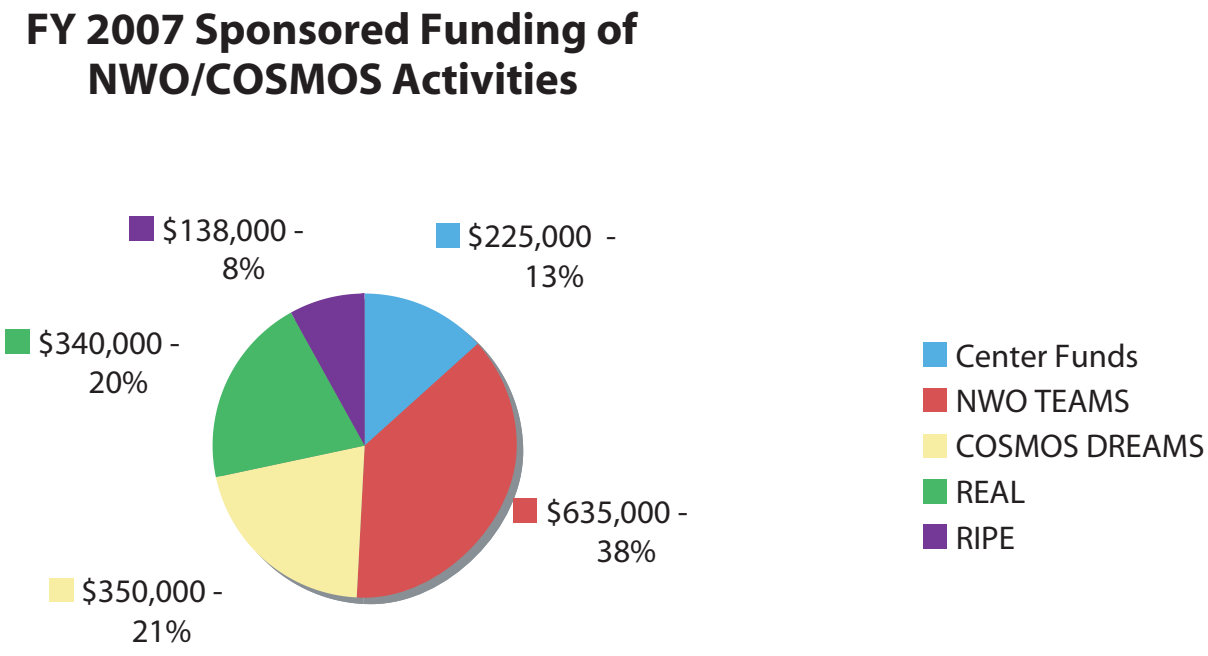
At BGSU, the administration has extended strong financial support to COSMOS again during 2007. University monies funded the COSMOS director at 100%. In addition, the University is paying for a half-time secretary and approximately 75% of the assistant director salary and benefits. BGSU will also fund a three-hour course release for two associate faculty each semester to conduct research and contribute to grant-writing efforts ($16,000). Moreover, COSMOS now has an internal budget of $10,000/year to serve as a university hybrid (research and teaching) center. COSMOS is officially "housed" in the Graduate College to promote quality research and grant writing activities. This support will ensure the life of the Center beyond Ohio Board of Regents funding.

During FY 2007, SciMaTEC had an internal university center budget of $15,000/year with no secretarial or administrative support.

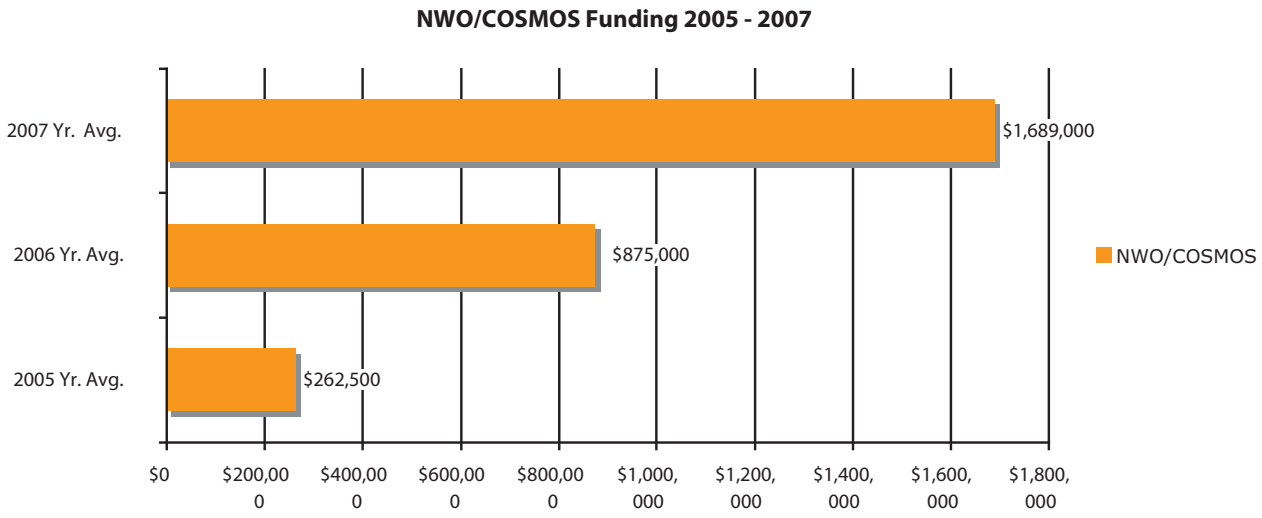
No other partner institutions of higher education currently have internal funds to support the activities of NWO.

NWO Center Funding Sources

Although Center funding from OBR will decrease over the next four years, funds from other grants will not only sustain current activities but, will also support the rapid growth of proposed Center activities. In total, FY 2007 Center-related external funding was approximately $1.7 million. We utilize Center and university matching funds to develop faculty and staff, build capacity, and leverage resources to attain additional grant dollars. So far, the NWO Center model seems to be working very well in helping secure additional dollars to further our reach.



Center funds contributed by OBR will constitute a small percentage of the total operating budget of FY 2007. Grant dollars from several key initiatives significantly contributed toward our sustainability, and we anticipate the renewal of these grant projects and securing funding from additional grant submissions (federal, private foundation, and/or state).



The projected yearly NWO total budget has increased dramatically with funding through both OBR and Ohio Department of Education from approximately $262,000 in 2005 to nearly $1.7 million in 2007.

NWO ORC Collaboration

The Center has continued to be involved in promoting the Ohio Resource Center through Center programs aimed at fostering research-based best practices and also through the university courses and professional development offered by the Center faculty.

- In science and mathematics methods classes, students have assignments that involve the use of lesson plans from the ORC. Similarly, in some of the mathematics classes for early and middle childhood majors, students must search for a lesson plan on a given topic and explain how they would adapt the lesson to the grade level they would like to teach. The physics MAT classes also frequently reference ORC. This amounts to 18 separate courses on campus.
- Many of the MAT scholarship students and NWO teachers use the ORC lesson plans in their classrooms and presented the results of the lesson implementation to the NWO partners at the Blast-Off (beginning of the year), Symposium (mid-year), or Summit (end of the year) events.
- The NWO website has a search feature that allows teachers visiting the site to search ORC for high-quality lessons, assessments, and other resources.
- When providing guidance for local school districts, NWO recommends the professional development, lesson, and assessment resources that populate the ORC website.
- In all affiliated projects, NWO/COSMOS staff use ORC recommended lessons and curricula.

Issues, Problems, and Anticipated Solutions

- The biggest issue to date is still the collaborative efforts between UT and BGSU. With the departure of Dr. Emilio Duran, 2004-2006 SciMaTEC Director, we have taken many steps backwards once again. The search to hire a new SciMaTEC Director was not successful, and we do not know who is serving in this role at this time. The communication must improve in order to rebuild trust and subsequent partnerships. We will search both within the University of Toledo and across the region to find interested faculty willing and capable of leading and teaming NWO activities. The NWO Regional Grants to Partners Program reflects our efforts to find new partners and to ensure accountability for Center funds used to support their work.

- As per the memorandum of agreement, additional activities are being jointly sponsored each year by the three groups (BGSU, OCC, and UT). More center funding is being earmarked for NWO (vs. institution) activities.

- By encouraging STEM and STEM education faculty to collaborate on Center grants and activities, we decrease the apparent diversity and sheer number of proposals, when in effect the submissions are stronger, more complimentary, and more diverse. To address this issue, we will work with OBR, ODE, and other funding agencies to raise awareness regarding the nature of such Center collaborations. We also want to be sure that participation as a Center of Excellence does not limit the number of funded proposals that would be attained in the region without the Center's existence. So our focus will be to submit multiple, but well-coordinated and highly collaborative, NWO proposals.

- Although a sign of our success, the rapid growth of the NWO Center has resulted in a need to develop an investment strategy to build Center capacity to create, support, implement, and evaluate newly funded and future Center initiatives. We will work with the NWO Executive Board and within each higher education institution to craft this investment plan.

- There is a great deal of inequity of infrastructure among institutions. As described earlier, BGSU has a solid infrastructure in place, yet UT/SciMaTEC resources have been greatly reduced. There is a small operating budget in place. Yet there is no secretarial or GA support, and space is limited. Moreover, OCC, LC, and UF do not have infrastructures for this sort of work. We will continue to discuss ideas to build the infrastructure needed to support the region.

NWO Center: Regional Catalyst Building STEM Networks and Opportunities

NWO is a regional agent supporting and encouraging significant STEM activities for northwest Ohio K-16 students, educators, and community members. The impact of NWO in northwest Ohio has been due in large part to our success in providing worthwhile, rigorous K-16+ professional development in science and mathematics, both in content and pedagogy, and in developing new knowledge in, and collaborations for, the teaching and learning of science and mathematics.

During the next year, we plan to focus additional energy toward recruitment into STEM and STEM education disciplines and on conducting collaborative research in science and mathematics education. This alteration is possible because the professional development and building a collaborative alliance goals require much less time and fewer human resources now that they are well underway and beyond the initial time and resource-intensive development phase.

NWO catalyzes STEM action in northwest Ohio. As a maturing regional center, in FY 2008 NWO will continue to serve as an organizational framework building capacity within local universities, schools, and community partner organizations and leveraging resources for STEM programs and opportunities for people of all ages.

Appendices

Appendix A: Regional Grants to Partners Program

2007-08

Northwest Ohio Center of Excellence in Science and Mathematics Education:

Request for Regional Partner Projects

PURPOSE

The Northwest Ohio Center of Excellence in Science and Mathematics Education offers this opportunity to its NWO Regional Partners to develop projects that assist the effort in achieving the goals of NWO. The region includes northwest Ohio institutions of higher education, businesses and industry, educational organizations, and other community partners. Applications for projects, which must include at least two NWO partners, may be submitted in the range of $2,000 to $20,000.

PROJECT REVIEW CRITERIA

The Northwest Ohio Center of Excellence will only consider applications for projects that are directly aligned with our Mission:

> *Advancing science, technology, engineering and mathematics (STEM) education for people of all ages*

and our Goals:

1. Enhance the preparation of K-12 pre-service teachers, in-service teachers, and higher education faculty though research based professional development focusing on investigative mathematics and science teaching and learning.
2. Recruit and retain students and teachers into STEM and STEM education disciplines.
3. Conduct and communicate collaborative research on how people best teach and learn science and mathematics and on the barriers and enablers related to current reform efforts.
4. Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collective spirit for tackling current STEM education issues.

APPLICATION DEADLINE & PROJECT PERIOD

The deadline date for applications is **November 9, 2007** for this first round of support, and September 15 of each year thereafter (or next business day). Applications postmarked this round after November 9, 2007 will not be considered. This year's project period is from December 1 to June 30.

REVIEW PROCESS

The Northwest Ohio Center of Excellence Executive Board of Directors will carefully review applications. Applicants will be notified in writing of approval or denial of funding requests within 30 days after the deadline. Project expenses incurred by an applicant organization prior to notification cannot be paid by the Northwest Ohio Center of Excellence.

APPLICATION CONTENTS

The application should be submitted on the form provided. Keep text to the space provided. **Support letters are needed to document and authenticate proposed partnerships when appropriate**. An electronic copy of this form can be downloaded from http://www.nwocenter.org or http://cosmos.bgsu.edu/grants.

All applications must contain:

- ✓ Organization name and address plus the name and telephone number of the contact person taking the lead on the application and proposed scope of work.
- ✓ Purpose and Need – Summarize the goals and objectives of the project. Identify the problems or needs that will be addressed. Identify who or what constituency will benefit from this work.
- ✓ Implementation – Summarize the plans and time frame for implementation of the project. Identify individual(s) who will be responsible for overseeing the program and briefly describe their qualifications.
- ✓ Evaluation – State the criteria and procedures that will be used to measure the success of the project or program and relate this to the stated goals and objectives.
- ✓ Budget – Provide detailed projected incomes and expenses, all sources of program funding, and the period (beginning and ending date) for which funds are requested.
- ✓ Future Support – Identify plans for securing ongoing support for this program once the NWO funds are no longer available. Include anticipated future financial needs for the program and potential sources of funding.
- ✓ Dissemination – State how you will share the success of your program with other teachers and schools. Mandatory dissemination strategies are described below.
- ✓ An application must be signed by the appropriate administrator/president/director of the organization.
- ✓ An electronic application form must be submitted via e-mail for review.

REPORTS

All recipients of the funded projects must provide NWO with an annual report that contains a minimum of summarized data including: contact information for all leaders and participants, summary of activities including dates and times of events/activities, summarized attendance data, and summarized session evaluations using the NWO session evaluation instruments. A final budget report including detailed itemization of all approved expenses must also be included. Up to 5% of the funds can be re-allocated within the **approved** budget categories without written PRIOR consent, but these modifications must be explained in the annual budget report. The NWO Director as deemed necessary may request other data. The annual report is due 30 days after the completed event/activity. Costs will not be reimbursed until this report is submitted and approved.

COST REIMBURSEMENT

Approved costs expended between December 1, 2007 and June 30, 2008 of the funded period will be reimbursed by BGSU pending the approval of the annual project report as detailed above.

DISSEMINATION EXPECTATIONS

Recipients are also expected to present a brief summary of the impact of the project at the NWO Fall Executive Board Meeting and submit a proposal for a related presentation at the subsequent Northwest Ohio Symposium on Mathematics and Science Teaching.

SUBMISSION PROCESS

E-mail the grant application to Jodi Haney, PhD, NWO Director, at jhaney@bgsu.edu. To request additional information contact Emilio Duran, PhD, COSMOS Senior Associate Faculty, at 419.372.1262 or eduran@bgsu.edu.

IMPORTANT INFORMATION FOR EDUCATORS APPLYING FOR PROJECT SUPPORT

Please keep the following guidelines of the project in mind:

- Funding up to $2,000 - $20,000 is available for regional projects.
- Funding should focus on project/program implementation versus equipment, materials, and supplies.
- Funding will be considered for equipment only when there is a direct connection to the project activities and should be no more than 25% of the total budget.
- Your request should be for one year only (this year, December 1, 2007 and June 30, 2008). You may reapply if your project is successful.
- Please review the requirements of the Annual NWO Regional Partner Project Report Form so that your request will correspond to your evaluation.
- Your application will be acknowledged upon receipt and you may expect a response to your request within 30 days.

We congratulate you on this further demonstration of your motivation and commitment to advance STEM education across Northwest Ohio. If you have any questions, please do not hesitate to contact us.

Frequently Asked Questions about Regional Partner Projects

The NWO Executive Board will reflect on these questions as they review applications:

1. Is this application innovative or unique, does it fulfill a pertinent need?
2. Is the proposed activity collaborative? Does it include partners and participants across the region?
3. What is the potential impact of the project on science and mathematics teaching practices and student learning?
4. How well does this project align with the mission and goals of NWO?
5. Could the materials or equipment requested be purchased with other community/local, state, or federal funds?
6. Are the activities involved age-appropriate, group-appropriate, etc?
7. Is there evidence that this project addresses a critical teacher or student need?
8. If the requested funds include the purchase of equipment, materials, or extensive supplies, does the proposal include a clear implementation plan with expected outcomes that justifies the purchase?
9. Does the plan for evaluating the project adequately assess the quality and impact on student achievement and/or the objectives of the activities proposed?
10. Have the requesting partners done their part to support this project and/or this teacher?
11. Will the impact of this project be long lasting?

2007-08

Northwest Ohio Center of Excellence in Science and Mathematics Education:

Regional Partner Projects

APPLICATION FOR REGIONAL PARTNER PROJECT FUNDS

Application Submitted by _____

Organization/Higher Education Institution: _____ Date: _____

Address: _____

City, State, Zip: _____

Telephone: _____ E-mail: _____

Contact Person: _____

How much money is requested from NWO? _____

Has your organization received a grant from the Northwest Ohio Center of Excellence in the past? _____

Name and Signatures:

Lead Project Director:

Name: _____ Signature: _____ Date: _____

Partnering Project Director:

Name: _____ Signature: _____ Date: _____

Lead Authorized Administrator:

Name: _____ Signature: _____ Date: _____

Partnering Authorized Administrator:

Name: _____ Signature: _____ Date: _____

I. **Summary of Proposed Project:** In two or three sentences, provide a **Summary** of the project. (10 pts)

II. **The Purpose and Need**: List the goals and measurable outcomes of the project. Identify the problems or needs that will be addressed. Identify who will benefit from this experience. (20 pts)

III. **Implementation:** Summarize the plans and time frame for implementation of this project. Identify the individual(s) who will be responsible for overseeing the program and briefly describe their qualifications. (20 pts)

IV. **Evaluation:** Indicate the criteria and procedures that will be used to evaluate the success of the proposed project or program. Relate the evaluation measures to the stated goals and outcomes. (20 pts)

V. Budget: Provide the following information in this table and explain related details in the budget narrative. (20 pts)

BUDGET SPREADSHEET:

A. PERSONNEL

1. Salary	$ _____
2. Benefits	$ _____
3. Stipends	$ _____
4. Other	$ _____
SUBTOTAL	$ _____

B. NON-PERSONNEL

1. Supplies/Services	$ _____	
2. Travel	$ _____	
3. Equipment	$ _____	(limited to 25% of total budget or $3,500 maximum)
4. Communication	$ _____	
5. Consultants	$ _____	
6. Participant Support	$ _____	
7. Other	$ _____	
SUBTOTAL	$ _____	

C. CONTRACTUAL

1. _____	= $ _____
2. _____	= $ _____
SUBTOTAL	$ _____

D. FACILITIES & ADMINISTRATION

1. Fee (up to 8% allowed)	$ _____

TOTAL NWO FUNDS REQUESTED: $ _____ (Please provide Budget Narrative on next page)

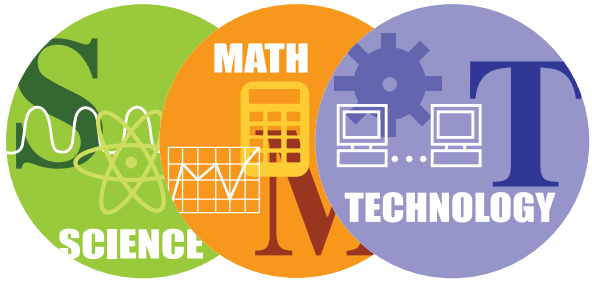
Budget Narrative [provide detail for the budget request above]:

VI. **Future Support:** Identify plans for securing potential ongoing support for this project once NWO funds are no longer available. Include anticipated future financial needs for the program and potential sources of funding. (5 pts)

VII. **Dissemination**: Discuss how project success and accomplishments will be shared with others. (5 pts)

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program

Friday, November 3rd &
Saturday, November 4th, 2006



Northwest Ohio Symposium on Science,
Math, and Technology Teaching

www.nwohiosymposium.org

You have a wonderful opportunity this year to win some great classroom resources.

You have enclosed in your registration envelope a yellow card to take around to the vendors in the Atrium. Each vendor has a different stamp. Get your card stamped by twelve different vendors and you will be entered in a special drawing for prizes that will be awarded between 5:00 and 5:30 on Saturday evening.

Drop your completed card (front and back) in the box at the check-in desk. Be sure to come back to the check-in area after your last session to see if you have won one of the great raffle prizes.

1

Welcome

We welcome you to the 2006 Northwest Ohio Symposium on Science, Math and Technology Teaching. This year, the symposium is again sponsored by the Northwest Ohio Center of Excellence in Science and Mathematics Education and its partners throughout the region. This event offers the invaluable opportunity for P-16 teachers to share and learn from one another in our common effort to advance science and mathematics education for people of all ages.

Last year, more than 500 university professors, teachers, graduate and undergraduate students, participated in over 80 sessions. We are expecting similar numbers this year. Additionally, the 2005 Symposium included 21 vendors from various educational resources. This year, 23 vendors will participate to keep educators abreast of new and exciting classroom materials. Once again, attendees will be allowed to examine new textbooks, pick up equipment for classroom use and preview some of the new classroom technologies now available. Lastly, 21 sponsors are donating more than $100 worth of classroom materials and supplies to all attendees.

We are hoping that the 2006 NWO Symposium on Science, Math and Technology Teaching will be an even bigger success than last year. With your help, we will continue to make this symposium the premier educational opportunity for science, mathematics and technology teachers in Northwest Ohio. Thank you for joining us!

Dr. Emilio Duran
SciMaTEC, UT
NWO Co-Director

Dr. Jodi Haney
COSMOS, BGSU
NWO Director

Dr. Anne Bullerjahn
Owens Community College
NWO Executive Board Member

Dr. David Carlson

The International Polar Year, 2007 through 2008, will represent one of the largest coordinated studies of our home planet ever attempted. Scientists from more than 60 countries, along with engineers, software designers, technicians, students, mechanics, cooks, pilots, and many other specialized polar support staff, perhaps 50,000 people in total, will work together to achieve the goal of understanding physical, ecological and social changes in polar regions and the impact of those changes on the rest of the planet. This talk will review some recent changes in polar regions that stimulate the interest and concern of people around the world. Dr. Carlson will show a few examples of the broad range of IPY science projects, and introduce the vast array of education and outreach events, including films, television series, museum exhibitions, and regular broadcast coverage. He will describe how educational institutions and individual educators can join or conduct local IPY events, can develop and evaluate new polar science educational materials, and can share and assess new engagement strategies that could have an enormous impact on public perception of science and on science education.

David Carlson received a B.A. in Biology from Augustana College, Rock Island, IL (1973) and a Ph.D. in Oceanography from the University of Maine, Orono, ME (1981). He served as an NRC Post-Doctorate Research Associate at the Naval Research Laboratory in Washington, DC.

He served on the graduate faculty in the College of Oceanography at Oregon State University from 1983 through 1990. While at OSU, he led research and education programs in the areas of marine chemistry, small-scale ocean physics and rheology, oceanic microbiology, and intertidal chemical ecology. Dr. Carlson designed and produced an ocean surface sampling system still in use in several oceanographic laboratories. He also developed new techniques for exploring molecular-scale rheology and for assaying photorepair enzymes.

He joined the University Corporation for Atmospheric Research in 1991 to lead the Tropical Ocean Global Atmosphere - Coupled Ocean Atmosphere Response Experiment (TOGA COARE) International Project Office. Dr. Carlson and the TCIPO staff worked with leading international scientists to plan and implement this large research experiment involving 1200 people from more than 20 nations. The project focused on the western Pacific tropical warm ocean pool because of that region's influence on global atmospheric circulation and on global climate variability. From 1994 to 2003, Dr. Carlson directed the Atmospheric Technology Division within the National Center for Atmospheric Research. The Atmospheric Technology Division provided advanced observing systems and associated support services to university researchers for purposes of climate and weather research worldwide. Under Dr. Carlson's leadership ATD built significant new capabilities in active and passive remote sensing, trace gas and particle detection, signal processing, computerized machining, and data visualization and distribution; Dr. Carlson led the planning, proposal, and acquisition process for an $80M aircraft, one of the largest single-item developments in NSF Geoscience history. Dr. Carlson also stimulated an innovative summer undergraduate engineering internship program.

During 2004, Dr. Carlson took a sabbatical year with the Climate and Global Dynamics Division at NCAR, working on upper ocean – lower atmosphere exchange processes.

Starting in 2005, Dr. Carlson serves as Executive Director of the International Programme Office for the **International Polar Year.** The IPY, planned for 2007 through 2008, represents an international effort to draw research and public attention to polar regions, particularly to the role of polar regions in global climate change and to the impacts of climate change on polar regions. The IPY International Programme Office resides at the British Antarctic Survey in Cambridge, England.

2

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

Table of Contents

Conference Agenda

Friday

9:30 am – 10:15 am ..... Check-in
10:30 am – 11:30 am ..... Keynote Address
11:45 am – 12:30 pm ..... Lunch in the Atrium
1:00 pm – 1:45 pm ..... Vendor Check-in
1:00 pm – 2:00 pm ..... Session A
2:15 pm – 3:15 pm ..... Session B
3:30 pm – 4:30 pm ..... Session C

Vendors open from 2:00 pm - 4:00 pm in Atrium

Saturday

7:00 am – 8:00 am ..... Check-in and Breakfast in Ballroom
8:15 am – 9:15 am ..... Session D
9:30 am – 10:30 am ..... Session E
10:45 am – 11:45 am ..... Session F
11:45 am – 12:30 pm ..... Lunch pick up in Brasseire, Eat in you next session's room
12:45 pm – 2:45 pm ..... Session G
3:00 pm – 5:00 pm ..... Session H
5:00 pm – 5:30 pm ..... Raffle Prize pick-up in Check-in area

Vendors open from 8:00 am - 4:00 pm in Atrium

Conference at a glance – Fri.

Session A (1:00 pm - 2:00 pm)

A-1 **STC/MSTM: Human Body Systems** — Limit 40
Presented By: Sally DeRoo, Carolina Biological Supply Company — **Room: Ballroom 1**

A-2 **Zoos: Menageries and Math** — Limit 50
Presented By: Linda Calcamuggio, Toledo Zoo — **Room: Ballroom 2**

A-3 **Tales From the Whale**
Presented By: Marcia Kaplan, Whale of a Tale — **Room: Ballroom 3**

A-4 **Natural Inquirer: Inquiring into Environmental Science**
Presented By: Don Howlett, USDA Forest Service — **Room: Ballroom 4**

A-5 **Professors Analyzing Their Teaching**
Presented By: George Shirk, The University of Toledo
Janet Struble, The University of Toledo
Alison Spongberg, The University of Toledo
Vernon Brown, The University of Toledo — **Room: Owens**

A-6 **Science, Mathematics and the Toledo Museum of Art**
Presented By: Carolyn Rozko, Toledo Museum of Art — **Room: Parlor A**

A-7 **OhioView SATELLITES-Students, Teachers, Scientists using Geospatial Technologies**
Presented By: Terri Benko, The University of Toledo
Kevin Czajkowski, The University of Toledo
Mandy Munro-Stasiuk, Kent State University — **Room: Parlor B**

A-8 **Track Tales - Becoming a Nature Detective** — Limit 25
Presented By: Eileen Sawyer, Bowling Green State University — **Room: Steuben**

A-9 **Let's Get Them Talking! Discourse in the Math Classroom** — Limit 30
Presented By: Julie Nurnberger-Haag,
Bowling Green State University — **Room: Waterford**

A-10 **Physical 3-D Models of Molecules!**
Presented By: Jim Zubricky, Owens Community College,
The University of Toledo — **Room: Wedgewood**

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

Conference at a glance - fri. cont.

Session B (2:15 pm - 3:15 pm)

B-1 Math Out of the Box — Limit 40
Presented By: Sally DeRoo, Carolina Biological Supply Company — **Room: Ballroom 1**

B-2 Explore NASA
Presented By: Marge Marcy, NASA Glenn Research Center — **Room: Ballroom 2**

B-3 Experimentally Understanding Evolution (Learning By Doing It)
Presented By: Donald Pribor, The University of Toledo — **Room: Ballroom 3**

B-4 You Too Can Teach Math or Science Online!
Presented By: Anne Bullerjahn, Owens Community College
Joanne Roehrs, Owens Community College
Pam Krompak, Owens Community College — **Room: Ballroom 4**

B-5 The Impact of Class Size on Student Learning
Presented By: Anjali Gray, Lourdes College — **Room: Owens**

B-6 NSTA/SECO on the College Campus
Presented By: D. Michael Waggoner, The University of Toledo
Jackie Must, The University of Toledo — **Room: Parlor A**

B-7 UT³: Transforming Science and Mathematics Teacher Recruitment, Preparation and Retention
Presented By: Charlene Czerniak, The University of Toledo
Rebecca Schneider, The University of Toledo
Janet Struble, The University of Toledo
Mark Templin, The University of Toledo — **Room: Parlor B**

B-8 Linking Literary Genres and Math Concepts — Limit 30
Presented By: Cherie Hunter, Monroe County Intermediate School District — **Room: Steuben**

B-9 A Modest Proposal for Those Who Cancel Fractions
Presented By: Donald Czarcinski, Lourdes College — **Room: Waterford**

B-10 ORC: Your Source for Best Practice Science Resources
Presented By: Terry Shiverdecker, Ohio Resource Center — **Room: Wedgewood**

Conference at a glance - fri. cont.

Session C (3:30 pm - 4:30 pm)

C-1 STC: Changes — Limit 40
Presented By: Sally DeRoo, Carolina Biological Supply Company — **Room: Ballroom 1**

C-2 What do Geckos, Bandages, and TVs Have In Common?
Presented By: Carin Helfer, Akron Global Polymer Academy
Charles Parson, Akron Global Polymer Academy
Justin Molenaur, Akron Global Polymer Academy — **Room: Ballroom 2**

C-3 Abbot and Costello Take an Online Course: Who's on First? — Limit 40
Presented By: Debra Gallagher, Bowling Green State University
Barbara Moses, Bowling Green State University — **Room: Ballroom 3**

C-4 They Can "Do" the Algebra, But Do They UNDERSTAND It?
Presented By: Daniel Brahier, Bowling Green State University — **Room: Ballroom 4**

C-5 Energy 101 — Limit 24
Presented By: Sue Tenney, Ohio Energy Project — **Room: Owens**

C-6 It's Not Just About Chemistry Anymore
Presented By: Edith Preciosa Klingberg, The University of Toledo
Brenda Snyder, The University of Toledo — **Room: Parlor A**

C-7 "It's Not Your Fault"
Presented By: Andrea Milner, The University of Toledo
Raymond Heitger, Bowling Green State University — **Room: Parlor B**

C-8 Exploring Inverse Functions with Tracing Paper
Presented By: Courtney Nagle, Penn State University — **Room: Steuben**

C-9 Using Technology to Promote Student Engagement
Presented By: Judy Lambert, The University of Toledo — **Room: Waterford**

C-10 Building a Presence (BaP) for Science in Ohio
Presented By: Mary Lightbody, Otterbein College, NSTA — **Room: Wedgewood**

Conference at a glance – Sat.

Session D (8:15 am – 9:15 am)

D-1 Awesome Geometry Fun!
Presented By: Janet Emerine, Bowling Green State University — **Room: Ballroom 1**

D-2 The ABC's of Assessment — Limit 25
Presented By: Mark Templin, The University of Toledo — **Room: Ballroom 2**

D-3 The Gresser Function and What I, the Instructor, Learned in Calculus Class
Presented By: Raymond Heitger, Bowling Green State University — **Room: Ballroom 3**

D-4 Opportunities for Earth Science Training Through the American Meteorological Society
Presented By: Phillip Lacey, American Meteorological Society — **Room: Ballroom 4**

D-5 Utilization of Online/Hybrid Course Formats in Undergraduate Science Education
Presented By: Craig Warren, Lourdes College — **Room: Owens**

D-6 Healthy Water, Healthy People (HWHP) — Limit 20
Presented By: Dennis Clement, Ohio Environmental Protection Agency — **Room: Parlor A**

D-7 P.H.Y.S.I.C.S.: A Collaborative Experience — Limit 20
Presented By: Kim Cortez, Arlington Local School, COSMOS
Carey Roehm, Arlington Local School — **Room: Parlor B**

D-8 Magnetism for Early Childhood Students — Limit 30
Presented By: Stephen Van Hook, Bowling Green State University — **Room: Steuben**

D-9 Successfully Teaching Mathematics in Predominantly African-American Classrooms
Presented By: William Thomas, The University of Toledo
Su Breymaier, TPS Lincoln Academy for Boys — **Room: Waterford**

D-10 Modeling in Science Education
Presented By: Greg Hartzler, Wapakoneta City Schools, COSMOS — **Room: Wedgewood**

Conference at a glance - sat. cont.

Session E (9:30 am – 10:30 am)

E-1 Spatial Visualization for Younger Students: How Cool!
Presented By: Janet Emerine, Bowling Green State University — **Room: Ballroom 1**

E-2 The New Look of Stone Lab
Presented By: Lyndsey Manzo, Stone Laboratory — **Room: Ballroom 2**

E-3 Physical Science: No Special Equipment Needed!
Presented By: Christie Pinney, Fairview High Schoo
Elizabeth McCullough, Olentangy Liberty High School — **Room: Ballroom 3**

E-4 Using Webquests in the Classroom and Beyond
Presented By: Karen Menard, Toledo Metroparks — **Room: Ballroom 4**

E-5 Shakes and Eruptions
Presented By: Mary Faw, Bowling Green State University, PRISM
Nancy Scott, Bowling Green State University, PRISM
Mari Tate, Bowling Green State University, PRISM — **Room: Owens**

E-6 "I Really Do Study" — Limit 30
Presented By: Debra Bercher, Lourdes College — **Room: Parlor A**

E-7 The Chemistry of Art — Limit 20
Presented By: Elizabeth Wise, Lourdes College — **Room: Parlor B**

E-8 From Natural Disasters to Sports: Teaching With the News — Limit 30
Presented By: Debby Geyer, The Toledo Blade — **Room: Steuben**

E-9 Space Quest
Presented By: Robert Cupp, Leipsic High School — **Room: Waterford**

E-10 Great Biology Collections: How To Make One On a Shoestring Budget
Presented By: Brenda Leady, The University of Toledo — **Room: Wedgewood**

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

Conference at a glance - sat. cont.

Session F (10:45 am – 11:45 am)

F-1 Technology & Information Literacy - Primary and Secondary Sources — Limit 48
Presented By: Jean Stoner, TRECA Digital Academy — **Room: Ballroom 1**

F-2 IPY: Cool Science-Hot Topics
Presented By: Louise Huffmann, IPY International Outreach, Education Steering Committee; Jenny Baesman, Kent State University — **Room: Ballroom 2**

F-3 Experimentally Understanding Evolution (Learning By Doing II)
Presented By: Donald Pribor, The University of Toledo — **Room: Ballroom 3**

F-4 The Science of Bio-products: Food and Fuel in the Future
Presented By: Jeanne Gogolski, Ohio Soy Bean Council; Carol Warkentien, Ohio Soy Bean Council — **Room: Ballroom 4**

F-5 Planting Seeds of Science in Growing Minds — Limit 24
Presented By: Diane Thurber, Toledo Botanical Gardens; Crystal Taylor, Toledo Botanical Gardens — **Room: Owens**

F-6 Inquiry Geology and the Pet Rock
Presented By: Adam Lark, Bowling Green State University, PRISM; Robyne Kramp, Bowling Green State University, PRISM — **Room: Parlor A**

F-7 Using Analogies to Learn about Algebraic Expressions
Presented By: Ryan Vigus, Bowling Green State University — **Room: Parlor B**

F-8 Oak Openings-Spread the Word and the Seeds — Limit 30
Presented By: Marya Czech, Lourdes College; Robin Ford Parker, Lourdes College — **Room: Steuben**

F-9 Painting by Numbers
Presented By: Paul Hewitt, The University of Toledo — **Room: Waterford**

F-10 Building a Presence (BaP) for Science in Ohio
Presented By: Mary Lightbody, Otterbein College, NSTA — **Room: Wedgewood**

Lunch (11:45 am - 12:30 pm)

Pick up Lunch in Brasserie and eat in you next session room

Conference at a glance - sat. cont.

Session G (12:45 pm – 2:45 pm)

G-1 Participation in Science Fairs is Fun and Rewarding…You Have To Be Kidding!
Presented By: Mark Camp, The University of Toledo; Mikell Lynne Hedley, The University of Toledo; Janet Struble, The University of Toledo — **Room: Ballroom 1**

G-2 Preparing Students for the Ohio Achievement Tests in Science
Presented By: Cathy Holmes, Ohio Department of Education; Sarah Woodruff, Ohio Department of Education — **Room: Ballroom 2**

G-3 Images from Space — Limit 40
Presented By: Marge Marcy, NASA Glenn Research Center — **Room: Ballroom 3**

G-4 JASON Expedition — Limit 64
Presented By: Andy Kazee, JASON in Ohio; Marilyn Zielinski, Toledo Lucas County Public Library; Kathy Kwiatkowski, Case Western Reserve University — **Room: Ballroom 4**

G-5 A Day in Space: Linking Content, NASA, and Students — Limit 25
Presented By: Julie Muffler, Challenger Learning Center of Lucas County — **Room: Owens**

G-6 Helpful, Special (Often Hidden), Features on the TI-83/84 Grapher — Limit 30
Presented By: Duane Bollenbacher, Bluffton University — **Room: Parlor A**

G-7 Using Research to Improve Learning in a Junior-level University Mechanics Course: Investigating Student Understanding of Oscillations — Limit 20
Presented By: Bradley Ambrose, Grand Valley State University — **Room: Parlor B**

G-8 Where Do We Grow From Here? Lessons on Population and Carrying Capacity — Limit 30
Presented By: Debra Gallagher, Bowling Green State University — **Room: Steuben**

G-9 Hmmm….I wonder what will happen if I do THIS? — Limit 30
Presented By: Michelle Shafer, Bowling Green State University, NWO-COSMOS — **Room: Waterford**

G-10 Explore the Science of the Oil and GAS Industry
Presented By: Carol Warkentien, Ohio Oil & Gas Energy Education Project; Jeanne Gogolski, Ohio Oil & Gas Energy Education Project — **Room: Wedgewood**

All Completed Raffle Tickets Must Be Turned In To The Check-in Desk by 3:00 pm

Conference at a glance - sat. cont.

Session H (3:00 pm – 5:00 pm)

H-1 Students Show What They Know — Limit 30
Presented By: Janet Struble, The university of Toledo — **Room: Ballroom 1**

H-2 Autumn-into-Winter…Seasonal Science Paints an Ohio Learning Perspective
Presented By: Linda Penn, Lourdes College Life Lab; Susan Gioiella, Lourdes College Life Lab; Marge Malinowski, Lourdes College Life Lab — **Room: Ballroom 2**

H-3 Radiation Experiments with a Free Geiger Counter — Limit 40
Presented By: Larry Grime, American Nuclear Society; Dave Briden, American Nuclear Society; Paul Williams, American Nuclear Society — **Room: Ballroom 3**

H-4 Natural Inquirer: Inquiring into Technology, Reading Comprehension, and Environmental Science
Presented By: Safiya Samman, USDA Forest Service — **Room: Ballroom 4**

H-5 Rocking Through the Ages–Where You Can Find Rocks, Minerals, and Fossils in Northwest Ohio and Southeast Michigan — Limit 24
Presented By: Mark Camp, The University of Toledo — **Room: Owens**

H-6 The Physics of Cell Phones and Wireless Communications — Limit 24
Presented By: Dave Simmons, St. John's Jesuit High School; Scott Zura, St. John's Jesuit High School — **Room: Parlor A**

H-7 Thinking Like a Scientist: An Inquiry Classroom Model — Limit 24
Presented By: Michelle Leow Klinger, COSI Toledo — **Room: Parlor B**

H-8 Technology Enhanced Elementary and Middle School Science (TEEMSS) — Limit 28
Presented By: Carolyn Staudt, The Concord Consortium — **Room: Steuben**

H-9 High Priced Scientific Equipment Created Cool & Cheap — Limit 30
Presented By: Stephen Lease, Frank Elementary School — **Room: Waterford**

H-10 Project EXCITE's Problem-Based Learning Odysseys: A Voyage Worth Taking! — Limit 30
Presented By: Bethany Ash, Bowling Green State University; Alison Ross, Bowling Green State University — **Room: Wedgewood**

Pick up Raffle Prizes Between 5:00 pm - 5:30 pm at the Check-in Area

FRIDAY SESSIONS:

Abbreviations Used:

M: Mathematics **O: Other** **Ped: Pedagogy**
E/S S: Earth/Space Science **LS: Life Science**
PS: Physical Science **T: Technology**

Session A (1:00 pm - 2:00 pm)

A1 **STC/MSTM: Human Body Systems** **(Limit 40)**

Get your blood pumping and your juices flowing with this workshop exploring some of the systems of the human body: circulatory, respiratory, digestive, and musculoskeletal. This STC/MSTM module, Human Body Systems, leads participants in a hands-on journey through the human body. A brief overview of the STC/MSTM curriculum will be provided at the beginning of this session. Science and Technology Concepts for Middle Schools TM was developed by the NSRC and is published and distributed exclusively by Carolina Biological Supply Company.

Presented by: Sally DeRoo, Carolina Biological Supply Company
Grade Levels: 7-9 (LS) *Room:* Ballroom 1

A2 **Zoos: Menageries and Math** **(Limit 50)**

What is the average stride of an elephant? How much meat does a tiger eat? This session will explore some of the exciting ways teachers can integrate math skills and concepts with zoos, and then use these real-world applications with students. Teachers (and future teachers, too) will explore ways students can blend science and math proficiencies to investigate and understand animal forms and functions and gain insights into the multitude of mathematics used in zoos and the natural world. Polar bear paw measurements, giraffe graphs, and metric conversions are just a few things on the agenda that will add up to calculated fun. You'll also get to preview our newest Discovery Box "ZOOS: Math and Measurement". Live animals may be added for extra fun!

Presented by: Linda Calcamuggio, Toledo Zoo
Grade Levels: Pk-3, Pre-service (M, LS) *Room:* Ballroom 2

A3 **Tales From the Whale**

This presentation is for grades 1-5 with emphasis on matching new trade books to your science and math curriculum using state standards as a guide. The presentations will include both fiction and non fiction titles to make science and math fun and exciting. Come and share an hour and learn what is new and exciting.

Presented by: Marcia Kaplan, Whale of a Tale
Grade Levels: 1-5 (M, E/S S. LS. PS) *Room:* Ballroom 3

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

A4 **Natural Inquirer: Inquiring into Environmental Science**

Are you and your students natural inquirers? If so, come learn about the Natural Inquirer, an environmental science journal, for middle school and high school students! The journal is a free educational resource produced by the USDA Forest Service that is based on peer-reviewed, contemporary Forest Service research. Each edition contains activities and a lesson plan as well as other resources available on the web site: www.naturalinquirer.usda.gov. Come join us to learn more about this fantastic resource and receive free copies of the journal!

Presented by: Don Howlett, USDA Forest Service
Grade Levels: 6-12 (E/S S) ***Room:*** Ballroom 4

A5 **Professors Analyzing Their Teaching**

Professors at The University of Toledo will share their experiences of being involved in "lesson study", a UT^3 (UToledo.UTeach.UTouch the Future) project. A "lesson study" is a teaching improvement process in which faculty work together to plan a lesson, observe the lesson being taught, analyze what took place in the classroom, and then refine the lesson. Come and learn about this process.

Presented by: George Shirk, The University of Toledo
Janet Struble, The University of Toledo
Alison Spongberg, The University of Toledo
Vernon Brown, The University of Toledo
Grade Levels: College (Ped) ***Room:*** Owens

A6 **Science, Mathematics and the Toledo Museum of Art**

Math and science are everywhere, including the collection at the Toledo Museum of Art. Images of botany, the environment, ecosystems, and more fill our galleries. Balance and motion from Physics are visually depicted in paintings and kinesthetic sculpture. From basic shapes to the golden triangle, to grids creating modern abstractions, students will be amazed to discover that the numbers they crunch in class are applied by artists in a variety of ways. Students will learn about the role of science and math in art on an exciting tour at the Toledo Museum of Art.

Presented by: Carolyn Rozko,Toledo Museum of Art
Grade Levels: K-12 (M, LS, PS) ***Room:*** Parlor A

A7 **OhioView SATELLITES-Students, Teachers, Scientists using Geospatial Technologies**

Discover cutting-edge geospatial technologies (satellite remote sensing, GPS, GIS) and how to bring excitement to your classroom through inquiry-based, fun, simple activities, hands-on GPS and InfraRed Thermometer (IRT) instruments, and a 'real' science project, the Surface Temperature Research Project, through the GLOBE program. The 2006-2007 Campaign's focus is on the International Polar Year (IPY). Students will create a poster reflecting their inquiry-based IPY investigation that will be shared at the inaugural SATELLITES Conference hosted at the Great Lakes Science Center in Cleveland. Geospatial technology is the 3rd growing career path in the USA (Gewin, 2004). OhioView recognizes an incredible opportunity to prepare our youth for direct entry into the geospatial industry or for advanced training. Please come and see what SATELLITES is all about!

Presented by: Terri Benko, The University of Toledo
Kevin Czajkowski, The University of Toledo
Mandy Munro-Stasiuk, Kent State University
Grade Levels: 7-12, Pre-service, College (M, E/S S, T) ***Room:*** Parlor B

A8 **Track Tales - Becoming a Nature Detective** **(Limit 25)**

The earth is covered in tracks and each track tells a story about who or what passed by: animals, the movement of plants, which way the wind was blowing at a given time, the movement of water, and so much more. The study of tracks leads to a greater awareness of the vast amount of life around a person that largely goes unnoticed in our busy lives. Tracking is more than identifying the owner of the track; it brings in the topics of mathematics, geology, botany, animal studies, the concept of patterns, and even an introduction to topographic maps. Most students find tracks to be fascinating and that interest can be a window into a wide variety of lessons.

Presented by: Eileen Sawyer, Bowling Green State University
Grade Levels: 4-9 (LS) ***Room:*** Steuben

A9 **Let's Get Them Talking! Discourse in the Math Classroom** **(Limit 30)**

We want students to talk with each other about mathematics as well as analyze the mathematical thinking and strategies of others, but how do we facilitate this? What does this look like and sound like in a mathematics classroom? Let,s enhance your experiences and expertise with tips, strategies, and a framework from articles published by the National Council of Teachers of Mathematics to get your students talking about their mathematical thinking. The presentation will be interactive and participants will leave with handouts.

Presented by: Julie Nurnberger-Haag, Bowling Green State University
Grade Levels: Pk-9 (M) ***Room:*** Waterford

A10 **Physical 3-D Models of Molecules!**

Have you ever had difficulty in a chemistry class because you couldn't picture what the molecules really look like in nature? Have you ever had a hard time trying to teach about how molecules really look like? Well this seminar is for you! This seminar will show you how to use a new type of technology (rapid prototyping) in order to create physical 3D models of molecules!

Presented by: Jim Zubricky, Owens Community College, The University of Toledo
Grade Levels: 7-12, Pre-service, College (Ped, PS, T) ***Room:*** Wedgewood

Session B (2:15 pm - 3:15 pm)

B1 **Math Out of the Box** **(Limit 40)**

Results add up with "Math Out of the Box": An Independent Effectiveness Study of the new "Math Out of the Box" Program by Education Testing Service. Achievement gaps close and student's mathematical comprehension increases with "Math Out of the Box", as shown by the results of this DuPont funded study by Education Testing Service. Discover how this program successfully accomplishes these goals with its unique inquiry-based lessons.

Presented by: Sally DeRoo, Carolina Biological Supply Company
Grade Levels: Pk-6 (M) ***Room:*** Ballroom 1

B2 **Explore NASA**

Discover NASA resources and opportunities available to educators from NASA that will help to inspire your students. Resources are connected to the National Standards. How to become a NASA Explorer School will be highlighted.

Presented by: Marge Marcy, NASA Glenn Research Center
Grade Levels: 4-12 (E/S S) ***Room:*** Ballroom 2

B3 **Experimentally Understanding Evolution (Learning By Doing It)**

Creative learning in people who have developed logical, conceptual thinking involves a transformation from an old point of view to the self-awareness that it no longer answers many relevant questions. Such as a person may be able to endure the chaos of not knowing or not understanding a new perspective and the repeated frustrations of trial and error proposing new ideas until he/she constructs a new point of view. This is an instance of evolution that may be summarized as order, chaos, and trial and error leading to a new order. Thus, the experience of creative learning is experimentally understanding evolution.

Presented by: Donald Pribor, The University of Toledo
Grade Levels: Pre-service, College (Ped) ***Room:*** Ballroom 3

B4 **You Too Can Teach Math or Science Online!**

There seems to be increasing interest in online courses. We will present our experiences teaching science and math classes online. We will provide advice on potential pitfalls of this mode of instruction as well as best practices we have learned along the way.

Presented by: Anne Bullerjahn, Owens Community College
Joanne Roehrs, Owens Community College
Pam Krompak, Owens Community College
Grade Levels: College (M, LS, T) ***Room:*** Ballroom 4

B5 **The Impact of Class Size on Student Learning**

With more and more colleges and universities offering ever increasing large classes, the impact on student learning will be discussed. Pros and cons of both small and big classes will be discussed.

Presented by: Anjali Gray, Lourdes College
Grade Levels: 12, College (Ped) ***Room:*** Owens

B6 **NSTA/SECO on the College Campus**

This presentation is geared toward the pre-service teacher, to show them the benefits of belonging to a professional organization such as NSTA and SECO. Co-Presenters are Jackie Must and D. Michel Waggoner Out going President and Vice President of the University of Toledo Chapter of NSTA/SECO. Jackie and Mike worked together on the organization and writing of the Constitution and Bylaws for the chapter. The presentation will help guide other pre-service teachers in organizing chapters on their particular college campus if they do not have one now.

Presented by: D. Michael Waggoner, The University of Toledo
Jackie Must, The University of Toledo
Grade Levels: Pre-service, College (O) ***Room:*** Parlor A

B7 **UT^3: Transforming Science and Mathematics Teacher Recruitment, Preparation and Retention**

UT^3 is designed to recruit and prepare students to become highly qualified urban science and mathematics teachers, and then support them in their first three years of their teaching. UT^3 is a partnership among UT Colleges (Education, Arts and Sciences, Engineering, and Pharmacy); Toledo Public Schools and Central City Catholic Schools; research teams; various UT centers; and supporting community partners. The UT^3 program is designed to create an institution-wide commitment to high quality teacher preparation that includes significant policy and practice changes supported by key leaders, which will result in permanent

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

changes making teacher education a central mission of UT. In this session, participants will learn about our comprehensive recruiting strategies (including undergraduate and graduate level scholarships and internships), innovative programming with Master Teachers, uses of technology, and induction year activities.

Presented by: Charlene Czerniak, The University of Toledo
Rebecca Schneider, The University of Toledo
Janet Struble, The University of Toledo
Mark Templin, The University of Toledo

Grade Levels: Pre-service, College (O) ***Room:*** Parlor B

B8 **Linking Literary Genres and Math Concepts** **(Limit 30)**

This session will examine quality literature to further understand mathematics. Linking stories and math concepts can help students construct meaning and improve problem solving techniques and strategies. Book List and handouts will be provided to participants.

Presented by: Cherie Hunter, Monroe County Intermediate School District
Grade Levels: Pk-6, Pre-service (M) ***Room:*** Steuben

B9 **A Modest Proposal for Those Who Cancel Fractions**

This is an examination of the erroneous thinking that results from teaching students to reduce fractions to lowest terms by a process known as "cancellation". It explains the dangers that arise from teaching process instead of mathematics. It includes a close examination of the process by which students are taught to add fractions with unequal denominators.

Presented by: Donald Czarcinski, Lourdes College
Grade Levels: 4-9 (M, Ped) ***Room:*** Waterford

B10 **ORC: Your Source for Best Practice Science Resources**

This presentation will demonstrate the quality science resources found on the Ohio Resource Center's website. Participants will engage in a brief science activity taken from one of our resources, and will learn how to locate and organize resources available through ORC. ORC's lessons are peer-reviewed and all resources are aligned to Ohio's Academic Content Standards for Science. Resources included in the ORC collection represent best practices in science education. All resources are freely available. Handouts including a Quick-Start Guide and information about ORC's projects will be available.

Presented by: Terry Shiverdecker, Ohio Resource Center
Grade Levels: Pk-12, Pre-service, College (E/S S, LS, PS) ***Room:*** Wedgewood

Session C (3:30 pm - 4:30 pm)

C1 **STC: Changes** **(Limit 40)**

Join us for an interactive exploration into the 2nd grade Science and Technology for Children® unit Changes. Exciting activities lead the students through the world of physical and chemical changes. A brief overview of the STC® curriculum will be provided at the beginning of this session. Science and Technology for Children® was developed by the National Science Resources Center and is exclusively published and distributed by Carolina Biological Supply Company.

Presented by: Sally DeRoo, Carolina Biological Supply Company
Grade Levels: Pk-3 (PS) ***Room:*** Ballroom 1

C2 **What do Geckos, Bandages, and TVs Have In Common?**

Polymers are a class of materials that have infiltrated our lives to the extent that we could not survive without them. They are found in things as diverse as geckos, bandages, and TVs, as well as the cars we drive, the clothes we wear, and the food we eat. Polymers even make up part of our bodies! Participants will learn about free online resources that they can use immediately in their classrooms to meet the Ohio Science Academic Content Standards.

Presented by: Carin Helfer, Akron Global Polymer Academy
Charles Parson, Akron Global Polymer Academy
Justin Molenaur, Akron Global Polymer Academy
Grade Levels: Pk-12 (PS) ***Room:*** Ballroom 2

C3 **Abbot and Costello Take an Online Course: Who's on First?** **(Limit 40)**

Abbott and Costello will discuss the who's, the what's, and the how's of online professional development. Bud and Lou will provide a glimpse of video clips of mathematics classrooms, an online discussion group, and a look at who successfully participates (and reaches first base) in online professional development.

Presented by: Debra Gallagher, Bowling Green State University
Barbara Moses, Bowling Green State University
Grade Levels: 4-9 (M, Ped, T) ***Room:*** Ballroom 3

C4 **They Can "Do" the Algebra, But Do They UNDERSTAND It?**

In this session, we will explore examples of problems typically studied in middle and high school algebra courses (or units) and compare the skills involved in solving the problems versus the conceptual development of mathematical ideas. For example, many students can solve an equation but do not understand the geometric interpretation of finding the solution. Or they can find the slope of a line but do not understand the real world meaning of the coefficient. Likewise, students can often simplify an expression but cannot explain why alternate ways of expressing the solution also make sense. Practical suggestions for teaching algebra for understanding will be presented.

Presented by: Daniel Brahier, Bowling Green State University
Grade Levels: 7-12 (M) ***Room:*** Ballroom 4

C5 **Energy 101** **(Limit 24)**

Explore the science of energy using hands-on activities and experiments. Learn classroom activities to present the ten sources of energy, electricity, transformations of energy and energy efficiency. All participating teachers will receive a free packet of grade level specific curriculum. Appropriate for 5th-7th grade science and technology teachers.

Presented by: Sue Tenney, Ohio Energy Project
Grade Levels: 4-7 (PS) ***Room:*** Owens

C6 **It's Not Just About Chemistry Anymore**

You have done everything you can to prepare your students for college level courses. They have studied well and have scored high on your exams. But are they really ready? Have you given them ALL of the skills that they need to pass "freshmen chemistry"? This presentation will briefly take you into a general chemistry class at UT and let you experience firsthand what your students will encounter on their first day of classes, both in lecture and in the laboratory. Common student errors and skills that are commonly lacking will be presented, and how to better prepare them for college chemistry will be discussed. If any of your students are going to be doctors, pharmacists, engineers, science educators, nurses, or any other field that is science related, they need this information.

Presented by: Edith Preciosa Klingberg, The University of Toledo
Brenda Snyder, The University of Toledo
Grade Levels: 7-12 (PS) ***Room:*** Parlor A

C7 **"It's Not Your Fault"**

In spite of many problems in education today, the mathematics and science communities are bending over backwards to help teachers educate all children in the United States. We will present evidence to show that placing the blame on teachers and schools is misdirected.

Presented by: Andrea Milner, The University of Toledo
Raymond Heitger, Bowling Green State University
Grade Levels: 10-12 (Ped) ***Room:*** Parlor B

C8 **Exploring Inverse Functions with Tracing Paper**

This presentation introduces an innovative way of teaching students about inverse functions using tracing paper. The presentation will include ideas for teaching students about the Horizontal Line Test, Inverse Trigonometric Functions, and derivatives of inverse functions, making it applicable to Trigonometry, Pre-Calculus and Calculus teachers.

Presented by: Courtney Nagel, Penn State University
Grade Levels: College (M) ***Room:*** Steuben

C9 **Using Technology to Promote Student Engagement**

Exciting technologies such as podcasting, virtual reality, and geographic information systems can promote critical thinking, interactivity, problem solving, creativity, and personal expression in students. The presenter will introduce and explain the hardware and software needed to use these technologies, exhibit student projects created with them; and discuss how these tools can support the Ohio standards-based curriculum in a variety of content areas. Packets of resources will be provided to participants to assist them in further exploration of the technologies.

Presented by: Judy Lambert, The University of Toledo
Grade Levels: K-12, Pre-service, College (T) ***Room:*** Waterford

C10 **Building a Presence (BaP) for Science in Ohio**

Building a Presence for Science has been launched in Ohio, and teachers who are willing to become part of the effort are encouraged to come to this session. Learn how BaP has ended the isolation of science teachers in other states by connecting teachers directly and electronically with each other. Learn about how you can become involved as a Point of Contact for your school and/or a Key Leader in your community. All participants will receive handouts, and examples of electronic communications ("e-blasts") that have been sent through the network this year. The BaP State Coordinator for Ohio will lead this session, and will provide an introduction to this exciting new electronic network; do join us because we need YOU to make this successful.

Presented by: Mary Lightbody, Otterbein College, NSTA
Grade Levels: Pk-12, College (T) ***Room:*** Wedgewood

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

SATURDAY MORNING SESSIONS

Abbreviations Used:

M: Mathematics O: Other
E/S S: Earth/Space Science
PS: Physical Science
Ped: Pedagogy
LS: Life Science
T: Technology

Session D (8:15 am – 9:15 am)

D1 **Awesome Geometry Fun!**
Geometry activities to delight the younger ones! Hands-on, minds-on activities to connect the Ohio Academic Content and Process Standards to the student's world!
Presented by: Janet Emerine, Bowling Green State University
Grade Levels: Pk-3 (M) ***Room:*** Ballroom 1

D2 **The ABC's of Assessment** **(Limit 25)**
Are you concerned about your students passing state proficiencies and the OGT? Come f ind out how effective assessment techniques throughout the year can lead your students to success in high stakes tests. Handouts will be provided.
Presented by: Mark Templin, The University of Toledo
Grade Levels: Pk-12 (Ped) ***Room:*** Ballroom 2

D3 **The Gresser Function and What I, the Instructor, Learned in Calculus Class**
I found that the student's inability to do a (what I thought was a straight forward) calculus graphing problem had nothing to do with the calculus, but with not being able to effectively use the calculator. I will discuss the problem and how we got around the difficulties.
Presented by: Raymond Heitger, Bowling Green State University
Grade Levels: College (T) ***Room:*** Ballroom 3

D4 **Opportunities for Earth Science Training Through the American Meteorological Society**
Come find out about The American Meteorological Society's Educational Programs. AMS sponsors a variety of residential and on-line training programs for science teachers who concentrate on the earth sciences. These programs offer FREE graduate credit to all teachers who have successfully completed each course. Special emphasis is given to weather, the oceans, and the global water cycle.
Presented by: Phillip Lacey, American Meteorological Society
Grade Levels: 4-12 (E/S S) ***Room:*** Ballroom 4

D5 **Utilization of Online/Hybrid Course Formats in Undergraduate Science Education**
The utilization of hybrid and online formats in undergraduate science education can be successful if appropriate resources are devoted to the program. There have been many recent advances in the technology used to deliver these types of courses. I propose to give the participants the tools they need to begin introducing these technologies in their undergraduate science courses.
Presented by: Craig Warren, Lourdes College
Grade Levels: College (LS, T) ***Room:*** Owens

D6 **Healthy Water, Healthy People (HWHP)** **(Limit 20)**
Session will involve participants in learning about water quality and the tools they will need to teach lessons on this issue. All activities will be hands-on and participants will be given (value $30.00) one set of HWHP Curriculum Guides for their use.
Presented by: Dennis Clement, Ohio EPA
Grade Levels: 4-12, Pre-service, College (LS, PS) ***Room:*** Parlor A

D7 **P.H.Y.S.I.C.S.: A Collaborative Experience** **(Limit 20)**
P.H.Y.S.I.C.S. (Physics and Chemistry students Helping Young Scientists by Incorporating Content Standards) is a program designed to help 4th-6th grade teachers in their teaching of Physical Science by collaborating with a highly qualified science teacher, aided by high school students. This program utilizes 5-E Model lessons packed with instructions, demonstrations, and labs for common weakness areas among elementary teachers. Complete lesson plans will be shared with participants.
Presented by: Kim Cortez, Arlington Local School, COSMOS
Carey Roehm, Arlington Local School
Grade Levels: 4-6, 10-12 (PS) ***Room:*** Parlor B

D8 **Magnetism for Early Childhood Students** **(Limit 30)**
I will share a set of content-rich magnetism lessons for early childhood students that also incorporate important science process skills. Have fun with magnets and learn a fun magnet song, too!
Presented by: Stephen Van Hook, Bowling Green State University
Grade Levels: Pk-3 (PS) ***Room:*** Steuben

D9 **Successfully Teaching Mathematics in Predominantly African- American Classrooms**
The achievement gap on the Ohio Graduation Test and the Ohio Achievement Tests in mathematics between blacks and whites stands as a silent but powerful witness to society today. Either we must accept that African American children cannot learn mathematics to the same levels as whites or that they are not being taught as effectively as they could be. The presenters will share data, approaches, and activities that have been proven successful with African American children. These activities and approaches have been used successfully in Lincoln Academy for Boys, one of the nations few all boys elementary schools, and other schools in Toledo and other urban areas. Come, participate, and bring ideas that work for you.
Presented by: William Thomas, The University of Toledo
Su Breymaier, TPS Lincoln Academy for Boys
Grade Levels: 4-9 (M) ***Room:*** Waterford

D10 **Modeling in Science Education**
Wapakoneta High School implemented the recognition of and increased utilization of modeling in their science instruction during the 2005-2006 school year. The results are in. Modeling had a positive effect on students and teachers alike. We would like to share our process and results to begin additional conversation between schools in Northwest/Western Ohio on this topic.
Presented by: Greg Hartzler, Wapakoneta City Schools, COSMOS
Grade Levels: 10-12 (Ped, E/S S, LS, PS, T) ***Room:*** Wedgewood

Session E (9:30 am – 10:30 am)

E1 **Spatial Visualization for Younger Students: How Cool!**
Spatial activities connecting the Content and Process Standards to the child's world! Activities that can be adapted to any early childhood classroom and used immediately!
Presented by: Janet Emerine, Bowling Green State University
Grade Levels: Pk-3 (M) ***Room:*** Ballroom 1

E2 **The New Look of Stone Lab**
Looking for ways to increase your science content knowledge while acquiring new teaching strategies? Interested in professional development that is active, hands-on, and easily integrated into your classroom? Come see what OSU's Stone Laboratory has to offer for formal and informal educators, as well as students (grades 4-12). Get information on the newest opportunities, including technology-infused courses at the lake, online short courses, and teacher-created, standards-based curricular materials. Find out how your students can participate in aquatic sampling cruises, post-secondary opportunities, and FREE videoconferences.
Presented by: Lyndsey Manzo, Stone Laboratory Fellow
Grade Levels: 4-12, College (Ped, E/S S, LS) ***Room:*** Ballroom 2

E3 **Physical Science: No Special Equipment Needed!**
A variety of physical science activities will be presented. What will set these activities apart from others is that these activities use materials that can be found at the local grocery, home improvement or department store. Eliminating the need for specialty equipment allows all teachers to do hands on science throughout the year. Activities can be modified for use in all grade levels.
Presented by: Christie Pinney, Fairview High School
Elizabeth McCullough, Olentangy Liberty High School
Grade Levels: 7-12 (PS) ***Room:*** Ballroom 3

E4 **Using Webquests in the Classroom and Beyond**
This session will explore the basics of a webquest and interesting ways it can be used to link classroom technology with other disciplines and community resources. Learn how a webquest can successfully incorporate your next field trip.
Presented by: Karen Menard, Toledo Metroparks
Grade Levels: 4-9 (E/S S, LS, T) ***Room:*** Ballroom 4

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

E5 **Shakes and Eruptions**

Teachers will see inquiry-based labs as well as writing activities for use in teaching earthquakes and volcanoes to intermediate grade students.

Presented by: Mary Faw, Bowling Green State University, PRISM
Nancy Scott, Bowling Green State University, PRISM
Mari Tate, Bowling Green State University, PRISM
Grade Levels: 4-6 (E/S S) ***Room:*** Owens

E6 **"I Really Do Study"** **(Limit 30)**

I really did study. How many times have teachers heard this statement from students after a poor performance on a test? We'll explore the differences between these students and the successful ones and how teachers can move these novices toward becoming experts.

Presented by: Debra Bercher, Lourdes College
Grade Levels: K-12 (Ped) ***Room:*** Parlor A

E7 **The Chemistry of Art** **(Limit 20)**

The general format of this introductory chemistry course for non-science majors will be described, a min lecture will be presented, and attendees will participate in a class activity. Basic principles of chemistry are applied to the topics of color, paint, paper, clay, glass, metals, photography, and art restoration.

Presented by: Elizabeth Wise, Lourdes College
Grade Levels: 7-12 (PS) ***Room:*** Parlor B

E8 **From Natural Disasters to Sports: Teaching With the News** **(Limit 30)**

How do we teach students in a world where the amount of information available to them is doubling every two and one-half years? How do we prepare them for careers that are not even imagined today? Discover how to help students use today's news to find relevant information that will enhance your curriculum, bridge the textbook gap and encourage higher-level thinking. Watch the light bulbs go on as students "get" the importance of math, science and technology in everyday life. Hands-on activities and lessons to take with you included in this session.

Presented by: Debby Geyer, The Toledo Blade
Grade Levels: 7-12 (M, E/S S, LS, PS, T) ***Room:*** Steuben

E9 **Space Quest**

Space quest is a hands on learning module that can be used over the course of a nine week period. It addresses a number of state standards in the area of Earth/Space science. The project originated from a presentation I attended at the symposium several years ago that was presented by the Challenger Learning Center. Their module Mars Geology is included in the Space Quest Module.

Presented by: Robert Cupp, Leipsic High School
Grade Levels: 7-9 (E/S S) ***Room:*** Waterford

E10 **Great Biology Collections: How To Make One On a Shoestring Budget**

Do you want your students to experience organisms by touching, holding, feeling them? Color pictures and video are great but the actual organism is better. But most of you have little to no budget for specimens. I'll share 17 years of experience in finding and preserving specimens on a tight budget including skulls, shells, plants, whole animals, etc. I'll bring examples from my own collection to illustrate. If you attended last year, I will have new specimens and techniques to share. I will offer extra organisms from the collection to interested participants.

Presented by: Brenda Leady, The University of Toledo
Grade Levels: Pk-12, College (LS) ***Room:*** Wedgewood

Session F (10:45 am – 11:45 am)

F1 **Technology & Information Literacy - Primary and Secondary Sources** **(Limit 48)**

Participants will be introduced to a variety of Internet resources, productivity tools, and multimedia software. Students learn about primary and secondary sources about the Wright Brothers and then create an autobiographical multimedia project. Technology Content Standard 5 - Technology & Information Literacy Information literacy, Internet use, and technology tools to answer questions and expand knowledge. (Understanding Information, Primary/Secondary Sources, Internet Concepts, Searching, Web Site Evaluation, and Research Model.)

Presented by: Jean Stoner, TRECA Digital Academy
Grade Levels: 4-9 (T) ***Room:*** Ballroom 1

F2 **IPY: Cool Science-Hot Topics**

As the International Polar Year (IPY) approaches (2007-2009), share significant Polar research as it,s happening, and involve your students in the process. Journey to the coldest place on Earth with a teacher who spent a research season in the Dry Valleys of Antarctica. Find out how to create an exciting learning environment that enables students and teachers to learn the process and content of science through connections to on-going scientific research in Antarctica. Participants will receive a packet of activities to use in their classrooms.!

Presented by: Louise Huffmann, IPY International Outreach Education Steering Committee
Jenny Baesman, Kent State University
Grade Levels: Pk-12 (E/S S, LS, PS) ***Room:*** Ballroom 2

F3 **Experimentally Understanding Evolution (Learning By Doing It)**

Creative learning in people who have developed logical, conceptual thinking involves a transformation from an old point of view to the self-awareness that it no longer answers many relevant questions. Such as a person may be able to endure the chaos of not knowing or not understanding a new perspective and the repeated frustrations of trial and error proposing new ideas until he/she constructs a new point of view. This is an instance of evolution that may be summarized as order, chaos, and trial and error leading to a new order. Thus, the experience of creative learning is experimentally understanding evolution.

Presented by: Donald Pribor, The University of Toledo
Grade Levels: Pre-service, College (Ped) ***Room:*** Ballroom 3

F4 **The Science of Bio-products: Food and Fuel in the Future**

Can biotechnology end world hunger? Are we creating frankenfoods? What is a bio-refinery? Integrate Ohio Science Standards using hands-on activities that illustrate food technology, biotechnology, biofuels and bioproducts. Use the 5 E learning cycle to explore air quality issues and biofuels, bio-power and the Ohio bio products industry. Look for answers to Why is Quik® quick? How can a school bus smell like French Fries? and What is the producer "point of view" on GMOs? Participants will receive several free 8-page activity guides that include web quests, kinesthetic science models, risk-benefit activities and issue-based teaching strategies. The Ohio Soybean Council supports and sponsors science education in Ohio.

Presented by: Jeanne Gogolski, Ohio Soy Bean Council
Carol Warkentien, Ohio Soy Bean Council
Grade Levels: 4-12, Pre-service (E/S S, LS, PS) ***Room:*** Ballroom 4

F5 **Planting Seeds of Science in Growing Minds** **(Limit 24)**

Do you think the birds and the bees are just for botanists! Is pollen just something that makes you sneeze? Are leaves and seeds nothing more than bothersome clutter on your windshield? It's time to let us get you excited about plant science! We'll lead you through some of the interactive games and inquiry based activities we use at the Toledo Botanical Garden to make our Field Trips and In Class Activities fun and educational! You'll also make and take two hands-on activities to use with your students, and we promise they can't be over or under watered and won't die during winter break! Yes, you can meet those science standards in an interesting and engaging way! Join us as we fertilize our minds and sprout new ideas for your classroom.

Presented by: Diane Thurber, Toledo Botanical Gardens
Crystal Taylor, Toledo Botanical Gardens
Grade Levels: Pk-6 (LS) ***Room:*** Owens

F6 **Inquiry Geology and the Pet Rock**

The pet rock is a classic experiment from many geology units. It takes a rock and has students do experiments to test for certain geological properties using a formulaic lesson plan with a "follow the steps" approach. Our lesson plan takes that idea and puts an inquiry spin on the experiment, paralleling the lesson with an entire geology unit! Students bond with their rock while exploring its properties, and learning everything geology has to offer about their pet rock.

Presented by: Adam Lark, Bowling Green State University, PRISM
Robyne Kramp, Bowling Green State University, PRISM
Grade Levels: 4-6 (E/S S) ***Room:*** Parlor A

F7 **Using Analogies to Learn about Algebraic Expressions**

The power of an analogy is that it can be used to extend previous experiences or knowledge to new situations. The hands-on lesson discussed in this session will combine the power of analogies and the power of inquiry to help students not only learn about algebraic expressions but also increase their ability to reason through algebraic expressions.

Presented by: Ryan Vigus, Bowling Green State University
Grade Levels: 4-9 (M) ***Room:*** Parlor B

F8 **Oak Openings-Spread the Word and the Seeds** **(Limit 30)**

Presentation will include geological and ecological history of the Oak Openings region and an overview of current research by area institutions and groups. Participants will become acquainted with indigenous plants and will assemble a tabletop greenhouse for which native seeds will be provided.

Presented by: Marya Czech, Lourdes College
Robin Ford Parker, Lourdes College
Grade Levels: 7-12 (LS) ***Room:*** Steuben

F9 **Painting by Numbers**

We will use simple algebra techniques (linear equations, quadratic functions, graphs, and a bit of trig) to explore how images are captured, displayed, transmitted, and manipulated. These ideas are employed daily on the web, in digital cameras, MRIs, and many other places - maybe even the human brain. These very modern methods are strongly linked to tricks of the trade that artists have used for eons. We will use numbers to make simple paintings - we will become mathematical Picassos.

Presented by: Paul Hewitt, The University of Toledo
Grade Levels: 10-12 (M) ***Room:*** Waterford

F10 **Building a Presence (BaP) for Science in Ohio**

Building a Presence for Science has been launched in Ohio, and teachers who are willing to become part of the effort are encouraged to come to this session. Learn how BaP has ended the isolation of science teachers in other states by connecting teachers directly and electronically with each other. Learn about how you can become involved as a Point of Contact for your school and/or a Key Leader in your community. All participants will receive handouts, and examples of electronic communications ("e-blasts") that have been sent through the network this year. The BaP State Coordinator for Ohio will lead this session, and will provide an introduction to this exciting new electronic network; do join us because we need YOU to make this successful.

Presented by: Mary Lightbody, Otterbein College, NSTA
Grade Levels: Pk-12, College (T) ***Room:*** Wedgewood

Lunch (11:45 am - 12:30 pm)
Pick up Lunch in Brasserie and eat in you next session room

SATURDAY AFTERNOON SESSIONS

Session G (12:45 pm – 2:45 pm)

G1 **Participation in Science Fairs is Fun and Rewarding…You Have To Be Kidding!**

Science Fair participation does not have to be drudgery. Come find out ways to make this experience rewarding to both you and your students. Step by step instructions will be given as to how to navigate the forms. Suggestions will be given on the types of projects that work well. Tips will be given on judging. A suggested timeline will be given that lets you and the students get things done for the Fair without last minute crunches. Science Fair gives the students opportunities to engage in real science inquiry and win awards including scholarships. The presenters have over fifty years of experience in doing Science Fairs so come and see how your students can participate in this opportunity without pain and misery. There will be a question and answer period. Handouts will be provided.

Presented by: Mark Camp, The University of Toledo
Mikell Lynne Hedley, The University of Toledo
Janet Struble, The University of Toledo
Grade Levels: 7-12, Pre-service (M, E/S S, LS, PS, T) ***Room:*** Ballroom 1

G2 **Preparing Students for the Ohio Achievement Tests in Science**

So you have given your students the half-length practice test in science...now what? Using the practice test items the Ohio Department of Education will elaborate on cognitive demands to clarify the range of expected learning outcomes in conjunction with the learning cycle to guide student inquiry prescribed in all six standards of the Ohio Academic Content Standards, K-12 Science

Presented by: Cathy Holmes, Ohio Department of Education
Sarah Woodruff, Ohio Department of Education
Grade Levels: K-12 (E/S S. LS, PS) ***Room:*** Ballroom 2

G3 **Images from Space** **(Limit 40)**

Teach mathematics, science, geography and Earth science through Earth images taken from space. Participants will discover where to find images, explore the images and see how they can be used in the classroom to teach various concepts.

Presented by: Marge Marcy, NASA Glenn Research Center
Grade Levels: 4-12 (M, E/S S, LS, PS, T) ***Room:*** Ballroom 3

G4 **JASON Expedition** **(Limit 64)**

The JASON Expedition was founded eighteen years ago by oceanographer and explorer Dr. Robert Ballard after finding the Titanic. The JASON Expedition is a science education program designed to excite and engage Grade 4-9 students through an inquiry-based curriculum, video supplements and an extensive online gated web-site. Expeditions explore current and ongoing research aligned to National and Ohio State Standards (GLI's). JASON provides an integrated curriculum science investigations, literary novels and technology utilization. Participants will receive an overview of the JASON Expedition components; participate in selected hands-on activities from "Disappearing Wetlands", "Mysteries of Earth and Mars" and "Monster Storms" curriculum packets as well as access to the gated-website. Visit www.jason.org and/or www.treca.org for more information regarding the JASON project components.

Presented by: Andy Kazee, JASON in Ohio
Marilyn Zielinski, Toledo Lucas County Public Library
Kathy Kwiatkowski, Case Western Reserve University
Grade Levels: 4-9 (E/S S, LS, PS, T) ***Room:*** Ballroom 4

G5 **A Day in Space: Linking Content, NASA, and Students** **(Limit 25)**

From lift off to landing, an astronaut's day is filled with inquiry, discovery, data collection, and problem solving. Learn how your students can participate in this space simulation that you can set up right in your classroom. Patterned after Challenger Center's "Touching the Future" workshop, the workshop has been updated and developed with today's students and the national content standards at its core. During the session, the attendees will participate in at least 5 of the activities in the simulation so that they are aware of the depth of the simulation. Each attendee will receive a CD containing the complete full-day simulation with 16 hands-on activities designed for students grades K - 4.

Presented by: Julie Muffler, Challenger Learning Center of Lucas County
Grade Levels: Pk-6 (Ped, E/S S, LS, PS) ***Room:*** Owens

G6 **Helpful, Special (Often Hidden), Features on the TI-83/84 Grapher** **(Limit 30)**

Even after teaching the TI-Graphing Calculators to mathematics teachers for 10 years at summer workshops, and using the TI almost daily in the HS and University classrooms for 15 years, I still continually find new features that save work and/or time, or allow me to do things that I thought impossible. Typing the SAME THING on different models will sometimes give completely different results or graphs. WHY? How many different ways can we evaluate an expression on the grapher? We will show helpful hints on finding the most useful window when graphing. How can you graph an ellipse? A hyperbola? How can you show the graph and its table on the same screen? Where is the "correlation" key in statistics? Bring your TI-82/83/84.

Presented by: Duane Bollenbacher, Bluffton University
Grade Levels: 10-12, College (M, T) ***Room:*** Parlor A

G7 **Using Research to Improve Learning in a Junior-level University Mechanics Course: Investigating Student Understanding of Oscillations** **(Limit 20)**

Ongoing research in physics education has demonstrated that physics majors often do not develop a working knowledge of Newtonian mechanics, even after advanced instruction. This research is guiding the development of Intermediate Mechanics Tutorials, a suite of inquiry-based classroom materials that supplements traditional lectures. These materials Polymers are a class of materials that have infiltrated our lives to the extent that we could not survive without them. They are found in things as diverse as geckos, bandages, and TVs, as well as the cars we drive, the clothes we wear, and the food we eat. Polymers even make up part of our bodies! Participants will learn about free online resources that they can use immediately in their classrooms to meet the Ohio Science Academic Content Standards. are designed to address persistent conceptual difficulties and guide students to make appropriate connections between the physics and mathematics. Workshop participants will learn about recent research results and obtain firsthand experience with selected tutorials on mechanical oscillators. (Project supported by NSF grants DUE-0441426 and DUE-0442388.)

Presented by: Bradley Ambrose, Grand Valley State University
Grade Levels: College (Ped) ***Room:*** Parlor B

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

G8 **Where Do We Grow From Here? Lessons on Population and Carrying Capacity** **(Limit 30)**

Engage in interdisciplinary, hands-on activities that examine limits to growth in a finite world. Free activities on CD-ROM!

Presented by: Debra Gallagher, Bowling Green State University
Grade Levels: 4-9, Pre-service (M, E/S S, LS) ***Room:*** Steuben

G9 **Hmmm….I wonder what will happen if I do THIS?** **(Limit 30)**

Students CAN go beyond random trial and error in their scientific quests! Try out easy techniques to help students formulate content-driven questions, design & conduct scientific investigations and analyze & interpret their results. Free materials!

Presented by: Michelle Shafer, Bowling Green State University, NWO-COSMOS
Grade Levels: 7-12 (Ped, PS) ***Room:*** Waterford

G10 **Explore the Science of the Oil and GAS Industry**

Participants will engage in 6 learning stations doing hands-on science experiments in geology (porosity, permeability of rocks), physics (design technology), chemistry (properties of oil and water), earth science (Ohio's geological make-up, recycling), and technology (new uses, future products). An energy industry expert will provide an overview about the oil and gas industry in Ohio and information on Ohio geology. Participants also receive instruction on the use of graphic organizers (models, maps, flowcharts, and diagrams), issue-based learning, and career development concepts (developing skills for the real world). Free teaching materials include background information, experiments, career connections and ideas for graphic organizers. Sponsored by OOGEEP (Ohio Oil & Gas Energy Education Program.

Presented by: Carol Warkentien, Ohio Oil & Gas Energy Education Project
Jeanne Gogolski, Ohio Oil & Gas Energy Education Project
Grade Levels: 4-9, Pre-service (E/S S, PS) ***Room:*** Wedgewood

All Completed Raffle Tickets Must Be Turned In To The Check-In Desk by 3:00 pm

Session H (3:00 pm – 5:00 pm)

H1 **Students Show What They Know** **(Limit 30)**

Are you looking for ways your students can illustrate their understandings of concepts? Dinah Zike's foldables are graphic organizers in 3-D. Science examples will be given, but foldables can be adapted to any content area. This session will be a make it/take it.

Presented by: Janet Struble, The University of Toledo
Grade Levels: Pk-12 (Ped) ***Room:*** Ballroom 1

H2 **Autumn-into-Winter…Seasonal Science Paints an Ohio Learning Perspective**

Enhance your inherent Naturalist Intelligence. Join the Lourdes College Life Lab Personnel for an up-close, senses-alive exploration of plants, animals and people. Get practical inquiry-based, hands-on, minds-on methods for immediate Monday-Morning learning application.

Presented by: Linda Penn, Lourdes College Life Lab
Susan Gioiella, Lourdes College Life Lab
Marge Malinowski, Lourdes College Life Lab
Grade Levels: Pk-6 (LS) ***Room:*** Ballroom 2

H3 **Radiation Experiments with a Free Geiger Counter** **(Limit 40)**

Learn about radiation and receive a free Geiger counter and a CD-ROM with lesson plans, slides, experiments etc. Perform several experiments using your Geiger counter.

Presented by: Larry Grime, American Nuclear Society
Dave Briden, American Nuclear Society
Paul Williams, American Nuclear Society
Grade Levels: 7-12 (E/S S, PS, T) ***Room:*** Ballroom 3

H4 **Natural Inquirer: Inquiring into Technology, Reading Comprehension, and Environmental Science**

Have you ever wondered about how to integrate technology, reading comprehension, and environmental science? During this workshop you will learn how to use the Natural Inquirer journal to help integrate technology and reading comprehension skills into your classroom. The Natural Inquirer is a free, environmental science journal that is specifically written for a middle and high school age audience. The journal is based on peer-reviewed, contemporary Forest Service research. The techniques and student work that will be shared with you are from a middle school teacher and his middle school students. Come join us and receive free copies of the journal, class handouts and other resources!

Presented by: Safiya Samman, USDA Forest Service
Grade Levels: 7-9 (E/S S, O, T) ***Room:*** Ballroom 4

H5 **Rocking Through the Ages–Where You Can Find Rocks, Minerals, and Fossils in Northwest Ohio and Southeast Michigan** **(Limit 24)**

Northwest Ohio and Southeast Michigan is underlain with Paleozoic age sedimentary rocks containing quite a diverse assemblage of minerals and fossils. Fossil Park near Sylvania provides a safe field trip site for your students and a great place for you to build a Devonian fossil collection. Abandoned quarries on Kelleys Island also are places to collect Devonian fossils. Silurian fossils come from quarry dumps at many sites east of Toledo, along with the minerals–celestite, calcite, fluorite, pyrite, and sphalerite. Glacial sediments exposed along stream banks and abandoned sand and gravel pits provide examples of most igneous and metamorphic rocks. The shore of Lake Erie also provides a good selection of rocks. Armed with a geologic map and knowledge of Midwest geology will allow a teacher and/or students to collect a representative samples of most geologic materials in the K-12 curriculum with little travel from your school.

Presented by: Mark Camp, The University of Toledo
Grade Levels: Pk-12 (E/S S) ***Room:*** Owens

H6 **The Physics of Cell Phones and Wireless Communications** **(Limit 24)**

Students use cell phones every day. Every modern cell phone has more memory and more computing power than the astronauts took with them to the moon and over 195 million Americans use cell phones, but hardly any of them have a clue about how they work. Over the past two years a curriculum has been developed to engage and inspire the next generation of scientists and engineers. In this session we will present the background of this innovative program and then participants will have the opportunity to work with some of the materials designed for the unit. A Two-day workshop for teachers wishing to implement the program is being planned for summer 2007.

Presented by: Dave Simmons, St. John's Jesuit High School
Scott Zura, St. John's Jesuit High School
Grade Levels: 7-12 (PS, T) ***Room:*** Parlor A

H7 **Thinking Like a Scientist: An Inquiry Classroom Model** **(Limit 24)**

Let COSI Toledo introduce you to our Inquiry Institute and ISIS programs designed to help students and teachers grow together as scientific inquirers in the K-6 classroom. This session will feature a hands-on inquiry science investigation and provide help building process skills, integrating science across the curriculum and designing inquiry assessment strategies.

Presented by: Michelle Leow Klinger, COSI Toledo
Grade Levels: Pk-6 (E/S S, LS, PS) ***Room:*** Parlor B

H8 **Technology Enhanced Elementary and Middle School Science (TEEMSS)** **(Limit 28)**

TEEMSS has produced 15 units keyed to the National Science Education Standards that take full advantage of computers, sensors, and interactive models across all platforms. Grade levels 3 - 4, 5 - 6, and 7 - 8 have five units each, targeting the five NSES standards: targeting Inquiry, Physical Science, Life Science, Earth and Space Science, and Technology and Design strands. Each unit contains two Investigations, each with a discovery question, several trials, analysis, and further investigations. There is also a teacher,s version of each investigation, which contains background material and a discussion guide. The TEEMSS activities are embedded in software (SensorPortfolio) that allows students to read the investigation, answer questions, collect data, analyze their results, and save their work within one application. SensorPortfolio is not specific to any sensor manufacturer or platform. It is designed to work with whatever curriculum, computers, handhelds, and sensors schools may adopt. The workshop will allow you to try out the some of the units and see how they would fit in your own classroom.

Presented by: Carolyn Staudt, The Concord Consortium
Grade Levels: Pk-9 (E/S S, LS, PS, T) ***Room:*** Steuben

H9 **High Priced Scientific Equipment Created Cool & Cheap** **(Limit 30)**

Teacher / Student devices generated by the teacher or class to visually demonstrate: why we need to revise and design in the world, trace electrical current, what happens to matter on a molecular level constantly that can not see with our own eyes, watch what happens when thermal energy is added to matter, increase thermal energy (heat),and/or what happens when pressure is added to matter.

Presented by: Stephen Lease, Frank Elementary School
Grade Levels: 4-6 (PS) ***Room:*** Waterford

Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.

39

H*1*8

Project EXCITE's Problem-Based Learning Odysseys: A Voyage Worth Taking! **(Limit 30)**

During this hands-on, minds-on workshop, we will immerse participants in a mini problem-based learning experience entitled, ZoOdyssey. We will walk through our four learning opportunities: Meet the Problem (understanding the issue), Investigate and Inquire (using diverse investigative strategies for research and problem solving), Build Solutions (brainstorming and critiquing possible options), and Take Action (exploring student service learning opportunities). EXCITE staff will explain the Design Templates used by classroom teachers to develop the current EXCITE Odyssey units. Participants will leave with a better understanding of how they can use our templates to develop their own local PBL, EHS unit. All participants will receive a complimentary, electronic copy of ZoOdyssey and our unique Odyssey design materials.

Presented by: Bethany Ash, Bowling Green State University
Alison Ross, Bowling Green State University

Grade Levels: 4-9 (O) *Room:* Wedgewood

Pick up Raffle Prizes Between 5:00 pm - 5:30 pm at the Check-in Area

Presenters

Keynote Speaker

Dr. David Carlson, International Polar Year Program Director, Cambridge, England

Session Presenters

Bradley Ambrose, Grand Valley State University
Bethany Ash, Bowling Green State University
Jenny Baesman, Kent State University
Terri Benko, OhioView Consortium – The University of Toledo
Debra Bercher, Lourdes College
Duane Bollenbacher, Bluffton University
Daniel Brahier, Bowling Green State University
Su Breymaier, TPS Lincoln Academy for Boys
Dave Briden, American Nuclear Society
Vernon Brown, The University of Toledo
Anne Bullerjahn, Owens Community College
Linda Calcamuggio, Toledo Zoo
Mark Camp, The University of Toledo
Dennis Clement, Ohio Environmental Protection Agency
Kimberly Cortez, Arlington Local School, COSMOS
Robb Cupp , Leipsic High School
Kevin Czajkowski, OhioView Consortium – The University of Toledo
Donald Czarcinski, Lourdes College
Marya Czech, Lourdes College
Charlene Czerniak, The University of Toledo
Sally DeRoo, Carolina Biological Supply Company
Janet Emerine, Bowling Green State University
Mary Faw, Bowling Green State University, PRISM
Robin Ford Parker, Lourdes College
Debra Gallagher, Bowling Green State University
Debby Geyer, The Toledo Blade
Susan Gioiella, Lourdes College
Jeanne Gogloski, Ohio Oil & Gal Energy Education Project, Ohio Soy Bean Council
Anjali Gray, Lourdes College
Larry Grime, American Nuclear Society
Greg Hartzler, Wapakoneta Schools, COSMOS
Mikell Lynne Hedley, The University of Toledo
Raymond Heitger, Bowling Green State University
Carin Helfer, Akron Global Polymer Academy
Paul Hewitt, The University of Toledo
Cathy Holmes, Ohio Department of Education
Don Howlett, USDA Forest Service
Louise Huffmann, IPY International Education Outreach Steering Committee
Cherie Hunter, Monroe County Intermediate School District
Marcia Kaplan, Whale of a Tale
Andy Kazee, JASON in Ohio
Edith Preciosa Klingberg, The University of Toledo
Robyne Kramp, Bowling Green State University, PRISM
Pam Krompak, Owens Community College
Kathy Kwiatkowski, Case Western Reserve University
Philip Lacey, East Liverpool High School, American Meteorological Society
Judy Lambert, The University of Toledo
Adam Lark, Bowling Green State University, PRISM

40

41

Presenters cont.

Brenda Leady, The University of Toledo
Stephen Lease, Frank Elementary School
Michelle Leow Klinger, COSI of Toledo
Mary Lightbody, Otterbein College, NSTA
Marge Malinowski, Lourdes College
Lyndsey Manzo, The Ohio State University Stone Lab Fellow
Marge Marcy, NASA Glenn Research Center
Elizabeth McCullough, Olentangy Liberty High School
Karen Menard, Toledo Metroparks
Andrea Milner, The University of Toledo
Justin Molenaur, Akron Global Polymer Academy
Barbara Moses, Bowling Green State University
Julie Muffler, Challenger Learning Center of Lucas County
Mandy Munro-Stasiuk, OhioView Consortium – Kent State University
Jackie Must, The University of Toledo
Courtney Nagel, Penn State University
Julie Nurnberger-Haag, Bowling Green State University, COSMOS
Charles Parson, Akron Global Polymer Academy
Linda Penn, Lourdes College
Christie Pinney, Fairview High School
Donald Pribor, The University of Toledo
Cary Roehm, Arlington Local School
Joanne Roehrs, Owens Community College
Alison Ross, Bowling Green State University
Carolyn Rozko, Toledo Art Museum
Safiya Samman, USDA Forest Service
Eileen Sawyer, Bowling Green State University
Rebecca Schneider, The University of Toledo
Nancy Scott, Bowling Green State University, PRISM
Michelle Shafer, Bowling Green State University, NWO-COSMOS
George Shirk, The University of Toledo
Terry Shiverdecker, Ohio Resource Center for Mathematics, Science and Reading
David Simmons, St. John's Jesuit High School
Brenda Snyder, The University of Toledo
Alison Spongberg, The University of Toledo
Carolyn Staudt, The Concord Consortium
Jean Stoner, TRECA Digital Academy
Janet Struble, The University of Toledo
Mari Tate, Bowling Green State University, PRISM
Crystal Taylor, Toledo Botanical Garden
Mark Templin, The University of Toledo
Sue Tenney, Ohio Energy Project
William Thomas, The University of Toledo
Diane Thurber, Toledo Botanical Garden
Stephen Van Hook, Bowling Green State University
Ryan Vigus, Bowling Green State University
D. Michael Waggoner, The University of Toledo
Carol Warkentien, Ohio Oil & Gas Energy Education Project, Ohio Soy Bean Council
Craig Warren, Lourdes College
Paul Williams, American Nuclear Society
Elizabeth Wise, Lourdes College
Sarah Woodruff, Ohio Department of Education
Marilyn Zielinski, Toledo Lucas County Public Library
Jim Zubricky, Owens Community College, The University of Toledo
Scott Zura, St. John's Jesuit High School

Vendors

Akron Global Polymer Academy
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http://www.biosciences.utoledo.edu/Outreach.html

Ohio Oil & Gas Energy Education Program
P.O. Box 187
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42

Vendors cont.

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The Reading Railroad, A Children's Bookshop
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We wish to thank all our vendors for their donations to our teacher raffle.

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http://www.concord.org

Donations cont.

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538 South Reynolds Road
Toledo, OH 43615
Robert L. Ehmann
1181632@cnrc.nav.mil
http://www.navy.gov

USDA Forest Service
320 Green Street
Athens, Georgia 30602
Barbara McDonald
bmcdonald@fs.fed.us
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Virtual Courseware Project
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http://ScienceCourseware.org

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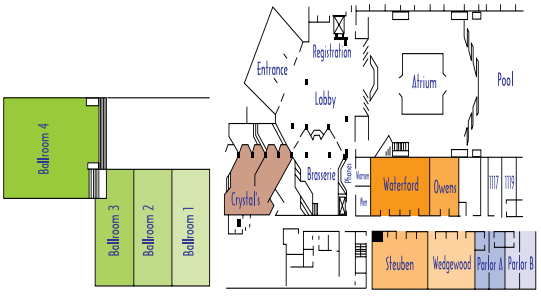
info@classroomgoodies.com
http://www.classroomgoodies.com

We wish to thank all our donors for their contributions to the success of our Symposium.

Clarion hotel floor plan



47

Thanks

We wish to acknowledge the following individuals who worked so hard to make this Symposium a success:

Symposium Planning Committee

Bowling Green University:	Jodi Haney Julie Nurnberger-Haag Michelle Shafer Stephan Van Hook
GTCTM:	Debra Shelt
Lourdes College:	Don Czarcinski William Lindeman Cynthia Molitor Elizabeth Wise
The University of Toledo:	Robin Brown Emilio Duran Mikell Lynne Hedley Leslie Smith Janet Struble William Thomas
Symposium Coordinator:	Mikell Lynne Hedley
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Notes

48

Notes

48

NWO

COSMOS

SciMaTEC

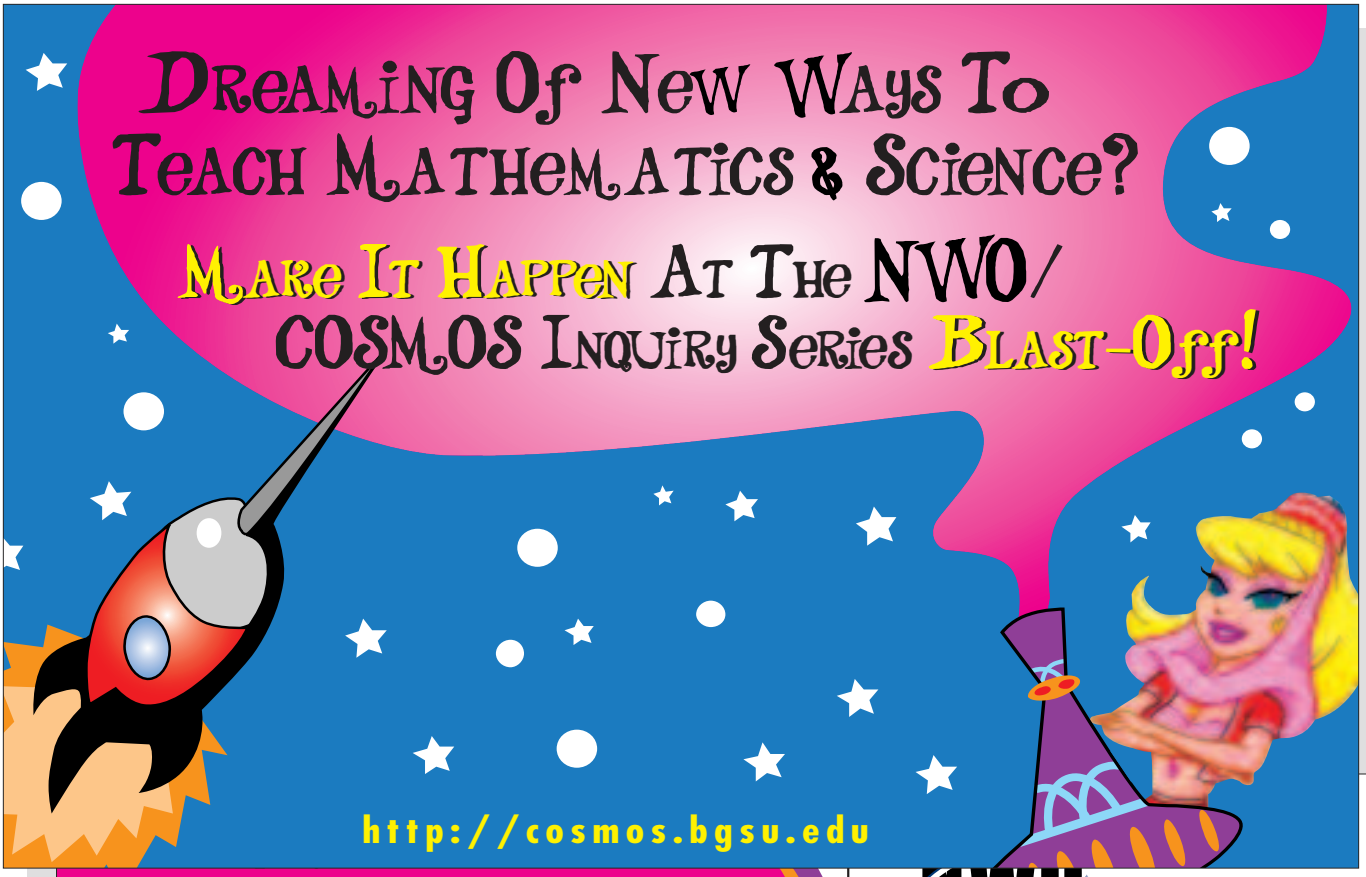
Northwest Ohio Center of Excellence in Science and Mathematics Education

coordinating partners

BGSU Bowling Green State University · Owens Community College · The University of Toledo

The 2006 NW Ohio Symposium on Science, Math and Technology Teaching is being sponsored by the Northwest Ohio Center of Excellence and its partners SciMaTEC, COSMOS, Owens Community College, and PRISM

Appendix C: 2006-07 NWO/COSMOS Inquiry Series Postcard



Investigative Mathematics & Science

Investigative Mathematics and Science Feature Presentations

Blast-Off, Sept 16: Keynote Speaker: Dr. Larry Lowery, Lawrence Hall of Science; Pick break out sessions just right for you! Math Science Bldg., BGSU; 8:30 am – 12:30 pm

* **Oct 5:** Investigating via Activities: Games, Manipulatives, Simulations, and Visualizations; 5 – 8 pm
* **Nov 3 & 4:** NWO Symposium on Science, Math and Technology Teaching
* **Dec 7:** Investigating Hands-on, Minds-on Learning; 5 – 8 pm
* **Jan 18:** Investigating via Technology Tools; 5 – 8 pm
* **Feb 22:** Using assessment to guide investigations; 5 – 8 pm
* **Mar 15:** Investigating via Problem Based Learning and Real-World Approaches; 5 – 8 pm

Summit, Apr 28: 8:30 am – 12:30 pm

Oct 5, **Dec 7**, **Jan 18**, **Feb 22**, and **Mar 15** will be held at Owens Community College, Audio-Visual Classroom Center, main room #125.

* *In place of these presentations, you can meet with other teachers to conduct action research or develop and implement a classroom inquiry action plan. NWO TEAMS teachers attend content sessions.*

CEUs available or 2 paid graduation credit hours [30 scholarships available]!

Register online TODAY at: http://cosmos.bgsu.edu

HIGHLY QUALIFIED TEACHER OPPORTUNITY!

COSMOS SciMaTEC

Northwest Ohio Center of Excellence in Science and Mathematics Education

Jodi Haney, Ph.D., Director
241 Math Science Bldg., BGSU
Bowling Green, OH 43403-0212
(419) 372-2718

overlapping partners BGSU Owens Toledo

COSMOS is a partner of the Northwest Ohio Center of Excellence in Science and Mathematics Education (NWO).

Funding provided by the Ohio Board of Regents and the Ohio Resource Center.

Appendix D: Larabee Mini-Grant: The Physics of Cell Phones and Wireless Communication

Announcing!
A Two-Day Workshop

The Physics of Cell Phones and Wireless Communications
An Inquiry-based, student –centered program

June 14-15, 2007

Supported in part by:
An **NWO/COSMOS Larabee Grants-to-Teachers** grant
and **St. John's Jesuit High School**

Join other outstanding physics and technology teachers from Ohio and Michigan to discover the fundamental science and engineering of cell phones and other wireless communications.

We live in a world with instantaneous global communications. Perhaps 200 million Americans have cell phones. Our students use cell phones, MP3s™, and iPods™ every day and their parents use Palms™, BlackBerrys™, and Trēos™. Despite the ubiquitous nature of modern communications, most students (and many teachers) don't have a clue of the science behind these wonderful, technological marvels. Three Detroit area high school teachers working with engineers from Cingular, Motorola, and the University of Michigan have developed an exciting and innovative three-week program.

They have discovered that these devices can be used to effectively teach physics concepts (vibrations and waves, sound, light, and electromagnetism), technology, engineering, and mathematics.

Not only will you learn the science, participants will:

- Design, build, and test devices to send and receive voices over personal radios, light beams, and through optical fibers.
- Learn the fundamentals of GSM and CDMA systems and structures of cell networks and the answers to most common student questions about cell phones.
- Learn how to effectively engage the students in the concepts.
- The pedagogy is "constructivist" and based on the best practices in science education as outlined in the National Resource Council's Guide, "***How People Learn***," and "***12 Brain/Mind Principles in Action*** (Corwin Press 2004)

Appendix D: Larabee Mini-Grant: The Physics of Cell Phones and Wireless Communication cont.

The two-day workshop will be hosted by St. John's Jesuit High School, 5901 Airport Hwy, Toledo, Ohio and has been partially funded by a grant from NOW/COSMOS (Northwest Ohio Center of Excellence, the Center of Science and Mathematics Education: Opportunities for Success).

Upon successful completion of the program, participants will have the right to borrow the set of equipment and student books (valued at near $2000) to use in their own classrooms. All teachers are requested to participate in an evaluation of the unit when implemented and participate in a presentation at a COSMOS symposium.

Benefits to Participants:

Upon successful completion of the workshop, participants will have the right to borrow the set of equipment and student books (valued at near $2000) to use in their own classrooms.

Participants will receive one-to-one assistance as they implement the curriculum.

Earn CEUs

Requirements of Participants:

Teachers who would like to participate in the workshop need to submit an application and $200 or a letter from their principal committing $200 towards the cost of materials by June 1, 2007.

Participants will also need to pay their own travel, meals and hotel expenses.

Participants are requested to participate in an evaluation of the unit when implemented and participate in a presentation at a NWO/COSMOS Symposium (cosmos.bgsu.edu)

Completed application should be sent preferably as an email attachment by **June 1, 2007** to:

dsimmons@sjjtitans.org
or to
David A. Simmons
St. John's Jesuit High School
5901 Airport Hwy
Toledo, OH 43615

If needed, you can fax to: 419-861-5002

(All applicants will receive e-mail acceptance notices by June 5.)

Please contact David Simmons by email or phone for further information
dsimmons@sjjtitans.org – 419-865-5743 ext 272
419-823-0290 (evenings)

Northwest Ohio Center of Excellence
in Science and Mathematics Education

Appendix E: Redesigned/Developed Courses

Activity	Professional Field of Participants	Number of Participants
New/Revised STEM Teacher Preparation/ Retention Courses		
BGSU MAT Scholarship Program	7-12 Physics, Mathematics and Biology Educators	15
BGSU: Jim Albert Course "Active Chance" (Su 07)	7-12 Mathematics Teachers	25
BGSU: Dan Brahier - Introduction to Secondary Mathematics (Fall 06 & Continuing)	7-12 Pre-Service Mathematics Teachers	25
BGSU: ENVS 415 - Earth as a System (Sp 07)	Pre-Service Teachers	24
BGSU: BIOL 450 - Teaching Evolution and the Nature of Science (Fall 06 & Continuing)	Pre-Service Teachers	14

Appendix F: NWO Faculty and Staff Scholarship

Faculty Refereed Publications

Articles by NWO core faculty published in FY 2007 that are directly related to NWO/COSMOS

Moran, T. (2007, February). Applications of sound spectrum analysis. *The Physics Teacher*.

Van Hook, S., Lark, A., Hodges, J., Celebrezze E., & Channels, L. (2007, February). Playground physics: Determining the moment of inertia of a merry-go-round. *The Physics Teacher*.

Van Hook, S., & Huziak-Clark, T. (2007, March). Spring into energy: Toy-based inquiry activities introduce primary students to key ideas about energy. *Science and Children*.

Articles by NWO core faculty published in FY 2007 that are NOT directly related to NWO/COSMOS

Haney, J. J., Keil, C. P., & Zoffel, J. (2007). From problem solving to taking action: A problem-based learning model for the middle grades. *Ohio Middle School Journal*.

Haney, J., Wang, J., & Keil, C. (in press). Enhancing teachers' beliefs and practices through the implementation of problem-based learning focused on locally pertinent environmental health science issues. *The Journal of Environmental Education*.

Haney, J. J., Keil, C., & Zoffel, J. (2007). From problem solving to taking action: A problem-based learning odyssey model for the middle grades. *Ohio Middle School Association Journa*l, 30(1), 6–11.

Keil, C. P., Haney, J. J., & Zoffel, J. (2006, October). Improvements in science process skills using environmental health science problem based learning curricula. *The Journal of Environmental Education*.

Lumpe, A., Czerniak, C., Beltyukova, S., & Haney, J. (2007, May). Beliefs about teaching science: The relationship between elementary teachers' professional development and student achievement. *Science Education*.

Underwood, E. (2006, 2007) Herp-of-the-month. *Toledo Herpetological Society Newsletter*.
2/07 Spotted python, *Liasis (Antaries) maculosa*
11/06 Mandarin ratsnake, *Elaphe mandarina*
6/06 Bearded dragon, *Pogona vitticeps*

Faculty Refereed Presentations

Presentations by NWO core faculty published in FY 2007 that are directly related to NWO/COSMOS

Nurnberger-Haag, J. (2007, May). *Let's get them talking: Discourse in the math classroom*. Presented at the Centers of Excellence Annual Conference, Columbus, OH.

Nurnberger-Haag, J. (2007, April). *Math on the move!* Presented at the NWO Inquiry Series Summit, Bowling Green, OH.

Nurnberger-Haag, J. (2006, November). *Let's get them talking: Discourse in the math classroom*. Presented at the NWO Symposium, Toledo, OH.

Nurnberger-Haag, J. (2006, October). *Teaching shape recognition in the early years: Do children's books help or hinder?* Presented at the Ohio Council of Teachers of Mathematics Annual Conference, Toledo, OH.

Nurnberger-Haag, J. (2006, October). *LCM or GCF: Which one is which?* Presented at the Allen County Technology in Education Conference, Bluffton, OH.

Nurnberger-Haag, J. (2006, October). *Math on the move!* Presented at the Allen County Technology in Education Conference, Bluffton, OH.

Shafer, M. (2007, May). *Strategies to bridge the hands-on, minds-on gap*. Presented at the Centers of Excellence Annual Conference, Columbus, OH.

Shafer, M. (2007, February). *I wonder what happens if I do this?* Presented at the Science Educators' Council of Ohio Annual Convention, Columbus, OH.

Shafer, M. (2006, November). *I wonder what happens if I do this?* Presented at the NWO Symposium, Toledo, OH.

Shafer, M. (2006, October). *Writing to learn science, learning to write about science.* Presented at the Allen County Technology in Education Conference, Bluffton, OH.

Presentations by NWO core faculty published in FY 2007 that are NOT directly related to NWO/COSMOS

Duran, E., Beltyukova, S., Fox, C., & Haney, J. J. (2007, April). *The impact of a professional development program entitled NWO TEAMS (Teachers Enhancing Achievement in Mathematics and Science) on the content knowledge and teaching skills of elementary science and mathematics teachers.* Presented at the National Association for Research in Science Teaching International Convention, New Orleans, LA.

Haney, J. J., Matulis, J., & Duran, E. (2007, April). U*sing logic models to guide mathematics and science program development and evaluation.* Presented at the Middle Grade Teaching and Learning Symposium, Columbus, OH.

Haney, J. J., & Zoffel, J. (2007, April). *Middle grades students EXCITE-d about learning…It's true!* Presented at the Middle Grade Teaching and Learning Symposium, Columbus, OH.

Huziak-Clark, T., Van Hook, S., Ballone Duran, L., & Nurnberger-Haag, J. (2007, April). *Impact of PRISM on teacher/graduate scientist or mathematician's use of inquiry in the classroom to improve student learning.* Presented at the annual meeting of the American Educational Research Association, Chicago.

Huziak-Clark, T., Ballone Duran, L., Beltyukova, S., Van Hook, S., & Nurnberger-Haag, J. (2007, April). *The impact of the Partnership for Reform through Inquiry in Science and Mathematics (PRISM) program on teachers' and graduate fellows' self-efficacy and beliefs about inquiry-based teaching.* Presented at the National Association for Research in Science Teaching Conference, New Orleans, LA.

Juelich, B., & Midden, W. R. (2007, February). *Collaboration and co-curricular programming in a living learning community.* Presented at the OCPA/OASPA Conference, Worthington, OH.

Midden, W. R. (2006, September 29). *Realizing the synergism of collaboration.* Keynote address for Arts & Sciences Colloquium of the Associated Colleges of Illinois, Des Plaines, IL.

Midden, W. R. (2006, September 30). *Learning chemistry through hands-on inquiry in a gen ed course for non-majors.* Symposium honoring Prof. Thomas H. Kinstle, Bowling Green State University, Bowling Green, OH.

Midden, W. R., & Holden, B. (2006, October 13). *BGSU's Chapman residential learning community: An RLC exemplar.* Presented at the 6th annual Ohio First Year Summit, Cincinnati, OH.

Midden, W. R., & Mahaffey, C. (2006, October 13). *Service learning at BGSU: Two examples*. Presented at the 6th annual Ohio First Year Summit, Cincinnati, OH.

Midden, W. R. (2006, November). *Assessment of higher order cognitive skills*. Presented at the 11th annual National Learning Communities Conference, Bay City, MI.

Midden, W. R. (2007, May 24). *Real research in a general education science course for first year undergraduate non-science majors.* Presented at the Enriching the Academic Experience of College Science Students Conference, University of Michigan, Ann Arbor.

Rathsack, C. E., & Haney, J. J. (2007, March). *Transforming learning: STEM2 learning communities of practice.* Presented at the Ohio Digital Commons for Education: The Convergence of Learning, Libraries, and Technology, Columbus, OH.

Rathsack, C. (2006, November). *CAT & mouse: Integrating classroom assessment techniques and technology tools.* Presented at the National Science Teachers Association Regional Conference, Baltimore, MD.

Rathsack, C. (2007, March). *Transforming learning: STEM3 learning communities of practice.* Presented at the ODCE Conference, Columbus, OH.

Rathsack, C. (2007, March). *Engaging students with visual Excel activities.* Presented at the NSTA National Conference, St. Louis, MO.

Scheuermann, A. M. (2007, April). *The validation of the explicit inquiry routine with one-variable equations.* Presented at the Council for Exceptional Children Annual Convention, Louisville, KY.

Scheuermann, A. M. (2007, March). *The explicit inquiry routine: Using modes of representation to solve word problems.* Presented at the National Council of Teachers of Mathematics Annual Meeting, Atlanta, GA.

Scheuermann, A. M. (2007, January). *The effects of the explicit inquiry routine on the performance of students with learning disabilities on one-variable equations.* Presented at the Hawaii International Conference on Education, Waikiki, HI.

Velotta, T., & Midden, W. R. (2006, October). *Bridging the cultural gap: Collaboration of residence life and academic faculty.* Presented at the National Conference of Living-Learning Programs and Residential Colleges, Syracuse, NY.

Van Hook, S., Huziak, T., Ballone Duran, L., & Nurnberger-Haag, J. (2006, July). *PRISM*. Poster session presented at the National Conference of the American Association of Physics Teachers, Syracuse, NY.

Non-Refereed Publications, Presentations, and Workshops Related to NWO/COSMOS

Haney, J. J. (2006). *Do you believe? EXCITE teachers do! Project EXCITE Taking Action Newsletter*, 4(1).

Underwood, E. (2006, June). *Biodiversity in reptiles*. AIMS Summer Program, BGSU.

Zoffel, J. (2006). Collaborative update: Project EXCITE. *Collaborative Express*, 2(2).

News Articles about NWO/COSMOS and Affiliated Projects

Romaker, J. (2006, April 13). Area students probe effects of 2nd-hand smoke. The Toledo Blade. http://toledoblade.com/apps/pbcs.dll/article?AID=/20060413/NEIGHBORS02/304130008/-1/NEIGHBORS

Tillett, T. (2006). Beyond the bench: Bringing EXCITEment to the classroom. *Environmental Health Perspectives*, 114(6), A350-A351.

Grant Submissions and Awards

COSMOS DREAMS. Ohio Department of Education Mathematics and Science Partnership (MSP) Grant. $350,000. March 2007.

NWO Center of Excellence for Science and Mathematics Education. Ohio Board of Regents grant. $800,000 over four years. October 2006.

NWO TEAMS Renewal grant. Ohio Department of Education Mathematics and Science Partnership (MSP) Grant. $636,000. March 2007.

OBOR-ITQ. CLASS ACT Project: Connected Learning: Assessing Student Success through Active Computer Technologies. Eileen Underwood, PI., Carrie Rathsack and Bonnie Fink, Co-PIs. $155,309 requested. Submitted 11/06. Denied.

OBOR-ITQ. RIPE: Research based Inquiry in Physics Education. Steven Van Hook PI, Tracy Huziak-Clark co-PI. $135,000 requested. Submitted 11/06. Funded.

OBOR-ITQ. UPSHOTS: Mandy Heddle, PI, Jodi Haney co-PI. $155,309 requested. Submitted 11/06. Denied.

REAL: Regent's Environmental Academy for Learning. The Ohio Board of Regents. $350,000. January 2007. Funded

Appendix G: COSMOS Publication: Moran, T. (2007)

Applications of Sound Spectrum Analysis

Timothy Moran,

Fig. 1. Sound spectrum produced by the author speaking a long "A" sound followed by the author whistling. During both sounds the pitch was raised and then lowered.

Fig. 2. Sound spectrum produced by the author blowing at the ends of tubes of two different lengths (22 cm and 25 cm, respectively, open at both ends) from a direction perpendicular to the axis of the tubes, followed by the author singing on the monophone.

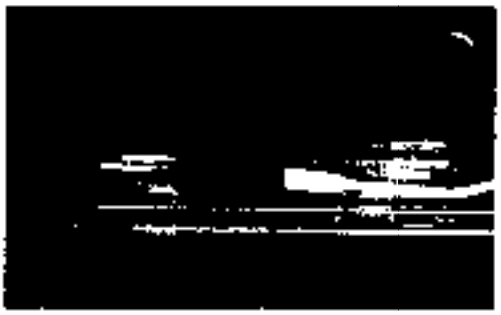


Fig. 3 Experimental setup to demonstrate the existence of nodes and antinodes in a tube of resonating air

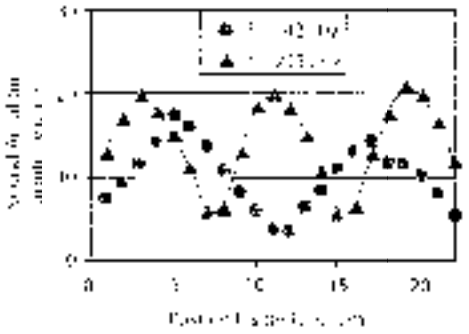


Fig. 4 Sound amplitude vs position inside a tube (length = 22 cm, diameter = 1 cm), made with a transparency sheet and tape, excited with sine waves at 2021 Hz (blue data points) and 2158 Hz (red data points). The vertical axis values were obtained using a graph of amplitude vs frequency by reading the amplitude value that matched the excitation frequency

Acknowledgments

References

Timothy Moran

Bowling Green State University, Bowling Green, OH

Appendix H: COSMOS Publication: Van Hook, et al. (2007)

Playground Physics: Determining the Moment of Inertia of a Merry-Go-Round

Stephen Van Hook, Adam Lark†, Jeff Hodges, Eric Celebrezze, and Lindsey Channels,

Fig. 1. The moving inward experiment. (a) Two of us stand on the outer edge of the MGR while a third person sits on the inside to start the data collection and tell the others when to start coming in. A fourth person spins up the MGR (and stops it after the experiment). (b) Once we have moved inside as much as we are able to given space constraints and our ability to pull ourselves inward.

Table 1. A comparison of τ and I_{MGR} determined from the centripetal acceleration and from video analysis.

	Calculated from a_c		Observed in video		% Difference	
Moving out						
Moving in						

Fig. 2. The centripetal acceleration vs time plots for our (a) moving outward and (b) moving inward runs for a 15 s interval. Notice that the transition in (a) is cleaner than in (b) since it was very easy to move outward on the MGR but moving inward was quite a struggle.

Conclusion

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Department of Physics & Astronomy, Bowling Green State University, Bowling Green, OH 43403, svanhoo@bgsu.edu

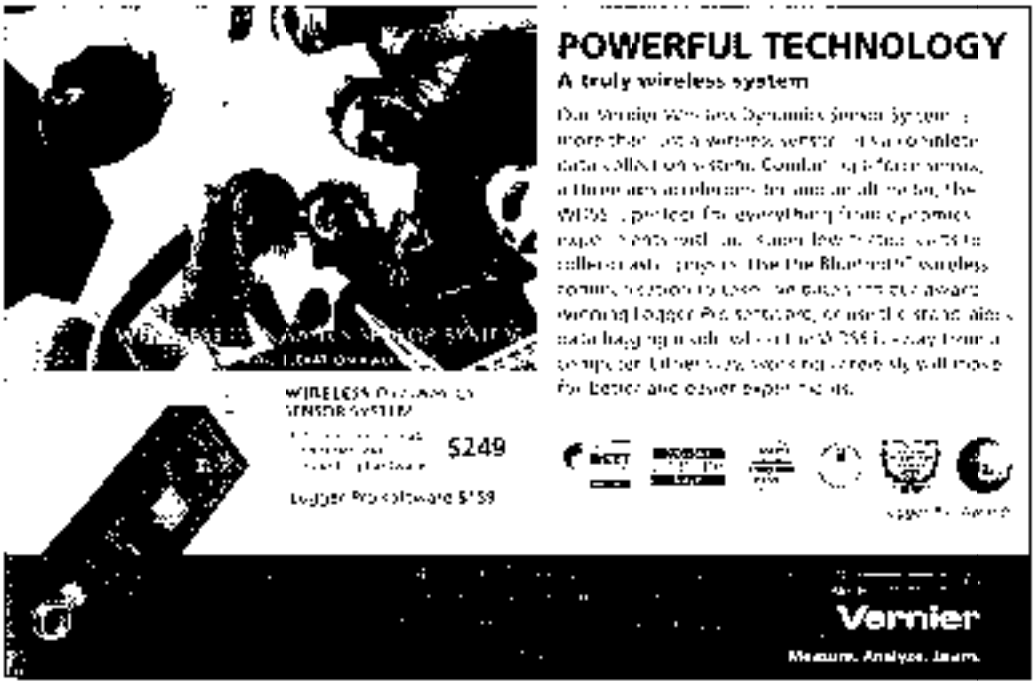
Adam Lara

Jeffrey Hodges

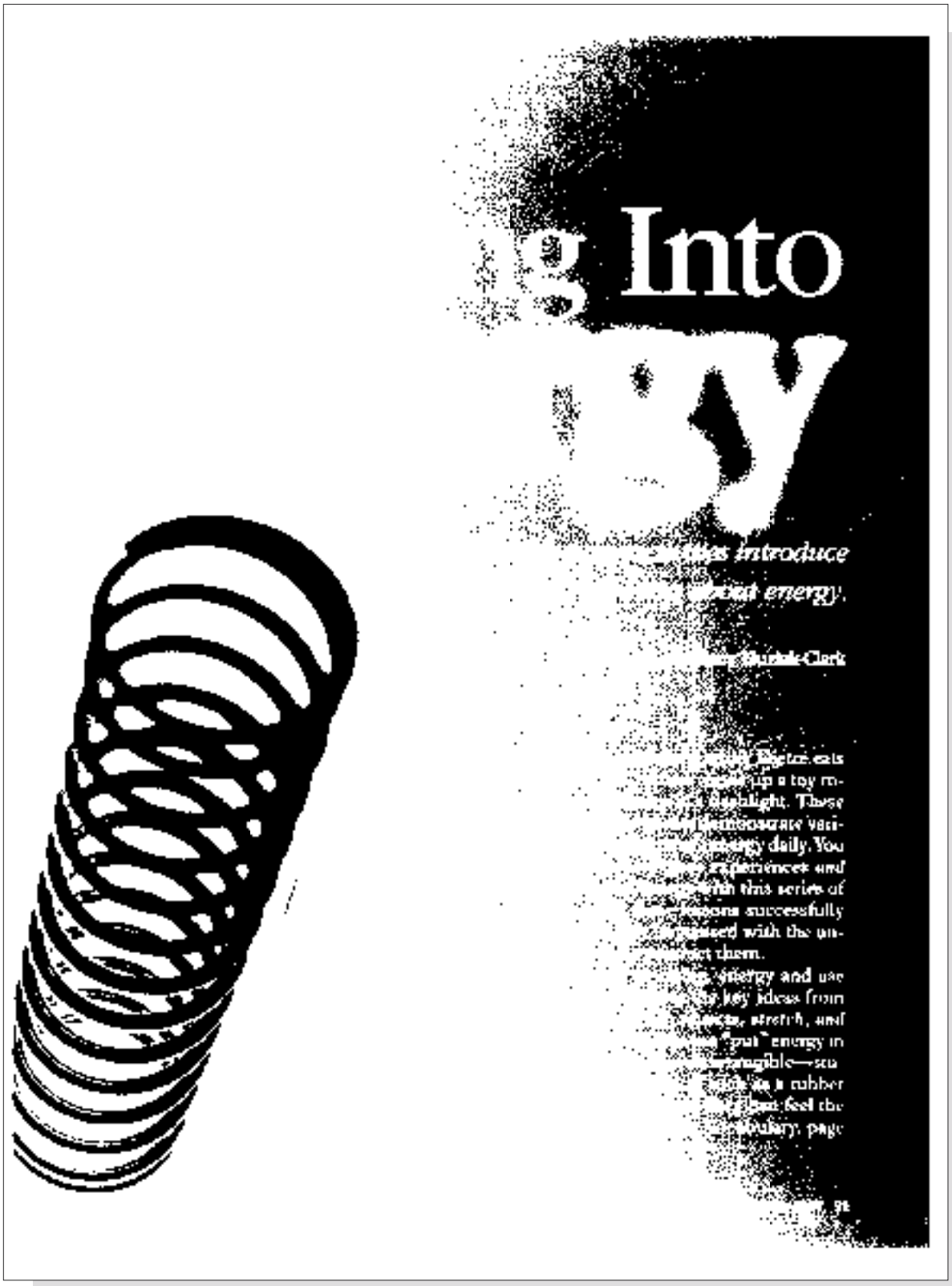
Eric Colchester

Lindsay Channels

References



Appendix I: COSMOS Publication: Van Hook and Huziak-Clark (2007)



Appendix I: COSMOS Publication: Van Hook and Huziak-Clark (2007) cont.

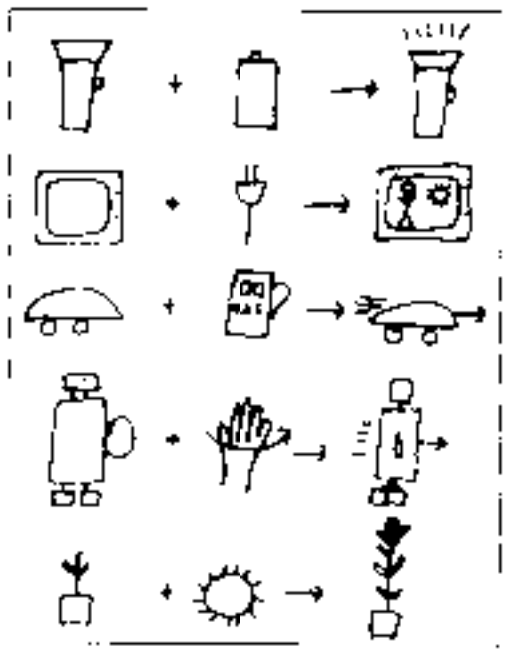
Lesson One:

Energy Vocabulary

Energy can take many forms: kinetic motion), thermal energy (heat), gravitational potential energy (lifted object), elastic potential energy (e.g., stretched rubber band), chemical potential energy (e.g., gasoline, food), electricity, magnetic potential energy, etc.

Elastic Potential Energy ("Spring Energy") is the form of energy an object has when it is stretched, compressed, twisted, bent, or otherwise has its shape changed as long as the object resists and will try to return to its original state. For example, a stretched rubber band will snap back to its original length. The greater the stretch, the more spring energy the object has.

Gravitational Potential Energy ("Lifting Energy") is the form of energy an object gains when it is lifted up against the Earth's gravitational force. The amount of energy is proportional to the weight of the object and the height to which it is lifted.



I need my energy
Where do I get it from?
Do I get it from a battery?
No, I get it from my food!
Does someone come and plug me in?
No, I get it from my food!
Do I get it from gasoline?
No, I get it from my food!
Does someone need to wind me up?
No, I get it from my food!
Do I get it from sunlight?
No, I get it from my food!
Do I get it from Mac and Cheese?
Yes, 'cause I get it from my food!

The teacher sings the questions (pointing at the item pictured on the chart) and the students reply with the echoed line. The tune of the song is based loosely on "This Little Light of Mine."

Lesson Two:

Let's give energy to our toys
Lift, Squeeze, Stretch, and Twist!
Wind those springs with a twist of our wrist.
Now everyone do arms and legs
Lift, Squeeze, Stretch, and Twist!

With its hand motions, this chant is performed like an aerobics video. The hand motions are simple: pretend to lift something over your head, squeeze a spring, stretch a rubber band, and twist an object in the air. "Lift, Squeeze, Stretch, and Twist." Pretend to wind an object during "Wind those springs with a twist of our wrist."

Lesson Three:

Lesson Four:

Lesson Five:

Assessments

Connecting to the Standards

This article relates to the following *National Science Education Standards* (NRC 1996):

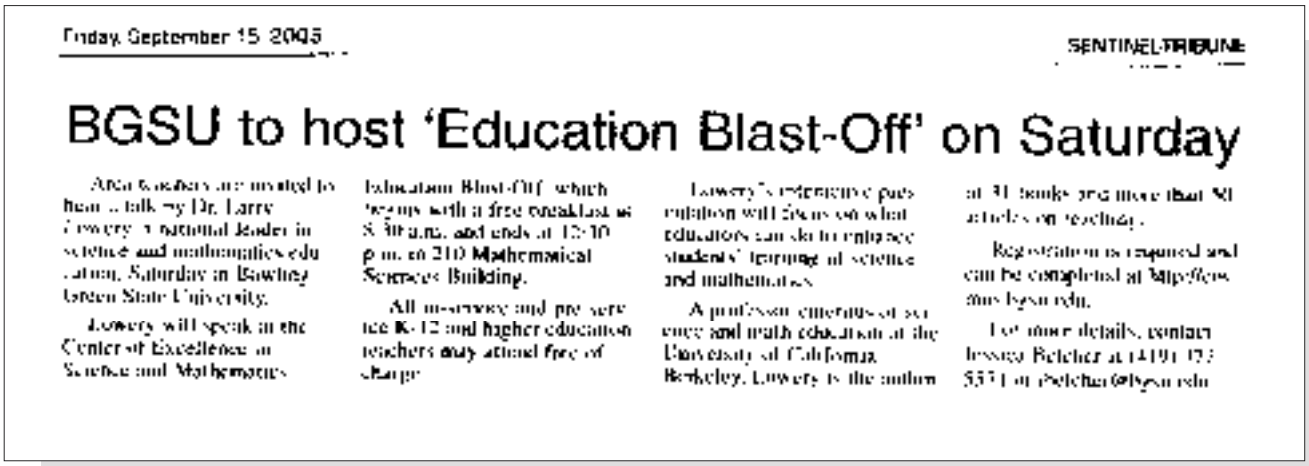
Content Standards

Grades K–4

Standard B: Physical Science

- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity, and magnetism

Appendix J: COSMOS Publicity: Sentinel-Tribune (2006)



Friday, September 15, 2006 SENTINEL-TRIBUNE

BGSU to host 'Education Blast-Off' on Saturday

Area teachers are invited to hear a talk by Dr. Larry Lowery, a national leader in science and mathematics education, Saturday in Bowling Green State University.

Lowery will speak at the Center of Excellence in Science and Mathematics Education Blast-Off, which begins with a free breakfast at 8:30 a.m. and ends at 12:30 p.m. in 210 Mathematical Sciences Building.

All in-service and pre-service K-12 and higher education teachers may attend free of charge.

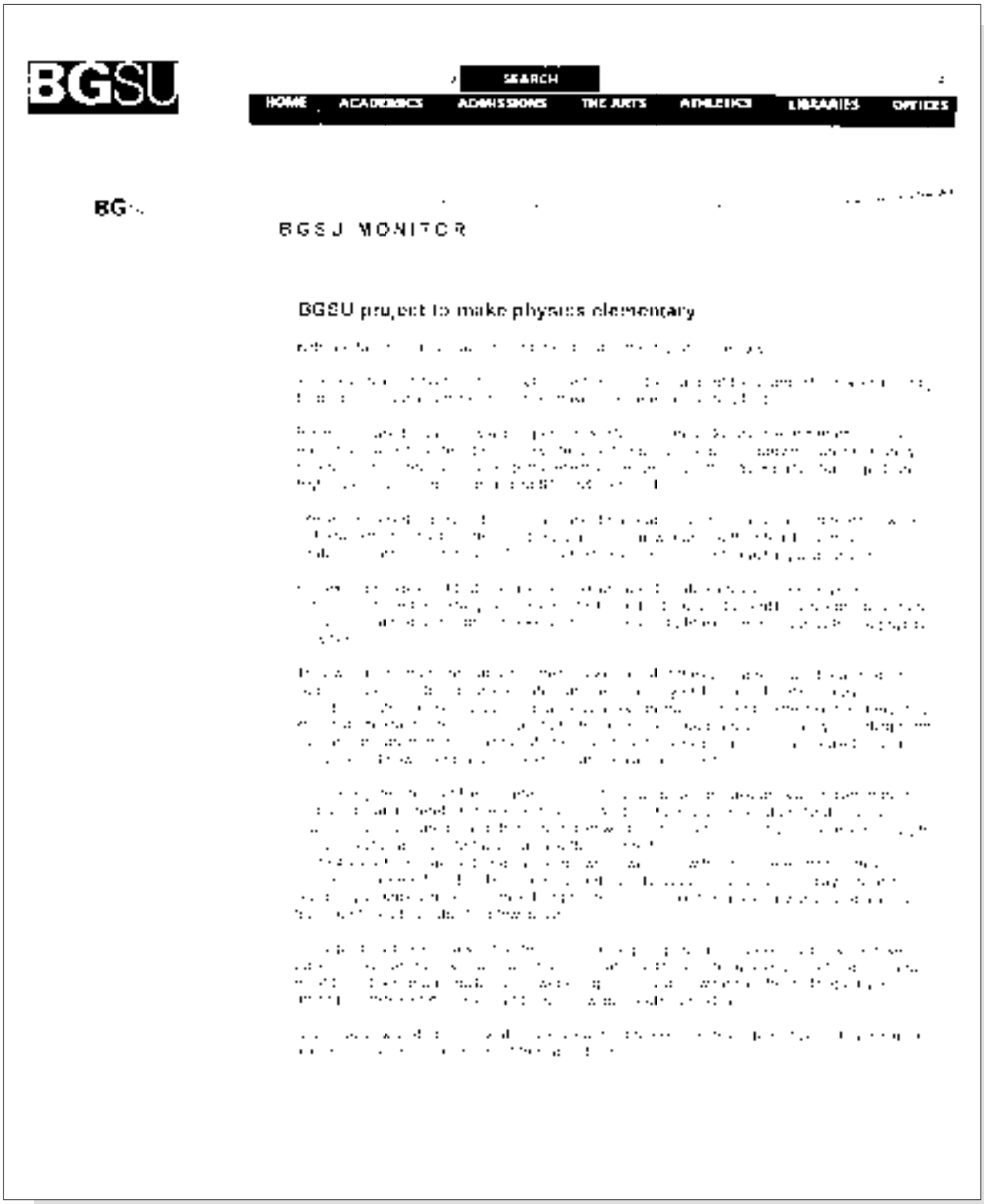
Lowery's interactive presentation will focus on what educators can do to enhance students' learning of science and mathematics.

A professor emeritus of science and math education at the University of California, Berkeley, Lowery is the author of 31 books and more than 50 articles on teaching.

Registration is required and can be completed at bgsu.edu/cosmos.

For more details, contact Jessica Belcher at (419) 372-5371 or jbelcher@bgsu.edu.

Appendix K: COSMOS Publicity: RIPE Monitor article (2007)



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BGSU MONITOR

BGSU project to make physics elementary

Appendix L: COSMOS Publicity: REAL Monitor article (2007)

BGSU to direct Regents Environmental Academy for high school students

BOWLING GREEN, O. — Bowling Green State University is getting REAL about environmental health with high school juniors and seniors.

The acronym stands for the Regents Environmental Academy for Learning, a program scheduled to begin this summer with $[illegible],000 in funding from the Ohio Board of Regents.

Owens Community College is a partner in the academy, one of 10 for which the regents approved $3.5 million at their Jan. 18 meeting. The academies are aimed at encouraging high school juniors and seniors to study the STEM disciplines (science, technology, engineering and mathematics) and foreign languages in college, particularly in hopes that the students will consider secondary teaching in those fields as a career.

Students who may not currently plan to study a STEM discipline or foreign language, or even to attend college, are targeted by the program. The academies will give about 500 Ohio juniors and seniors the chance to earn college credit at no cost to them, while also meeting high school requirements.

BGSU's academy will focus on problem-based learning approaches in environmental health science — a teaching model developed through the University's Project EXCITE (Environmental health science eXploration through Cross-disciplinary and Investigative Team Experiences). The National Institute of Environmental Health Sciences has funded EXCITE, primarily for students in the middle grades, with about $1.8 million over seven years.

"We're modifying for a higher grade level some of the curricula we developed for Project EXCITE," said Dr. Charles "Chris" Keil, the academy director and an associate professor of environmental health at BGSU.

The target number for the three-week residential program — tentatively scheduled for June [illegible] — is 35 students, who will be divided into [illegible] groups for instruction. In addition to earning college credit while their room and board is paid, participants will receive a $[illegible] stipend. "We're hoping that will get kids interested," he said, pointing out that applicants will be sought from throughout Ohio.

Students will earn credit in environmental health through BGSU and in chemistry through Owens, while exploring environmental health issues such as "factory" farming. That issue will probably be the primary one explored during the academy, although the students may [illegible] their own [illegible] investigations of others, including mosquito control and the West Nile virus, and food health and safety, Keil noted.

Additional credits will be available during the school year via distance learning. While on campus, he explained, the students will start a basic chemistry course, which they will have the rest of the summer and early fall to complete online. Those who meet

Appendix L: COSMOS Publicity: REAL Monitor article (2007) cont.

requirements may then take Environmental Health 316, which addresses international environmental health issues, as a distance course in spring 2008. That course meets BGSU's international perspectives requirement, and the University has agreed to waive instructional costs for taking it, he added.

Local teachers will collaborate with BGSU and Owens faculty to craft the academy curriculum, building on the materials and teaching approaches developed and field-tested in ENCITE. "We're hoping we'll get the best of the best to help us out," said Kerl, referring also to high school teachers who will join BGSU and Owens faculty and Bowling Green undergraduate students to form the three-member teaching teams that will instruct the four groups of students.

The goal for the juniors and seniors, he said, "is to get them in here and give them a really positive experience" with both science and the University.

###

Editor's note: For more information about the Regents Environmental Academy for Learning at BGSU, contact Dr. Chris Kerl at 419-372-0565 or Jennifer Zachel, program manager for Project ENCITE, at 419-372-9132.

Appendix M: 2006-07 COSMOS DREAMS Recruiting Brochure

Those who can...

lead

DREAMS

Developing Regional Excellence for Achievement in Mathematics and Science Education

Apply online by June 1, 2007

http://cosmos.bgsu.edu/dreams

Enhance your career with DREAMS Leadership options!

today's fulfilling menu includes...

Option 1

Appetizer STEM Leadership Academy

Main Course Coursework/experience towards a **Specialist Endorsement in K-6 Mathematics or K-9 Science**

Dessert Leadership Internship/Project

Option 2

Appetizer STEM Leadership Academy

Main Course Coursework towards a **Master of Arts in Teaching Interdisciplinary Mathematics & Science** (Middle Childhood Teachers)

Dessert Leadership Internship/Project

Option 3

Appetizer STEM Leadership Academy

Main Course **Master of Arts in Teaching Physics or Mathematics** (AYA/Secondary Teachers)

Dessert Leadership Internship/Project

Nutritional value for all menu options

- Coursework towards a Master of Arts in Teaching or a Specialist Endorsement in Mathematics or Science
- $250 stipend after successful completion of each year
- Up to 9 graduate credits each year paid by the program
- Leadership development
- Career enhancement

For more information visit us at: http://cosmos.bgsu.edu/dreams
Or contact: Jessica Belcher, Project Coordinator
E-mail: jbelche@bgsu.edu or Ph: 419.372.5571

Apply online by June 1, 2007

http://cosmos.bgsu.edu/dreams

Funding provided by the Ohio Department of Education, MSP grant.

DREAMS is a project affiliated with COSMOS. COSMOS is a partner of the Northwest Ohio Center of Excellence in Science and Mathematics Education (NWO).

Appendix N: 2006-07 REAL Recruiting Brochure

Get REAL this summer with

BGSU Bowling Green State University

Owens Community College

and the Regents Environmental Academy for Learning

REAL

Would you rather . . .

- Participate in active, hands-on learning
- Spend 3 weeks this summer living on campus @ BGSU
- Enter college with general education science credits
- Earn credit for your high school classes at the same time
- Study relevant, real-world issues
- Earn $600 upon successful completion

OR

- Learn passively from a book
- Stay @ home all summer
- Have no experience taking college classes
- Spend extra time completing your high school requirements
- Study topics that are not meaningful to you personally
- Earn no $$$

If the choices on the left look good to you, then you should look into REAL!!!

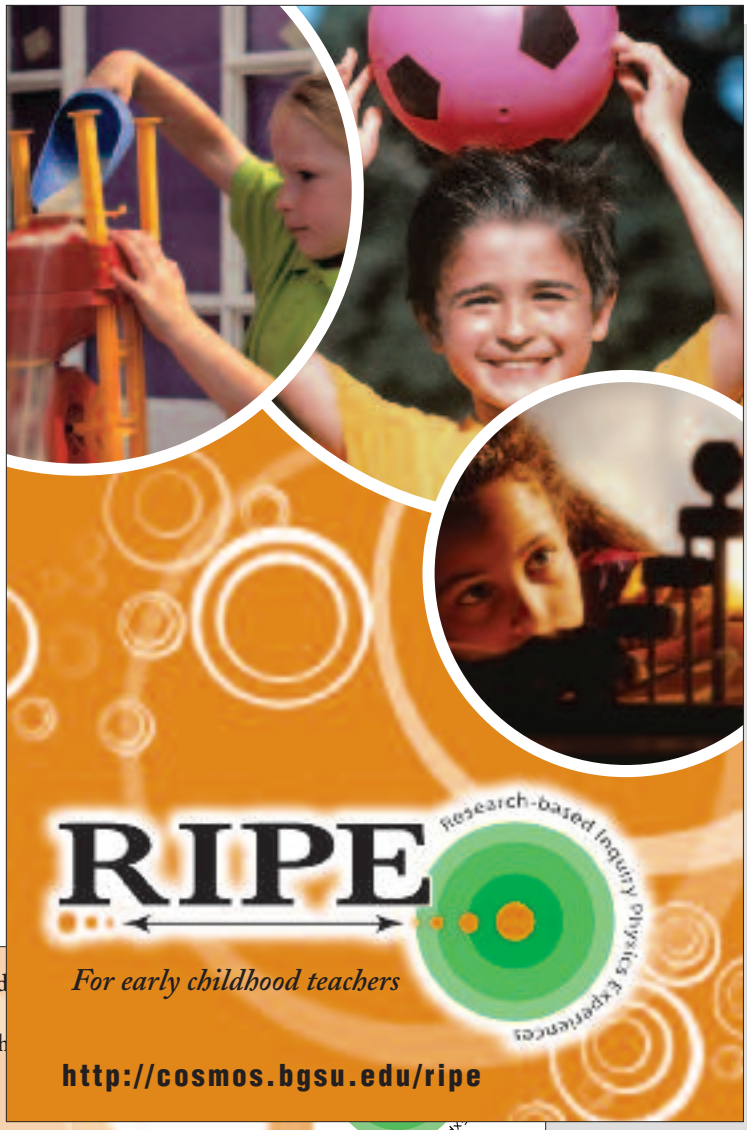
What is REAL?

A three-week summer program at Bowling Green State University for Ohio high school students entering 11th and 12th grades who are interested in exploring environmental topics. Participants in REAL will receive room and board during the academy, college and high school course credit, weekend activities (on and off campus), and a $600 stipend. This program is fully funded by the Ohio Board of Regents. Tentative dates 6/11/07-6/29/07.

To Learn More: Visit our website and read our press release: **www.bgsu.edu/departments/envh/real.html**

Applications will be posted to our website soon. To be added to our Contact Information Database, please call 419.372.9135 or send an email to excite@bgsu.edu. We will send program updates and information directly to those people in our database.

Appendix O: RIPE Recruiting Brochure



RIPE

Research-based Inquiry Physics Experiences

For early childhood teachers

http://cosmos.bgsu.edu/ripe

Are you an early childhood teacher who wants your stud
to better understand physical science? Do you want to
a deeper understanding of the concepts and how to teach th
If so, the 2007 RIPE summer workshop is the place to be!

Incentives:

- Physical science curriculum materials for early childhood students aligned to state standards
- Teacher content preparation with other K-3 professionals
- Participants will receive 4 **FREE** graduate credit hours from Bowling Green State University
- Participants will receive a material resource kit of approximately $500 value

Teacher Requirements:

- Apply online at **http://cosmos.bgsu.edu/ripe** for the program
- Modify, implement, and evaluate one physical science unit
- Participate actively in all meetings and program evaluation

Schedule:

- 2 Week (8 day) Summer Institute, June 18th - June 28th (80 contact hours)
- 4 meetings in the Fall Semester 2007 (15 contact hours)

Equivalent to 4 Semester hours (3 after Summer Institute, 1 after Fall '07)

For more information, please contact Tracy Huziak-Clark, thuziak@bgsu.edu, (419) 372-7363.

http://cosmos.bgsu.edu/ripe

Funded by the Ohio Board of Regents Improving Teacher Quality 2007 grant program

Additional support for the RIPE summer workshop is provided by the BGSU College of Education & Human Development, College of Arts & Sciences, the School of Teaching & Learning, the Department of Physics & Astronomy, the Center of Excellence in Science and Mathematics Education: Opportunities of Success (COSMOS), and the Northwest Ohio Center of Excellence in Science and Mathematics Education (NWO).

Appendix P: NWO TEAMS Recruiting Brochure

Register today!

Three options for registration:

1. Online at www.nwocenter.org

2. Fill out the application on the other side of this page and send to the following address:

   Jessica Belcher
   Program Coordinator
   241 Math Science Bldg.
   BGSU
   Bowling Green, OH 43403

3. Call or email Jessica Belcher:
   jbelche@bgsu.edu or
   419.372.5571, fax: 419.372.2738

Who can participate?

- Teachers grades 3-6 who teach mathematics and science.
- **We are looking for teams of teachers to attend together!** Grade level teams, school based teams, and even multi-school teams of teachers will get preferential registration. ***Tell your colleagues; come and learn together!***

NWO TEAMS
NWO TEAMS
241 Math Science Bldg.
BGSU
Bowling Green, OH 43403

www.nwocenter.org

Funding provided by the Ohio Board of Regents and the Ohio Resource Center

TEAMS: Teachers Enhancing Achievement in Mathematics and Science

NWO TEAMS
Teachers Enhancing Achievement in Mathematics and Science

Funding provided by Ohio Department of Education

www.nwocenter.org

What is NWO TEAMS?

- A grant program funded by the Ohio Department of Education to revise and enhance the OSCI and OMAP modules at a regional level.
- Teachers who participate will experience over 100 hours of high-quality, sustained professional development focused on grade specific science and mathematics topics. Participants will engage in science and mathematics modules during Summer Institute I and science modules during the Academic Year and Summer Institute II.
- Mathematics and science university faculty and K-12 facilitators will co-instruct the NWO TEAMS summer institutes as well as the Academic Year Content Study Groups.
- While participating in NWO TEAMS, teachers will utilize classroom sets of FOSS science kits, which are best-practices, research-based curriculum materials.

www.nwocenter.org

What will the professional development consist of?

Summer Institute I – 2007

Dates: Monday, June 25 – Saturday, June 30 and Monday, July 2 – Tuesday, July 3
Time: 8:00 a.m. - 3:00 p.m.

- Eight days of intensive hands-on science and mathematics experiences.
- Co-taught by an experienced educator and scientist/mathematician teaching team.
- Content learned will directly apply to the Ohio content standards grade level indicators and benchmarks as well as the curriculum materials of the district.

Academic Year Content Study Groups

- Eight monthly science content study group meetings.
- Time will be spent forming collaborative professional relationships with peers while learning content and discussing implementation challenges and successes.

Summer Institute II – 2008

- Four days of hands-on science experiences, with field trips to local centers of informal science education such as the Toledo Zoo and Stranahan Arboretum.
- Content learned will directly apply to the Ohio content standards grade level indicators and benchmarks as well as the curriculum materials of the district.

Incentives:

- $800 stipend ($400 after the successful completion of the summer institute and $400 after the academic year).
- $200 provided by your district* for classroom materials. [*For financial reasons, some districts may be unable to pay the full amount for materials].
- A wealth of standards-aligned high-quality curricular materials and kits available for classroom use by any NWO TEAMS participant.
- Scholarships for graduate credit at UT and BGSU.

Questions? Please contact Jessica Belcher at jbelche@bgsu.edu or 419.372.5571.

NWO TEAMS (Teachers Enhancing Achievement in Mathematics and Science)

NWO TEAMS application

(all team members fill out individual applications and mail applications together)

Name _____

Team members _____

School _____

School address _____

District _____

Home address _____

Email _____

Phone number _____

Grade level ❑ 3 ❑ 4 ❑ 5 ❑ 6

I teach ❑ math ❑ science ❑ both

I'm interested in receiving credit ❑ Yes ❑ No

Are you currently in a degree program? ❑ Yes ❑ No
If so, where? ❑ UT ❑ BGSU ❑ Other

I prefer vegetarian meals ❑ Yes ❑ No

Appendix Q: TeachOhio Recruiting Brochure

Questions? & Contact

Julie Nurnberger-Haag
Partner School Liaison & Recruiter
NWO Center of Excellence in Science and Mathematics Education

241 Math Science Building
Bowling Green State University
Bowling Green, OH 43403

jnurnbe@bgsu.edu
419.372.5572 or 419.372.2718

Apply *Today!*

Go to http://www.nwocenter.org and click on the link for NWO TeachOhio Program to obtain application materials.

Jodi J. Haney, PhD, Co-Director NWO
241 Math Science Building
Bowling Green State University
Bowling Green, OH 43403

www.nwocenter.org

Funding provided by the Ohio Board of Regents.

Those Who Can... Teach!

Thinking about becoming a science and/or mathematics teacher?

NWO TeachOhio can help you pave your new career path!

NWO TeachOhio

coordinating partners: BGSU, Owens Community College, University of Toledo

TeachOhio

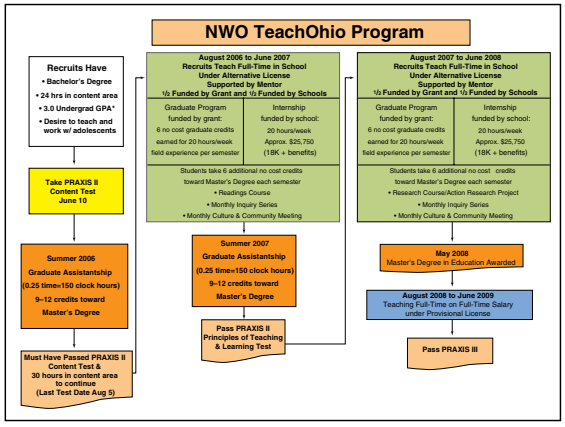
A grant sponsored by the Ohio Department of Education to increase the pool of highly qualified science and mathematics teachers in northwest Ohio through alternative licensure.

Do You Have...

- A bachelor's degree?
- At least 24 semester hours in a science or mathematics?
- An undergraduate GPA* of at least 3.0? and
- A desire to ignite adolescents' interest in science and/or mathematics while teaching them the subject you know so well?

plan look like?

The diagram below shows how NWO TeachOhio will help you develop into a highly qualified science and/or mathematics teacher...



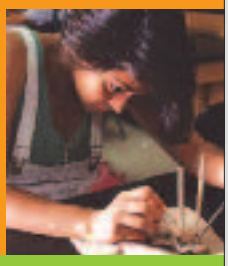
Apply *Online*

*Exceptional candidates not meeting this requirement may be considered.

http://www.nwocenter.org

chOhio *Can Make It Happen...*

- Earn a master's degree in education, NO COST tuition! Start your degree this summer with a graduate assistant stipend.
- No waiting! You start teaching fall 2006 in one of our partner school districts!
- Earn $18,000 a year for the first two years and a regular teacher salary and benefit package in year three.
- Receive mentoring and professional support from your district and the TeachOhio program during the first two years of your teaching career.
- Commit to teaching in an identified Ohio district for three years (2006–2009).
- From 2006 to 2008 teach middle school or high school with an alternative license and then transfer to a provisional license for the 2008–2009 school year.



Become a NWO TeachOhio partner district!

Contact:

Julie Nurnberger-Haag
Partner School Liaison & Recruiter
NWO Center of Excellence in Science and Mathematics Education

241 Math Science Building
Bowling Green State University
Bowling Green, OH 43403

jnurnbe@bgsu.edu
419.372.5572 or 419.372.2718

or

Jodi J. Haney, PhD
Director, COSMOS
Co-Director, NWO Center of Excellence in Science and Mathematics Education

241 Math Science Building
Bowling Green State University
Bowling Green, OH 43403

jhaney@bgsu.edu
419.372.7361

NWO TeachOhio

Jodi J. Haney, PhD, Co-Director NWO
241 Math Science Building
Bowling Green State University
Bowling Green, OH 43403

www.nwocenter.org

Funding provided by the Ohio Board of Regents.

Those Who Can... Teach!

Are you looking for highly qualified science or mathematics teachers?

NWO TeachOhio can help!

NWO TeachOhio

coordinating partners BGSU Owens Community College University of Toledo

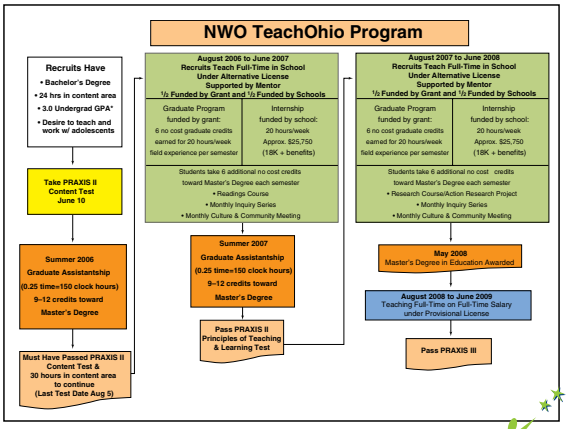
A grant sponsored by the Ohio Department of Education to increase the pool of highly qualified science and mathematics teachers in northwest Ohio through alternative licensure.

Who are we recruiting?

- A cohort of 20 candidates into an alternative licensure program leading to a master's degree in education.
- Successful candidates will have at least a bachelor's degree, 24 semester hours in a science or mathematics, a 3.0 undergraduate GPA*, PRAXIS II passage in their content area(s), and a desire to ignite adolescents' interest in science and/or mathematics while teaching a subject in which they have expertise.
- Many of the recruits who have contacted us already have a master's degree in their content area and/or substantial experience teaching in K–12 schools.
- Once candidates are admitted to the program, partner districts will have the opportunity to interview candidates whose areas of licensure match their needs and NWO TeachOhio will facilitate placements based on district and candidate needs and preferences.

TeachOhio plan look like?

The diagram below shows how NWO TeachOhio will help the candidates develop into highly qualified science and/or mathematics teachers…



*Exceptional candidates not meeting this requirement may be considered.

achOhio right for your district?

Do you have…

- A difficult time recruiting or retaining highly qualified science and/or mathematics teachers?
- Long-term substitute teachers in science or mathematics positions?
- A need to find a replacement for a science or mathematics teacher who will retire after the next school year begins?
- A teacher with a middle childhood license who wants to gain 7–12th grade licensure in science or mathematics?
- A high percentage of students on free or reduced lunch?
- A significant number of students who are not proficient in science or mathematics?

District benefits…

- Participating in NWO TeachOhio will guarantee that some or all of your science and/or mathematics positions are filled with highly qualified teachers who may have experience in industry, research, or other fields that would enrich students' learning.
- Candidates commit to teaching in your district for at least three years.
- During the first two years, your district pays only $18,000 a year plus benefits (approximately $25,750).
- Students in your district will have more highly qualified teachers with strong content knowledge who will also have a master's degree in education by 2008.
- The program includes opportunities for candidates to interface with other teachers in northwest Ohio through NWO center activities. This should facilitate their development as faculty who would continue to seek these opportunities throughout their careers.

http://www.nwocenter.org

Appendix R: Executive Board Minutes

NWO Executive Board Minutes
The Guest House, Perrysburg, Ohio
May 21, 2007 ~ 12:30-3:00pm

Attendees:

Anne Bullerjahn – Owens Community College, Life Sciences
Jessica Belcher – BGSU, COSMOS Program Coordinator
Emilio Duran – UT, Co-Director NWO, Director SciMaTEC
Anjali Gray – Lourdes College, Department Chair, Biological Sciences
Jodi Haney – BGSU, Director NWO and COSMOS
Nancy Hoose – BGSU, COSMOS Secretary
Michelle Leow Klinger – COSI Toledo, Education Director
Linda Lower – Perstorp Polyols, Inc.
Mitch Magdich – Toledo Zoo, Curator of Education
Julie McIntosh – U of Findlay, Science Education
Cherie Pilatowski (for Julie Campbell) – TPS, Teacher
Mary Richter – Northwest RSIT, Regional School Improvement Facilitator

Not In Attendance:

Carla Johnson – UT, Asst. Professor, Curriculum & Instruction
Jane McCleary – Hancock Co. ESC, Curriculum Director
Eileen Underwood – BGSU, Assoc. Professor, Biological Sciences

After lunch, the meeting began with introductions. All members of the executive board received a folder with the agenda, minutes of September 29, 2006, meeting, directory, NWO brochure, draft of bylaws, draft of partnership agreement form, proposed budget, and copy of PowerPoint presentation. Minutes of the last meeting were read and approved with two minor corrections.

Using a PowerPoint presentation, Jodi Haney reviewed NWO activities for the current year: The problem, the solution, NWO vision, NWO partners, current work and accomplishments, affiliated NWO projects, summary of average yearly funding, number of individuals actively involved in COSMOS/NWO initiatives, what's next, and budget proposal for FY 2008.

During the presentation, several discussions took place:

- NWO Vision
  - ➢ STEM: There has been a neglect of technology and engineering; also, possibly health sciences could be added as another "M" (medicine).
- COSMOS Initiatives
  - ➢ Inquiry Series: Suggested to add Praxis workshop.
  - ➢ Research Community: Is it possible to video conference? Mary Richter noted that the Northwest RSIT uses Illuminate software, which is easy to use, for online meetings.
  - ➢ Learning Sciences PHD proposal: Has been submitted and is being reviewed at university level.

- NWO Collaborative Activities
  - ➢ Symposium: Currently, no lead person (SciMaTEC director has not been named yet).
  - ➢ Future Teachers Conference: Not held last year because of health of coordinator. Jodi suggested that possibly available monies could be utilized throughout region to facilitate these types of activities and requested a recommendation from the board.
- Affiliated NWO Projects (TeachOhio, TEAMS, REAL, RIPE, DREAMS)
  - ➢ Mary Richter noted that due to cut in funds, there is going to be a tremendous need for professional development. Michelle Leow Klinger asked what is the best way to communicate activities with ODE, noting that getting the word out to teachers is critical. Mary had to leave the meeting at this point, but will send e-mail with her comments regarding this topic.

The executive board directory was reviewed, and one addition made.

Bylaws for the executive board were discussed:

- Jessica Belcher, who crafted the bylaws, noted that she had used a basic template for executive boards that manage non-profit organizations, which provides a simplified structure.
- Article II Purposes
  - ➢ Mission: Add second M (medicine) to STEM.
  - ➢ Vision: Add second M to STEM; transpose words in item (c)
  - ➢ Goals: Add second M to STEM; change "science and mathematics" to "STEM2" in goals 2, 3, and 5.
- Article III Membership
  - ➢ Emilio Duran asked if PIs should be members of the executive board. Jodi replied that the board would become too large, but they could possibly serve on an advisory committee.
  - ➢ Board members names are to be deleted and replaced with reference to directory.
  - ➢ It was agreed to keep the 75% majority vote so everyone has a voice.
- Article IV Power and Duties
  - ➢ Delete "(NWO, COSMOS, SciMaTEC)" from item (4).
- Article VI Order of Business
  - ➢ Minutes are to be distributed following each meeting and also before the next meeting.
- Article VII Committees
  - ➢ Add "Non-board members may serve on subcommittees, which allows them to attend and present at executive board meetings, but they do not have voting rights."
- Article X NWO Partners and Collaborative Efforts
  - ➢ In item (3) change "five (5) business days to vote" to "ten (10) business days to vote."
  - ➢ Change STEM to STEM2 throughout document.
  - ➢ It was noted that a non-vote is the same as an abstention (neither a yes or no vote).

Jodi briefly reviewed the Partnership Agreement form, noting that it is a very rough draft. The purpose of the form is to formalize partnerships, which do not always have to be monetary. The form would be completed at the beginning of the partnership and would be binding until terminated. The agreement can be regularly changed. Board members were asked to read the document and send revisions to Jodi.

The budget for FY 2008 was reviewed. Julie McIntosh moved to accept the budget with one change: Symposium line revised to "(includes Owens subcontract of $10,000)"; Linda Lower seconded; motion carried. A question was raised regarding the $60,000 subcontracted to UT for certain activities. The board recommended that these funds be opened up to the region, but noting that current activities such as FTC and OJSHS are to be continued. Interested parties would write a proposal for an activity and request funds; all board members would review and vote on these proposals. Jodi will take this recommendation to The Ohio Board of Regents.

Several discussions took place during the Open Forum:

- Emilio noted the need to tap into industry. Linda reviewed the current activities of her company. Jodi proposed a sub-committee to look at other activities. Michelle noted that COSI and the Toledo Zoo have redesigned their activities so that they are not duplicating professional development currently offered by other organizations; she noted that we should be helping each other, rather than duplicating efforts. Emilio noted the need for more international opportunities. Linda discussed how international travel is important to foster understanding and that her company is extremely committed to international opportunities. Julie noted that BP has a program to pay teacher coaches.
- Sub-committees are needed for the following:
    1. Business Partnerships
    2. Regional Praxis
    3. Future Teachers Conference (COSI has interest in this)
    4. Symposium
- 9th Annual Community Resources Workshop: Michelle noted she needs funds for "freebies" for the approximately 60 teachers who attend this workshop. It was suggested that she apply for funding and possibly she could use leftover materials from the Symposium.
- Recruiting: NWO could possibly recruit COSI and Zoo teen volunteers by making scholarship monies available.

The following are to be sent to the board members along with the minutes of the meeting:

- Revised bylaws
- Partnership agreement form
- List of sub-committees

Members will have 10 days (May 30 – June 12) to cast their vote for the approval of the revised bylaws. If a vote is not submitted within this time frame, the vote will be recorded as an abstention. Members are asked to review both the Partnership Agreement form and the list of sub-committees and submit any suggested modifications to either document by June 22.

The next meeting of the executive board is tentatively scheduled for September 28, 12:30-3:00pm.

NOTE: After the Executive Board meeting, Jodi spoke with both a federal and state government science educator who indicated that STEM is better than using STEM2. (They thought that STEM will have longevity over STEM2.) Therefore, STEM was not changed to STEM2 in the bylaws. If members feel strongly about the use of STEM2, they may issue a "No" vote and offer discussion that will be sent out to the board and another vote taken.

Appendix S: NWO Executive Board Bylaws

The Northwest Ohio Center of Excellence in Science and Mathematics Education
Executive Board Bylaws

BYLAWS FOR the *Northwest Ohio Center of Excellence in Science and Mathematics Education*
A NOT-FOR-PROFIT ORGANIZATION

ARTICLE I ORGANIZATION

The name of the organization shall be the *Northwest Ohio Center of Excellence in Science and Mathematics Education* or *NWO*.

The Center shall be governed by these Bylaws, as amended from time to time in a manner consistent with the Memorandum of Agreement between COSMOS (Center of Excellence in Science and Mathematics Education) located at Bowling Green State University and SciMaTEC located at The University of Toledo signed on September 28, 2004.

ARTICLE II PURPOSES

The following are the purposes for which this organization has been organized.

Mission: Advancing science, technology, engineering, and mathematics (STEM) education for people of all ages.

Vision: NWO aims to advance science, technology, engineering, and mathematics (STEM) education for people of all ages. Our purpose is (a) to work with community partners to generate new knowledge about the science of teaching and learning, (b) apply this knowledge by developing the expertise of K-12 educators and higher education faculty, (c) increase understanding of and public support for the STEM subject areas, and (d) to stimulate the interest of young people, especially those in underrepresented groups, in these rewarding fields of study and career opportunities.

Goals: Together, NWO activities help us attain the following goals:

1. Recruit and retain students and faculty into STEM and STEM education disciplines.
2. Develop the expertise of pre-service and in-service teachers though research-based professional development framed by investigative STEM teaching and learning.
3. Conduct and communicate collaborative research on how people best teach and learn STEM and on the barriers and enablers related to current reform efforts.
4. Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues.
5. Increase the leadership capacity for STEM education in northwest Ohio.

ARTICLE III EXECUTIVE BOARD MEMBERSHIP

The Executive Board, consisting of no more than 13 members including the Chair of the Board, shall manage the business of this organization. The Chair of the Board will rotate every three (3) years beginning with the COSMOS Director who took office in July 2006. A year is defined as beginning in the fall and ending the following fall (i.e., Fall 2006 to Fall 2007 = 1 year of service). After three years, the SciMaTEC Director will take over as Chair of the Board beginning with the fall meeting of 2009. This rotation process will continue for the existence of NWO. If there is no acting director for COSMOS or SciMaTEC, the NWO Executive Board will vote on a Chair of the Board for the next rotation.

The first Executive Board for NWO was proposed jointly by the COSMOS and SciMaTEC Directors (currently Jodi J. Haney and Emilio Duran). Executive Board Members will serve two (2) year terms, with the first Board Members beginning their term in the fall of 2006. Membership may be renewed, but is not guaranteed. Nominations for new Board Members may come from any existing Board Member and all nominees will be contacted by the NWO Chair, and upon accepting the nomination, the nomination will be submitted to the Board and approved by a 75% (10 of 13 Members) majority vote of the Executive Board Members.

At all times, no one organization shall have more than two (2) members serving on the NWO Executive Board. There shall be an equitable representation from higher education, school, business, and community partners. Equity in representation is determined by the degree of fiscal and human resources dedicated to the mission, vision, and operations of NWO.

For a current list of NWO Executive Board members, please reference the NWO Executive Board Directory.

The Executive Board shall have the oversight of the affairs and business of NWO.

The Executive Board may make such rules and regulations covering its meetings as it may in its discretion determine necessary. These changes must be approved by a 75% (10 of 13 Members) majority vote of the Executive Board Members. If approved, the change will be added to the Bylaws.

Vacancies on the Executive Board will be filled following the procedures used to appoint new members.

ARTICLE IV POWER AND DUTIES OF THE EXECUTIVE BOARD MEMBERS

The NWO Executive Board Members shall:

(1) Attend all meetings of the Executive Board.
(2) Participate in all voting actions of the Executive Board either in person or via proxy using the established voting procedures as laid out in the Executive Board Bylaws Article V.
(3) Serve on sub-committees as deemed necessary by the Executive Board.
(4) Serve in an advisory capacity to the Center Directors.
(5) Receive and review reports from committees and make recommendations to the Center Directors.
(6) Promote the mission, vision, goals, and programs of NWO.
(7) Serve as a liaison and recruiter between NWO and the organization they represent.

ARTICLE V VOTING

At all Board meetings votes will be cast via e-mail within five (5) business days of the meeting. Votes must be sent to the Chair of the Board and all Board Members must be copied on this e-mail. The Chair will count the votes at the end of the five (5) business days and announce the voting results to the entire Board via e-mail.

In order for a vote to pass, 75% (10 of 13) of the Members of the Executive Board must vote in favor of the item. (See Article VIII regarding voting regulations for amendments to the Bylaws.)

A Board Member may vote by proxy, only if he/she notifies the Chair in writing via e-mail at least two (2) business days prior to the meeting. Once a proxy is selected and the Chair is notified, the proxy will serve as the voting member of the Board until all voting has been completed following the Board meeting. A proxy cannot be an already existing Member of the Board.

During the spring meeting, the Board will vote on the proposed budget for the next fiscal year. A 75% (10 of 13) majority of the Board must vote to approve the budget in order for the vote to pass. If the budget does not pass, the NWO Center Director will propose a new budget within ten (10) business days following the meeting. At that time, the NWO Center Director will e-mail the new budget to the entire Board for voting. All Board Members must follow the standard voting procedures for this vote. This process will continue until a budget is approved. All budgets will include

enough detail to provide evidence of the scope of work to be completed. Sub-contract awards will be proposed and approved following the same budget proposal and voting procedures. All proposed budget activities should support the NWO mission, vision, and one or more goals. All individuals proposing budgets should present the budget request at the spring Executive Board meeting.

ARTICLE VI ORDER OF BUSINESS

1. Roll Call
2. Reading of the Minutes of the preceding meeting
3. Approval of Minutes from previous meeting (motion and second needed)
4. Reports of Committees (only if committees were established and met since the last meeting)
5. Old and Unfinished Business
6. New Business
7. Open Forum to foster collaboration
8. Adjournment (motion and second needed)

ARTICLE VII COMMITTEES

There are no standing committees for this organization. However, if a need arises for a committee to be formed, the Chair of the Board will create the committee and appoint members to serve on the committee. The committee will remain active until the Chair determines it is no longer needed. At this time it will be disbanded.

Non-board members may serve on sub-committees, which allows them to attend and present at executive board meetings, but they do not have voting rights.

ARTICLE VIII AMENDMENTS

These Bylaws may be altered, amended, repealed, or added to by an affirmative vote of not less than an 85% (11 of 13) majority of the Board Members.

ARTICLE IX MEETINGS

The NWO Executive Board shall meet at least two (2) times a year. The time and format for these meetings are:

- Fall Executive Board Meeting—Held on the last Friday in September from 12:30 PM to 3:00 PM and shall focus on the following items:
  (1) Review of the previous fiscal year budget and corresponding activities.
  (2) Presentation by COSMOS and SciMaTEC Directors regarding new activity plans for the current year.
  (3) Presentation and voting of the Executive Summary of the NWO Annual Report for the preceding year.
  (4) Open forum to foster collaboration among partners.
- Spring Executive Board Meeting—Held on the third Friday in May from 12:30 PM to 3:00 PM and shall focus on the following items:
  (1) Presentation of current NWO year in review.
  (2) Review and vote on the proposed budget and corresponding activities for the upcoming fiscal year.
  (3) Open forum to foster collaboration among partners.

ARTICLE X NWO PARTNERS AND COLLABORATIVE EFFORTS

The unified mission of NWO is: advancing science, technology, engineering, and mathematics (STEM) education for people of all ages. In order to complete this mission, NWO creates and sustains authentic partnerships among

institutions of higher education, schools, businesses, and other community agencies. There are varying levels of partnership within NWO; at minimum, a NWO partner will:

- Support the mission, vision, and goals of NWO.
- Participate in NWO sponsored activities.
- Help recruit participants and other partners into NWO.
- List or link the NWO website on the partner website and list NWO as a partner on other publications as space and logic allows.
- Sign a partnership agreement form (attached).

In return, NWO will do the following:

- List and link the partnering organization on the NWO website partner page and list them as a partner and on other publications as space and logic allows.
- Support the partner in their outreach activities that meet the mission, vision, and goals of NWO as negotiated and outlined on the partnership agreement form (attached).

Along with the mission, vision, and goals of NWO, the Center is focused on collaborative efforts among partners. To ensure consistency of the NWO message, any collaborative grant proposal that would like to have a letter of support from NWO and be considered an NWO grant must contain the following items:

- The Center Director, or a member of the NWO Executive Board, must be listed as at least a Co-PI on the project and have at least a 5% time commitment to the project (with appropriate pay coming from grant dollars or from matching sources).
- At least three of the official NWO partners must have a significant role in the grant activities and an authenticated letter of support from all of these partners must be included in the grant proposal.
- The grant may or may not incorporate participants into at least one pre-established NWO activity (i.e., NWO Inquiry Series, NWO Symposium, Northwest Ohio Future Teachers Conference, Ohio Junior Science & Humanities Symposium, BG/UT SECO & CTM, etc.). If not, the proposal should describe ways in which NWO students, teachers, and/or partners will be able to participate in the proposed grant activities.

NOTE: Grants may be considered either an "NWO Initiative" (meaning a highly collaborative project developed by an NWO team as commissioned by the NWO Executive Board) or an "NWO Affiliated Project" (meaning a collaborative project envisioned and developed by a sub-set of NWO individuals, but still meeting the outlined requirements above). The project principle investigator should designate the status (NWO Initiative or Affiliated Project) that is requested upon submission of the materials as outlined below.

The process for determining if a grant proposal is an NWO grant is as follows:

(1) The abstract, draft budget, authenticated letters of support from NWO partners, and rationale explaining why the principal investigator is requesting an "NWO grant status" (specifically NWO Initiative or Affiliated Project status) must be sent to the Executive Board Chair three (3) weeks prior to the submission deadline for the grant (i.e., the Chair must have the documents at least fifteen [15] business days before the deadline).
(2) The Chair will send the submitted materials to the entire Board for a vote.
(3) The Executive Board will have ten (10) business days to vote (following standard voting procedures established in Article V) on whether the grant should be considered an NWO grant (Initiative or Affiliated Project).
(4) If the Board votes to approve the grant as an NWO Initiative, then the full proposal must be sent to the Center Director at least one (1) week prior to the submission deadline (i.e., the Center Director must have the documents at least five [5] business days before the deadline).
(5) The Center Director will then write and return one of two letters either in support of the grant as an NWO Initiative or Affiliated Project (submitted to the PI and copied to all Executive Board Members) or a letter explaining the rejection of this proposal as an NWO grant (submitted to the PI and copied to all Executive Board Members).

(6) Upon acceptance of the proposal as an NWO Initiative or Affiliated Project, NWO has the right to include the NWO grant submission and/or award in the annual reports and other public relations presentations, documents, press releases, etc.

NOTE: If the grant release to deadline time frame does not allow for the timeline outlined above, every attempt will be made by the NWO Executive Board Chair and Members to move through this process prior to grant deadline. However, there are no guarantees that NWO grant status can be provided in the adjusted time frame.

Appendix T: COSMOS Collaborative Council Minutes

COSMOS COLLABORATIVE COUNCIL
February 7, 2007 ~ 3:00-4:30pm Room 246 Math Science Bldg.
Minutes

Attendance:

Ron Ayotte, COSMOS
Jessica Belcher, COSMOS
Jodi Haney, COSMOS
Mandy Heddle, COSMOS
Heidi Koedam, COSMOS
Julie Nurnberger-Haag, COSMOS
Michelle Shafer, COSMOS
Steve Van Hook, COSMOS/Physics
Karen Creps, Wood County ESC
Mary Himmelein, NWO RSIT
Scott Hoff, Putnam County ESC
Kathy Hott, Springfield Local Schools
Sally Kovar, NWO ESC
Kim Kovin, Anthony Wayne Schools
Jane McCleary, Hancock County ESC
Neil Weber, Swanton Local Schools

I. Introductions

A. Michelle began this initial meeting by asking all members to introduce themselves.
B. Jodi spoke about the reasons for the existence of this Council, mainly to promote the exchange of information and data concerning math and science education in school districts across northwest Ohio.

II. Announcements

A. Julie provided a brief synopsis of the TeachOhio program (alternative licensure program for 7-12 grade math and science, leading to a masters in curriculum and instruction).
B. Michelle reminded the group of the passage of the new legislative action that effects math and science curriculum and graduation requirements in Ohio schools. It was mentioned that perhaps 500 new mathematics teachers might be needed in Ohio schools to meet the new state requirements.
C. Michelle introduced a new mathematics graduate course at BGSU for middle and high school teachers titled "Active Chance." This online probability course will run during the first six weeks of summer (5/14-6/22).
D. Jodi talked about the promotion of science and math teaching by the Science and Mathematics Education Policy Advisory Council (SAMEPAC). SAMEPAC will announce recommendations in Columbus on Feb 19.
E. Michelle announced the Ohio Centers of Excellence state conference to be held April 26-27 in Columbus. This year's focus is on middle level teaching and learning.
F. Three dates remain in the NWO/COSMOS Inquiry Series this spring. Feb 22 and Mar 15 are both from 5-8 pm at Owens Community College, Toledo. The Summit will be on April 28 from 8:30-12:30 at BGSU.
G. Jessica announced the creation of a second cohort of teachers that will participate in NWO TEAMS this year. Recruitment brochures were distributed to those in attendance and will be mailed out to area schools next week.

H. Steve explained a project at BGSU named Research-based Inquiry Physics Experiences (R.I.P.E.),which hopes to attract 40 science teachers from pre-kindergarten through grade 3 to start teaching beginning concepts of physics at those early grade levels.

I. High school juniors and seniors will be invited to participate in a program funded by the Ohio Board of Regents called Regents Environmental Academy for Learning (REAL). This project has the goal of attracting around 50 students to stimulate an interest in science, technology, engineering, and mathematics that would encourage students to consider a career of teaching secondary education in those fields. Drs. Chris Keil (Environmental Health) and Jodi Haney are leading this program.

J. Mandy spoke on a potential new project, DREAMS (Developing Regional Excellence and Achievement in Mathematics and Science education). The goal of this project is to increase leadership capacity of regional mathematics and science teachers through quality professional development. MSP projects that are funded will be announced Feb 15.

III. General Discussion

A. Time was allotted for members to break into small groups to focus on the highest needs of students and teachers in their districts.

1. Teacher understanding and assessment of indicators: Some of the needs discussed involved the fact that some teachers do not seem to understand fully the meaning of some of the state indicators that they should be focusing their teaching on. Others mentioned the need to raise the levels of math and science instruction, which would then, hopefully, raise test scores of students in these areas. Science and/or Mathematics Curriculum Topic Study and Lesson Lab for Mathematics were also both mentioned as professional development tools to increase content knowledge and pedagogical content knowledge.
2. Mathematics courses in light of OhioCore: The nomenclature used for math curriculums in different districts was discussed. For instance, what exactly does a course in integrated math cover or just what are you supposed to teach in Algebra Two?
3. Building leadership capacity within schools for data based decision-making: The need to thoroughly analyze multiple sources of data and then let findings productively guide instruction was discussed. Lima City Schools' data team structure was mentioned, as well as short cycle assessments and developing instructional coaches within districts.

B. Topics mentioned through the general discussion will become working items for the rest of the scheduled meetings. The next meeting was scheduled for March 14 at 3:00 PM. A new meeting room may be announced because of the need for more space.

COSMOS COLLABORATIVE COUNCIL
March 14, 2007 ~ 3:00-4:30pm Room 204 Life Sciences Bldg.
Minutes

Attendance:

Jessica Belcher, COSMOS
Jodi Haney, COSMOS
Tracy Huziak-Clark, COSMOS/STL
Julie Nurnberger-Haag, COSMOS
Michelle Shafer, COSMOS
John Crecelius, Perrysburg Schools
Karen Creps, Wood County ESC
Rose Kandik, Lucas County ESC
Gary Keller, Bowling Green City Schools
Joe Morgan, Eastwood Schools
Ralph Schade, Toledo Public Schools
Sharon Shaffer, Rossford Junior High
Neil Weber, Swanton Local Schools
Deb Wickerham, Findlay City Schools
Judy Withrow, Findlay City Schools

I. General discussion

A. RIPE (June 18-28, 9:00am-3:00pm) – Research-based Inquiry Physics Experiences
1. Need K-3 grade teachers to apply.
2. Of the 40 slots, only 28 remain.
3. Three graduate credits for the summer.

B. REAL (June 11-29) – Regents Environmental Academy for Learning
1. For 11th and 12th grade rising students.
2. Looking for Master teachers to instruct during the 3-week summer institute.

C. NWO TEAMS (June 25-July 3, 8:00am-3:00pm) – Teachers Enhancing Achievement in Math and Science
1. Need teachers for math and science in grades 3-6 to apply.
2. Featuring an $800 stipend, graduate scholarship, and use of FOSS materials.
3. PDF of brochure attached to minutes.

D. DREAMS (July 30-Aug 8) – Developing Regional Excellence in Math and Science Education
1. New grant: math and science leadership, content and pedagogy professional development opportunity for teachers K-12.
2. End product options: Master of Arts in Teaching (either mathematics, physics, or interdisciplinary science and math), Specialist endorsement in mathematics K-6, Specialist endorsement in science K-9.
3. PDF of recruitment postcard attached to minutes.

E. Math and Science teacher needs for 2007-2008
1. Teachers always needed in Lima and Toledo Public Schools.
2. Findlay needs 3-4 high school and middle school Math and Science teachers.
3. Springfield is looking for teachers with diversity.

F. Centers of Excellence conference
    1. Middle level education focus.
    2. In Columbus on April 26-27, 2007.
G. Inquiry Series
    1. Summit 2007 has a variety of sessions.
    2. Registration will open soon at cosmos.bgsu.edu.

II. Working items

A. SAMEPAC
    1. Five recommendations from state level science and mathematics advisory committee.
    2. PowerPoint of SAMEPAC recommendations (attached to minutes).
B. ODE updates
    1. Standards will be revised: ELA and Math - 2008, Science and SS - 2009.
    2. Algebra II end of course test is being prepared and will be piloted spring 08.
C. Small group discussion topics:
    1. Diversity:
        a) Need to raise awareness for subgroups.
        b) Teachers need more effective strategies for narrowing achievement gaps.
    2. Teacher understanding, assessment, and instruction of the standards:
        a) Not understanding the language of the standards.
        b) Teachers would benefit from a couple of PD days to break down standards.
        c) Districts allowing teachers to talk to trained colleagues.
        d) Guidance on PD for each district
        e) Using technology for delivering resources of PD. Follow-up with a person.

NEXT MEETING: Wednesday, April 11, 3:00-4:30pm, Room 204 Life Sciences Bldg.

ATTACHMENTS:
SAMEPAC PowerPoint
DREAMS postcard (pdf)
NWO TEAMS brochure (pdf)

COSMOS COLLABORATIVE COUNCIL
April 11, 2007 ~ 3:00-4:30pm Room 204 Life Sciences Bldg.
Minutes

Attendance:

Jessica Belcher, COSMOS
Karen Creps, Wood County ESC
Mandy Heddle, COSMOS
Scott Hoff, Putnam County ESC
Rose Kandik, Lucas County ESC
Michelle Leow Klinger, COSI Toledo
Jennifer Kogut, Sylvania Schools
Sally Kovar, NWO ESC
Jane McCleary, Hancock County ESC
Matt Partin, COSMOS/BGSU Biology
Amy Scheuermann, COSMOS/BGSU Education
Michelle Shafer, COSMOS

I. General discussion

A. Regional activities
1. REAL, RIPE, TEAMS, DREAMS Calendar
2. DREAMS- Please choose 5 amazing people to recruit from your schools
3. Cognitive Coaching (Beginning of August)- Eight day training, spread over two years. Will be a feature of DREAMS

B. Ohio Resource Center (ohiorc.org)
1. For use as a resource for professional development resources and research

II. Working items

A. DREAMS
1. Participant Options: Master of Arts in Teaching, Science or Mathematics Specialist Endorsement, Nat'l Board Certification
   a) Licensure handout
   b) COSMOS DREAMS can pay for 9 credit hours/year
   c) E-Portfolio will mirror the Nat'l Board requirements
2. Ideas to structure the program
   a) Math and science literacy and reading interwoven
   b) Special education intervention/differentation/achievement gap
   c) Series and a follow-up for modeling in the upper levels
3. Leadership Academy
   a) Establishing a sense of urgency and use data for organizational change
   b) Modeling the strategies for change
   c) Addressing evaluating effectiveness of change; qualitative analysis
   d) Addressing motivation (intrinsic)
   e) Grant writing and alternative funding; possibility of matching funds
   f) Academic diversity

B. Curriculum Topic Study PowerPoint

NEXT MEETING: Wednesday, May 9, 3:00-4:30pm, Room 204 Life Sciences Bldg.

ATTACHMENTS:
Activities Calendar
Curriculum Topic Study (PowerPoint)

COSMOS COLLABORATIVE COUNCIL
May 9, 2007 ~ 3:00-4:30pm Room 204 Life Sciences Bldg.
Minutes

Attendance:

Jessica Belcher, COSMOS
John Crecelius, Perrysburg Schools
Karen Creps, Wood County ESC
Mandy Heddle, COSMOS
Cathy Heidelberg, Ottawa Hills Schools
Treva Jeffries, Toledo Public Schools
Michelle Leow Klinger, COSI Toledo
Jane McCleary, Hancock County ESC
Julie Nurnberger-Haag, COSMOS
Amy Scheuermann, COSMOS/BGSU Education
Michelle Shafer, COSMOS

I. General discussion

A. Achievement Test Debrief
1. General agreement that no new surprises for math, science could be difficult and teachers will be awaiting results
2. COSI has had a dramatic increase in school visits due to OAT preparation

B. COSMOS Planning Retreat May 16
1. All CCC participants are invited
2. Planning for next year's Inquiry Series, Symposium, and other outreach activities

C. Regional activities for the summer
1. REAL, RIPE, TEAMS, DREAMS Calendar
2. DREAMS- Reminder to please choose 5 amazing people to recruit from your schools
3. Cognitive Coaching (Beginning of August)- Eight day training, spread over two years. Will be a feature of DREAMS, may be open to others
4. Question was raised---how does NWO/COSMOS advertise for these opportunities? Modes of communication and best means to share information were discussed (when possible, send to a specific teacher or use school contact to disseminate materials)

II. Working items

A. Professional Development Needs for 2007-08
1. Brainstormed lists of PD needs for next year
a) Differentiated curriculum
b) Research into best practices for science & math
c) Modeling for Science
d) Elementary math and science
e) 4-9 licensed individuals need math and/or science content
f) Effective incorporation of technology in math and science
g) Curriculum Topic Study to help teachers understand content and developmental appropriateness of concepts in grade level indicators
h) Value added/Layered Curriculum/Partnership with special and regular education

2. Potential PD solution: DREAMS program participants may be able to provide PD at the schools of CCC and other partner districts
3. Potential grant ideas: Layered Lessons creation in math and science (guided by Kathie Nunley)

NEXT MEETING: Wednesday, June 9, 3:00-4:30pm, Room 204 Life Sciences Bldg.

ATTACHMENTS:
Activities Calendar

COSMOS COLLABORATIVE COUNCIL
June 6, 2007 ~ 3:00-4:30pm Room 204 Life Sciences Bldg.
Minutes

Attendance:

Jessica Belcher, COSMOS
Karen Creps, Wood County ESC
Jodi Haney, COSMOS
Mandy Heddle, COSMOS
Rose Kandik, Lucas County ESC
Jennifer Kogut, Sylvania Schools
Jane McCleary, Hancock County ESC
Julie Nurnberger-Haag, COSMOS
Amy Scheuermann, COSMOS/BGSU Education
Michelle Shafer, COSMOS
Sharon Shaffer, Rossford Schools

A. The COSMOS Planning Retreat was summarized by Jodi, Michelle and Mandy. During the 2007-08 Academic Year, area teachers will be able to attend the Inquiry Series and the Symposium at no cost. Look for mailings and emails about these two opportunities at the beginning of the school year. NWO/COSMOS will increase its efforts at STEM and STEM educational careers. The higher ed faculty research community will continue to expand efforts to study how people learn mathematics and science K-16+.
B. Summer Grant and other Opportunities Updates
    1. NWO TEAMS- 91 area teachers registered. See attached list for numbers per district.
    2. COSMOS DREAMS- we've received 82 teacher applications from all across Ohio. See attached list for numbers per district.
    3. NWO/COSMOS REAL- 40+ high school students start June 11 at BGSU for a 3-week residency college experience.
    4. NWO/COSMOS RIPE- 40 pK-3 teachers will participate beginning June 18. Over 70 applied for this workshop. It will be offered next year, too.
    5. Cognitive Coaching will be offered August 3 from 8:30-3:30 at BGSU. Look for more information coming soon to all CCC members.
C. Academic Year opportunities
    1. Inquiry Series—Look for postcards coming out the beginning of September
    2. Online courses—LessonLab for Mathematics teachers K-6; graduate level biology courses also available for teachers
    3. Improving Teacher Quality grants—the CCC meetings at the beginning of next academic year will focus on developing mutually beneficial proposals for these and other grants
D. Ways to ensure that the CCC continues to be a valuable resource were discussed. Mentioned were learning about new professional development opportunities, and co-planning professional development programs from the beginning through implementation
E. Meeting schedule for next year: September 5, October 3, November 7, December 5, January 9, February 6, March 5, April 2, May 7, June 4; from 3:00-4:30. Location TBA.

Appendix U: NWO Evaluation Report MetriKsAme'rique

Northwest Ohio Center of Excellence in Science and Mathematics Evaluation

Annual External Evaluation Report, 2006 – 2007

July 15, 2007

Analyzed and Written by:

MetriKsAmérique
5840 Summit Street Sylvania, Ohio 43560

TABLE OF CONTENTS

Introduction

The external evaluation team from MetriKs Amérique conducted the second year (2006-2007) external evaluation of the Northwest Ohio Center of Excellence in Science and Mathematics (further referred to as the NWO Center or the Center). This report is organized by the revised goals of the NWO Center and focuses on the progress made by the Center in the attainment of these goals. The revised goals of the NWO Center are presented first (see Part I), followed by the evaluation questions that were researched to obtain evidence of the success of the NWO Center (see Part II). The evaluation results are summarized next by each goal of the NWO Center (see Part III) and triangulating all the data sources to allow for a more comprehensive evaluation. The report concludes with the evaluation highlights and recommendations for the next year.

Back to top

PART I. NWO Center Goals and Evaluation Questions

In preparation of this annual external evaluation of the Northwest Ohio Center of Excellence in Science and Mathematics the evaluation team examined all the collected information for its relevance to each of the goals and objectives set by the Center, as listed below. These goals and objectives were revised by the NWO Center to better address its mission and vision as well as match the research agenda. These are introduced in this part of the report to set the ground for the interpretation of the evaluation results presented in subsequent sections.

NWO Mission

The mission of the NWO Center is to advance Science, Technology, Engineering, and Mathematics (STEM) Education for people of all ages.

NWO Vision

The Northwest Ohio Center of Excellence aims to advance science, technology, engineering and mathematics (STEM) education for people of all ages. The purpose is to work with community partners to (a) generate new knowledge about the science of teaching and learning, (b) apply this knowledge by developing the expertise of K-12 educators and higher education faculty, (c) increase public support for, and understanding of, the STEM subject areas, and (d) to stimulate the interest of young people, especially those in underrepresented groups, in these rewarding fields of study and career opportunities.

Back to top

Original NWO Goals

The following goals were originally formulated by the NWO Center:

Goal #1: Increase the capacity of urban and other at-risk districts to enhance student achievement in science and mathematics through partnerships among universities, K-12 schools, and the Ohio Resource Center

Goal #2: Increase the recruitment of pre-service teachers and retention of in-service teachers of science and mathematics

Goal #3: Improve in-service teacher preparation programs in science and mathematics

Goal #4: Strengthen coordination/communication among college faculties (teacher education, sciences and mathematics) and with funding agencies to improve the sustainability, cultural and financial foundation for the Center

Goal #5: Establish on-going collaboration among institutions of higher education, school districts, professional development centers, and the Ohio Resources Center to identify and solve root barriers to science and mathematics achievement

Last year's evaluation of the Center conducted by the University of Cincinnati Evaluation Services partially addressed these goals and focused mostly on the annual sub-goals. To better align the initiatives of the Center and avoid compartmentalizing evaluation of the Center in the future, the original goals have been revised (see *Revised NWO Goals and Objectives* below) and matched with the NWO Center activities, evaluation questions and data courses (see Table 1).

Back to top

Revised NWO Goals and Objectives

Goal #1: Enhance the preparation of pre-service and in-service teachers though research-based professional development focusing on investigative mathematics and science teaching and learning.

The Center addressed Goal 1 through the following initiatives/activities/ programs/events:

- Modification of undergraduate and graduate courses or programs
- Undergraduate professional organizations (BG-UT SECO and CTM)
- Praxis II Preparation Workshop
- Graduate MAT program scholarships
- NWO Symposium

- Sessions and workshops on effective strategies for teaching science, math, and technology through Inquiry Series
- Affiliated Programs (e.g., TEAMS, TeachOhio, PRISM, REAL, DREAMS)

Goal #2: Recruit and retain students into STEM and STEM education disciplines.

The Center addressed Goal 2 through the following initiatives/activities/ programs/events:

- Future Teacher Conference
- TeachOhio alternative licensure program
- OJSHS

Goal #3: Conduct and communicate collaborative research on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts.

The Center addressed Goal 3 through the following initiatives/activities/ programs/events:

- Research Community
- Educational Statistics Seminar

Goal #4: Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues.

The Center addressed Goal 4 through the following initiatives/activities/ programs/events:

- COSMOS Collaborative Council (CCC)
- NWO Executive Board

Goal #5: Increase the leadership capacity for mathematics and science education in northwest Ohio.

The Center addressed Goal 5 through the following initiatives/activities/ programs/events:

- Inquiry Series Symposium
- Summit Presentations

Back to top

Part II. Evaluation Goals, Questions, and Procedures

Evaluation Goals and Questions

The overall goal of the 2006-2007 annual evaluation of the NWO Center was to determine the progress of the Center towards the attainment of its revised goals. This was accomplished by formulating evaluation/research questions specific for each goal, aligning the Center initiatives/activities/programs/events with each goal, and identifying multiple data sources that could be triangulated to enhance the validity of the findings (see Table 1 for details).

Table 1. Alignment of NWO Center Goals and Initiatives/Activities with the Evaluation Questions and Data Sources

Revised NWO Center Goals	NWO Center Activities/ Initiatives	Evaluation Questions	Evaluation Data Sources Used to Answer These Questions
Goal 1: Enhance the preparation of pre-service and in-service teachers though research based professional development focusing on investigative mathematics and science teaching and learning	- Undergraduate and graduate course or program modification - Undergraduate professional organizations (BG-UT SECO and CTM) - Praxis II Preparation Workshop - Graduate MAT program scholarships - NWO Symposium - Inquiry Series - Affiliated Programs (TEAMS, TeachOhio, PRISM, DREAMS)	1). What are the beliefs and practices of NWO participants? How do these beliefs compare for TEAMS, TeachOhio and Other NWO participants? 2). What are the emic and etic perceptions regarding the effectiveness of the NWO professional development? 3). How do participants perceive that NWO activities have impacted their beliefs and practices?	- TBI survey data - Session evaluations - Teacher Interviews - Faculty Interviews - PD Observations
		4). How have the universities responded by developing/ revising courses/programs to better prepare teachers?	- # courses developed and/or modified; - Faculty interviews
		5). In what ways are participants deepening their content knowledge in their subject areas?	# of students in MAT programs; # hours successfully completed each year; names of courses completed; # SECO/CTM meetings; attendance at SECO/CTM meetings; # members in SECO/CTM; faculty interviews; attendance of Praxis II Tutoring sessions in math and science; workshop evaluation by participants
		6). How do participants transfer skills and knowledge received through NWO professional development into the classroom?	- Classroom observations - Teacher interviews

Table 1. Alignment of NWO Center Goals and Initiatives/Activities with the Evaluation Questions and Data Sources (Cont.)

Revised NWO Center Goals	NWO Center Activities/ Initiatives	Evaluation Questions	Evaluation Data Sources Used to Answer These Questions
Goal 2: Recruit and retain students into STEM and STEM education disciplines	- Future Teacher Conference; - TeachOhio - OJSHS	1). What types and how many students have been served as a result of the NWO recruiting and retention activities?	- Attendance data for Future Teacher Conference, TeachOhio, and OJSHS; - Session evaluations from these events and Inquiry Series (for TeachOhio candidates) - Program documentation
		2). How did these participants rate the effectiveness of each activity?	

NWO Center Goals	NWO Center Activities	Evaluation Questions	Evaluation Data Sources
Goal 3: Conduct and communicate collaborative research on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts.	- Research Community - Educational Statistics Seminar	1). How have BGSU faculty contributed to the body of knowledge on how people best learn science and mathematics and/or on the barriers and enablers related to current reform efforts?	- Attendance data - Mid-year evaluations - Faculty interviews
		2). What do faculty believe about the utility of the Research Community as a faculty development opportunity that serves to enhance the research efforts of the university in mathematics and science education?	
		3). How do faculty perceive the role of NWO in impacting problems associated with K-16 mathematics and science teaching and learning?	

NWO Center Goals	NWO Center Activities	Evaluation Questions	Evaluation Data Sources
Goal 4: Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues.	- COSMOS Collaborative Council (CCC) - NWO Executive Board	1). How has NWO developed and sustained a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues?	- Attendance and minutes from the CCC council; - Attendance and minutes from the 2 NWO Executive Board meetings - Faculty Interviews

Table 1. Alignment of NWO Center Goals and Initiatives/Activities with the Evaluation Questions and Data Sources (Cont.)

Revised NWO Center Goals	NWO Center Activities/ Initiatives	Evaluation Questions	Evaluation Data Sources Used to Answer These Questions
Goal 5: Increase the leadership capacity for mathematics and science education in northwest Ohio.	- Inquiry Series	1). In what ways have NWO teachers taken on leadership roles in the region?	- List of sessions presented by NWO teachers for Sept and April (teacher name, group affiliation, name of session); - Session ratings of these sessions by teachers

Most of the data analyzed in this evaluation report were provided to MetriKs by the NWO Center, with the exception of the faculty interviews.

Back to top

Participants

In 2006-2007, the NWO Center served 331 pre-service and in-service teachers as well as higher education faculty and other educators in the area (see Table 2 for details). The participants self-selected themselves to participate in the NWO Center activities and therefore constitute a volunteer sample.

Table 2. 2006-2007 NWO Participants by Affiliation and Category

Activity	Category Served	# Participants
Inquiry Series	In-Service, Pre-Service, Faculty, Other	322
NWO Symposium	In-Service, Pre-Service, Faculty, Other	325
MAT	In-Service	14
TEAMS	In-Service	136
Future Teacher Conference	Pre-Service	n/a
Praxis II Tutoring	Pre-Service	30
BG SECO/CTM	Pre-Service	190
TeachOhio	In-Service, Pre-Service	17

PRISM	In-Service, Faculty, Other	21
OJSHS	HS students	50
REAL	HS students	54
Research Community	Faculty	28
Course Modification	Faculty	4
COSMOS Collaborative Council (CCC)		31
NWO Executive Board		15

All the participants were used as the target population for the evaluation of the NWO Center. However, different sampling frames were used in different evaluation questions and depending on the data collection strategy. The number of sampled NWO participants and the response rates are reported in the section *Data Collection Strategies and Procedures* as well as in different sections of the Part III *Evaluation Results* of this report.

Back to top

Data Collection Instruments[1]

Surveys: Teacher Beliefs Inventory

The *Teacher Beliefs Inventory* (*TBI*) was used with all NWO participants to collect data and assess the impact of the professional development offered through the Center on teacher beliefs. The *TBI* consists of the following three sections:

- Section 1: *Beliefs About Teaching Science and Mathematics* (Enochs & Riggs, 1990) has 25 items on a 7-point Likert scale (Strongly Disagree, Agree, Barely Agree, Unsure, Barely Disagree, Disagree, and Strongly Agree). These items form two subscales: Outcome Expectancy (OE) and Self Efficacy (SE).
- Section 2: *Science and Mathematics Classroom Learning Environment Survey* (Becker & Anderson, 1998; Haney, 2005) contains 30 items on the same 7-point Likert scale. The items in this section measure four constructs represented by the following subscales: Classroom Environment (CE), Teaching Activities & Assessment (TA), Teacher's Role (TR) and Instructional Goals (IG).
- Finally, Section 3: *Instructional Practices Inventory* is comprised by 20 items on a 7-point frequency scale (Daily, Frequently, Often, Rarely, Occasionally, Barely, and Never). These 20 items are grouped into the following two subscales: Traditional Strategies (TS) and Reform Strategies (RS).

Interviews: NWO Participant Interview Protocol

The NWO Participant Interview Protocol was developed by the NWO staff to be used with the teachers after they have been observed in the classroom. This allowed for collecting more in-

[1] Copies of the instruments were included in the last year's report and therefore not provided here, with the exception of the Faculty E-mail Interview Protocol that has been restructured to fit this data collection mode

depth information from the participants with regard to the effectiveness of the Center in enhancing the preparation of the in-service teachers for inquiry-based teaching of science and mathematics.

Interviews: Higher Education Faculty E-Mail Interview Protocol

Using the interview protocol developed last year by the UCESC and the NWO Center to measure faculty involvement with the Center, MetriKs restructured this protocol to better fit the data collection mode of e-mail interviewing used in this year's evaluation process. This approach offered certain advantages over the regular phone interviewing, such as no costs associated with transcription, opportunity for the respondents to revisit their responses and check them for accuracy; a more naturalistic interview process that leads to increased richness of narratives; and greater ownership of the narratives by the respondents (James & Busher, 2006). The original 14-item protocol was broken down into 12 contact session questions (see Appendix A for details)

Session Evaluations: NWO Participant Session Evaluation Protocol

Different Session Evaluation Protocols have been developed and used by the NWO staff to collect session evaluations by the participants. Each was tailored to the specific NWO initiative/activity/program/event and allowed for collecting both quantitative ratings on a 5-point scale and qualitative feedback about each session.

Observations: Horizon's Professional Development Protocol

A standard Horizon's Professional Development Protocol was used by trained observers to evaluate the quality of the NWO professional development activities. To rate each session, observers used a narrative summary approach with overall numeric ratings for the following categories: ***Design*** (what the facilitator intended for the session), ***Implementation*** (what actually happened in the session), ***Content*** (appropriateness of material covered), ***Culture*** (participation and climate), and ***Overall Capsule*** (overall assessment of the quality and likely impact of the session). Possible ratings ranged from 1 (not at all reflective of best practice) to 5 (extremely reflective of best practice) for Design, Implementation and Content. Culture ratings ranged from 1 (interfered with participant learning) to 5 (facilitated the learning of all participants). Overall Capsule descriptions of the quality of the session rating options are listed in Table 3.

Table 3. Description of Possible Overall Session Observation Capsule Ratings

Possible Ratings	Description
Level 1	**Ineffective Professional Development:** There is little or no evidence of participant thinking or engagement with important ideas of mathematics/science education. Session is *highly unlikely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s). Professional development appears to be either: *Passive "Learning"* -Session is pedantic and uninspiring. Participants are passive recipients of information; material is presented in a way that is inaccessible to or inappropriate for many of the participants. *Activity for Activity's Sake* - Participants are involved in hands-on activities or other individual or group work, but it appears to be activity for activity's sake. Session lacks a clear sense of purpose and/or a clear link to the conceptual development of participants.
Level 2	**Elements of Effective Professional Development:** Session contains some elements of effective practice in professional development, but there are *serious problems* in the design, content, and/or implementation given the purposes of the session. For example, the content is presented in a way that would reinforce misconceptions or the pace is clearly too rapid for meaningful participant engagement. Overall, the session is *very limited* in its likelihood to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).
3 (Low, Solid, or High)	**Beginning Stages of Effective Professional Development:** Professional development is purposeful and at times effective, but there are *weaknesses*, ranging from substantial to fairly minor, in the design, content, or implementation of the session. For example, participants' expertise is not well-utilized; or participants are not given sufficient opportunity to reflect on what they are learning. Overall, the session is *somewhat limited* in its likelihood to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).
Level 4	**Accomplished, Effective Professional Development:** Facilitation is skillful and participants are engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to deepen their understanding of important mathematics/science concepts; enhance their pedagogical skills and knowledge; increase their ability to use the designated instructional materials; or to enhance their leadership skills. The facilitator(s) implement the professional development session well and participants' contributions are valued, but adaptation of content or format in response to participants' needs and interests may be somewhat limited. The session is *quite likely* to enhance the capacity of most participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).
Level 5	**Exemplary Professional Development:** Facilitation is skillful, and participants are highly engaged in purposeful work (e.g., investigations, discussions, presentations, reading) designed to deepen their understanding of important mathematics/science concepts; enhance their pedagogical skills and knowledge; increase their ability to use the designated instructional materials; or to enhance their leadership skills. The session is artfully implemented, with flexibility and responsiveness to participant needs/interests. The session is *highly likely* to enhance the capacity of participants to provide high quality mathematics/science education or to be effective leaders of mathematics/science education in the district(s).

Observations: Horizon's Classroom Observation Protocol

A standard Horizon's Classroom Observation Protocol was used by trained observers to evaluate the quality of the transferability of the content and strategies learned by the NWO participants into the classroom. To rate each lesson, observers used a narrative summary approach with overall numeric ratings for the following categories: ***Design*** (what the teacher intended for the lesson), ***Implementation*** (what actually happened in the classroom), ***Content*** (appropriateness of material covered), ***Classroom Culture*** (student participation and climate), and ***Overall Capsule*** (overall assessment of the quality and likely impact of the lesson). Possible ratings ranged from 1 (not at all reflective of best practice) to 5 (extremely reflective of best practice) for Design, Implementation and Content. Classroom Culture ratings ranged from 1 (interfered with student learning) to 5 (facilitated the learning of all students). Overall Capsule descriptions of the quality of the lesson rating options are listed in Table 4.

Table 4. Description of Possible Overall Capsule Ratings

Possible Ratings	Description
1	***Ineffective Instruction***: Little or no evidence of student thinking or engagement. Instruction is *highly unlikely* to enhance students' understanding of the discipline of to develop their capacity to successfully "do" mathematics/science. Characterized by either of the following: *Passive Learning*—Instruction uninspiring where students are passive recipients of information from the teacher or textbook. *Activity for Activity's Sake*—Students are involved in hands-on activities, but it appears to be activity for activity's sake. Lesson lacks clear sense of purpose and/or a clear link to conceptual development.
2	***Elements of Effective Instruction***: Serious problems in the design, implementation, content, and/or appropriateness for many students in the class. Overall, the lesson is *very limited* in its likelihood to enhance students' understanding of the discipline or to develop their capacity to successfully "do" mathematics/science.
3 (Low, Solid, or High)	***Beginning Stages of Effective Instruction***: Some elements of effective practice but there are weaknesses ranging from substantial to fairly minor, in design, implementation, or content of instruction. The teacher may short-circuit a planned exploration by telling students what they "should have found"; instruction may not adequately address the needs of a number of students; or the classroom culture may limit the accessibility or effectiveness of the lesson. Overall, the instruction is *somewhat limited* in its likelihood to enhance students' understanding of the discipline of to develop their capacity to successfully "do" mathematics/science.
4	***Accomplished, Effective Instruction***: Instruction is purposeful and engaging for most students. Students actively participate in meaningful work. The lesson is well-designed and the teacher implements it well, but adaptation of content or pedagogy in response to student needs and interests is limited. Instruction is *quite likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.
5	***Exemplary Instruction***: Instruction is purposeful and all students are highly engages most or all of the time in meaningful work. The lesson is well-designed and artfully implemented, with flexibility and responsiveness to students' needs and interests. Instruction is *highly likely* to enhance most students' understanding of the discipline and to develop their capacity to successfully "do" mathematics/science.

Back to top

Data Collection Strategies and Procedures

Surveys: Teacher Beliefs Inventory

The *TBI* was administered to most of the NWO participants by the NWO staff at two points in time during the academic year (AY) – in the fall of 2006 (this excludes TEAMS) and in the spring of 2007 (this includes all the participants). The fall administration of the *TBI* was in the paper-and-pencil format and was carried out during the Blast-off NWO Center event in September. The spring administration of the *TBI* was done on-line after the Summit NWO Center event in April. A total of 69 responses were received in the fall (this excludes TEAMS) and 80 were received in the spring (43 TEAMS, 8 TeachOhio and 29 other NWO/COSMOS participants – a 57% response rate). In addition to these data collection events, the TeachOhio participants were surveyed twice in the summer of 2006 using the paper-and-pencil format - in June (pre) and in August (post) after the methods class. All the TeachOhio participants completed the pre- and post-surveys in summer. However, slightly more than 50% of the TeachOhio participants completed the *TBI* survey on-line in April 2007. The TEAMS participants were also surveyed twice in summer of 2006 using the paper-and-pencil format. There were 62 usable TEAMS responses from the pre-survey (84% response rate) and 59 from the post-survey (80% response rate).

Interviews: NWO Teacher Interview

The teacher interview data were collected and transcribed by the NWO staff throughout the academic year. The data came from a sample of the NWO participants who were also observed in their classrooms. A total of 39 interviews were conducted: 10 for TEAMS, 20 for TeachOhio (10 pre and 10 post), 7 for Other NWO participants (PRISM, MAT, and In-Service), and 2 from control group teachers (as part of TEAMS evaluation).

Interviews: Higher Education Faculty E-Mail Interview

The faculty interviews were conducted by MetriKs in May - June of 2007 using an e-mail interview method (vs. telephone interviews that were done previously). As previously mentioned, this was preferred over telephone interview for the following reasons: no costs associated with transcription, opportunity for the respondents to revisit their responses and check them for accuracy; a more naturalistic interview process that leads to increased richness of narratives; and greater ownership of the narratives by the respondents. These characteristics of email interviews along with probing enhance credibility (reliability) and establish authenticity (validity) of the evaluation (James & Busher, 2006). A total of 20 (compared to 6 last year) faculty responded (69% response rate).

Session Evaluations: NWO Participant Session Evaluation

Session evaluations data were collected, entered and summarized by the NWO staff after each session using the NWO Participant Session Evaluation Protocol.

Observations: Horizon's Professional Development Protocol

A total of nine AY sessions were observed by five trained observers in 2006-2007 across all NWO projects.

Observations: Horizon's Classroom Observation Protocol

A total of 39 classroom observations were conducted across all NWO projects –20 TeachOhio, 10 TEAMS, 7 Other, and 4 from control group teachers (as part of TEAMS evaluation).

TEAMS Classroom Observations: TEAMS and comparison group teachers were recruited to participate in classroom observations. TEAMS teachers selected for the observation identified a non-TEAMS teacher from their home school. The inclusion criteria included teaching the same grade level and teaching a similar content. Of the 10 TEAMS classroom observations, eight were in science classrooms and two were in math classrooms. The science observations included four 5th grade science, three 4th grade science, and one 3rd grade science classroom. The math observations included one 5th grade math and one 6th grade math classroom. The two comparison observations were conducted for one 5th grade science classroom and one 3rd grade math classroom.

TeachOhio Classroom Observations: Two observations were made for each of the 10 TeachOhio participants who were observed teaching science, with the first occurring in the late Fall of 2006 and early winter of 2007 (pre-observation) and the second occurring in the Spring of 2007 (post-observation). Of the ten teachers who were observed, one taught 8th grade, four taught 9th grade, 2 taught tenth grade, one taught 11th grade, and two others were identified as teaching multiple levels, i.e., one teacher taught grades 10-12 and another taught grades 11 – 12.

Other NWO: Of the 7 classroom observations that were completed of the Other NWO participants, 3 were for PRISM, 2 for MAT, and 2 for INSERVICE. The three PRISM observations included: one 4th grade science class, one 6th grade science class, and one 6th grade math class. The MAT observations included two science classrooms, with one in 10th grade and one in 12th grade. The INSERVICE observations included one 5th grade science class and one 7th grade math class.

Back to top

Data Analysis Methods

Surveys: TBI

The *Teacher Beliefs Inventory* (*TBI*) analysis of change in participants' beliefs was conducted differently for different groups of NWO participants.

For TEAMS participants, The *Teacher Beliefs Inventory* (*TBI*) analysis of change in participants' beliefs was conducted for each of the three sections of the survey, in addition to the following subscales: Outcome Expectancy (OE), Self Efficacy (SE), Classroom Environment (CE), Teaching Activities & Assessment (TA), Teacher's Role (TR), Instructional Goals (IG), Traditional Strategies (TS), and Reform Strategies (RS). Appropriate items were reversed before computing subscale and section totals. A repeated-measures analysis was then used to assess change across the three time periods based on a sample of n=29 cases. As mentioned earlier, there were 62 usable TEAMS responses from the first day of the Summer Insititute (pre-SI survey), 59 from the post-SI survey and 43 from the post AY on-line survey. However, only 29 cases matched across three points in time because some of the participants did not include

an ID and others wrote only a partial ID. Cohen's d was then calculated to estimate the effect size for the difference between pre-SI and post-SI scores, as well as between post-SI and AY scores.

For TeachOhio participants, The *Teacher Beliefs Inventory* (*TBI*) analysis of change in participants' beliefs was also conducted for each of the three sections of the survey, in addition to the following subscales: Outcome Expectancy (OE), Self Efficacy (SE), Classroom Environment (CE), Teaching Activities & Assessment (TA), Teacher's Role (TR), Instructional Goals (IG), Traditional Strategies (TS), and Reform Strategies (RS). Appropriate items were reversed before computing subscale and section totals. A dependent t-test was then used to assess change from pre-SI to post-SI. The post AY survey data were not used due to a very low response rate. Cohen's d was then calculated to estimate the effect size for the difference between pre and post-SI scores, as well as post-SI and AY scores.

For all other NWO participants, The *Teacher Beliefs Inventory* (*TBI*) analysis of change in beliefs was conducted for the first two sections of the TBI, in addition to their following subscales: Outcome Expectancy (OE), Self Efficacy (SE), Classroom Environment (CE), Teaching Activities & Assessment (TA), Teacher's Role (TR), and Instructional Goals (IG). Appropriate items were reversed before computing subscale and section totals. A dependent t-test was then used to assess difference between the retro ratings (i.e., what the participants believed at the beginning of the year) and the TODAY ratings (i.e., what the participants believed on the day of taking the survey). Cohen's d was then calculated to estimate the effect size. Due to the nature of the questions asked, data for the third section of the TBI, i.e., the *Instructional Practices Inventory*, were collected for only one scale: the *Post Today* scale/period. Thus, only the Post Today data were reported for this section, as well as its subscales: Traditional Strategies (TS), and Reform Strategies (RS).

Conducting separate TBI analyses for three groups (TEAMS, TeachOhio and Other NWO participants) was chosen for two major reasons – loss and comparability of the data. More specifically, the TeachOhio data were available for pre-SI and post-SI, with very few cases from the post-AY administration. Hence to avoid loss of data, only pre-post SI data for TeachOhio were analyzed. The TEAMS data were available and analyzed for three time periods (pre-SI, post-SI and post-AY). For all other participants, only 13 common cases were obtained when merging pre-AY and post-AY. Therefore, we used post-AY survey data for this group and analyzed their retro responses along with their TODAY responses.

Interviews

The interview data collected from the NWO participants (in person) and higher education faculty (by e-mail) were examined for themes and separately for each evaluation question.

Session Evaluations

The session evaluations data were examined for numeric ratings as well as qualitative responses and separately for each evaluation question.

PD Observations

The ratings of professional development session observations were calculated by taking the average rating across all sessions for each category (*design, implementation, content, culture,*

and *capsule*). Supporting qualitative comments from the raters, regarding strengths and recommendations for each rating category, are summarized in each category

Classroom Observations
The ratings of TEAMS classroom observations were calculated by taking the average rating across all 10 participants for each category (*design, implementation, content, culture,* and *capsule*) and comparing those ratings to the ratings of the control teachers where possible. Supporting qualitative comments from the raters, regarding strengths and recommendations for each rating category, are summarized in each category.

The pre-post ratings of TeachOhio classroom observations were calculated by taking the average rating across all 10 participants for each category (*design, implementation, content, culture,* and *capsule*) and comparing those ratings from pre to post. Supporting qualitative comments from the raters, regarding strengths and recommendations for each rating category, are summarized in each category.

The ratings of Other NWO participants' classroom observations were calculated by taking the average rating across all 10 participants for each category (*design, implementation, content, culture,* and *capsule*). Supporting qualitative comments from the raters, regarding strengths and recommendations for each rating category, are summarized in each category.

Back to top

Limitations of the Data

The generalizability of the results in this report is affected by small sample sizes (which limited the data analysis in many instances to descriptive statistics only), differences in the response rate from pre to post survey administrations (which made the change analysis sometimes impossible), volunteer sampling of classroom observations (which limited the observations data mostly to experienced teachers who were willing to let the observer into the classroom), and some inconsistencies and changes in the data collection methods (which decreased the response rate). The inconsistencies in the data collection included switching from the paper-pencil to the on-line survey administration as well as collecting data from some groups of NWO participants at different points in time. The change in the data collection mode, however, was deemed necessary in order to maximize the use of classroom time for learning. This change was initiated by the NWO staff in response to many participants' suggestions for reducing the amount of time devoted to data collection during the NWO activities. Collecting data at different points in time was also unavoidable due to the need to assess the immediate effect of some NWO projects (such as TEAMS and TeachOhio). These limitations should be kept in mind when reading and interpreting the evaluation results presented next.

Back to top

Part III. Evaluation Results

Effectiveness Of The NWO Center Research Based Math And Science Professional Development Programs Geared Towards Pre-Service And In-Service Teachers

The progress of the NWO Center towards fulfillment of its Goal 1 was assessed by examining the effectiveness of the NWO professional development component. This was accomplished by triangulating data from six different sources - (1) examining beliefs and practices of the NWO teachers that they shared on the TBI survey, (2) thematically analyzing the emic session evaluations data (e.g., written evaluations of the professional development sessions) obtained from the participants, (3) thematically analyzing the faculty interview data, (4) thematically analyzing the teacher interview data, (5) summarizing the etic session evaluations data (e.g., professional development observations ratings provided by the external observers), and (6) studying other statistics collected by the NWO Center about different activities (e.g., course and program modification documents, PD attendance data, MAT credit hour completion data, and Symposium participant involvement data, etc.). The evaluation results below are organized by each evaluation question that was researched. Program-specific as well as overall summaries are provided as appropriate and enabled by the data.

Back to top

Goal 1 - Evaluation Question 1: What are the beliefs and practices of NWO participants? How do these beliefs compare for TEAMS, TeachOhio and Other NWO participants?

TEAMS: The means, F values, and effect sizes of 29 TEAMS teacher responses to the *TBI* items are presented in Table 5. Significant changes across time are shaded in grey whereas medium to small effect sizes are bolded in red. Not all of the significant results were due to a consistent increase across time. Rather, some of the subscales showed an increase from pre-SI to post-SI, but then a drop down to baseline levels at the AY posttest. Thus, effect sizes are important to examine in addition to the statistical significance.

Table 5 shows that moderate to large changes in the positive direction were found *pre to post SI* for the total STEBI scores, the total Classroom Learning Environment scores, and three of its four subscales: Classroom Environment (CE), Teaching Activities & Assessment (TA), and Instructional Goals (IG). For the total Instructional Practices Inventory scores and one of its two subscales: Reform Strategies (RS), the moderate effect sizes were found pre to post SI in the

negative direction. However, these scores turned around to produce extremely large effect sizes post SI to post AY for *all* sections of the Instructional Practices Inventory.

Table 5. Summary of the TBI Survey Results for TEAMS (n=29)

Part A – modified STEBI

Scale	Mean Pre SI	Mean Post SI	Mean Post AY	F	Cohen's d (Pre SI to Post SI)	Cohen's d (Post SI to Post AY)
OE	45.90	48.86	48.07	1.60	.38	.01
SE	58.72	62.0	63.41	3.64*	.36	.24
Total	104.62	110.86	111.48	5.60**	.52	.05

Part B – Classroom Learning Environment Survey

Scale	Mean Pre SI	Mean Post SI	Mean Post AY	F	Cohen's d (Pre SI to Post SI)	Cohen's d (Post SI to Post AY)
CE	31.24	33.55	32.72	5.40*	.61	.14
TA	34.24	39.06	35.86	26.21***	.93	.47
TR	25.52	25.31	24.03	2.70	.40	.09
IG	26.76	30.34	28.76	9.33***	.74	.28
Total	115.75	128.28	121.38	23.32***	.87	.39

Part C – Instructional Practices Inventory

Scale	Mean Pre SI	Mean Post SI	Mean Post AY	F	Cohen's d (Pre SI to Post SI)	Cohen's d (Post SI to Post AY)
TS	16.33	18.63	32.36	41.98***	.39	2.6
RS	24.85	17.77	45.44	52.31***	.71	3.12
Total	39.63	33.41	77.26	83.34***	.56	4.26

Note: * p<.05; **p<.01; ***p<.001
Note: Effect sizes between .5 and .8 are MEDIUM; Effect sizes > .8 are LARGE

TeachOhio: The means, t values, and effect sizes of 14 TeachOhio participants' responses to the *TBI* items are presented in Table 6. Significant changes across time are shaded in grey whereas medium to small effect sizes are bolded in red. The ES reported here are different from those included in the earlier TeachOhio report as they were calculated in a more conservative way. As seen in Table X, large changes in the positive direction were found *pre to post SI* for the Self Efficacy (SE) subscale, the total STEBI scores, the Teacher Role (TR) subscale, the Reform Strategies (RS) subscale and the total score on Instructional Practices Inventory.

Table 6. Summary of the TBI Survey Results for TeachOhio (n=14)

Part A – modified STEBI

Scale	Mean Pre	Mean Post	t	Cohen's d (effect size)
OE	47.0	49.0	-.99	.34
SE	58.07	65.79	-2.79*	.84
Total	105.07	114.78	-2.33*	.86

Part B – Classroom Learning Environment Survey

Scale	Mean Pre	Mean Post	t	Cohen's d (effect size)
CE	25.28	26.25	-.99	.30
TA	29.07	27.07	1.04	.38
TR	18.14	22.71	-2.53*	1.06
IG	26.21	27.28	-.50	.16
Total	98.7	103.43	-.89	.35

Part C – Instructional Practices Inventory

Scale	Mean Pre	Mean Post	t	Cohen's d (effect size)
TS	30.07	30.28	-.16	.04
RS	37.71	47.64	-3.96**	1.50
Total	63.57	74.28	-4.09***	1.23

Note: * p<.05; **p<.01; ***p<.001

Note: Effect sizes between .5 and .8 are MEDIUM; Effect sizes > .8 are LARGE

Other NWO Participants: The means for beginning post and post, t values, and effect sizes of 29 other NWO participants' responses to the *TBI* items are presented in Table 7. Significant changes across time are shaded in grey whereas medium to small effect sizes are bolded in red. Table 7 shows that large changes in the positive direction were found *pre to post SI* for all subscales and total scales of the TBI. For the total Instructional Practices Inventory scores and its subscales, the mean Post Today scores were nearly identical to the mean Post AY scores for the TEAMS data.

Table 7. Summary of the TBI Survey Results for TeachOhio for NWO Other Participants (n=29)

Part A – modified STEBI

Scale	Mean Beginning Post	Mean Post Today	t	Cohen's d (effect size)
OE	35.03	48.55	-8.29***	1.54
SE	45.27	61.69	-8.45***	1.46
Total	80.31	110.24	-10.0***	1.64

Part B – Classroom Learning Environment Survey

Scale	Mean Beginning Post	Mean Post Today	t	Cohen's d (effect size)
CE	21.79	32.04	-9.31***	1.98
TA	29.74	36.07	-4.54***	1.04
TR	16.61	22.32	-5.03***	.95
IG	25.81	29.11	-2.94**	.80
Total	89.03	113.17	-5.97***	.84

Part C – Instructional Practices Inventory

Scale	Mean Post Today
TS	31.00
RS	45.70
Total	76.32

Note: * p<.05; **p<.01; ***p<.001
Note: Effect sizes between .5 and .8 are MEDIUM; Effect sizes > .8 are LARGE

When comparing the above results across the three groups (TEAMS, TeachOhio, and Other), several patterns emerged. Thus, a statistically significant increase was found on the self-efficacy (SE) subscale for all three groups, with the largest effect size for other NWO participants. Patterns of change were similar between TEAMS and Other groups on the subscales of the Classroom Learning Environment Survey (the scores increased significantly on 3 out of 4 subscales for TEAMS and on all four subscales for Other). Finally, for the total Instructional Practices Inventory scores and its subscales, the mean Post Today scores were nearly identical to the mean Post AY scores for the TEAMS data.

Back to top

Goal 1 - Evaluation Question 2: What are the emic (participants') and etic (observers') perceptions regarding the effectiveness (quality, relevance, and usefulness) of the NWO Center professional development activities?

Emic Perspective: In their written evaluations of the AY professional development sessions, participants, regardless of the specific program they were affiliated with, gave high ratings to the usefulness, relevance and quality of many common aspects of the professional development they received through the NWO Center.

Inquiry Series: The quantitative ratings of the Inquiry Series averaged 3.6 on a 5-point scale (see Table 8), with the highest ratings received for the sessions in December and January. Review of the magnitudes of the program-specific ratings suggest that participants from every program they affiliated with found at least one Inquiry Series session very useful, i.e., rated it the highest as compared to participants in other program. Thus, the highest ratings for the December Inquiry Series session were given by the TEAMS participants and higher education faculty, for the January Inquiry Series session by TEAMS, for the February session by TEAMS, undergraduates and higher education faculty. TEAMS and MAT students also rated the March Inquiry Series session higher than others. Finally, MAT students and in-service teachers highly rated the Summit. More than 50% of the participants rated the Blast-off session at level 4 and 5.

Praxis II Tutoring: The overall rating for Praxis II professional development was 3.6, with the Life Science Workshop rated at 3.3 and Mathematics Workshop rated at 4.4. The overall rating of the Praxis II Tutoring workshop was 3.8 on a 5-point scale, with the Life Science Workshop rated at 3.4 and Mathematics Workshop rated at 4.7. Based on the evaluation of the Praxis II tutoring workshop by 21 participants (13 attending the Life Science tutoring session and 8 attending the math tutoring session), three most common objectives for attending the workshop included learning the content (6), learning test taking strategies (12), and learning about the test format, types of questions and what to expect on the test (13). These objectives were satisfied partially or completely on the average in 55% of the cases (i.e., the participants said they received exactly or partially what they wanted from the workshop) – 50% for content, 67% for test taking strategies, and 46% for learning about the test. In 25% of the cases, the participants received what they expected and even more. In 75% of the cases when the expectations were not met, the participants admitted that they learned some other things from the workshop. Most of these cases (i.e., when the expectations were not met) involved wanting to learn about the test but learning the test taking strategies instead. Seventeen (81%) of the attendees rated the workshop as having a positive impact on their future work, 1 (5%) person had negative comments about the workshop, and 2 (10%) people were neutral in their perceptions of the value of the workshop. Some of the positive comments included:

> *"I feel that the workshop has given me more confidence going into the exam."*
>
> *"I think that although the test will be hard, this workshop allowed me to see some of my strengths and weaknesses and demonstrated how I can prepare."*
>
> *"I am more aware of the content of the test and the types of questions it will be asking. It will help me look for those types of things in my classes and course information."*
>
> *"I learned a few techniques for some problems that I have not learned in any of my math classes thus far and those techniques will benefit me greatly."*

The neutral comments included:

> *"I'm not sure… I got a little review, but not much."*

The single negative comment was:

> *"I left there more confused than before."*

NWO Symposium: The overall rating for the NWO Center Symposium was 3.5 across 80 sessions. In their written evaluations of the Symposium sessions, the participants spoke very positively about the content of the sessions as well as the organization of the entire event, both pointing to the high quality and usefulness of this professional development experience. More specifically, the participants noted the impressive variety of the sessions and vendors, were pleased with more chemistry content, liked the materials and had an overall positive experience. Several participants want to see more math sessions next year. More preK-3 sessions and "more workshops on strategies to use in the classroom that will inspire students to like science and math" were also mentioned. The participants found so many sessions so useful that they suggested that some sessions be repeated. In one person's words, it is "hard to choose when all sound so good."

Table 8. Average Ratings of Different NWO Professional Development Programs for In-Service and Pre-Service Teachers

NWO Activity	Average Rating
Inquiry Series	3.6
Praxis II Preparation Workshop	3.6
NWO Symposium	3.5

Reflecting on the quality, relevance and usefulness of the professional development, the participants thought the Center was effective at providing them with: good ideas to use in the classroom (e.g., hands-on science lab ideas, understanding that learning requires movement and that students can't learn new things under stress) (especially TeachOhio and In-service), new ways to use technology (TeachOhio, In-service, and MAT), providing good handouts, science lessons and good content knowledge (TeachOhio and In-service), and a better understanding of how students learn (TeachOhio, TEAMS, Undergraduate, and MAT). A lot of participants said they liked speakers and everybody loved breakout sessions and wanted more of those in the future. As the sessions progressed, almost everybody mentioned the value of cohort discussions and learning about others' lesson plans and implementation (TeachOhio, TEAMS, undergraduate,). One TeachOhio participant intended to apply the information immediately. Another said, "I <u>really</u> liked the inquiry series from last year. It truly opened my eyes."

In addition to these common comments, participants in different programs pointed out to other areas in which the professional development was useful and relevant. Thus, in-service teachers said it reminded them to use inquiry more of often and more effectively in their classes. TEAMS participants emphasized that in this program they learned creative inquiry-based ideas that they might be able to implement into teaching right away, developed a deeper and richer understanding of how comparisons and connections must take place for learning to occur, loved foldables, learned about three types of inquiry-based lessons, found them very practical and helpful in planning lessons, and learned better how to make units much better and more aligned with standards. For the undergraduate students, the professional development was relevant and useful in terms of learning fun and interactive activities for teaching math science and teaching in a kinesthetic way and through exploration, developing an understanding of the importance of differential instruction for reaching students and making connections between things for the students, developed a better understanding why hands-on active learning was essential, what

were the benefits of three levels of inquiry, and which teaching style was most helpful to students. The also loved foldables.
The participants also made a lot of good suggestions for further improving the quality of the NWO Center professional development. Specific suggestions broken down by the program or participant category included:

- **TeachOhio:** more sessions on time management, group work and alternative assessment, more content aligned lesson plans, tips on how to teach inquiry on a limited budget and demonstrations of how to use computers with inquiry methods, more modeling of inquiry lessons and activities, more information on organizations and groups that can give materials and grants to schools, more vendor presentations, more life science sessions, more strategies for motivating and helping high-risk students, more emphasis on 7-12 and dinner open discussion forums, more integration of science and math
- **TEAMS:** more math focus, more hands-on ideas, more sessions on standards and assessment of student learning, more information on how to integrate math, science, and technology together, more materials, more grade-specific lesson ideas, more information on grant writing. Several of the participants found the inquiry sessions and the entire program so useful that would like to see this type of workshop for Language Arts and Social Studies (e.g., Earth and Space). Participants also mentioned starting on time and earlier, better microphones, and overall better organization
- **In-Service Teachers:** more networking opportunities, more emphasis on 7-12, more comfortable classrooms, better microphones
- **Undergraduate Students:** more hands-on, interactive workshops, more ideas to keep students engaged and involved in the classroom, more lessons on specific topics, opportunities to go to more sessions, sessions geared towards pre-service teachers, sessions for pre-schools and kindergartens, more math for higher grades, a workshop on grant writing and more discussion on assessment and fewer surveys.
- **MAT Graduate Students:** grant writing, how to be hands-on and still prepare the students to pass the test, more help with developing inquiry lessons and more such lessons.

Back to top

Etic Perspective: Table 9 summarizes the overall ratings given for nine NWO professional development sessions observed by five trained observers. The details behind these ratings averaged across all nine observed sessions follow.

Table 9. Overall NWO PD Ratings

Session	Design	Implementation	Content	Culture	Overall
Sept	5	4	4	5	4
October	n/a	n/a	n/a	n/a	3
November	solid 3	Low 3	Low 3	2	Low 3
December	4	4	4	5	4
January	4	High 3	4	High 3	High 3
February	4	4	4	5	4
March	5	4	5	5	5
April 1	5	3	n/a	5	4
April 2	4	5	5	3	High 3
Average	4.25	3.75	4.14	4.13	3.7

Detailed Results for NWO PD Session Observations

Design: An average rating of **4.3** was given for the design of the observed PD sessions.

Strengths included: careful planning (8); incorporating tasks, roles, interactions consistent with investigative science (8); highly collaborative approach to teaching and learning (7); adequate time and structure for sense-making and wrap-up (6); using resources/materials that contributed to accomplishing purpose of instruction (6); attention to students' experience, prior knowledge and learning styles (4); framing the session to help participants understand the purpose of the session and where it fit into the larger professional development picture (3); and the design being reflective of best practice (2).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Recommendations included: more time for sense making and wrap-up (3), having a structure for regrouping to enhance sense-making (1), more encouragement of collaborative learning (1); having a structure to share experiences and insights (1); having more handouts (1).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Implementation: An average rating of **3.8** was given to the observed sessions on implementation.

Strengths included: implementing instructional strategies consistent with investigative science (e.g., Giving the participants little information and then allowing them to investigate the available resources to formulate a theory on their own with little guidance) (3); confident facilitators (5); pace of the session appropriate for adult learners (4); facilitator's classroom management style enhanced the quality of the session (2); effective modeling of questioning strategies (5).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Recommendations included: Increase the amount of sense-making time (2); better modeling of effective questioning strategies (1); more engaging presentations (2); more modeling of effective assessment strategies (1).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Content : An average rating of **4.1** was given to the observed sessions on content. This aspect of the sessions was the second most highly rated after the design of the sessions.

Strengths included: the sessions contained content that was significant and worthwhile (4); the content was reflective of content standards (3); appropriate connections were made to the 'real world' and other disciplines (5); the facilitator portrayed science/math as a dynamic body of knowledge (3); the content was accurate (4); the content reflected important concepts (5); the content was appropriate for the purposes of professional development and the backgrounds of the participants (5); the content was appropriately explored using inquiry strategies (1); and there was an adequate degree of sense-making (5).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Recommendations included: include more intellectual engagement of the participants (1); provide more connections to other disciplines and real world contexts (1); present the information in a "classroom ready" format (1); and add more time for sense-making (1).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Culture: An average rating of **4.1** was given to the observed sessions on culture. This aspect of the sessions was the third most highly rated after the design and content of the sessions.

Strengths included: high engagement of the participants (4); encouragement of active participation by all participants (5); climate of respect for the participants (5); use of good management strategies (1); intellectual rigor, constructive criticism and the challenging of ideas were evident (2); having a climate that encourages the participants to generate ideas and propositions (6); collaborative relationship between the facilitator and the participants (4); and collaborative relationship among the participants (5).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Recommendations included: encourage more active participation (1), increase intellectual rigor (1), use more constructive criticism (2), and consider challenging of participants' ideas (2).
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Overall Capsule: An average overall rating of **3.7** was given to the observed sessions.

Rationale included: session demonstrated exemplary and accomplished instruction (1); instruction was purposeful (3); participants were actively engaged (1); session was well-designed (1); session had a positive impact on participants' ability to identify and understand important ideas in science and mathematics (1); session modeled investigative teaching strategies (4); facilitators were knowledgeable (3). However sometimes not enough time was provided for closure (2); not enough focus was made on how students learn (1); participants' expertise was not well utilized (2); not enough opportunity was provided for participation and sharing of ideas (1)
Note: the numbers in parentheses indicate how many of the nine observed sessions this was applicable to.

Back to top

Goal 1 - Evaluation Question 3: How do participants perceive that NWO activities have impacted their beliefs and practices?

TEAMS Participant Interview Results: The impact of NWO Center activities on teacher beliefs and practices can be inferred from teachers' responses to several interview questions, based on what the teachers believe they can and should be doing. One of such examples is that the teachers said they felt more confident as a result of participating in TEAMS in what they were teaching and how. This implies that they believe in the direct relationship between confidence and good teaching. Another example is that they believe that doing inquiry-based teaching is more beneficial than the more traditional teaching. Thus, one teacher said, "I'm definitely a more inquiry-based teacher. I feel that my questioning skills have increased greatly and I have become more of a facilitator and not so much a giver of knowledge." Another teacher said, "I've become a better observer and … I'm able to see if a student is getting something…It doesn't necessarily need to be something I see written down on a piece of paper." All of these are examples of beliefs and practices that the teachers started valuing more after the professional development. Even analyzing the reasons for participating in TEAMS is a good source of information about teacher beliefs. Thus one of the reasons mentioned by the teachers was to learn about hands-on activities and experiments that could be linked to indicators, i.e., they

believed that doing such experiments would prepare their kids do better on tests. Many other comments about TEAMS professional development pointed to the impact of TEAMS on the following teacher beliefs. Examples of these are: understanding how students learn is important, not teaching from a book is important, engaging students is important, linking assessment to indicators is important, group work is important, letting students ask and answer their own questions is important, helping students see science as fun is important, students learn better when they are actively engaged, stepping out of the box for both teachers and students is important, using discovery and investigation is important. Several teachers re-examined their own lessons after participating in TEAMS, which is yet another indicator that their beliefs and practices of teaching has been impacted. One teacher believes that TEAMS ideas and strategies help develop life-long learners in the children by putting the responsibility of learning back in their hands.

TeachOhio Participant Interview Results: Similar beliefs and practices can be inferred from TeachOhio participants' interview data. Thus, one participant said hat learning about constructivist teaching strategies and 5E's was the most helpful aspect of the TeachOhio program. Other beliefs mentioned in the interviews included but are not limited to the following: increasing content knowledge and confidence is important; using the hands on/visual examples in the classroom is an eye opening experience for kids; fair assessment of student learning is important; learning about productive group work and making sure students are responsible for work are important; and encouraging students to think more deeply is important.

Other NWO Participant Interview Results: Similar beliefs and practices were mentioned by the other NWO participants as important: doing more hand-on activities, teaching inquiry by intent instead of by accident, always looking for ways to become a better teacher, doing laboratory exercises and demonstrations inquiry-based (one teacher said that it was more important than reading a book or watching a movie in that the kids "have to write their own lab procedure, they have to come up with it and of course it's great because they all come up with a perfect solution and it doesn't work, so then they have to go back and do the problem solving and it's a double period, so they have enough time to problem solve this. So it's fun to do this"), being aware of the standards, learning more content and becoming more confident as a teacher.

Back to top

Goal 1 – Evaluation Question 4: How have the universities responded by developing/revising courses and/or programs to better prepare teachers?

Course and Program Modification: The NWO Center continues to make progress in encouraging faculty to develop new courses and modify the existing ones to prepare better pre-service and in-service teachers. In the last year's evaluation of the Center, four course modifications and six new course developments were reported. The trend is consistent in that this year four BGSU faculty modified their courses and aligned them to the Ohio Content Standards. Thus, two math and two science courses have been and continue to be revised. These include "Active Chance" course for 7-12 mathematics teachers, Introduction to Secondary Mathematics course, "Earth as a System" undergraduate course and Teaching

Evolution and the Nature of Science undergraduate course. The syllabi of these courses are available from the COSMOS office.

Back to top

Goal 1 – Evaluation Question 5: In what ways are participants deepening their content knowledge in their subject areas?

Undergraduate professional organizations (BG-UT SECO and CTM): As part of its goal to enhance the preparation of pre-service and in-service teachers through research based professional development, the NWO Center continued supporting professional development through the BG/UT SECO/CTM chapter activities. Compared to last year (when the BG/UT SECO/CTM held four professional development workshops), this year the number of workshops increased to nine. Five of these were held by BG SECO and the other four by BG CTM. The BG SECO workshops included Mission to the Moon at the Challenger Space Center, Project Learning Tree at the Stranahan Arboretum, Population Connection, and Project WILD.

When asked about the impact of NWO activities on pre-service teachers, one faculty member made a comment that was specifically related to the professional development of pre-service and in-service teachers. That person claimed that the dovetailing worked '*very well*', and stated:

> *I also work with technology education for pre-service teachers, and the goals, objectives, mindsets are very similar... toward better teaching for increased student learning."*

Other faculty responses included the following:

> [NWO] *serves as a resource to improve their teaching and to find new techniques/strategies; it has a positive impact through the inquiry series; it provides teachers with a way to interact/communicate with colleagues and university educators; it prepares them for field experiences and student teaching as well as their first few years of teaching; teachers have the opportunity to "vent" about what hasn't worked; and they get reinforced that they are doing the right things in their classes.* One negative comment, however, was, "*it seems to me that NWO/COSMOS and K-12 teachers are working in different pages: one try to make change and the others have no chance to make changes*."

The BG SECO meetings' attendance ranged from 8 to 30, with the average of 17 students. The BG CTM meetings' attendance ranged from 45 to 80, with the average of 61 students. The membership of BG SECO/CTM also increased dramatically. Thus, the BG SECO had 40 new members this year while the BG CTM had 150 members, compared to the total of 49 members last year (i.e., the BG/UT SECO/CTM increased its membership by more than four times).

Back to top

Praxis II Preparation Workshop: A total of 30 pre-service teachers attended Praxis II tutoring mathematics and science (biology) sessions on February 22, 2007. This was 13% more than

last year. Half of the 2007 participants were registered to take Praxis II; 18 have not taken the test yet, 1 person took it once and 3 others took it twice; 29 were undergraduate students and 1 TeachOhio participant. Details of the attendees' perceptions of the workshop were presented under Goal 1 – Evaluation Question 2 above and will not be repeated here.

Graduate MAT program scholarships: As noted in the last year's evaluation report, in 2005-2006 COSMOS under the auspices of the NWO Center provided MAT scholarships to 15 students at BGSU. In 2006-2007, 10 of these students were also given the scholarship in 2006-2007. On the average, they completed 14.4 credit hours in 2005-2006 and were estimated to complete 10.2 – 10.8 credit hours in 2006-2007. Scholarship funding was also provided to 4 new MAT students with the expectation that these students will complete on the average 10.5 – 11.25 credit hours. The total number of credit hours that the funded MAT students were expected to complete was 144 – 153. As shown in Table 10, this expectation was fulfilled. Individual student completion data are not available to establish personal credit hour completion rates.

Table 10. Summer 2006-Spring 2007 Enrollment in the MAT programs and Credit Hours Successfully By Course Name

Major	# of MAT students	Courses Taken	Course Credit Hours
Physics	5	PHYS 651 - Mechanics	3
Physics	6	PHYS 652 - Electromagnetism	3
Physics	6	PHYS 653 - Waves and Light	3
Physics	1	PHYS 684 - Rdng Res Physics Educ	1
Physics	1	EDTL 612 - Classroom Tech for Teachers	3
Physics	2	EDTL 645 - Prob. Tch HS Science	3
Physics	1	EDTL 680 - Cross Sch Curric Bldg	2
Physics	13	PHYS 661 - Labs/Demonstrations PHYS	1
Physics	6	PHYS 691 - Directed Research Physics	3
Physics	1	PHYS 691 - Directed Research Physics	2
Physics	5	EDTL 680 - Invest Math/Sci Education	2
Math	1	MATH 670 - FTC/Student Understanding	1
Math	3	EDTL 680 Trends/Resources Math Teach	3
Math	4	MATH 682 - Adv Mathematical Thinking	3
Math	2	EDFI 641 - Statistics in Education	3
Math	1	MATH 501 - Number Theory	3
Math	1	MATH 670 - Rdgs Geometry thru Grades	3
Math	1	MATH 670 - Rdgs Visual Appr Calculus	3
Math	1	MATH 670 - Issues with FTC	1
Math	2	MATH 603 - Algebra HS Math Teachers	3
Biology	2	BIO 540: Conservation Biology	3
Biology	1	BIO 641: Behavioral Ecology	3
Biology	1	BIO 549: Epidemiology	n/a
Total Physics	**47**		**106**

Total Biology	**4**	**9**
Total Math	**15**	**43**
Grand Total	**66**	**158**

Back to top

Goal 1 – Evaluation Question 6: How do participants transfer the skills and knowledge received through NWO professional development into the classroom?

TEAMS Participant Science Classroom Observations Results

Tables 11 and 12 summarize the results of average and range of ratings given for science and mathematics lessons observed in TEAMS and Comparison groups. However, the interpretation of the comparison of the results between TEAMS and Comparison groups is not provided at this time due to the limited number of comparison observations.

Table 11. Average and Range of TEAMS Science Ratings

	Science					
	TEAMS			Comparison*		
	Mean	High Score	Low Score	Mean	High Score	Low Score
Design	3.5	5	2	3	3	3
Implementation	3.75	5	Low 3	3	3	3
Content	3.75	5	Low 3	3	3	3
Classroom Culture	3.75	5	High 3	3	3	3
Overall	3.6	5	2	3	3	3

NOTE. * denotes only **one** classroom observation for the category at this time.

Table 12. Average and Range of TEAMS Mathematics Ratings

	Mathematics					
	TEAMS			Comparison*		
	Mean	High Score	Low Score	Mean	High Score	Low Score
Design	3.5	4	Low 3	3	3	3
Implementation	3.5	4	3	4	4	4
Content	3.0	High 3	Low 3	3	3	3
Classroom Culture	3.5	4	Low 3	3	3	3
Overall	3.5	4	Low 3	3	3	3

NOTE. * denotes only **one** classroom observation for the category at this time.

Back to top

Detailed Results for TEAMS Participant Science Classroom Observations

Design (***TEAMS Teachers***): An average rating of **3.5** was given for TEAMS science teachers' observed lesson design.

Strengths included: incorporating tasks, roles, interactions consistent with investigative science (8); careful planning and/or organization (7); highly collaborative/groups nature of investigation (3); resources/materials contributing to accomplishing purpose of instruction (4); attention to students' prior experience (4); adequate time for sense-making and wrap-up (3); instructional strategies and activities reflecting attention to issues of access, equity, and diversity for students (2); design of the lesson encouraging a collaborative approach to learning (1); and the instructional strategies and activities reflecting attention to students' experience and learning styles (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: the need for better organization (1); more time for sense making and wrap-up (5); more encouragement of collaborative learning (1); more tasks consistent with investigative science (1); the need to adjust size of student groupings (1); the suggestion to report to a smaller group (1) and changing roles within the groups (1); and more use of graphing (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Design (***Comparison Teachers***): A rating of **3.0** was given for the Comparison science teacher's observed lesson design.

Strengths included: consistency of tasks with investigative science; encouraged collaborative approach to learning; attention to students' prior experiences; and adequate time and structure provided for sense-making and wrap-up.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included: the need for better organization; changing classroom environment (moving furniture) for better instruction; and paying attention to students who are too far away from part of central lesson.
Note: there are no numbers in parentheses because there was only one lesson observed.

Implementation (***TEAMS Teachers***): An average rating of **3.75** was given for TEAMS science teachers' observed lesson implementation.

Strengths included: consistency of instructional strategies with investigative science (6); good use of probes and/or wait time to get at student's understanding (4); teacher confidence and/or flexibility in teaching science (7); teacher classroom management style enhanced quality of lesson (4); appropriate use of scientific terminology (1); adjusted instruction for students' needs when appropriate (1); teacher's questioning strategies were likely to enhance the development of student conceptual understanding (2); and pace of the lesson was appropriate for the developmental levels of the students and the purpose of the lesson (2).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: the need for more review from previous learning of content (1); leaving enough time for all students to share (1); and using higher level questioning (2); and the need for the teacher to appear more confident (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Implementation (***Comparison Teachers***): A rating of **3.0** was given for the Comparison science teacher's observed lesson implementation.

Strengths included: consistency of instructional strategies with investigative science; instructor confidence in delivery of material; and appropriate pace.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included: using terminology at the students' level of understanding; the terminology used too difficult for the students.
Note: there are no numbers in parentheses because there was only one lesson observed.

Science Content (***TEAMS Teachers***): An average rating of **3.75** was given for TEAMS science teachers' observed lesson content.

Strengths included: teacher displaying understanding of science content (7); teacher drawing real world applications (4); covering significant and worthwhile content (8); presentation of science as a dynamic body of knowledge enriched by conjecture and proof (3); and teaching the content appropriate for the developmental levels of students in class (8); and students as intellectually engaged with important ideas relevant to the focus of this lesson (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: paying greater attention to student understanding of the material and considering re-teaching it if needed (1); making more real world connections (2); including

elements of science abstraction (1); allowing more time for wrap-up (1); correcting student misconceptions (1); and anticipating student responses for better comfort and preparation (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Science Content (***Comparison Teachers***): A rating of **3.0** was given for the Comparison science teacher's observed lesson content.

Strengths included: covering significant and worthwhile content; and the accurate discussion of the content and use of scientific terms.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included making sure that all students are intellectually engaged with content at all times.
Note: there are no numbers in parentheses because there was only one lesson observed.

Classroom Culture (***TEAMS Teachers***): An average rating of **3.75** was given for TEAMS science teachers' observed lesson classroom culture.

Strengths included: high engagement of students (4); encouragement of active participation by all students (7); student discussions/collaborations with one another (7); collaborative relationship between teacher and students (7); challenging of ideas (4); having a climate that encourages students to generate ideas and propositions for experimentation (4); and a climate of respect (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: calling not only on students who volunteered, but on others as well (1); increasing female whole group participation (1); encouraging students to generate questions, conjectures, propositions (1); paying attention to the student speaking (1); and improvement of classroom management.
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Classroom Culture (***Comparison Teachers***): A rating of **3.0** was given for the Comparison science teacher's observed lesson classroom culture.

Strengths included: active participation and encouragement of all students; giving compliments to student ideas; intellectual rigor and challenging of ideas; and collaborative working relationship between students and teacher.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included: encouraging collegial working relationships among students (interactions **did not** reflect collegial working relationships among students) and making sure that students understand what was being asked of them and/or ask the teacher to clarify.
Note: there are no numbers in parentheses because there was only one lesson observed.

Overall Capsule (***TEAMS Teachers***): An average rating of **3.6** was given for TEAMS science teachers' observed lesson overall capsule.

Rationale included: lesson being *limited* in its likelihood to enhance students' understanding of science (1); extent to which students' understanding of science as a dynamic body of knowledge was enriched by this investigation (5); extent to which lesson appeared to increase students'

interest in science (5); and extent to which instruction was *quite*/*highly likely* to enhance student understanding and successfully "do" science (5); and need for more 'sense-making' (2).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Overall Capsule (***Comparison Teachers***): A rating of **3.0** was given for the Comparison science teacher's observed lesson overall capsule.

Rationale included: students having *some* ability to carry out own inquiry; some instruction being above level of students; the extent to which student understanding of science as a dynamic body of knowledge was enriched; low student self-confidence in science; and some weaknesses in implementation and design of the lesson.
Note: there are no numbers in parentheses because there was only one lesson observed.

Back to top

Detailed Results for TEAMS Participant Math Classroom Observations

Design (***TEAMS Teachers***): A rating of **3.6** was given for the TEAMS mathematics teacher's observed lesson design.

Strengths included: careful planning and organization (2); incorporating tasks, roles and interactions consistent with investigative mathematics (2); using multiple hands-on activities to investigate (1); the instructional strategies and activities reflected attention to issues of access, equity and diversity (1); and the design of the lesson encouraged a collaborative approach to learning (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: considering a possibility of assessing each student's understanding (1); ensuring that all students participate through individual or small group activity prior to whole group activity (1); and allowing more time for sense-making and wrap-up (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Design (***Comparison Teachers***): A rating of **3.0** was given for the Comparison math teacher's observed lesson design.

Strengths included: consistency with investigative mathematics by generating ideas for the next lesson; careful organization, connection-building from prior experiences and knowledge; and the opportunity to participate at various ability levels.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included: Need for more investigative strategies (less sitting time) and more sense-making.
Note: there are no numbers in parentheses because there was only one lesson observed.

Implementation (***TEAMS Teachers***): A rating of **3.6** was given for the TEAMS mathematics teacher's observed lesson implementation.

Strengths included: incorporating classroom discussion (1); teaching at an appropriate pace (1); using investigative mathematics strategies (2); implementing hands-on and minds-on activities (1); teacher's classroom management strategies enhanced the quality of the lesson (1); the

teacher appeared confident in ability to teach mathematics (1); and students were able to work at there own pace that was appropriate for their developmental needs (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: the need for better utilization of mathematical "terms" (properties, volume, etc.) and making better mathematical connections(1); and allowing students to return materials one at a time to better build trust (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Implementation (***Comparison Teachers***): A rating of **4.0** was given for the Comparison math teacher's observed lesson design.

Strengths included: teacher valued student ideas and contributions ; good use of questioning strategies; and teacher's classroom management strategies enhanced the quality of the lesson.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations included: activity did not provide much opportunity for the teacher to ask higher-level questions.
Note: there are no numbers in parentheses because there was only one lesson observed.

Mathematics Content (***TEAMS Teachers***): A rating of **3.0** was given for the TEAMS mathematics teacher's observed lesson content.

Strengths included: content being developmentally appropriate for the students (1); content experienced in multiple ways (1); class discussion portraying mathematics as a discipline enriched by discourse, conjecture, and justification (1); teacher displayed an understanding of mathematics concepts (1); students were intellectually engaged with important ideas relevant to the focus of the lesson (1); and the mathematics content was significant and worthwhile (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: increasing opportunities to introduce mathematical terms or properties (1); paying attention to mathematical inaccuracies (1); making more and better mathematical connections (1); and make connections to real-world contexts (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Mathematics Content (***Comparison Teachers***): A rating of **3.0** was given for the Comparison math teacher's observed lesson content.

Strengths included: connection to real world situations and to prior knowledge of other disciplines; activity was appropriate for the developmental levels of the students and provided a basis for later study.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations: need for greater degree of "sense-making".
Note: there are no numbers in parentheses because there was only one lesson observed.

Classroom Culture (***TEAMS Teachers***): A rating of **3.6** was given for the TEAMS mathematics teacher's observed lesson classroom culture.
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Strengths included: students working collaboratively (2); active engagement in learning mathematics (1); many different students participating in whole group discussion (1);

encouragement of students to use their own words in explanations (1); climate of respect for student contributions (1); active participation of all was encouraged and valued (1); and the climate of the lesson encouraged students to generate ideas, conjectures and questions (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: none.

Classroom Culture (***Comparison Teachers***): A rating of **3.0** was given for the Comparison math teacher's observed lesson classroom culture.

Strengths included: active participation of all students was encouraged; teacher demonstrated respect for student ideas; teacher fostered respect of students towards one another; and evidence of collegiality.
Note: there are no numbers in parentheses because there was only one lesson observed.

Recommendations: incorporate the students' application of ideas, generation of questions or conjectures, and/or challenging each other's ideas
Note: there are no numbers in parentheses because there was only one lesson observed.

Overall Capsule (***TEAMS Teachers***): A rating of **3.6** was given for the TEAMS mathematics teacher's observed lesson overall capsule.

Rationale included: majority of lesson mathematically being accurate (1); teacher's questioning strategy being aligned with investigative mathematics (1); students developing confidence and self-sufficiency in mathematics (1); instruction likely to enhance most students' understanding of the discipline (2); and students' understanding of mathematics as a dynamic body of knowledge (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Overall Capsule (***Comparison Teachers***): A rating of **3.0** was given for the Comparison math teacher's observed lesson overall capsule.

Rationale included: The lesson was consistent with investigative mathematics: students made many connections between mathematics and other disciplines; the lesson could have been more investigative; and the lesson was somewhat limited in its likelihood to enhance students' understanding of mathematics as a discipline.
Note: there are no numbers in parentheses because there was only one lesson observed.

Back to top

TeachOhio Participant Classroom Observations Results

Due to the small sample size and restricted range of possible ratings, only descriptive comparisons of average pre and post ratings for each section of the Classroom Observation Protocol were done. These comparisons showed an increase in average ratings from pre to post observation, for all five sections of the protocol - ***design, implementation, content, culture,*** and ***capsule*** (see Table 13). Furthermore, the average post ratings were all between 3.5 and 4.2, which represents instruction that is beyond *beginning effective instruction* and is either close to or at *accomplished, effective instruction* (i.e., a rating of 4).

Table 13. Average TeachOhio Science Ratings

	Teach Ohio					
	Pre Observation			Post Observation		
	Mean	High Score	Low Score	Mean	High Score	Low Score
Design	3.7	5	2	3.8	5	2
Implementation	3.5	5	2	4.1	5	3
Content	3.4	5	2	3.5	5	Low 3
Classroom Culture	3.7	5	3	4.2	5	3
Overall	3.4	High 4	2	3.9	5	Low 3

Back to top

Detailed Results for TeachOhio Participant Classroom Observations

Average Ratings per Category from Pre to Post, Averaged Across Participants
Given the restricted range of possible ratings, statistically significant changes were not expected and were not found for any of the five rating categories. However, the ratings and the descriptive summary that are provided below for each category and followed by participant reflections are useful in evaluating the quality and effectiveness of teaching of TeachOhio participants.

Design (***Pre Observation Rating*: 3.7; *Post Observation Rating*: 3.8)**
Strengths at the pre-observation included: careful planning and/or organization (10); encouragement of a collaborative approach to learning (7); adequate time for sense-making (6); adequate time for wrap-up (6); incorporating tasks, roles, interactions consistent with investigative science (4); and using instructional strategies that reflected attention to the students' experience, preparedness, and learning styles (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Strengths at the post-observation included: careful planning and/or organization (10); encouragement of a collaborative approach to learning (4); adequate time for sense-making (7); adequate time for wrap-up (6); incorporating tasks, roles, interactions consistent with investigative science (7); and using instructional strategies that reflected attention to the students' experience, preparedness, and learning styles (2).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the pre-observation included: more time for sense making and wrap-up (4); more frequent use of instructional strategies that reflect the students' experience, preparedness, and learning styles (1); provision of written goals for the lesson and tasks for the students to accomplish (1); use of formal assessments that are consistent with investigative science (1); better visual representation of the lesson (1); a more interactive approach to note-taking (1); greater focus on safety (1); and a more collaborative approach to learning (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the post-observation included: more time for sense making and wrap-up (4); more frequent use instructional strategies that reflect the students' experience, preparedness, and learning styles (1); provision of written goals for the lesson and tasks for the students to accomplish (1); the use of formal assessments that are consistent with investigative science (1); more collaborative approach to learning (3); use of a better springboard for discussion (1); better connection of previous and future learning (1); questioning the students

while summarizing the concepts (1); addition of a scoring rubric (1); and creating opportunities to share students' knowledge, contributions, and experiences (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Implementation (***Pre Observation Rating: 3.5; Post Observation Rating: 4.1)***
Strengths at the pre-observation included: consistency of instructional strategies with investigative science (2); teacher confidence and/or flexibility in teaching science (7); teacher classroom management style that enhanced quality of lesson (5); adjusted instruction for students' needs when appropriate (1); using instructional strategies consistent with investigative science (2); using questioning strategies that were likely to enhance the development of the students' decision-making process (7); appropriateness of the pace of the lesson for the developmental needs of the students and purposes of the lessons (5); and a good use of springboards to capture students' attention (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Strengths at the post-observation included: consistency of instructional strategies with investigative science (5); teacher confidence and/or flexibility in teaching science (8); teacher classroom management style that enhanced quality of lesson (3); adjusted instruction for students' needs when appropriate (4); using questioning strategies that were likely to enhance the development of the students' decision-making process (9); appropriateness of the pace of the lesson for the developmental needs of the students and purposes of the lessons (7); and use of higher-order questioning (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the pre-observation included: better pacing of instructional time (1); more frequent use of open-ended questioning strategies (3); more appropriate use of 'wait time' (3); better classroom management (3); better use of transitions within lessons (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the post-observation included: better pacing of instructional time (1); better classroom management (2); better attention to lab safety (1); use of different questioning techniques (1); and more appropriate use of 'wait time' (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Science Content (***Pre Observation Rating: 3.4; Post Observation Rating: 3.5)***
Strengths at the pre-observation included: teacher displaying understanding of science content (3); teacher drawing real world applications (4); covering significant and worthwhile content (6); presentation of science as a dynamic body of knowledge enriched by conjecture and proof (2); teaching the content appropriate for the developmental levels of students in class (3); making connections to past and future lessons (1); intellectually engaging students with the material (8); and appropriate use of 'sense-making' (8).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Strengths at the post-observation included: teacher displaying understanding of science content (2); teacher drawing real world applications (2); covering significant and worthwhile content (9); presentation of science as a dynamic body of knowledge enriched by conjecture and proof (5); teaching the content appropriate for the developmental levels of students in class (4); intellectually engaging students with the material (9); and appropriate use of 'sense-making' (5).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the pre-observation included: making more real world connections (4); making connections to other areas of science and other disciplines (1).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the post-observation included: more intellectual engagement of students (1); making more real world connections (6); making connections to other areas of science and other disciplines (1) and avoiding to make inaccurate scientific statements (2).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Classroom Culture (***Pre Observation Rating: 3.7; Post Observation Rating: 4.2)***
Strengths at the pre-observation included: encouragement of active participation by all students (8); collaborative relationship between teacher and students (5); evidence of a climate that encourages students to generate ideas and propositions for experimentation (7); friendliness (2); appropriate discipline (2); diverse make-up of groups (1); intellectual rigor and the challenging of ideas (6); environment that fostered collegial relationships (4); and climate of respect (4).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Strengths at the post-observation included: encouragement of active participation by all students (8); collaborative relationship between teacher and students (6); evidence of a climate that encourages students to generate ideas and propositions for experimentation (4); friendliness (1); appropriate discipline (1); intellectual rigor and the challenging of ideas (5); environment that fostered collegial relationships (4); and climate of respect (7).
Note: the numbers in parentheses indicate how many of the ten observed lessons this was applicable to.

Recommendations at the pre-observation included: including intellectual rigor throughout entire lesson (2); developing greater collegiality among some students and between students and teacher (1); drawing all students into the discussion (2); greater use of modeling strategies (1); engaging students in more interactive activities (1); and making sure all students are on task (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations at the post-observation included: including intellectual rigor throughout entire lesson (2); developing greater collegiality among some students (2); drawing all students into the discussion (1); more interaction between groups (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Overall Capsule (***Pre Observation Rating: 3.4; Post Observation Rating: 3.9)***
Rationales for capsule ratings were summaries of the strengths and recommendations of the previous four categories, and hence are not repeated here.

Back to top

Other NWO Participant Classroom Observations Results

Tables 14 and 15 summarize the results of average and range of ratings given for science and mathematics lessons observed in NWO Other group. However, the interpretation of the comparison of the results is not provided at this time due to the limited number of observations.

Table 14. Average and Range of NWO Other Participant Science Ratings

	PRISM			MAT			INSERVICE		
	Mean	High Score	Low Score	Mean	High Score	Low Score	Mean	High Score	Low Score
Design	4	5	Low 3	3.5	4	Low 3	5	5	5
Implementation	3.75	4.5	High 3	4	5	Solid 3	5	5	5
Content	3.75	4.5	Solid 3	3.5	4	Low 3	5	5	5
Classroom Culture	4	5	Low 3	3	Solid 3	Low 3	5	5	5
Overall	4	5	Low 3	3	Solid 3	Low 3	5	5	5

Table 15. Average and Range of NWO Other Participant Math Ratings

	PRISM			MAT			INSERVICE		
	Mean	High Score	Low Score	Mean	High Score	Low Score	Mean	High Score	Low Score
Design	3	High 3	High 3	N/A	N/A	N/A	3	Low 3	Low 3
Implementation	4	4	4	N/A	N/A	N/A	3	Low 3	Low 3
Content	3	Solid 3	Solid 3	N/A	N/A	N/A	3	Low 3	Low 3
Classroom Culture	4	4	4	N/A	N/A	N/A	3	Low 3	Low 3
Overall	3	High 3	High 3	N/A	N/A	N/A	3	Low 3	Low 3

Back to top

Detailed Results for NWO Other Participant Science Classroom Observations

Design: An average rating of **4.0** was given for COSMOS science teachers' observed lesson design.

Strengths included: careful planning and organization (5); student prior knowledge was solicited through peer discussions (1); evidence of a collaborative approach to learning (3); attention was paid to student prior knowledge and engagement (1); adequate time was provided for sense making and wrap-up (1); the design of this lesson incorporated tasks, roles and interactions consistent with investigative science (3); instructional strategies and activities used in this lesson reflected attention to students experience and learning styles (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: allow more time and structure for sense making/ wrap-up (3); add a component of conjecture (1); have students work actively on their own to come up with some theories (1); focus on a more engaged and informed debate (1); and allow more time for collaboration (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Implementation: An average rating of **4.1** was given for COSMOS science teachers' observed lesson implementation.

Strengths included: lesson was consistent with best practices for inquiry (1); student- centered teaching (1); instructional strategies were consistent with investigative science (3); the teacher was confident in her ability to teach science (5); teacher used an iterative process of the learning cycle (1); teacher's questioning style enhanced the class (3); teacher's management strategies enhanced the quality of the lesson (2); and the pace of the lesson was appropriate for the developmental needs of the students and the purpose of the lesson (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: Increase the amount of wait time (1); probe for deeper conceptual understanding (1); add open-ended questions (2); pose questions to guide students through the concepts (1); give students more time to explore their misconceptions (1); have students share their ideas in small groups (1); encourage students to explain what they are seeing and experiencing (1); and encourage more discussion (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Science Content : An average rating of **3.9** was given for COSMOS science teachers' observed lesson content.

Strengths included: the lesson contained science content that was significant and worthwhile (4); the lesson addressed the state indicators (2); the lesson addressed deep concepts relating to the physical properties of sound such that students were engaged with important ideas (1); appropriate connections were made to the 'real world' (2); the teacher provided a learning opportunity in science as a dynamic body of knowledge and of themselves as investigators and scientists (1); teacher presented accurate information (3); the science content was appropriate for the developmental level of students (2); and there was an adequate degree of sense-making (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: include more intellectual engagement with the activity (1); include elements of conjecture and hypothesis testing (1); connect material to other areas of science or real world contexts with which the students are engaged (1); and make more time for sense-making (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Classroom Culture: An average rating of **3.8** was given for COSMOS science teachers' observed lesson classroom culture.

Strengths included: high engagement of students (2); encouragement of active participation by all students (3); climate of respect for students (4); teacher use of good management strategies (1); intellectual rigor, constructive criticism and the challenging of ideas were evident (1); having a climate that encourages students to generate ideas and propositions (2); and collaborative relationship between teacher and students (2).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: consider the assignment of roles to different students at the beginning of the class and have them report out to one another, and then to the class (1); incorporate a system for discussion (1); and minimize the negative impact of those students who do not participate (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Overall Capsule: An average rating of **3.8** was given for COSMOS science teachers' observed lesson overall capsule.

Rationale included: lesson demonstrated exemplary instruction (1); instruction was purposeful (1); the design was based on a 5E model and aimed to engage students in the lesson (1); the students were able to carry out their own inquiries and were highly engaged most of the time (1); the goals of the lesson were focused and meaningful (1); the collaboration of the scientist and teacher was exemplary, which contributed to the success of the lesson (1); the students were actively engaged in the lesson (1); there needed to be a stronger connection to science as

a dynamic body of knowledge in order to truly engage the students and enhance their ability to effectively 'do' science (1); the lesson is somewhat limited in its likelihood to enhance students' understanding of the discipline or to develop their capacity to "do" science (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Back to top

Detailed Results for NWO Other Participant Math Classroom Observations

Design : A rating of **3.0** was given for the COSMOS mathematics teacher's observed lesson design.

Strengths included: careful planning and organization (1); incorporating tasks, roles and interactions consistent with investigative mathematics (2); time was allowed for sense-making (1); lesson designed for students to learn collaboratively (1); and lesson involved real-life applications and utilizes multiple mathematics skills (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: allow adequate time for wrap-up (2); encourage collaborative approach to learning among students (1); incorporate more investigative strategies (1); and consider different group sizes (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Implementation : A rating of **3.5** was given for the COSMOS mathematics teacher's observed lesson implementation.
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Strengths included: instructors were confident (2); the pace was appropriate for the developmental needs of the students (1); teacher class management techniques enhanced the lesson (1); and the teacher seemed to read the students level of understanding (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: pay more attention to how students are grouped for activities (1); change management style to address off-task behavior (1); and adjust the pace or expectations for students based on their developmental levels(1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Mathematics Content : A rating of **3.0** was given for the COSMOS mathematics teacher's observed lesson content.

Strengths included: the instructors displayed an understanding of mathematic concepts and provided accurate information (1); mathematical content was significant and worthwhile (2); real-world connections were made (1); students were intellectually engaged with important ideas relevant to the focus of the lesson (1); and the degree of sense making of mathematics content within the lesson was appropriate for the purpose of this lesson as well as students needs (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: increase the difficulty level of the lesson (1); give the students more freedom to create their own diagram in order to portray mathematics as a dynamic body of

knowledge (1); incorporate tasks that tap prior-knowledge (1); and incorporate tasks to help students see mathematics as a dynamic discipline enriched by conjecture (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Classroom Culture: A rating of **3.5** was given for the COSMOS mathematics teacher's observed lesson classroom culture.

Strengths included: students working collaboratively (1); active participation of all was encouraged (1); climate of respect for students' questions (2); interactions among the students reflected collegial working relationships among students (2); interactions between the instructors reflected a collaborative working relationship between teacher and students (1); and the climate of the classroom encouraged students to generate ideas, questions or conjectures (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Recommendations included: incorporate intellectual rigor and the challenging of ideas (1).
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Overall Capsule : A rating of **3.0** was given for the COSMOS mathematics teacher's observed lesson overall capsule.

Rationale included: Students' appeared to be confident in doing this particular mathematic skill (1); the teacher provided students with a project that in many ways was consistent with investigative mathematics (1); students had a genuine interest and appreciation for the discipline (1); students were able to apply this mathematic skill to real-world situations (1); The project involved real-world application and related to prior content (1); students were able to carry out their own inquires (1); students understanding of mathematics as a dynamic body of knowledge could have been improved using more investigation concepts (1); and lesson as observed was somewhat limited in its likelihood to enhance students' understanding of mathematics or to develop their capacity to successfully do mathematics.
Note: the numbers in parentheses indicate how many of the five observed lessons this was applicable to.

Back to top

Comparison of Classroom Observation Ratings Across NWO Projects

Comparing classroom observation ratings and comments across the three groups, several commonalities were observed. **The aspects of the design** in which the NWO participants seem to be very successful in their teaching include: careful planning and/or organization (98% of observed lessons), incorporating tasks, roles, interactions consistent with investigative science (78% of observed lessons), using collaborative approach to learning (51% of observed lessons). The observed teachers appear to need to improve on the following: providing adequate time for sense-making and wrap-up (was observed only in 39% of observed lessons), attention to students' prior experience, preparedness and learning styles (was observed only in 19% of observed lessons), using instructional strategies and activities that reflected attention to issues of access, equity and diversity (was observed only in 6% of observed lessons). Among the recommendations for improving teaching, the following were mentioned across the three groups (TEAMS, TeachOhio and Other NWO): more time for sense-making and wrap-up, more investigative tasks and strategies, and greater encouragement of collaborative learning.

The aspects of the implementation in which the NWO participants seem to be very successful in their teaching include: lesson was consistent with best practices for inquiry and investigative science (54% of observed lessons); teacher confidence and/or flexibility in teaching science (65% of observed lessons); teacher's management strategies enhanced the quality of the lesson (45% of observed lessons); using questioning strategies that were likely to enhance the development of the students' decision-making process (49% of observed lessons – especially high for TeachOhio); and using appropriate pace for the developmental needs of the students (44% of observed lessons). The observed teachers appear to need to improve on adjusting instruction for students' needs when appropriate (12% of observed lessons). Other recommendations for improving the implementation aspect of teaching that were mentioned across the three groups (TEAMS, TeachOhio and Other NWO) included: increasing amount of "wait" time, using higher order, open-ended questioning, better classroom management, encouraging more discussion, and giving students more time to explore misconceptions.

The aspects of the content in which the NWO participants seem to be very successful in their teaching include: teacher displaying understanding of math/science content (50% of observed lessons); teacher drawing real world applications (33% of observed lessons); covering significant and worthwhile content (72% of observed lessons); presentation of math/science as a dynamic body of knowledge (30% of observed lessons); teaching the content appropriate for the developmental levels of students (35% of observed lessons); and engaging students intellectually with important ideas relevant to the focus of the lesson (47% of observed lessons). The observed teachers appear to need to improve on providing adequate degree of sense-making (25% of observed lessons). Other recommendations for improving the content aspect of teaching that were mentioned across the three groups (TEAMS, TeachOhio and Other NWO) included: making more real world connections and connections to other disciplines and paying attention to science and math inaccuracies.

The aspects of the culture in which the NWO participants seem to be very successful in their teaching include: encouragement of active participation by all students (68% of observed lessons); a climate of respect (59% of observed lessons); having a climate that encourages students to generate ideas, questions or conjectures (50% of observed lessons); collaborative relationship between teacher and students (48% of observed lessons); of observed lessons); intellectual rigor and challenging of ideas (30% of observed lessons). Among the recommendations for improving teaching, the following were mentioned across the three groups (TEAMS, TeachOhio and Other NWO): drawing all students into the discussion, developing greater collegiality among students, encouraging participation of all students, increasing participation of females, and increasing the intellectual rigor.

Finally, the numeric ratings (see Tables 16 and 17) show that, on the average, implementation aspect of classroom teaching received the highest ratings across all three groups, followed by classroom culture. Content and lesson design received similar ratings. All ratings were above 3.5 on a 5-point scale.

Table 16. Average Classroom Science Observation Ratings Across Projects

	TEAMS	Comparison*	Teach Ohio		PRISM	MAT	IN-SERVICE
			Pre	Post			
Design	3.5	3	3.7	3.8	4	3.5	5
Implementation	3.75	4	3.5	4.1	3.75	4	5

Content	3.75	3	3.4	3.5	3.75	3.5	5
Classroom Culture	3.75	3	3.7	4.2	4	3	5
Overall	3.6	3	3.4	3.9	4	3	5

NOTE. * denotes only **one** classroom observation for the category at this time.

Table 17. Average Classroom Math Observation Ratings Across Projects

	TEAMS	Comparison*	PRISM	IN-SERVICE
Design	3.5	3	3	3
Implementation	3.5	4	4	3
Content	3.0	3	3	3
Classroom Culture	3.5	3	4	3
Overall	3.5	3	3	3

NOTE. * denotes only **one** classroom observation for the category at this time.

Back to top

Effectiveness Of The NWO Center Recruitment And Retention Of Students Into STEM And STEM Education Disciplines

The progress of the NWO Center towards fulfillment of its Goal 2 was assessed by (1) examining the attendance data for the following three NWO activities/events - Future Teacher Conference, TeachOhio, and OJSHS, (2) reviewing available program documentation, and (3) analyzing the emic session evaluations data (e.g., written evaluations by the participants). The evaluation results below are organized by each evaluation question that was researched.

Back to top

Goal 2 – Evaluation Question 1: What types and how many students have been served as a result of the NWO recruiting and retention activities?

TeachOhio: According to the documentation provided by the TeachOhio staff, the program recruitment goal was almost met. The program staff had to make adjustments to their initial recruitment strategy for the reasons beyond their control and in response to the diverse needs of the population of interest. Thus, originally it was planned to recruit only those who had the appropriate content background to begin teaching in Fall 2006. However, during the recruitment process, several excellent candidates were identified who did not quite fit the initial inclusion criteria but wanted to become teachers of science and mathematics. Thus, they were accepted into the program. Additionally, the initial plan was to recruit 20 Adolescent to Young Adult (AYA) science and mathematics teacher candidates from non-traditional and underrepresented populations. Half of these were supposed to be recruited in collaboration with the University of West Indies, Trinidad and Tobago. However, the main contact person received her own grant and this recruitment strategy was no longer available to the TeachOhio staff. As a result of the intensive TeachOhio's local recruitment efforts (which included advertisements in several newspapers and newsletters, mailing brochures, involving university faculty/staff and superintendents into the process, focusing on the needs of local school districts, and holding information meetings), 16 participants were identified and accepted into the program, of which 8 fit the initial model and taught in 2006-2007, 4 are still taking AEL content classes, and 2 are teaching on their current licensure and taking content classes under the AEL. One person dropped out and one switched to a different program, which points to a high retention rate of the TeachOhio program as well as the right choice of inclusion criteria that enabled the TeachOhio staff to accept the "right" candidates.

Additional evidence of the success of the recruitment strategies (i.e., that the "right" candidates were accepted) comes from the examination of the professional development attendance data. Thus, for the Inquiry Series sessions, attendance ranged from 81% to 100% across seven sessions, with the average attendance of 91%. The reasons for non-attendance by very few participants included having parent-teacher conferences, taking a content course, or fulfilling another TeachOhio Program requirement that conflicted with the Inquiry Series sessions. All TeachOhio participants attended the Symposium. Two participants who still had to take content

tests attended PRAXIS II tutoring sessions, making it 100% attendance of those who could benefit from the review attended the workshop. Finally, the average attendance data for seven TeachOhio dinners was 89% ranging from 81% to 100%.

Channels through which they learned about TeachOhio included flyers in the mail, ads in the paper, meetings, and personal referrals. The participants suggested the following measures that can be taken for future recruitment:

- getting out info to all science teachers in a district, not just COSMOS teachers;
- addressing positives of teaching in the media so that people don't shy away from the profession;
- continue COSMOS' focus on hands-on minds-on learning; Incorporate Soil and Water, Ohio Dept. of Natural Resources, local business. "…bring science into people's hands;" and
- recruit within the high schools.

Ohio Junior Science and Humanities Symposium: 50 high school students participated in this year's OJSHS compared to approximately 100 student in the previous years. The OJSHS does not directly recruit students into STEM disciplines. However, the experiences that the OJSHS provides to these students make them more likely to pursue such careers. This is evidenced by the comments that the OJSHS participants made on the evaluation forms. The summary of these is presented in the next section.

Future Teacher Conference: no data were available for this event

Back to top

Goal 2 – Evaluation Question 2: How did these participants rate the effectiveness of each activity?

TeachOhio: During the academic year, the participants in the TeachOhio Program attended the following professional development events - Inquiry Series, NWO Symposium, PRAXIS II tutoring sessions, and TeachOhio dinners. The numeric ratings of these sessions by the TeachOhio participants were combined together with other groups' ratings and reported earlier. This section includes the summary of the qualitative responses that show that overall the participants take the TeachOhio program very seriously as evidenced by their thoughtful responses to the interview questions related to the quality of professional development activities. The following were mentioned as the strengths of the NWO professional development program:

- getting ideas for activities to use and ideas apply to students;
- getting lesson ideas, especially by first year teachers
- great relevance of the PD activities for first time teachers;
- learning about constructivist teaching strategies and 5E's; one participant said she actually applied these; several mentioned constructivism as the most helpful aspect of the program;
- increasing content knowledge and confidence in what they can teach their kids and how well they know what they are teaching;

- sharing activities among the participants;
- learning about available resources, including people as resources, materials, kits, technology, web links, discussion boards, grants to purchase equipment and materials, and resources available at schools;
- the integration of new and experienced teachers (as mentioned by new teachers)
- a class on classroom management; although one participant said this class was not useful and in fact s/he was told later not to do things the class said to do;
- the COSI experience; one intern used some of the hands on/visual examples in the classroom and remembered reactions of the kids as eye opening.
- attending support dinners and discussing students and classroom
- interactions among teachers all over Ohio; learning from each other's experiences; knowing about role models
- learning to use rubrics and be fair in assessment of student learning; examples include teachers not looking at names on test
- learning about productive group work and making sure students are responsible for work
- learning to encourage students to think more deeply;
- cater teaching to the jobs students want

The participants however had a wish-list which includes:

- less theory in summer; it was relevant but hard to put to practical use;
- more training on how to apply the information on assessing student learning;
- more classes on behavioral management; more urban training; adding an urban flavor and addressing behavioral issues, gangs, and classroom management (e.g., how to deal with interruptions, acting up, strangers entering classroom) was mentioned by several participants;
- greater attention to the relevance of activities to urban schools (e.g., in terms of equipment and technology that the inner-city schools lack);
- making sure the activities and the topics are relevant for both new and experienced teachers as well as for high school teachers; a suggestion was made to split off in groups, with TeachOhio being a separate group; several admitted they had to tweak the activities that were more appropriate for elementary and junior high school levels; create a session for HS science projects and issues;
- adjusting constructivist inquiry-based activities to make them equally appropriate for new and experienced teachers; some new teachers perceived constructivist inquiry-based activities as more geared toward experienced teachers and suggested adding a course on the basics;
- making sure that the courses that push open inquiry are realistic for the level of students in urban schools
- more lesson plan and activity generation; less journal writing; several mentioned journals as not very useful
- more examples of an inquiry-based classroom
- more hands-on activities
- more materials for students to use
- more research on project based learning
- a possibility of a course credit for using one of the summer semesters to put together new strategies to use, to line up the lessons and materials so that in the fall they would have some new things ready to go instead of starting off the fall with nothing new; and
- more opportunities of making lessons with the people in the cohort who have students with similar levels of apathy, similar problems at home, similar things.

Ohio Junior Science and Humanities Symposium: The overall evaluation rating of the OJSHS by the participants was 4.8 on a 5-point scale (n=26). The average rating across different aspects of the program was 4.5. The above average ratings were noted for the clarity of scheduled activities, general flow of the program, paper and poster session chairpersons, awards presentations, selection of winners for papers, student paper presentations, audio-visual equipment and videotaping, administrative mailings and notices, location of the symposium, facilities, and hospitality room. The students also liked cash awards, printed programs with photos, certificates and prizes, souvenirs, evening activities, UT Recreation Center visit, and breaks.

In their written comments about the OJSHS, the students focused on three major areas in which the symposium was successful in their perception – organization and format, professional working atmosphere, and recreation/entertainment. Of all the positive comments made, 12 were work-related, 9 were about organization and format, and 13 were about recreation activities. Some of the comments included:

Organization*: All of the activities were spread out over the event so none of breaks seemed too long or the activities packed too close together.*

Brevity of paper sessions kept people from losing interest.

Structured, yet the scheduled presentations didn't feel rushed or rigid.

… the program was very helpful with a comprehensive schedule w/abstracts, keeping the length of the sessions to a moderate length helped me stay interested.

Atmosphere: *Fostering respect and congeniality of participants was wonderful this year.*

Recreation: *The variety of evening activities was also enjoyable. The food was also excellent and overall I am glad I attended this symposium.*

Everything: *As this is my first year to attend, I was impressed with every part.*

I'm a happy camper this year – was close to flawless.

The OJSHS was an interesting way to enjoy the study of science. Very fun!

Suggestions for improvement included the need to have more poster judges to avoid having them in pairs, a better judging procedure (e.g., judging only the work that the students actually did independently on the project), and more diversity in judges' backgrounds. Several participants mentioned judge bias, presenters being able to ask other presenters "to make them look bad," and not understanding the purpose for some types of questions that were asked. The participants would like to be able to tour science research labs at the university.

Future Teacher Conference: no data were available for this event

Back to top

Effectiveness Of The NWO Center Collaborative Research Initiatives Aimed At Conducting And Communicating About How People Best Teach And Learn Science And Mathematics And/Or The Barriers And Enablers Related To Current Reform Efforts

The progress of the NWO Center towards fulfillment of its Goal 3 was assessed by (1) studying participation and presentation rates of the Research Community members, (2) analyzing the emic Research Community session evaluations data (e.g., open-ended evaluations of the Research Community by the participants), (3) examining faculty interview data. The evaluation results below are organized by each evaluation question that was researched.

Back to top

Goal 3 – Evaluation Question 1: How have BGSU faculty contributed to the body of knowledge on how people best learn science and mathematics and/or on the barriers and enablers related to current reform efforts?

A total of 28 BGSU faculty participated in at least one of the 15 meetings of the Research Community held in the fall of 2006 and 27 participants attended at least one of the 14 meetings in the spring of 2007 (see Table 18). The highest number of the meetings attended by a Research Community member in the fall was 11, with the average of 6 meetings; on the average, there were 12 participants per meeting, with the range from 8 to 17. The highest number of the meetings attended by a Research Community member in the spring was 8, with the average of 5 meetings; on the average, there were 11 participants per meeting, with the range from 8 to 16. The participants made a total of 26 presentations, with 12 of these in the fall and 14 in the spring. Off these, six were turned into manuscripts for publication, pointing to the success of the idea of a Writing Community that evolved in summer of 2006.

Table 18. Research Community Participation

	2005	2006
# Participants	33	28
# Meetings	n/a	29
Average # Meetings Attended by a Participant	n/a	5-6
Average # Participants per Meeting	n/a	11-12
# Presentations	19	26
# Publications	n/a	6
# Submitted Grants	n/a	2

Back to top

Goal 3 – Evaluation Question 2: What do faculty believe about the utility of the Research Community as a faculty development opportunity that serves to enhance the research efforts of the university in mathematics and science education?

Based on the evaluations provided by 20 Research Community participants, the overall usefulness of the Research Community was rated very high - 4.75 on a 5-point Likert scale (see Table 19). The ratings of the specific aspects of the Research Community ranged from 4.2 to 4.65, with the average of 4.5 and the highest rating being given to the usefulness of the Research Community in developing professional knowledge of research in science and math education. These findings are consistent with the last year's results. The participants also noted a good organization of the Research Community meetings.

Table 19. Research Community Ratings by Participants

	Mean Rating
Overall Usefulness	4.75
Usefulness for Teaching and Learning	4.55
Usefulness for Research	4.45
Usefulness for Establishing Collaboration	4.50
Usefulness for Developing Professional Knowledge of Research in Science and Math Education	4.65
Learning Something New and Practical	4.20
Having a True Sense of Community	4.40
Well Organized	4.65

In their open-ended evaluations and faculty interviews, the participants spoke highly about the utility of the Research Community in enhancing research on mathematics and science education. As a result of being part of the Research Community meetings, some participants ended up working on grants together or collaborating on grants with others in their field, finding common research interests and considering a co-authored manuscript, seeking and obtaining feedback on research, understanding better the value and scope of educational research, developing an interest in research, expanding existing research agendas, identifying specific journals where they can publish, considering long-term research projects, reflecting on the quality and methods used in their own research, and seeing connections between research conducted in different disciplines. Several participants mentioned feeling more connected to science and math education community as well as more energized and empowered to do and/or continue doing research.

Some however felt that they needed more directed discussions and a better, more generalizable, more current and relevant selection of examples of research on teaching and learning in sciences. For example, some wanted more exposure to research that investigates best practices used in math and science content courses at the college level. Other suggestions for increasing the effectiveness of the Research Community in enhancing research included the need to make a better use of time in the Learning Community meetings (hoping for a research project or grant proposal to emerge from the meetings); the need to focus less on theoretical points of view and more on practical applications; addressing the problem that a few of the participants don't really seem to want to believe that different approaches can work; a suggestion to schedule time for individual members to share their projects, struggles and accomplishments, the need for a more structured protocol for evaluating research articles, and reading and discussing classic papers/books in STEM education in order to develop an understanding of how STEM education has evolved over time.

Below are the examples of participants' reflections in their own words:

> *This learning community provides opportunities to expand the types or topics of research articles I read. It provides a structured time so that reading such articles becomes a priority.*
>
> *I am developing an appreciation for the value of educational research as well as difficulties involved in correctly planning the project…*
>
> *I am been empowered to continue with my new research projects. I have been more reflective about what methodologies I will employ in my research.*

I've been "forced" to read literature in areas different from my own, and as a result have developed a greater appreciation for what it means to execute math/science ed research in the classroom.

I have been re-energized to complete work on a project due to the presentation of a similar project by a community member.

The community inspired me to … submit an ITQ grant. I will probably try again next year, making use of further discussions about grant writing process held with this community.

I got some excellent feedback from colleagues on my presentation and proposed study as well as some sources for data.

… meeting new faculty with similar interests and sharing research ideas and projects across colleges. A better understanding of scientific research in education. A better understanding of the views and attitudes regarding effective science teaching and learning from our scientists/mathematicians…

Fostering exchange if helpful information and expertise among academics and developing fruitful scholarly and pedagogical collaborations

This research community is very unique and serves as a model for others who might be trying to establish similar collaborations at other institutions.

Back to top

Goal 3 – Evaluation Question 3: How do faculty perceive the role of NWO in impacting problems associated with K-16 mathematics and science teaching and learning?

With regard to the problems or challenges associated with K-16 mathematics and science teaching and learning, the faculty mentioned several areas that the information provided by the Center was beneficial to them. These include inquiry assessments, ideas on how to get students to become critical thinkers, master communication skills and be active learners. Some also mentioned that as a result of participating in the Center activities, they started to look more into inquiry-based teaching techniques and learned about the on-line resources for more active student-focused teaching. They also learned how to enhance the learning process of the students.

Back to top

Effectiveness Of The NWO Center In Addressing Current STEM Education Issues

The progress of the NWO Center towards fulfillment of its Goal 4 was assessed by examining the effectiveness of the NWO professional development component. The latter was established by (1) studying attendance data and minutes from the CCC council, (2) studying attendance data and minutes from the two NWO Executive Board meetings, and (3) analyzing the faculty interview. The evaluation results below are organized by each evaluation question that was researched.

Goal 4 – Evaluation Question 1: How has NWO developed and sustained a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues?

The collaborative alliance among the university, school and community partners was sustained by conducting regular COSMOS Collaborative Council (CCC) and Executive Board meetings (monthly for the CCC, with the average attendance of 14 members, and at the beginning and at the end of the academic year for the Executive Board, with the average attendance of 10 members). These entities were charged with the mission to promote the exchange of information and data concerning math and science education in school districts across northwest Ohio and serve as an advocacy group for NWO activities and to guide the direction of NWO through long-term planning.

The concepts and ideas that were discussed and communicated at these meetings are indicative of the visionary approach taken by the NWO Center to tackling current STEM education issues. In particular, the CCC members were regularly informed about the NWO Center initiatives aimed at increasing the number of students pursuing STEM careers (e.g., TeachOhio alternative licensure program). They discussed recent legislative actions affecting math and science curriculum), reviewed the most current statistics on the need for math teachers in Ohio, brainstormed professional development ideas for the next year (e.g., differentiated curriculum, research into best practices for science & math, modeling for science, elementary math and science, effective incorporation of technology in math and science, Curriculum Topic Study to help teachers understand content and developmental appropriateness of concepts in grade level indicators, value added/Layered Curriculum/Partnership with special and regular education).

Other topics related to STEM included using NWO initiatives (e.g. REAL) to stimulate an interest in science, technology, engineering, and mathematics that would encourage students to consider a career of teaching secondary education in those fields, ODE math and science standards and the importance of understanding them by teachers, and increasing leadership capacity of regional mathematics and science teachers through quality professional development. The discussions ranged from very specific NWO Center issues to very broad issues related to math and science education. The Board discussed grant writing and international collaboration opportunities and bylaws.

Back to top

Effectiveness Of The NWO Center In Increasing The Leadership Capacity For Mathematics And Science Education In Northwest Ohio

The progress of the NWO Center towards fulfillment of its Goal 5 was assessed by (1) examining the number of sessions presented by the NWO teachers and (2) analyzing session ratings of these sessions by other participants. The evaluation results below are organized by each evaluation question that was researched.

Back to top

Goal 5 – Evaluation Question 1: In what ways have NWO teachers taken on leadership roles in the region?

The NWO participants made a total of 35 presentations at the Blast-off session (1) in September of 2006, NWO Symposium in November of 2006 (17) and Summit in April of 2007 (14). The majority of the presenters were affiliated with MAT (12), followed by PRISM (10), other NWO/COSMOS (9), and TEAMS (4). Four of the NWO participants affiliated with PRISM and MAT presented twice. The average rating of these sessions by other participants was 4.6 on a 5-point scale. Additionally, 6 NWO participants were grant winners for the A+ for Energy Program from BP.

Back to top

Evaluation Highlights

The external evaluation team from MetriKs Amérique conducted the second year (2006-2007) external evaluation of the Northwest Ohio Center of Excellence in Science and Mathematics (the NWO Center). The overall goal of the evaluation was to determine the progress of the Center towards the attainment of its revised goals. These goals were the following:

Goal #1: Enhance the preparation of pre-service and in-service teachers though research-based professional development focusing on investigative mathematics and science teaching and learning.

Goal #2: Recruit and retain students into STEM and STEM education disciplines.

Goal #3: Conduct and communicate collaborative research on how people best teach and learn science and mathematics and/or on the barriers and enablers related to current reform efforts.

Goal #4: Develop and sustain a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues.

Goal #5: Increase the leadership capacity for mathematics and science education in northwest Ohio.

The Center achieved these goals through the following initiatives/activities:

- Modification of undergraduate and graduate courses or programs
- Undergraduate professional organizations (BG-UT SECO and CTM)
- Praxis II Preparation Workshop
- Graduate MAT program scholarships
- NWO Symposium
- Sessions and workshops on effective strategies for teaching science, math, and technology through Inquiry Series
- Affiliated Programs (e.g., TEAMS, TeachOhio, PRISM, REAL, DREAMS)
- Future Teacher Conference
- OJSHS
- Research Community
- COSMOS Collaborative Council (CCC)
- NWO Executive Board

Specific evaluation questions were formulated and researched for each goal as well as aligned the NWO Center initiatives/activities. Multiple instruments and data sources were identified to yield data that could be triangulated to enhance the validity of the findings.

The progress of the NWO Center towards fulfillment of its Goal 1 was assessed by examining the effectiveness of the NWO professional development component. This was accomplished by triangulating data from six different sources and (1) examining beliefs and practices of the NWO teachers that they shared on the TBI survey, (2) thematically analyzing the emic session evaluations data (e.g., written evaluations of the professional development sessions) obtained from participants, (3) thematically analyzing the faculty interview data, (4) thematically analyzing the teacher interview data, (5) summarizing the etic session evaluations data (e.g., PD observations ratings provided by the external observers), and (6) studying other statistics collected by the NWO Center about different activities (e.g., course and program modification documents, PD attendance data, MAT credit hour completion data, and Symposium participant involvement data).

The progress of the NWO Center towards fulfillment of its Goal 2 was assessed by (1) examining the attendance data for the following three NWO activities/events - Future Teacher Conference, TeachOhio, and OJSHS, (2) reviewing available program documentation, and (3) analyzing the emic session evaluations data (e.g., written evaluations by the participants).

The progress of the NWO Center towards fulfillment of its Goal 3 was assessed by (1) studying participation and presentation rates of the Research Community members, (2) analyzing the emic Research Community session evaluations data (e.g., open-ended evaluations of the Research Community by the participants), (3) examining faculty interview data.

The progress of the NWO Center towards fulfillment of its Goal 4 was assessed by examining the effectiveness of the NWO professional development component. The latter was established by (1) studying attendance data and minutes from the CCC council, (2) studying attendance data and minutes from the two NWO Executive Board meetings, and (3) analyzing the faculty interview. These are summarized and presented in Table 1.

Evaluation Highlights: Participants

In 2006-2007, the NWO Center served 331 pre-service and in-service teachers as well as higher education faculty and other educators in the area (see Table 2 for details). The participants self-selected themselves to participate in the NWO Center activities and therefore constitute a volunteer sample. All the participants were used as the target population for the evaluation of the NWO Center. However, different sampling frames were used in different evaluation questions and depending on the data collection strategy.

Evaluation Highlights: Beliefs and Practices of NWO Participants

Teacher beliefs and practices were analyzed and compared across three groups of the NWO participants: TEAMS, TeachOhio and Other (which included PRISM, In-Service, etc.). This was chosen for two major reasons – loss and comparability of the data. More specifically, the TeachOhio data were available for pre-SI and post-SI, with very few cases from the post-AY administration. Hence to avoid loss of data, only pre-post SI data for TeachOhio were analyzed. The TEAMS data were available and analyzed for three time periods (pre-SI, post-SI and post-AY). For all other participants, only 13 common cases were obtained when merging pre-AY and post-AY. Therefore, we used post-AY survey data for this group and analyzed their retro responses along with their TODAY responses.

The results show a statistically significant increase on the self-efficacy (SE) subscale for all three groups, with the largest effect size for other NWO participants. Patterns of change were also similar between TEAMS and Other groups on the subscales of the Classroom Learning Environment Survey (the scores increased significantly on 3 out of 4 subscales for TEAMS and on all four subscales for Other). Finally, for the total Instructional Practices Inventory scores and its subscales, the mean Post Today scores were nearly identical to the mean Post AY scores for the TEAMS data.

Evaluation Highlights: Participant Perceptions of the Effectiveness of the NWO Activities

In their written evaluations of the AY professional development sessions, participants, regardless of the specific program they were affiliated with, gave high ratings to the usefulness, relevance and quality of many common aspects of the professional development they received through the NWO Center. Their quantitative ratings of the Inquiry Series averaged 3.6 on a 5-point scale. The overall rating for Praxis II professional development was 3.6. The overall rating for the NWO Center Symposium was 3.5 across 80 sessions. The overall evaluation rating of the OJSHS by the participants was 4.8 on a 5-point scale (n=26). The average rating across different aspects of the program was 4.5.

Review of the magnitudes of the program-specific ratings suggest that participants from every program they affiliated with found at least one Inquiry Series session very useful. Seventeen (81%) of the attendees rated the Praxis II workshop as having a positive impact on their future work, 1 (5%) person had negative comments about the workshop, and 2 (10%) people were neutral in their perceptions of the value of the workshop. In their written evaluations of the Symposium sessions, the participants spoke very positively about the content of the sessions as well as the organization of the entire event, both pointing to the high quality and usefulness of this professional development experience.

Reflecting further on the quality, relevance and usefulness of the professional development, the participants thought the Center was effective at providing them with: good ideas to use in the classroom, new ways to use technology, good handouts, science lessons and good content knowledge, and a better understanding of how students learn. A lot of participants said they liked speakers and everybody loved breakout sessions and wanted more of those in the future. As the sessions progressed, almost everybody mentioned the value of cohort discussions and learning about others' lesson plans and implementation.

In addition to these common comments, participants in different programs pointed out to other areas in which the professional development was useful and relevant. Thus, in-service teachers said it reminded them to use inquiry more of often and more effectively in their classes. TEAMS participants emphasized that in this program they learned creative inquiry-based ideas that they might be able to implement into teaching right away, developed a deeper and richer understanding of how comparisons and connections must take place for learning to occur, loved foldables, learned about three types of inquiry-based lessons, found them very practical and helpful in planning lessons, and learned better how to make units much better and more aligned with standards. For the undergraduate students, the professional development was relevant and useful in terms of learning fun and interactive activities for teaching math science and teaching in a kinesthetic way and through exploration, developing an understanding of the importance of differential instruction for reaching students and making connections between things for the students, developed a better understanding why hands-on active learning was essential, what were the benefits of three levels of inquiry, and which teaching style was most helpful to

students. The also loved foldables. The participants also made a lot of good suggestions for further improving the quality of the NWO Center professional development.

The HS participants of the OJSHS gave above average ratings for the clarity of scheduled activities, general flow of the program, paper and poster session chairpersons, awards presentations, selection of winners for papers, student paper presentations, audio-visual equipment and videotaping, administrative mailings and notices, location of the symposium, facilities, and hospitality room. The students also liked cash awards, printed programs with photos, certificates and prizes, souvenirs, evening activities, UT Recreation Center visit, and breaks.
In their written comments about the OJSHS, the students focused on three major areas in which the symposium was successful in their perception – organization and format, professional working atmosphere, and recreation/entertainment. Of all the positive comments made, 12 were work-related, 9 were about organization and format, and 13 were about recreation activities.

No data were available for the Future Teacher Conference. This event was not held this year due to the health of the coordinator.

Evaluation Highlights: Participant Perceptions of the Impact of the NWO activities on Their Beliefs and Practices

The impact of NWO Center activities on teacher beliefs and practices was inferred from teachers' responses to several interview questions, based on what the teachers believe they can and should be doing. Examples of these across all three groups (TEAMS, TeachOhio and Other) included feeling more confident as in what they were teaching and how, believing that doing inquiry-based teaching was more beneficial for students than the more traditional teaching, understanding the importance of: learning about hands-on activities and experiments that could be linked to indicators, understanding how students learn, not teaching from a book, engaging students, linking assessment to indicators, letting students ask and answer their own questions is important, helping students see science as fun is important, actively engaging students, stepping out of the box for both teachers and students, using discovery and investigation, encouraging students to think more deeply, doing fair assessment of student learning, always looking for ways to become a better teacher, and being aware of the standards, to name just a few.

Evaluation Highlights: Response of the universities by developing/revising courses and/or programs to better prepare teachers

The NWO Center continues to make progress in encouraging faculty to develop new courses and modify the existing ones to prepare better pre-service and in-service teachers. In the last year's evaluation of the Center, four course modifications and six new course developments were reported. The trend is consistent in that this year four BGSU faculty modified their courses and aligned them to the Ohio Content Standards.

Evaluation Highlights: Ways in Which Participants Are Deepening their Content Knowledge in Math and Science

The NWO Center continued supporting professional development through the BG/UT SECO/CTM chapter activities. Compared to last year (when the BG/UT SECO/CTM held four

professional development workshops), this year the number of workshops increased to nine. The BG SECO meetings' attendance ranged from 8 to 30, with the average of 17 students. The BG CTM meetings' attendance ranged from 45 to 80, with the average of 61 students. The membership of BG SECO/CTM also increased dramatically. Thus, the BG SECO had 40 new members this year while the BG CTM had 150 members, compared to the total of 49 members last year (i.e., the BG/UT SECO/CTM increased its membership by more than four times).

The NWO Center also promoted deeper content learning through Praxis II workshop. A total of 30 pre-service teachers attended Praxis II tutoring mathematics and science (biology) sessions on February 22, 2007. This was 13% more than last year. Based on the evaluation of the Praxis II tutoring workshop by 21 participants (13 attending the Life Science tutoring session and 8 attending the math tutoring session), three most common objectives for attending the workshop included learning the content (6), learning test taking strategies (12), and learning about the test format, types of questions and what to expect on the test (13). These objectives were satisfied partially or completely on the average in 55% of the cases (i.e., the participants said they received exactly or partially what they wanted from the workshop) – 50% for content, 67% for test taking strategies, and 46% for learning about the test. In 25% of the cases, the participants received what they expected and even more. In 75% of the cases when the expectations were not met, the participants admitted that they learned some other things from the workshop. Most of these cases (i.e., when the expectations were not met) involved wanting to learn about the test but learning the test taking strategies instead.

Furthermore, under the auspices of the NWO Center, COSMOS continued to provide MAT scholarships to 10 students at BGSU. On the average, these students completed 14.4 credit hours in 2005-2006 and were estimated to complete 10.2 – 10.8 credit hours in 2006-2007. Scholarship funding was also provided to 4 new MAT students with the expectation that these students will complete on the average 10.5 – 11.25 credit hours. The total number of credit hours that the funded MAT students were expected to complete was 144 – 153. The data show that this expectation was fulfilled.

The opportunities to gain content knowledge were also provided through such initiatives of the NWO Center as the NWO Symposium attended by 325 people, Inquiry Series attended by xxx participants affiliated with different programs as well as specific programs such as TEAMS, TeachOhio, PRISM, etc.

Evaluation Highlights: Ways in Which Participants Transfer Their Knowledge into Classroom

Comparing classroom observation ratings and comments across the three groups, several commonalities were observed. **The aspects of the design** in which the NWO participants seem to be very successful in their teaching include: careful planning and/or organization (98% of observed lessons), incorporating tasks, roles, interactions consistent with investigative science (78% of observed lessons), using collaborative approach to learning (51% of observed lessons). The observed teachers appear to need to improve on the following: providing adequate time for sense-making and wrap-up (was observed only in 39% of observed lessons), attention to students' prior experience, preparedness and learning styles (was observed only in 19% of observed lessons), using instructional strategies and activities that reflected attention to issues of access, equity and diversity (was observed only in 6% of observed lessons). Among the recommendations for improving teaching, the following were mentioned across the three groups

(TEAMS, TeachOhio and Other NWO): more time for sense-making and wrap-up, more investigative tasks and strategies, and greater encouragement of collaborative learning.

The aspects of the implementation in which the NWO participants seem to be very successful in their teaching include: lesson was consistent with best practices for inquiry and investigative science (54% of observed lessons); teacher confidence and/or flexibility in teaching science (65% of observed lessons); teacher's management strategies enhanced the quality of the lesson (45% of observed lessons); using questioning strategies that were likely to enhance the development of the students' decision-making process (49% of observed lessons – especially high for TeachOhio); and using appropriate pace for the developmental needs of the students (44% of observed lessons). The observed teachers appear to need to improve on adjusting instruction for students' needs when appropriate (12% of observed lessons). Other recommendations for improving the implementation aspect of teaching that were mentioned across the three groups (TEAMS, TeachOhio and Other NWO) included: increasing amount of "wait" time, using higher order, open-ended questioning, better classroom management, encouraging more discussion, and giving students more time to explore misconceptions.

The aspects of the content in which the NWO participants seem to be very successful in their teaching include: teacher displaying understanding of math/science content (50% of observed lessons); teacher drawing real world applications (33% of observed lessons); covering significant and worthwhile content (72% of observed lessons); presentation of math/science as a dynamic body of knowledge (30% of observed lessons); teaching the content appropriate for the developmental levels of students (35% of observed lessons); and engaging students intellectually with important ideas relevant to the focus of the lesson (47% of observed lessons). The observed teachers appear to need to improve on providing adequate degree of sense-making (25% of observed lessons). Other recommendations for improving the content aspect of teaching that were mentioned across the three groups (TEAMS, TeachOhio and Other NWO) included: making more real world connections and connections to other disciplines and paying attention to science and math inaccuracies.

The aspects of the culture in which the NWO participants seem to be very successful in their teaching include: encouragement of active participation by all students (68% of observed lessons); a climate of respect (59% of observed lessons); having a climate that encourages students to generate ideas, questions or conjectures (50% of observed lessons); collaborative relationship between teacher and students (48% of observed lessons); of observed lessons); intellectual rigor and challenging of ideas (30% of observed lessons). Among the recommendations for improving teaching, the following were mentioned across the three groups (TEAMS, TeachOhio and Other NWO): drawing all students into the discussion, developing greater collegiality among students, encouraging participation of all students, increasing participation of females, and increasing the intellectual rigor.

Finally, the numeric ratings show that, on the average, implementation aspect of classroom teaching received the highest ratings across all three groups, followed by classroom culture. Content and lesson design received similar ratings. All ratings were above 3.5 on a 5-point scale.

Evaluation Highlights: Types And The Number Of Students That Have Been Served As A Result Of The NWO Recruiting And Retention Activities

In 2006-2007, the NWO Center served 331 pre-service and in-service teachers as well as higher education faculty and other educators in the area

Activity	Category Served	# Participants
Inquiry Series	In-Service, Pre-Service, Faculty, Other	322
NWO Symposium	In-Service, Pre-Service, Faculty, Other	325
MAT	In-Service	14
TEAMS	In-Service	136
Future Teacher Conference	Pre-Service	n/a
Praxis II Tutoring	Pre-Service	30
BG SECO/CTM	Pre-Service	190
TeachOhio	In-Service, Pre-Service	17
PRISM	In-Service, Faculty, Other	21
OJSHS	HS students	50
REAL	HS students	54
Research Community	Faculty	28
Course Modification	Faculty	4
COSMOS Collaborative Council (CCC)		31
NWO Executive Board		15

Evaluation Highlights: Contributions of the BGSU to the body of knowledge on how people best learn science and mathematics and/or on the barriers and enablers related to current reform efforts

A total of 28 BGSU faculty participated in at least one of the 15 meetings of the Research Community held in the fall of 2006 and 27 participants attended at least one of the 14 meetings in the spring of 2007. The highest number of the meetings attended by a Research Community member in the fall was 11, with the average of 6 meetings; on the average, there were 12 participants per meeting, with the range from 8 to 17. The highest number of the meetings attended by a Research Community member in the spring was 8, with the average of 5 meetings; on the average, there were 11 participants per meeting, with the range from 8 to 16. The participants made a total of 26 presentations, with 12 of these in the fall and 14 in the spring. Off these, six were turned into manuscripts for publication, pointing to the success of the idea of a Writing Community that evolved in summer of 2006.

Evaluation Highlights: Faculty beliefs about the utility of the Research Community as a faculty development opportunity that serves to enhance the research efforts of the university in mathematics and science education

Based on the evaluations provided by 20 Research Community participants, the overall usefulness of the Research Community was rated very high - 4.75 on a 5-point Likert scale. The ratings of the specific aspects of the Research Community ranged from 4.2 to 4.65, with the average of 4.5 and the highest rating being given to the usefulness of the Research Community in developing professional knowledge of research in science and math education. These findings are consistent with the last year's results. The participants also noted a good organization of the Research Community meetings.

In their open-ended evaluations and faculty interviews, the participants spoke highly about the utility of the Research Community in enhancing research on mathematics and science education. As a result of being part of the Research Community meetings, some participants ended up working on grants together or collaborating on grants with others in their field, finding common research interests and considering a co-authored manuscript, seeking and obtaining feedback on research, understanding better the value and scope of educational research, developing an interest in research, expanding existing research agendas, identifying specific journals where they can publish, considering long-term research projects, reflecting on the quality and methods used in their own research, and seeing connections between research conducted in different disciplines. Several participants mentioned feeling more connected to science and math education community as well as more energized and empowered to do and/or continue doing research. The faculty also made some suggestions for improvement.

Evaluation Highlights: The Progress of the NWO Center towards development and sustainability of a regional collaborative alliance including university, school, and community partners through a shared vision and collaborative spirit for tackling current STEM education issues

The collaborative alliance among the university, school and community partners was sustained by conducting regular COSMOS Collaborative Council (CCC) and Executive Board meetings (monthly for the CCC, with the average attendance of 14 members, and at the beginning and at the end of the academic year for the Executive Board, with the average attendance of 10 members). The concepts and ideas that were discussed and communicated at these meetings are indicative of the visionary approach taken by the NWO Center to tackling current STEM education issues. In particular, the CCC members were regularly informed about the NWO Center initiatives aimed at increasing the number of students pursuing STEM careers, discussed recent legislative actions affecting math and science curriculum, reviewed the most current statistics on the need for math teachers in Ohio, brainstormed professional development ideas for the next year. Other topics related to STEM included using NWO initiatives to stimulate an interest in science, technology, engineering, and mathematics that would encourage students to consider a career of teaching secondary education in those fields, ODE math and science standards and the importance of understanding them by teachers, and increasing leadership capacity of regional mathematics and science teachers through quality professional development. The discussions ranged from very specific NWO Center issues to very broad issues related to math and science education.

Evaluation Highlights: Ways In Which The NWO Teachers Have Taken On Leadership Roles In The Region

The NWO participants made a total of 35 presentations at the Blast-off session (1) in September of 2006, NWO Symposium in November of 2006 (17) and Summit in April of 2007 (14). The majority of the presenters were affiliated with MAT (12), followed by PRISM (10), other NWO/COSMOS (9), and TEAMS (4). Four of the NWO participants affiliated with PRISM and MAT presented twice. The average rating of these sessions by other participants was 4.6 on a 5-point scale. Additionally, 6 NWO participants were grant winners for the A+ for Energy Program from BP.

Back to top

Recommendations

The recommendations offered in this final section of the evaluation report come from three different sources: those voiced by the NWO participants and mostly related to the specific NWO initiatives/activities/ programs/events, those noted by session and classroom observers and also related to the content of the professional development, and those made by the evaluation team and mostly related to the data collection instruments and procedures.

Suggestions from the NWO participants, related to the content of professional development:

- More sessions on standards
- More sessions on alternative assessment of student learning
- More sessions on inquiry lessons (tips on how to teach inquiry on a limited budget, demonstrations of how to use computers with inquiry methods, modeling of inquiry lessons, help with developing such lessons)
- More hands-on ideas
- More information on how to integrate math, science, and technology together
- More sessions on grant writing
- More information on how to motivate and keep students (especially high-risk) engaged and involved in the classroom
- More math in general and more math for higher grades
- More emphasis on 7-12 grade level

Other suggestions included more sessions on time management and group work, more content aligned lesson plans, more information on organizations and groups that can give materials and grants to schools, more vendor presentations, more life science sessions, and more dinner open discussion forums (TeachOhio); more materials, more grade-specific lesson ideas, starting on time and earlier, and better microphones (TEAMS), more networking opportunities, more comfortable classrooms, and also better microphones (In-service); more lessons on specific topics, more opportunities to go to more sessions, more sessions geared towards pre-service teachers, and more sessions for pre-schools and kindergartens (undergraduate students); and how to be hands-on and still prepare the students to pass the test (MAT). Some of the suggestions mentioned by the participants were also made by the observers of the sessions.

Suggestions from the observers for improving quality of NWO professional development:

- more time for sense making and wrap-up
- more encouragement of collaborative learning
- having a better structure to share experiences and insights
- more handouts
- better modeling of effective questioning strategies
- more engaging presentations
- more modeling of effective assessment strategies

- more intellectual engagement of the participants
- more connections to other disciplines and real world contexts
- more information in a “classroom ready” format
- increase intellectual rigor
- use more constructive criticism
- more challenging of participants’ ideas

The observers in the classrooms also noted some areas in which the NWO participants can improve by participating in the NWO Center professional development. The observed teachers appeared to need more tips and training in how to:

- provide adequate time for sense-making and wrap-up
- pay attention to students’ prior experience, preparedness and learning styles
- use instructional strategies and activities that reflect attention to issues of access, equity and diversity
- use more investigative tasks and strategies
- encourage collaborative learning and draw all students into the discussion
- develop greater collegiality among students
- encourage participation of all students
- increase participation of females
- adjust instruction for students’ needs when appropriate
- using higher order, open-ended questioning,
- give students more time to explore misconceptions
- making more real world connections and connections to other disciplines
- avoid/recognize science and math inaccuracies

Suggestions from high school students for improving the OJSHS:

- more poster judges to avoid having them in pairs
- a better judging procedure (e.g., judging only the work that the students actually did independently on the project)
- more diversity in judges’ backgrounds
- opportunity to tour science research labs at the university

Suggestions from faculty for improving the Research Community:

- more directed discussions
- better, more generalizable, more current and relevant selection of examples of research on teaching and learning in sciences
- better use of time in the Learning Community meetings (hoping for a research project or grant proposal to emerge from the meetings)
- less focus on theoretical points of view and more on practical applications
- scheduling time for individual members to share their projects, struggles and accomplishments
- more structured protocol for evaluating research articles
- reading and discussing classic papers/books in STEM education in order to develop an understanding of how STEM education has evolved over time.

Suggestions for survey data collection:

- Although the Center has made a substantial progress in standardizing the types and times of data collection, differences were still pronounced with regard to the TBI survey administration (some groups were surveyed twice, some three times, and the times of data collection differed). This made the analysis of change in teacher beliefs and practices less straightforward and clear. It is therefore important to define more clearly which analysis of change will be the most meaningful.

Suggestions for session evaluation data collection:

- The Center needs to further determine what comparisons across activities/programs/events are of importance and ensure that the session evaluations data are collected and entered with clear identification of the participant affiliation.
- It is also important to define more clearly what is meant by NWO professional development activities (e.g., whether this includes only those activities/events that are attended by all participants or program-specific activities as well or both). The data collected this year did not always allow for a clear identification and separation of the responses.

Suggestions for data collection instruments:

- The number of questions in the teacher and faculty interview protocols as well as in the classroom and session observation protocols can be reduced to increase the efficiency of the data collection, entry and analysis.
- For the same reasons as well as to increase the consistency of ratings, the nature of some questions should be changed to better fit the evaluation/research questions that are of interest to the Center.

Back to top

References

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Back to top

Appendix A

Higher Education Faculty E-Mail Interview Protocol

Contact 1 questions:

1. How many years have you taught at the university level?
2. Have you had any teaching experience other than at the university level? If so, where and for how long?
3. What subjects do you teach now?

Contact 2 questions:

4. You have been involved in NWO/COSMOS activities administered by Bowling Green State University and the University of Toledo. What made you decide to become involved with the NWO/COSMOS?
5. In which NWO/COSMOS activities have you participated since becoming involved in the project?
6. Can you estimate your total number of hours/days of involvement in both summer and academic year activities.

Contact 3 questions:

7. What specific characteristics of the NWO/COSMOS have been most helpful to you as a faculty member?

Contact 4 questions:

8. What aspects of the NWO/COSMOS have been least helpful? Why?

Contact 5 questions:

9. How well do NWO/COSMOS activities dove-tail with other teacher education initiatives?

Contact 6 questions:

10. What additional activities do you think the NWO/COSMOS should provide to help you to improve your teaching?

Contact 7 questions:

11. With which other NWO/COSMOS partners/members have you interacted in activities sponsored by NWO/COSMOS?
12. Can you briefly describe the nature of the activities in which interaction took place and the perceived quality of the interaction.

Contact 8 questions:

13. What factors do you believe influence the continuance of current K-12 teachers in teaching as a career?

Contact 9 questions:

14. What are your impressions of the quality of mathematics and science teachers being prepared by BGSU and/or UT? What is their content and pedagogy preparedness?

Contact 10 questions:

15. What impact do you think NWO/COSMOS activities have been having on K-12 teachers and pre-service teachers generally?

Contact 11 questions:

16. What do you think the NWO Center should do to help retain science and mathematics teachers?

Contact 12 questions:

17. Do you have any other comments you would like to share?

Back to top