Michelle Shafer, MEd
Co-Assistant Director, COSMOS
Bowling Green State University
Bowling Green, OH

Julie Nurnberger-Haag, MEd
Co-Assistant Director, COSMOS
Bowling Green State University
Bowling Green, OH

Jodi Haney, PhD
Director, NWO
Director, COSMOS
Bowling Green State University
Bowling Green, OH

www.nwocenter.org
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R. Executive Board Minutes  
S. NWO Executive Board Bylaws  
T. COSMOS Collaborative Council Minutes  
U. NWO Evaluation Report MetriKs Amérique
**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 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.

<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Presenter – Title of Presentation</th>
<th>Discussant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. August 31</td>
<td>N/A</td>
<td><strong>Thurs:</strong> Jodi Haney</td>
</tr>
<tr>
<td>2. September 13 / 14</td>
<td>N/A</td>
<td><strong>Wed &amp; Thurs:</strong> Mandy Heddle</td>
</tr>
</tbody>
</table>
| 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                                             |
|                    |                                                                                                   | **Thurs:** Eileen Underwood                                             |
| 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                                                |
<p>|                    |                                                                                                   | <strong>Thurs:</strong> Karen Sirum                                                 |</p>
<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Presenter – Title of Presentation</th>
<th>Discussant</th>
</tr>
</thead>
</table>
### Research in Science and Mathematics Education Learning Community ~ Spring 2007 Schedule

**Mondays 1:30-3:00 ~ Thursdays 12:30-3:00**

<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Presenter – Title of Presentation</th>
<th>Discussant</th>
</tr>
</thead>
</table>
| 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  
**Thurs:** Steve Langendorfer  
| 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  
**Thurs:** Yu Zhou  
| 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  
**Thurs:** Bob Midden  
| 5. Mar 19/22 | **Mon:** Dale Klopf er  
*Spatial Ability and Success in Math and Science*  
**Thurs:** Jodi Haney  
*Developmental Sequencing of Teacher Beliefs* | **Mon:** Dale Klopf er  
**Thurs:** Jodi Haney  
<table>
<thead>
<tr>
<th>Meeting Date</th>
<th>Presenter – Title of Presentation</th>
<th>Discussant</th>
</tr>
</thead>
</table>
| 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  
**Thurs:** Articles from Cutler’s Journal  
| 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  
**Thurs:** Matt Partin  

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.

**NWO Faculty Participants**

```
<table>
<thead>
<tr>
<th>Institution</th>
<th>Education</th>
<th>Arts and Sciences</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGSU</td>
<td>20</td>
<td>9</td>
</tr>
<tr>
<td>UT</td>
<td>16</td>
<td>3</td>
</tr>
<tr>
<td>OCC</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>UF</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>LC</td>
<td>4</td>
<td></td>
</tr>
</tbody>
</table>
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*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:

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

### College of Education faculty include:

<table>
<thead>
<tr>
<th>Faculty Name</th>
<th>Department/Program</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haney</td>
<td>BGSU - School of Teaching and Learning and The Center for Environmental Programs, Science and Environmental Education (Joint Appointment).</td>
</tr>
<tr>
<td>Ballone-Duran, Huziak-Clark, Worch</td>
<td>BGSU - School of Teaching and Learning, Science Education</td>
</tr>
<tr>
<td>Brahier, Emerine, Gallagher</td>
<td>BGSU - School of Teaching and Learning, Mathematics Education</td>
</tr>
<tr>
<td>Mertler</td>
<td>BGSU - School of Leadership and Policy Studies</td>
</tr>
<tr>
<td>Scheuermann</td>
<td>BGSU - School of Intervention Services</td>
</tr>
<tr>
<td>Macintosh</td>
<td>UF - AYA and Multi-Age Program Director</td>
</tr>
<tr>
<td>Pindiprolu</td>
<td>UT - College of Education, Dept of Early Childhood, Physical and Special Education</td>
</tr>
<tr>
<td>Beltyukova, Fox</td>
<td>UT - College of Education, Dept of Research and Measurement</td>
</tr>
</tbody>
</table>
**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 Hedle, 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 Huzia-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 through 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:

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

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<tr>
<td>Conference travel, registration, mileage</td>
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<tr>
<td>MAT tuition waivers</td>
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<tr>
<td>Other</td>
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<tr>
<td>UT subcontract**</td>
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<tr>
<td>Owens subcontract</td>
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<td>Indirect costs</td>
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<tr>
<td><strong>TOTAL</strong></td>
<td>$211,311</td>
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**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.

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<td>Conference travel, registration, mileage</td>
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<td><strong>Total direct costs</strong></td>
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</tr>
<tr>
<td>Indirect costs</td>
<td>$12,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>$211,311</strong></td>
</tr>
</tbody>
</table>
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**

<table>
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<tr>
<th>Category</th>
<th>Count</th>
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<tbody>
<tr>
<td>Administrators</td>
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<tr>
<td>COSMOS Staff</td>
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<td>K-12 Teachers</td>
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<td>BGSU faculty</td>
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<td>Community Partners</td>
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<td>ESC staff</td>
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**Collaborating District/ESC Info.**

<table>
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</thead>
<tbody>
<tr>
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<tr>
<td>Suburban</td>
<td>10</td>
</tr>
<tr>
<td>RURAL</td>
<td>4</td>
</tr>
</tbody>
</table>

**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 a 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. BG SU 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, SciMaTEChad 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.

FY 2007 Sponsored Funding of NWO/COSMOS Activities

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 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
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 through 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.
Appendix A: Regional Grants to Partners Program cont.

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?
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: _______
Appendix A: Regional Grants to Partners Program cont.

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)
Appendix A: Regional Grants to Partners Program cont.

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)
Appendix A: Regional Grants to Partners Program cont.

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

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 K-12 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 2006 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 NWOS 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

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.

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

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, artists, poets, and many other specialized polar support staff, perhaps 15,000 people in total, will work together to achieve the goals of understanding the 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 programs, and introduce the wide array of education and outreach events including films, television series, music CDs, exhibitions, and regular broadcast coverage. He will describe how educational institutions and groups can develop local projects, and how individuals can join or conduct local IPY events, can develop and evaluate new polar science education programs, and can share and assess new engagement strategies that could have an enormous impact on public perception of science and 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 Texas, Ocean, UT (1981). He served as an NRC Post-Doctorate Research Associates at the National Oceanic and Atmospheric Administration in Washington, DC.

He served as a research faculty member in the College of Oceanography at Oregon State University from 1983 through 1985. While at OSU, he led research and education programs in the areas of marine chemistry, small-scale ocean physics and biology, 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. 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, broad band and particle detection, signal processing, computerized man-in-the-loop data assimilation and visualization. Dr. Carlson led the planning, proposal, and acquisition process for an international atmospheric observatory. He also managed the initial project. Under Dr. Carlson's leadership, ATD also stimulated an innovative summer undergraduate engineering internship program.

During 2004, Dr. Carlson took a sabatical year with the Climate and Global Dynamics Division at NCAR, working on issues related to the joint monitoring of the ozone layer and stratospheric chemistry.

In 2005, Dr. Carlson served as Executive Director of the International Programme Office for the International Polar Year. The IPY is 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.

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

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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

Conference at a glance – Fri.

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

Table: Conference Agenda

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<th>Title</th>
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<td>A-1</td>
<td>STC/MSTM: Human Body Systems</td>
<td>40</td>
<td>Sally DeRoo, Carolina Biological Supply Company</td>
<td>Ballroom 1</td>
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<td>A-2</td>
<td>Zoos: Menageries and Math</td>
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<td>Linda Calcamuggio, Toledo Zoo</td>
<td>Ballroom 2</td>
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<tr>
<td>A-3</td>
<td>Tales From the Whale</td>
<td></td>
<td>Marcia Kaplan, Whale of a Tale</td>
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<td>A-4</td>
<td>Natural Inquirer: Inquiring into Environmental Science</td>
<td></td>
<td>Don Howlett, USDA Forest Service</td>
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<td>A-5</td>
<td>Professors Analyzing Their Teaching</td>
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<td>George Shirk, The University of Toledo, Janet Struble, Alison Spongberg,</td>
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<td>Vernon Brown, The University of Toledo</td>
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<td>A-6</td>
<td>Science, Mathematics and the Toledo Museum of Art</td>
<td></td>
<td>Carolyn Rozko, Toledo Museum of Art</td>
<td>Parlor A</td>
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<td>A-7</td>
<td>OhioView SATELLITES: Student, Teachers, Scientists using Geospatial</td>
<td></td>
<td>Kevin Czajkowski, The University of Toledo, Kevin Calabrese, Kent State</td>
<td>Parlor B</td>
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<td></td>
<td>Technology</td>
<td></td>
<td>University, Kent State University</td>
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<tr>
<td>A-8</td>
<td>Track Tales: Becoming a Nature Detective</td>
<td></td>
<td>Elizabeth Sawyer, Bowling Green State University</td>
<td>Ballroom 1</td>
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<tr>
<td>A-9</td>
<td>Let’s Get Them Talking! Discussion in the Math Classroom</td>
<td></td>
<td>Julie Nurnberger-Haag, Bowling Green State University</td>
<td>Ballroom 2</td>
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<td>A-10</td>
<td>Physical 3-D Models of Macromolecules</td>
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<td>Jason Zellick, Owens Community College, The University of Toledo</td>
<td>Wedgewood</td>
</tr>
</tbody>
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Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.
Appendix B: 2006 Northwest Ohio Symposium on Science, Mathematics, and Technology Teaching Program cont.
Session C (3:30 pm - 4:30 pm)

C1: Changes
Join us for an interactive exploration into the 2nd grade Science and Technology for Children® until 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

C6: 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 blaming the blame on teachers and schools is misplaced.

Presented by: Ronald Gehrke, The University of Toledo
Grade Levels: Pk-12, Pre-service, College (O)
Room: Waterford

C3: Effective Use of 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 presenters 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: Courtney Nagel, Penn State University
Grade Levels: College (M)
Room: Choices

C7: BUILDING A PRESENCE (RAP) FOR SCIENCE IN OHIO
Building a Presence for Science has been launched in Ohio, and teachers who are selling become part of the effort are encouraged to come to this session. Learn how RAP has re-energized the coalition of other state bodies 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 move handouts, and examples of electronic communications (“RAPlets”) that have been sent out through the network this year. The RAP State Coordinator for Ohio will lead this session, and will provide an introduction to this exciting new electronic network, so do join us because we need YOU to make it successful.

Presented by: Mary Lighthebody, Otterbein College, NITA
Grade Levels: Pk-12, College (T)
Room: Wedgewood
SATURDAY MORNING SESSIONS

Abbreviations Used:
M: Mathematics  O: Other  E/S S: Earth/Space Science  PS: Physical Science
L: 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 Emmerle, Bowling Green State University
Grade Levels: PK-12 (M)
Room: Ballroom 1

**D2: O/E’s of Assessment**
Are you concerned about your student’s passing state proficiency and the OST? Come find out how effective assessment techniques throughout the year can lead your student to success in high stakes tests. Handouts will be provided.

**Presented by**: Mark Singer, The University of Toledo
Grade Levels: PK-12 (Pd)
Room: Ballroom 2

**D3:渌our Function and What It, the Instructor, Learned in Calculus Class**
If I found that the student’s inability to do a task I thought was a straightforward 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 Hedges, Bowling Green State University
Grade Levels: College (T)
Room: Ballroom 3

D4: Modeling 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-15 (P)
Room: Stratford

D5: Successfully Teaching Mathematics in Predominantly African–American Classrooms
The achievement gap on the Ohio Graduation Test and the Ohio Achievement Test 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 Linwood Academy for Boys, one of the nations first boys elementary schools, and other schools in Toledo and other urban areas. Come, participate, and bring ideas that other schools in Toledo and other urban areas. Come, participate, and bring ideas that

**Presented by**: William Therien, The University of Toledo
Grade Levels: PK-12 in Rm. 1545, 1547
Room: Waterloo

D6: Spatial Visualization for Younger Students: How Cool!
Spatial visualization activities connecting the Content and Process Standards to the student’s world! Activities that can be adapted to any early childhood classroom and used immediately!

**Presented by**: Janet Emmerle, Bowling Green State University
Grade Levels: PK-3 (M)
Room: Ballroom 1

**D7: 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 measures are devoted to the program. There have been many recent advances in the technology used to deliver these courses. I propose to give the participants the tools they need to begin introducing these technologies in their undergraduate science courses.

**Presented by**: Craig Warner, Lourdes College
Grade Levels: College (LS, T)
Room: Quoquon

**D8: Healthy Water, Healthy People (HWHP)**
the Ohio Academic Content and Process Standards to the student’s world! Activities that can be adapted to any early childhood classroom and used immediately!

**Presented by**: Kim Cortina, Arlington Local School, COSMOS
Room: Park A

**D9: P.H.Y.S.I.C.S.: A Collaborative Experience**
(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 weaknesses areas among elementary teachers. Complete lesson plans will be shared with participants.

**Presented by**: Kim Cortina, Arlington Local School, COSMOS
Grade Levels: 4-12 (PS)
Room: Park B

**D10: Healthy Water, Healthy People (HWHP)**
Grade Levels: 4-12, College (E/S S, LS, T)
Room: Waterford

**E1: 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**: Philip Lear, American Meteorological Society
Grade Levels: 4-12 (E/S S)
Room: Ballroom 4

**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 ORU’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 lab; online short courses; and teacher-centered, standards-based curricular materials. Find out how your students can participate in aquatic sampling cruises, post-secondary opportunities, and FREE videoconferences.

**Presented by**: Lindsey Mann, Stone Laboratory Fellow
Grade Levels: 4-12, College (E/S S, LS, T)
Room: Ballroom 1

**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 at all grade levels.

**Presented by**: Christie Payne, Fairview 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 Munkel, Toledo Metroparks
Grade Levels: 4-12 (E/S S, LS, T)
Room: Ballroom 4

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

**F16**

**Oak Openings—Spread the Word and the Seeds**

Participants will become acquainted with indigenous plants and will assemble a tabletop greenhouse for which native seeds will be provided.

Presented by: Mary Ann Clevenger, Lucas County

Grade Levels: 5-12 (ILS)

Room: Strouds

**F17**

**Painting by Numbers**

We will use simple algebra techniques (linear equations, quadratic functions, graphs, and a bit of trig) to explain how images are captured, displayed, transmitted, and manipulated. These ideas are employed daily on the web in digital cameras, MP3s, 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 500 years. We will see no numbers to make simple paintings — we will become mathematical Picassos.

Presented by: Paul Heathcote, The University of Toledo

Grade Levels: 10-12 (M, L, S, T)

Room: Waterloo

**F18**

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

Building a Presence for Science has been launched in Ohio, and teachers are being encouraged to become part of the effort in order to come to this session. Learn how BaP has endeavored to isolate science teachers in other states by connecting teachers directly and electronically with each other. Learn about how you can become involved in a Print of Contact for your school and/or a Regional Coordinator 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-6 (ILS, PS, T)

Room: Wedgewood

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

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

---

**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 for both you and your students. Step-by-step instructions will be given on 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 rushes. Science Fair gives the students opportunities to engage in real science inquiry and win awards including scholarships. The presenters have over twenty 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

Mark Lynes Hooley, The University of Toledo

Joel Straddle, The University of Toledo

Grade Levels: 7-12, Pre-service (M, E/SS, L, S, PT)

Room: Ballroom 1

**G2**

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

Do you have your students’ STAAR math test in science…now what? Using the practice test items from the Ohio Department of Education will elaborate on cognitive demands to clarify the items of expected learning outcomes in conjunction with the learning cycle to guide student inquiry provided in all of the standards of the Ohio Academic Content Standards, K-12 science.

Presented by: Cathy Holmes, Ohio Department of Education

Sarah Woodford, Ohio Department of Education

Grade Levels: K-12 (K-3, L, S, PS)

Room: Ballroom 2

**G3**

**From Space**

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

Presented by: Marge Marty, NASA Glenn Research Center

Grade Levels: 6-12 (M, E/SS, L, S, PT, T)

Room: Ballroom 3

**G4**

**JASON Expedition (Limit 64)**

**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 4-12 students through an inquiry-based curriculum, video supplements and an extensive online gateway site. Expedition explore current and ongoing research aligned to National and Ohio State Standards, K-12 Science.

JASON provides an integrated curriculum science investigations, science novels and technology utilization. Participants will receive an overview of the JASON Expedition components; participate in selected hands-on activities from “Disappearing Zebras”, “Mysteries of Earth and Man” 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 Knaus, JASON in Ohio

Marilynn Ruhlstein, Toledo Lucas County Public Library

Kathy Kotowicki, Case Western Reserve University

Grade Levels: 4-12 (ILS, L, S, PS, T)

Room: Ballroom 4

**G5**

**APY in Space: Linking Content, NASA, and Students**

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 become acquainted with indigenous plants and will assemble a tabletop greenhouse for which native seeds will be provided.

Presented by: Julie Miller, Challenger Learning Center of Lucas County

Grade Levels: Pre-K (Pod, M, E/SS, L, S, PS)

Room: Choose

---

**SATURDAY AFTERNOON SESSIONS Session G (1:45 pm - 2:45 pm)**

**G1**

**Making Special (Often Hidden), Features on the TI-83/84 Grapher**

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 you think of to do a graph? 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 share the graph and its table on the same screen? When is the “solution” key in statistics? Bring your TI-83/84/85/86/83+/84+/85+/86+.

Presented by: Diane Bollensdorfer, Bluffton University

Grade Levels: 10-12, College (M, T)

Room: Parker A

**G2**

**Long Research to Improve Learning in a Junior-level University Mathematics Course: Investigating Student Understanding of Oscillations**

Diligent 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 Tutorial, a suite of inquiry-based classroom materials that supplement 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 gears, handbags, 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 the fine online resources that can be used immediately in their classroom 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-0464204, and DUE-0464204.1)

Presented by: Bradley Ambrosio, Grand Valley State University

Grade Levels: College (Pod)

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

Donations cont.

American Physical Society
One Physics Ellipse
College Park, MD 20740-3844
http://www.ap.org

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Suite 408
Washington, DC 20005
http://www.joi.org

National Park Service & National Park Foundation
P.O. Box 2007
Denton, CO 80535
Bruce North
b.north@nps.gov
http://www.nps.gov/naturescience/infrastruc.html

National Space Biomedical Research Institute
One Wayfare Place
Houston, TX 77062
Jonathan B. Decker
jdecker@nsbri.org
http://www.nsbri.org/

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2000 Marine Road, Bldg. C-1
Columbus, OH
http://www.ossm.edu/

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132 South Front Street
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b.north@nps.gov
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10 Concord Crossing, Suite 300
Coxwood, MA 02872
Carolyn Staudt
conrad@concord.org
http://www.concord.org

The Space Foundation
Coalition for Space Exploration Education
101 Energy Way
Cape Canaveral, FL 32920
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jim@spacefoundation.org
http://www.spacefoundation.org

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Toledo, OH 43606
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We wish to thank all our donors for their contributions to the success of our Symposium.

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We wish to thank all our donors for their contributions to the success of our Symposium.
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 Shuler
- Stephan Van Hook

GTCTM:
- Debra Shelt

Lourdes College:
- Don Czarinsoki
- 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

Symposium IT Coordinator:
- Dale Leady

Symposium Webmaster:
- Stephan Van Hook

Creative Design Director:
- Lisa Addis
Inquiry Series 2006-07: Investigative Mathematics and Science

CEUs available as paid graduation credit hours [30 scholarships available]!

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

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.
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 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)
**Appendix E: Redesigned/Developed Courses**

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


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


  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. (2006, October). LCM or GCF: Which one is which? 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, 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


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.
Appendix F: NWO Faculty and Staff Scholarship cont.


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.


Appendix F: NWO Faculty and Staff Scholarship cont.


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


News Articles about NWO/COSMOS and Affiliated Projects


Appendix F: NWO Faculty and Staff Scholarship cont.

Grant Submissions and Awards


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


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.


Applications of Sound Spectrum Analysis

Timothy Moran,


Application of sound spectrum analysis involves the detection of sound and vibration, and it has been extensively used in various fields, including seismology and medical imaging. The analysis is based on the Fourier transform, which converts a time-domain signal into its frequency-domain representation.

Fig. 1. Sound spectrum produced by the author spitting a long, thin sound followed by the author making a blowing noise. During both sounds the pitch was varied and then lowered.

Fig. 2. Sound spectrum produced by the author blowing at the end of tubes of two different lengths 25 cm and 25 cm. Experimentation was done by blowing in one direction perpendicular to the pipes of the tubes, followed by the author blowing in the opposite direction.

---

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

---

Fig 5 Sound amplitude vs. time showing a 22 cm diameter 0.8 cm thick glass plate with a transparency sheet and taped with wire waves at 902 Hz (data points) and 2158 Hz (red data points). The vertical axis values were obtained using a chart of amplitudes in frequency by reading the amplitude value that matched the excitation frequency.

Acknowledgments

References

Author Name

Affiliation

Introduction

Design

Methods

Participants

Procedures

Results

Discussion

Conclusion


Acknowledgments

This research was supported by the National Institute on Disability and Rehabilitation Research (NIDRR) through Grant No. H133A160012 to The National Research Council of Canada. The opinions expressed are those of the authors and do not necessarily reflect the views of the NIDRR.

References

1. Author Name. (Year). Title. Journal Name, Volume(Issue), Pages.

2. Author Name. (Year). Title. Book Publisher, City.


4. Author Name. (Year). Title. Online resource, Retrieved from URL.
Playground Physics: Determining the Moment of Inertia of a Merry-Go-Round

Stephen Van Hook, Adam Lark², Jeff Hodges, Eric Celebrezze, and Lindsey Channell³

1

A playground merry-go-round provides a great opportunity to study aspects of physics of rotational motion. This activity can be used to reinforce concepts taught in a mechanics course. The students are divided into groups of six: two individuals are assigned the role of the observer, two are assigned the role of the experimenter, and two members of the group are responsible for maintaining order and recording data.

The experimental setup consists of a standard merry-go-round with a maximum mass of 100 kg. The experimenter stands on one end of the merry-go-round, while the observer stands on the opposite end. The experimenter then begins spinning the merry-go-round while the observer records the time it takes for the merry-go-round to come to a stop. The experiments are repeated with the roles reversed, and the data are recorded for analysis.

The momentum equation is used to determine the moment of inertia of the merry-go-round. The equation is given by:

\[ I = \frac{2m \times \frac{V^2}{a}}{g} \]

where
- \( I \) is the moment of inertia
- \( m \) is the mass of the merry-go-round
- \( V \) is the velocity of the merry-go-round
- \( a \) is the acceleration of the merry-go-round
- \( g \) is the acceleration due to gravity

The mass of the merry-go-round and the acceleration due to gravity are known quantities, and the velocity and acceleration can be measured experimentally. By solving the equation for the moment of inertia, the students can determine the moment of inertia of the merry-go-round.

Fig. 1. The experimental setup for two of us standing on the outer edge of the merry-go-round while the other person sits on the inner edge and spins the merry-go-round. The observer times how long it takes for the merry-go-round to come to a stop. The mass of the merry-go-round is then used to calculate the moment of inertia.

References:

Table 1: A comparison of visual and less determined from the luminous observation and from using the confusion.

<table>
<thead>
<tr>
<th>Calculation</th>
<th>Observation</th>
<th>Less</th>
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<tbody>
<tr>
<td>Method 1</td>
<td>Method 2</td>
<td>Method 3</td>
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<td>Value 1</td>
<td>Value 2</td>
<td>Value 3</td>
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<td>Value 4</td>
<td>Value 5</td>
<td>Value 6</td>
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</table>

Fig. 1: The expected distribution of time plots for our final moving out and inflowing method run for a 35 a interval. Notice that the transition in (a) is delayed such that it is only seen by a moving centered on the MSFR, but moving lineal into quite a struggle.

Conclusion

The data and results discussed in this section are a part of the experimental study to determine the efficiency of a moving point source of light through the atmosphere, which releases the MSFR. Centering on the transition point, the experimental study is at a delay in the experimental plane to determine the efficiency of the movement through the atmosphere. This results in the measurement of the transition points per failure in the data.

- We have a good differentiation on the movement and the transition points. We have a very good correlation with the data, which confirms the previous work.
- The experimental data are very much aligned with the previous work.
- The experimental data are very much aligned with the previous work.
- The experimental data are very much aligned with the previous work.
- We have a very good differentiation on the movement and the transition points. We have a very good correlation with the data, which confirms the previous work.

36
Lesson One:

Energy Vocabulary

Energy is the ability to do work. Energy can be in many forms, such as kinetic energy (energy due to motion), potential energy (stored energy), and thermal energy (heat energy)....

Lesson Three: Setting Strategy

We need to set a clear, achievable goal and to ensure that every person involved understands what needs to be done and how it will be done. We should also have a clear understanding of the impact of our actions on the environment. This includes considering the potential effects on the local community and the broader environment.

Lesson Four: Managing Change

We need to plan for change and to prepare our people for the new reality. This includes developing a strategy for change management and ensuring that everyone understands their role in the process. We should also consider the potential impacts of change on the local community and the broader environment.

Supplementary 2007 NWO Center of Excellence • Appendix

Assessments


Connecting to the Standards

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

Content Standards

Grades K-8

- Properties of objects and materials
- Position and motion of objects
- Light, heat, electricity, and magnetism
Friday, September 15, 2006

BGSU to host ‘Education Blast-Off’ on Saturday

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

Leeworthy will speak at the Center of Excellence in Science and Mathematics Education Blast-Off, which begins with a free breakfast at 8 a.m. and ends at 12:10 p.m. in 210 Mathematical Sciences Building.

All lunches and refreshments are provided. Middle and higher education teachers may attend free of charge.

Leeworthy’s afternoon presentation will focus on what educators can do to enhance students’ learning of science and mathematics.

A lunchtime session of science and math education at the University of California, Berkeley, Leeworthy is the author of 11 books and more than 80 articles on education.

Registration is required and can be completed at http://www.bgsu.edu/education

For more details, contact Irene Pettit at 419-734-3571 or mpettit@bgsu.edu
Appendix K: COSMOS Publicity: RIPE Monitor article (2007)

BGSU

BG SU MONITOR

BG SU project to make physics elementary

BG SU has launched a project to make physics elementary.

The project involves the development of a new curriculum for elementary schools in which physics is taught in a way that is accessible to young children.

The goal is to help students develop a foundational understanding of physics concepts and to foster an interest in science at an early age.

The project team consists of educators, physicists, and educational researchers who are working together to create a curriculum that is engaging and effective.

The curriculum will be piloted in select schools in the upcoming academic year, with plans to expand to more schools in subsequent years.

BG SU hopes that this initiative will not only improve the teaching and learning of physics but also inspire future scientists and engineers.

For more information, please visit the BG SU website or contact the project team directly.

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For more information, please visit the BG SU website or contact the project team directly.
Appendix L: COSMOS Publicity: REAL Monitor article (2007)

RGSC is targeting high school students for the Regents Environmental Academy.

RGSC will offer a program focused on environmental health, with high school juniors and seniors.

The program is called the Regents Environmental Academy, which will be held at RGSC for a four-week residential program starting June 19th. The program is open to high school students who are interested in environmental science.

Students will participate in workshops and activities that focus on environmental issues such as air pollution, water quality, and soil health. Participants will also have the opportunity to work with scientists and researchers on various projects.

The program aims to provide a hands-on learning experience that will help students understand the importance of environmental science and its role in solving global challenges.

The program is free to participants, and includes free room and board. Participants will also receive a stipend of $200 for their participation.

Participants will be selected based on their interest in environmental science and their academic performance. The application process is open to all high school students, and applications are due by April 1st.

The Regents Environmental Academy is sponsored by the NWO Center of Excellence for Economic Development and Innovation, and is part of the larger effort to promote environmental education and awareness in the region.

...
Appendix M: 2006-07 COSMOS DREAMS Recruiting Brochure

Enhance your career with DREAMS Leadership options!

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

Apply online by June 1, 2007
http://cosmos.bgsu.edu/dreams

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

Those who can... lead

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).
Get REAL this summer with

BG SU
Bowling Green State University

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.
Are you an early childhood teacher who wants your students to better understand physical science? Do you want to gain a deeper understanding of the concepts and how to teach them? 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

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!

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.

What will the professional development consist of?

Summer Institute I - 2007
Date: 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 curriculum 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.

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

www.nwocenter.org

Funding provided by Ohio Department of Education

www.nwocenter.org

NWO TEAMS application

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

Name ____________________________ Team members ____________________________
School ____________________________ School ____________________________
District ____________________________ Home address ____________________________
Email ____________________________

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

1. I teach: ❑ math ❑ science ❑ both
2. I prefer vegetarian meals: ❑ Yes ❑ No
3. I’m interested in earning credit: ❑ Yes ❑ No
4. Are you currently in a degree program? ❑ Yes ❑ No
5. If so, where? ❑ UT ❑ BGSU ❑ Other

What is NWO TEAMS?
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
jnmnrbe@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.

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?

Thinking about becoming a science and/or mathematics teacher?

NWO TeachOhio can help you pave your new career path!

TeachOhio plan look like?

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

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.

Apply Online

http://www.nwocenter.org

Apply

Online

2007 NWO Center of Excellence • Appendix
Appendix Q: TeachOhio Recruiting Brochure cont.

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

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.

Those Who Can... TeachOhio plan look like?

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

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.

- This 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.

*Exceptional candidates not meeting these requirements may be considered.
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 Illuminato software, which is easy to use, for online meetings.
  ➢ Learning Sciences PHD proposal: Has been submitted and is being reviewed at university level.
Appendix R: Executive Board Minutes cont.

• 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.
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.

Page 1 of 5
Approved June 12, 2007
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 Kvar, NWO ESC
Kim Kvin, 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 NWOTEAMS 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  Gary Keller, Bowling Green City Schools
Jodi Haney, COSMOS  Joe Morgan, Eastwood Schools
Tracy Huziak-Clark, COSMOS/STL  Ralph Schade, Toledo Public Schools
Julie Nurnberger-Haag, COSMOS  Sharon Shaffer, Rossford Junior High
Michelle Shafer, COSMOS  Neil Weber, Swanton Local Schools
John Crecelius, Perrysburg Schools  Deb Wickerham, Findlay City Schools
Karen Creps, Wood County ESC  Judy Withrow, Findlay City Schools
Rose Kandik, Lucas County ESC

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. NWOTeams (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.

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
      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)
Appendix T: COSMOS Collaborative Council Minutes cont.

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

Attendance:
Jessica Belcher, COSMOS  Jennifer Kogut, Sylvania Schools
Karen Creps, Wood County ESC  Sally Kovar, NWO ESC
Mandy Heddle, COSMOS  Jane McCleary, Hancock County ESC
Scott Hoff, Putnam County ESC  Matt Partin, COSMOS/BGSU Biology
Rose Kandik, Lucas County ESC  Amy Scheuermann, COSMOS/BGSU Education
Michelle Leow Klinger, COSI Toledo  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/differentiation/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  Michelle Leow Klinger, COSI Toledo
John Crecelius, Perrysburg Schools  Jane McCleary, Hancock County ESC
Karen Creps, Wood County ESC  Julie Nurnberger-Haag, COSMOS
Mandy Heddle, COSMOS  Amy Scheuermann, COSMOS/BGSU Education
Cathy Heidelberg, Ottawa Hills Schools  Michelle Shafer, COSMOS
Treva Jeffries, Toledo Public Schools

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
Appendix T: COSMOS Collaborative Council Minutes cont.

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    Jane McCleary, Hancock County ESC  
Karen Creps, Wood County ESC  Julie Nurnberger-Haag, COSMOS  
Jodi Haney, COSMOS  Amy Scheuermann, COSMOS/BGSU Education  
Mandy Heddle, COSMOS  Michelle Shafer, COSMOS  
Rose Kandik, Lucas County ESC  Sharon Shaffer, Rossford Schools  
Jennifer Kogut, Sylvania 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.
Northwest Ohio Center of Excellence in Science and Mathematics Evaluation


July 15, 2007

Analyzed and Written by:

MetriKsAmérique

5840 Summit Street  Sylvania, Ohio  43560
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**Recommendations**

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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.

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.
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).

---

**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
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

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<th>Revised NWO Center Goals</th>
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| **Goal 1:** Enhance the preparation of pre-service and in-service teachers through 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?  
4). How have the universities responded by developing/ revising courses/programs to better prepare teachers?  
5). In what ways are participants deepening their content knowledge in their subject areas?  
6). How do participants transfer skills and knowledge received through NWO professional development into the classroom? | - TBI survey data  
- Session evaluations  
- Teacher Interviews  
- Faculty Interviews  
- PD Observations  
- # courses developed and/or modified;  
- Faculty interviews  
- # 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  
- Classroom observations  
- Teacher interviews |
### Table 1. Alignment of NWO Center Goals and Initiatives/Activities with the Evaluation Questions and Data Sources (Cont.)

<table>
<thead>
<tr>
<th>Revised NWO Center Goals</th>
<th>NWO Center Activities/Initiatives</th>
<th>Evaluation Questions</th>
<th>Evaluation Data Sources Used to Answer These Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 2:</strong> Recruit and retain students into STEM and STEM education disciplines</td>
<td>- Future Teacher Conference; - TeachOhio - OJSHS</td>
<td>1). What types and how many students have been served as a result of the NWO recruiting and retention activities?</td>
<td>- Attendance data for Future Teacher Conference, TeachOhio, and OJSHS; - Session evaluations from these events and Inquiry Series (for TeachOhio candidates) - Program documentation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NWO Center Goals</th>
<th>NWO Center Activities</th>
<th>Evaluation Questions</th>
<th>Evaluation Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 3:</strong> 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.</td>
<td>- Research Community - Educational Statistics Seminar</td>
<td>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?</td>
<td>- Attendance data - Mid-year evaluations - Faculty interviews</td>
</tr>
<tr>
<td></td>
<td></td>
<td>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?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3). How do faculty perceive the role of NWO in impacting problems associated with K-16 mathematics and science teaching and learning?</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>NWO Center Goals</th>
<th>NWO Center Activities</th>
<th>Evaluation Questions</th>
<th>Evaluation Data Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal 4:</strong> 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.</td>
<td>- COSMOS Collaborative Council (CCC) - NWO Executive Board</td>
<td>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?</td>
<td>- Attendance and minutes from the CCC council; - Attendance and minutes from the 2 NWO Executive Board meetings - Faculty Interviews</td>
</tr>
</tbody>
</table>
**Table 1. Alignment of NWO Center Goals and Initiatives/Activities with the Evaluation Questions and Data Sources (Cont.)**

<table>
<thead>
<tr>
<th>Revised NWO Center Goals</th>
<th>NWO Center Activities/Initiatives</th>
<th>Evaluation Questions</th>
<th>Evaluation Data Sources Used to Answer These Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goal 5: Increase the leadership capacity for mathematics and science education in northwest Ohio.</td>
<td>- Inquiry Series</td>
<td>1). In what ways have NWO teachers taken on leadership roles in the region?</td>
<td>- 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</td>
</tr>
</tbody>
</table>

Most of the data analyzed in this evaluation report were provided to MetriKs by the NWO Center, with the exception of the faculty interviews.

**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**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Category Served</th>
<th># Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry Series</td>
<td>In-Service, Pre-Service, Faculty, Other</td>
<td>322</td>
</tr>
<tr>
<td>NWO Symposium</td>
<td>In-Service, Pre-Service, Faculty, Other</td>
<td>325</td>
</tr>
<tr>
<td>MAT</td>
<td>In-Service</td>
<td>14</td>
</tr>
<tr>
<td>TEAMS</td>
<td>In-Service</td>
<td>136</td>
</tr>
<tr>
<td>Future Teacher Conference</td>
<td>Pre-Service</td>
<td>n/a</td>
</tr>
<tr>
<td>Praxis II Tutoring</td>
<td>Pre-Service</td>
<td>30</td>
</tr>
<tr>
<td>BG SECO/CTM</td>
<td>Pre-Service</td>
<td>190</td>
</tr>
<tr>
<td>TeachOhio</td>
<td>In-Service, Pre-Service</td>
<td>17</td>
</tr>
</tbody>
</table>
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.

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**Data Collection Instruments**

**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-

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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

<table>
<thead>
<tr>
<th>Possible Ratings</th>
<th>Description</th>
</tr>
</thead>
</table>
| **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). |
| **Level 3**      | **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

<table>
<thead>
<tr>
<th>Possible Ratings</th>
<th>Description</th>
</tr>
</thead>
</table>
| **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. |
**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.

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 Institute (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-AW and post-AW. Therefore, we used post-AW 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.

**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.
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.

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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

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre SI</th>
<th>Mean Post SI</th>
<th>Mean Post AY</th>
<th>F</th>
<th>Cohen's d (Pre SI to Post SI)</th>
<th>Cohen's d (Post SI to Post AY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OE</td>
<td>45.90</td>
<td>48.86</td>
<td>48.07</td>
<td>1.60</td>
<td>.38</td>
<td>.01</td>
</tr>
<tr>
<td>SE</td>
<td>58.72</td>
<td>62.0</td>
<td>63.41</td>
<td>3.64*</td>
<td>.36</td>
<td>.24</td>
</tr>
<tr>
<td>Total</td>
<td>104.62</td>
<td>110.86</td>
<td>111.48</td>
<td>5.60**</td>
<td>.52</td>
<td>.05</td>
</tr>
</tbody>
</table>

### Part B – Classroom Learning Environment Survey

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre SI</th>
<th>Mean Post SI</th>
<th>Mean Post AY</th>
<th>F</th>
<th>Cohen's d (Pre SI to Post SI)</th>
<th>Cohen's d (Post SI to Post AY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>31.24</td>
<td>33.55</td>
<td>32.72</td>
<td>5.40*</td>
<td>.61</td>
<td>.14</td>
</tr>
<tr>
<td>TA</td>
<td>34.24</td>
<td>39.06</td>
<td>35.86</td>
<td>26.21***</td>
<td>.93</td>
<td>.47</td>
</tr>
<tr>
<td>TR</td>
<td>25.52</td>
<td>25.31</td>
<td>24.03</td>
<td>2.70</td>
<td>.40</td>
<td>.09</td>
</tr>
<tr>
<td>IG</td>
<td>26.76</td>
<td>30.34</td>
<td>28.76</td>
<td>9.33***</td>
<td>.74</td>
<td>.28</td>
</tr>
<tr>
<td>Total</td>
<td>115.75</td>
<td>128.28</td>
<td>121.38</td>
<td>23.32***</td>
<td>.87</td>
<td>.39</td>
</tr>
</tbody>
</table>

### Part C – Instructional Practices Inventory

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre SI</th>
<th>Mean Post SI</th>
<th>Mean Post AY</th>
<th>F</th>
<th>Cohen's d (Pre SI to Post SI)</th>
<th>Cohen's d (Post SI to Post AY)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>16.33</td>
<td>18.63</td>
<td>32.36</td>
<td>41.98***</td>
<td>.39</td>
<td>2.6</td>
</tr>
<tr>
<td>RS</td>
<td>24.85</td>
<td>17.77</td>
<td>45.44</td>
<td>52.31***</td>
<td>.71</td>
<td>3.12</td>
</tr>
<tr>
<td>Total</td>
<td>39.63</td>
<td>33.41</td>
<td>77.26</td>
<td>83.34***</td>
<td>.56</td>
<td>4.26</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre</th>
<th>Mean Post</th>
<th>t</th>
<th>Cohen's d (effect size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OE</td>
<td>47.0</td>
<td>49.0</td>
<td>-.99</td>
<td>.34</td>
</tr>
<tr>
<td>SE</td>
<td>58.07</td>
<td>65.79</td>
<td>-2.79*</td>
<td>.84</td>
</tr>
<tr>
<td>Total</td>
<td>105.07</td>
<td>114.78</td>
<td>-2.33*</td>
<td>.86</td>
</tr>
</tbody>
</table>
### Part B – Classroom Learning Environment Survey

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre</th>
<th>Mean Post</th>
<th>t</th>
<th>Cohen’s d (effect size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>25.28</td>
<td>26.25</td>
<td>-.99</td>
<td>.30</td>
</tr>
<tr>
<td>TA</td>
<td>29.07</td>
<td>27.07</td>
<td>1.04</td>
<td>.38</td>
</tr>
<tr>
<td>TR</td>
<td>18.14</td>
<td>22.71</td>
<td>-2.53*</td>
<td>1.06</td>
</tr>
<tr>
<td>IG</td>
<td>26.21</td>
<td>27.28</td>
<td>-.50</td>
<td>.16</td>
</tr>
<tr>
<td>Total</td>
<td>98.7</td>
<td>103.43</td>
<td>-.89</td>
<td>.35</td>
</tr>
</tbody>
</table>

### Part C – Instructional Practices Inventory

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Pre</th>
<th>Mean Post</th>
<th>t</th>
<th>Cohen’s d (effect size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>30.07</td>
<td>30.28</td>
<td>-.16</td>
<td>.04</td>
</tr>
<tr>
<td>RS</td>
<td>37.71</td>
<td>47.64</td>
<td>-3.96**</td>
<td>1.50</td>
</tr>
<tr>
<td>Total</td>
<td>63.57</td>
<td>74.28</td>
<td>-4.09***</td>
<td>1.23</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Beginning Post</th>
<th>Mean Post Today</th>
<th>t</th>
<th>Cohen's d (effect size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OE</td>
<td>35.03</td>
<td>48.55</td>
<td>-8.29***</td>
<td>1.54</td>
</tr>
<tr>
<td>SE</td>
<td>45.27</td>
<td>61.69</td>
<td>-8.45***</td>
<td>1.46</td>
</tr>
<tr>
<td>Total</td>
<td>80.31</td>
<td>110.24</td>
<td>-10.0***</td>
<td>1.64</td>
</tr>
</tbody>
</table>

Part B – Classroom Learning Environment Survey

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Beginning Post</th>
<th>Mean Post Today</th>
<th>t</th>
<th>Cohen's d (effect size)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CE</td>
<td>21.79</td>
<td>32.04</td>
<td>-9.31***</td>
<td>1.98</td>
</tr>
<tr>
<td>TA</td>
<td>29.74</td>
<td>36.07</td>
<td>-4.54***</td>
<td>1.04</td>
</tr>
<tr>
<td>TR</td>
<td>16.61</td>
<td>22.32</td>
<td>-5.03***</td>
<td>.95</td>
</tr>
<tr>
<td>IG</td>
<td>25.81</td>
<td>29.11</td>
<td>-2.94**</td>
<td>.80</td>
</tr>
<tr>
<td>Total</td>
<td>89.03</td>
<td>113.17</td>
<td>-5.97***</td>
<td>.84</td>
</tr>
</tbody>
</table>

Part C – Instructional Practices Inventory

<table>
<thead>
<tr>
<th>Scale</th>
<th>Mean Post Today</th>
</tr>
</thead>
<tbody>
<tr>
<td>TS</td>
<td>31.00</td>
</tr>
<tr>
<td>RS</td>
<td>45.70</td>
</tr>
<tr>
<td>Total</td>
<td>76.32</td>
</tr>
</tbody>
</table>

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.

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**

<table>
<thead>
<tr>
<th>NWO Activity</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry Series</td>
<td>3.6</td>
</tr>
<tr>
<td>Praxis II Preparation Workshop</td>
<td>3.6</td>
</tr>
<tr>
<td>NWO Symposium</td>
<td>3.5</td>
</tr>
</tbody>
</table>

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 really 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.

**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

<table>
<thead>
<tr>
<th>Session</th>
<th>Design</th>
<th>Implementation</th>
<th>Content</th>
<th>Culture</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sept</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>October</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
<td>Low 3</td>
</tr>
<tr>
<td>November</td>
<td>solid 3</td>
<td>Low 3</td>
<td>Low 3</td>
<td>2</td>
<td>Low 3</td>
</tr>
<tr>
<td>December</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>January</td>
<td>4</td>
<td>High 3</td>
<td>4</td>
<td>High 3</td>
<td>High 3</td>
</tr>
<tr>
<td>February</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>March</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>April 1</td>
<td>5</td>
<td>3</td>
<td>n/a</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>April 2</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>High 3</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>4.25</td>
<td>3.75</td>
<td>4.14</td>
<td>4.13</td>
<td>3.7</td>
</tr>
</tbody>
</table>
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.

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.

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.

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).

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**

<table>
<thead>
<tr>
<th>Major</th>
<th># of MAT students</th>
<th>Courses Taken</th>
<th>Course Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics</td>
<td>5</td>
<td>PHYS 651 - Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>6</td>
<td>PHYS 652 - Electromagnetism</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>6</td>
<td>PHYS 653 - Waves and Light</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>PHYS 684 - Rdng Res Physics Educ</td>
<td>1</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>EDTL 612 - Classroom Tech for Teachers</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>2</td>
<td>EDTL 645 - Prob. Tch HS Science</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>EDTL 680 - Cross Sch Curric Bldg</td>
<td>2</td>
</tr>
<tr>
<td>Physics</td>
<td>13</td>
<td>PHYS 661 - Labs/Demonstrations PHYS</td>
<td>1</td>
</tr>
<tr>
<td>Physics</td>
<td>6</td>
<td>PHYS 691 - Directed Research Physics</td>
<td>3</td>
</tr>
<tr>
<td>Physics</td>
<td>1</td>
<td>PHYS 691 - Directed Research Physics</td>
<td>2</td>
</tr>
<tr>
<td>Physics</td>
<td>5</td>
<td>EDTL 680 - Invest Math/Sci Education</td>
<td>2</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>MATH 670 - FTC/Student Understanding</td>
<td>1</td>
</tr>
<tr>
<td>Math</td>
<td>3</td>
<td>EDTL 680 Trends/Resources Math Teach</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>4</td>
<td>MATH 682 - Adv Mathematical Thinking</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>EDFI 641 - Statistics in Education</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>MATH 501 - Number Theory</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>MATH 670 - Rdgs Geometry thru Grades</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>MATH 670 - Rdgs Visual Appr Calculus</td>
<td>3</td>
</tr>
<tr>
<td>Math</td>
<td>1</td>
<td>MATH 670 - Issues with FTC</td>
<td>1</td>
</tr>
<tr>
<td>Math</td>
<td>2</td>
<td>MATH 603 - Algebra HS Math Teachers</td>
<td>3</td>
</tr>
<tr>
<td>Biology</td>
<td>2</td>
<td>BIO 540: Conservation Biology</td>
<td>3</td>
</tr>
<tr>
<td>Biology</td>
<td>1</td>
<td>BIO 641: Behavioral Ecology</td>
<td>3</td>
</tr>
<tr>
<td>Biology</td>
<td>1</td>
<td>BIO 549: Epidemiology</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**Total Physics**  47  106
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

<table>
<thead>
<tr>
<th>Science</th>
<th>TEAMS</th>
<th>Comparison*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>High Score</td>
</tr>
<tr>
<td>Design</td>
<td>3.5</td>
<td>5</td>
</tr>
<tr>
<td>Implementation</td>
<td>3.75</td>
<td>5</td>
</tr>
<tr>
<td>Content</td>
<td>3.75</td>
<td>5</td>
</tr>
<tr>
<td>Classroom Culture</td>
<td>3.75</td>
<td>5</td>
</tr>
<tr>
<td>Overall</td>
<td>3.6</td>
<td>5</td>
</tr>
</tbody>
</table>

NOTE. * denotes only one classroom observation for the category at this time.

Table 12. Average and Range of TEAMS Mathematics Ratings

<table>
<thead>
<tr>
<th>Mathematics</th>
<th>TEAMS</th>
<th>Comparison*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>High Score</td>
</tr>
<tr>
<td>Design</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Implementation</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Content</td>
<td>3.0</td>
<td>High 3</td>
</tr>
<tr>
<td>Classroom Culture</td>
<td>3.5</td>
<td>4</td>
</tr>
<tr>
<td>Overall</td>
<td>3.5</td>
<td>4</td>
</tr>
</tbody>
</table>

NOTE. * denotes only one classroom observation for the category at this time.

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.*

**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 their 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.*

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**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

<table>
<thead>
<tr>
<th>Teach Ohio</th>
<th>Pre Observation</th>
<th>Post Observation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean High Score</td>
<td>Low Score</td>
</tr>
<tr>
<td>Design</td>
<td>3.7 5 2</td>
<td></td>
</tr>
<tr>
<td>Implementation</td>
<td>3.5 5 2</td>
<td></td>
</tr>
<tr>
<td>Content</td>
<td>3.4 5 2</td>
<td></td>
</tr>
<tr>
<td>Classroom Culture</td>
<td>3.7 5 3</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>3.4 High 4 2</td>
<td></td>
</tr>
</tbody>
</table>

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.
Table 14. Average and Range of NWO Other Participant Science Ratings

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<th></th>
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<td>Low Score</td>
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<td>Low 3</td>
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Table 15. Average and Range of NWO Other Participant Math Ratings

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<th></th>
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<td>N/A</td>
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<td>Content</td>
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<tr>
<td>Overall</td>
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<td>High 3</td>
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</tr>
</tbody>
</table>

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.

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.

*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.*

**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); 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

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<th></th>
<th>TEAMS</th>
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<th>Teach Ohio</th>
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NOTE. * denotes only **one** classroom observation for the category at this time.
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.

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

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**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.

Breavity 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
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.
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. Of 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

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td># Participants</td>
<td>33</td>
<td>28</td>
</tr>
<tr>
<td># Meetings</td>
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<td>29</td>
</tr>
<tr>
<td>Average # Meetings Attended by a Participant</td>
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<td>5-6</td>
</tr>
<tr>
<td>Average # Participants per Meeting</td>
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<td>11-12</td>
</tr>
<tr>
<td># Presentations</td>
<td>19</td>
<td>26</td>
</tr>
<tr>
<td># Publications</td>
<td>n/a</td>
<td>6</td>
</tr>
<tr>
<td># Submitted Grants</td>
<td>n/a</td>
<td>2</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Mean Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Usefulness 4.75</td>
</tr>
<tr>
<td>Usefulness for Teaching and Learning 4.55</td>
</tr>
<tr>
<td>Usefulness for Research 4.45</td>
</tr>
<tr>
<td>Usefulness for Establishing Collaboration 4.50</td>
</tr>
<tr>
<td>Usefulness for Developing Professional Knowledge of Research in Science and Math Education 4.65</td>
</tr>
<tr>
<td>Learning Something New and Practical 4.20</td>
</tr>
<tr>
<td>Having a True Sense of Community 4.40</td>
</tr>
<tr>
<td>Well Organized 4.65</td>
</tr>
</tbody>
</table>

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.
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.

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 development 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.

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.

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.
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); 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.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Category Served</th>
<th># Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inquiry Series</td>
<td>In-Service, Pre-Service, Faculty, Other</td>
<td>322</td>
</tr>
<tr>
<td>NWO Symposium</td>
<td>In-Service, Pre-Service, Faculty, Other</td>
<td>325</td>
</tr>
<tr>
<td>MAT</td>
<td>In-Service</td>
<td>14</td>
</tr>
<tr>
<td>TEAMS</td>
<td>In-Service</td>
<td>136</td>
</tr>
<tr>
<td>Future Teacher Conference</td>
<td>Pre-Service</td>
<td>n/a</td>
</tr>
<tr>
<td>Praxis II Tutoring</td>
<td>Pre-Service</td>
<td>30</td>
</tr>
<tr>
<td>BG SECO/CTM</td>
<td>Pre-Service</td>
<td>190</td>
</tr>
<tr>
<td>TeachOhio</td>
<td>In-Service, Pre-Service</td>
<td>17</td>
</tr>
<tr>
<td>PRISM</td>
<td>In-Service, Faculty, Other</td>
<td>21</td>
</tr>
<tr>
<td>OJSHS</td>
<td>HS students</td>
<td>50</td>
</tr>
<tr>
<td>REAL</td>
<td>HS students</td>
<td>54</td>
</tr>
<tr>
<td>Research Community</td>
<td>Faculty</td>
<td>28</td>
</tr>
<tr>
<td>Course Modification</td>
<td>Faculty</td>
<td>4</td>
</tr>
<tr>
<td>COSMOS Collaborative Council (CCC)</td>
<td></td>
<td>31</td>
</tr>
<tr>
<td>NWO Executive Board</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

**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. Of 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.
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.

References


Science Attitudes, Skills, and Knowledge Survey (SASKS). Arizona Collaborative for Excellence in the Preparation of Teachers Supported by the National Science Foundation under Grant DUE-0084434 September, 2000.
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 dovetail 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?