

Science Education Standards-Based Course Design

Final Report

CINSAM 2000-15

Yvonne J. Meichtry
Project Director
School of Education

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Introduction

The purpose of this project was to update and enrich the inventory of science education resources currently available to teach standards-based inservice teacher science education courses through the School of Education. This report describes the project accomplishments in regard to the ordering and acquiring of resources and the subsequent use of these resources in course design and instruction. New initiatives that resulted from the project activities are presented, followed by a summary of future plans to maintain and extend the work of this project.

Project Accomplishments

This section of the report is a summary of the resources ordered and acquired during the time period between December 1999 and June 2000. The courses impacted by the project activities are listed and the use of the resources by course instructors and students is described.

Ordering and Acquisition of Resources

To better address national and state science education standards, resources were acquired in the areas of curriculum, inquiry-based laboratory instruction, and technology. Decisions made in regard to which resources to order were based on a review of the following standards:

- The *Standards for Science Teacher Preparation* (NSTA, 1998) which serve as criteria for the accreditation of teacher education programs by the National Council for Accreditation of Teacher Education (NCATE);
- The *National Science Education Standards* (National Academy Press, (1996);
- *Benchmarks for Science Literacy* (AAAS, 1993);
- Kentucky Department of Education *Program of Studies, Core Content for Assessment, and Transformations: Kentucky's Curriculum Framework*.

A listing of all resources that were ordered and acquired is presented in Appendix A. An accounting record of project expenses, totaling \$19068.34, is found in Appendix B.

Inventory and Storage System of Resources

An inventory system was developed that categorized resources as follows (See Appendix A):

- National Standards Publications and Resources
- Instructor Resources
- Reform-Based Curriculum Programs and Activity Books

- Elementary
- Elementary-Middle Grades
- Middle Grades
- High School
- K-12
- Lab Equipment
- Hands-On Instructional Resources
- General Instructional Resources
- Technology
 - Labware and Guides
 - Software
 - Computer Application Programs
 - Teaching Station for BEP 164
 - Video Recorder Equipment
- Miscellaneous Purchased Locally

A database has also been developed using Microsoft Excel (See Appendix C). It is intended that faculty and students will be able to search the database for a listing and description of resources available. The database will be accessible through the teaching station computer in BEP 164 and hopefully through the Science Education website.

The inventory categories are being used to develop a storage system that will allow the resources to be easily accessible to instructors and students. Due to limited space in the BEP science education facility, this storage system is being established on a temporary basis in BEP 158, 162 and 164.

Resource Use in Course Design and Instruction

The newly acquired resources has made it possible to design courses that incorporate national and state science and technology standards to a much greater extent than was previously possible. A brief description of how the resources were used by instructors and students in science and environmental education courses taught during the spring and summer is presented in Table 1. The courses identified with each course prefix are as follows:

- EDU 640 Teaching Elementary School Science
- EDU 646 Teaching Environmental Education
- EDU 308 Teaching Science in the Elementary Grades

Table 1: Course Use of New Resources

| New Resource | Courses | Instructor Use | Student Use |
|--|-----------------------------------|--|--|
| Standards Documents: Benchmarks National Standards | EDU 640 | Teaching & course assignments | Readings and application to course activities & assignments |
| Curriculum Programs BSCS EL Curriculum FOSS Nutshell KY ACES Program AIMS GEMS TOPS All K-12 Activity Books | EDU 640, EDU 646, & EDU 308 | Designed course activity to review programs; Modeling of teaching the activities | Review using standards-based criteria; Review for potential use in school adoptions |
| Lab Equipment Beakers | EDU 640 & EDU 308 | Design & use of hands-on activities | Hands-on activities |
| Hands-On Resources Rock sets Tuning forks | EDU 640 & EDU 308 | Design & use of hands-on activities | Hands-on activities |
| Software DK Science Bundle Science Court Science Sleuths Laserdiscs | EDU 640 & EDU 308 | Demonstrated use; Course assignment to review, using standards-based science & technology criteria | Review for purposes of software evaluation assignment and potential use in classroom teaching |
| Teaching Station | EDU 640, EDU 646, & EDU 308 | PowerPoint presentations; Software demonstrations; Laserdisc demonstration; Spreadsheet demo; Teach WWW application; Show instructional videotapes; Demo Video Flex Camera | Powerpt presentations; Software reviews; Laserdisc practice; WWW Access; Show videotapes of elementary students; Practice Video Flex Camera use |
| Video Recorder | EDU 646 & EDU 308 | Videotape field trips, school-based activities, & peer teaching | Videotape school-based activities & class peer teaching |
| Instructor Resource Environmental Grants CD | EDU 646 | Demonstrate CD use for identifying funding sources | Option for final project assignment; Review for school use |

| | | | |
|--|---------|-----------------------------|---------------------|
| Labware CBLs & Graphing Calculators | EDU 646 | Design lesson; Teach use | Hands-on activities |
|--|---------|-----------------------------|---------------------|

New Initiatives Engendered by the Project

As a result of implementing the project activities, several initiatives evolved as means to further improve science education courses offered through the School of Education. These initiatives included engaging in professional development opportunities related to technology training, the development of a proposal for a new graduate student option in mathematics and science education, the development of an NKU Science Education website and brochure, and a formal request to relocate the BEP science education facility to the Natural Sciences Center when the new science building is complete or to another more adequate space on campus.

Technology Training

As a result of acquiring new and upgraded technology resources, the need for technology training arose. This training was obtained through a number of sources. One of these sources was a technology grant received by the School of Education at NKU. During the 1999/2000 fiscal year, the School of Education received a one-year Capacity Building Grant, called *Preparing New Teachers for Technology-Rich School Environment*, which was funded by the U.S. Department of Education's (DOE) "Preparing Tomorrow's Teachers to Use Technology" (PT3) initiative. Training to incorporate the use of CBLs and graphing calculator technology was provided by Dr. Vern Hicks of the Chemistry Department at NKU and by Dan Sheffield, who were hired as Project Assistants through funds received by the U.S. DOE Grant.

Dr. Hicks provided training in the use of computer programs available to enhance the full capability, and thus learning potential, of the graphing calculator and CBL technology. He also trained faculty in the use of CBL probeware and provided a wealth of information related to curriculum resources and accessibility of information through a variety of websites. Dan provided assistance in setting up and teaching a CBL and graphing calculator lab for EDU 646 *Teaching Environmental Education* during the summer session, 2000.

Training was also obtained as a result of working as a member of the DOE Technology Capacity-Building Team led by Dr. Valeria Amburgey, Project Director of the DOE Technology Grant. As a member of this team, a small group of School of Education faculty met during the Summer 2000 to receive training in areas of technology identified as priority needs by the group. The faculty met throughout the summer, devoting time equivalent to teaching a 3 credit hour

course, to develop skills related to identified areas of need. This opportunity provided additional time to pursue the development of skills related to CBL and graphing calculator technology and planning the use of such technology in science education courses. Other technology skills developed as a result of this training initiative were related to web-enhanced instruction and the use of digital photography as an instructional tool. All of these training opportunities helped to refine skills and knowledge related to using the new resources acquired as a result of this project.

Proposed Graduate Option in Mathematics and Science Education

The primary focus of this grant project was to develop more standards-based graduate science education courses. One such course, *Teaching Elementary Science* (EDU 640) was offered during the spring semester 1999/2000. In addition to training teachers in the use of standards-based curricula, it was intended that the course would serve as a vehicle to begin an ongoing network of science teachers for purposes of collaboration and to recruit supervisors for preservice teacher field experiences.

Although there is an enrollment capacity of 25 students, only 3 teachers registered for the course. This is an elective course for teachers admitted to the Masters degree and Rank 1 Teacher Certification programs. The low number of teachers who enrolled in this course was a great concern to faculty. In an effort to build the graduate science education program at NKU, faculty have plans to offer the several elective courses on a continuing basis. The courses *Teaching Environmental Education* (EDU 646) & *Topics Teaching and Learning K-12 Science* (EDU 693) were planned for summer session 2000. While EDU 646 was offered, EDU 693 was cancelled due to low enrollment. Another course, *Topics: Teaching Science in the Middle Grades* (EDU 693) offered for fall semester 2000, has also been cancelled.

Concern about the low enrollment in science education graduate courses prompted action to pursue options to recruit more teachers. One action taken was the development of a proposal to add a graduate program option to specialize in mathematics and science education (See Appendix D). The rationale for this proposal was based on the premises that the more options we offer teachers, the better we can meet their needs and that a graduate program option in mathematics and science education more closely aligns teacher education graduate programs with the goals of CINSAM.

The proposal was developed during the spring semester with input from faculty members representing each of the Science Departments, the Mathematics Department, and the Science and Mathematics Education program areas. Faculty in each of the three Program Units in the School of Education have voted unanimously to approve the proposal. During the fall semester, 2000 the proposal will be considered by vote by the School of Education faculty and the Teacher Education Committee. It is anticipated that the proposal will be approved by all voting bodies during the fall semester and become effective January, 2001.

Enrollment Enhancement Grant Initiatives

As another means to help recruit teachers and to better serve their science education needs, a grant proposal was developed and submitted to the Enrollment Planning Group at NKU in January, 2000. (See Appendix E). These funds were made available by the President's Executive Group to support initiatives designed to spur enrollment growth for the 2000/2001 academic year. The grant, *Recruitment of Science Education Inservice Teachers*, was funded in the amount of \$1,462.00.

The activities of this grant are to develop and maintain a Science Education website and to design and disseminate a brochure which describes Science Education programs and courses offered through the School of Education. The website was developed during the spring semester. Brandon Foltz was hired as Webmaster through funding provided by the grant. Brandon graduated from NKU in December, 1999 and is currently a middle school science teacher at Highlands Middle School in the Ft. Thomas School District.

The website can be accessed at the URL www.nku.edu/~scienceed or can be accessed through the Science Education hyperlink from the School of Education homepage. The website is continually being enhanced. Additional funds were provided through the DOE Technology Capacity-Building Grant to support Brandon's assistance through the summer, 2000. He will also be working on the website as a part of his Masters degree program, which he will begin at NKU fall semester, 2000.

Plans to design and disseminate a brochure of science education programs at NKU will be implemented by science and mathematics education faculty upon approval of the graduate degree

option to specialize in mathematics/science education. In addition to the distribution of brochures through traditional avenues such as graduate orientation meetings and faculty advising sessions, the brochure will be disseminated through mass mailings to all schools within the NKU Service Area, through CINSAM programs, and through Mathematics and Science Alliance meetings and other professional meetings throughout the Tri-State Area.

Proposed Renovation or Relocation of Science Education Classroom Facilities

The space provided by the science education facility in BEP 164 is limiting in a number of ways. As a result of ordering the new equipment and resources to develop standards-based science education courses for teachers, these limitations became increasingly evident. There is currently insufficient space to display and use these resources in a manner conducive to learning. To effectively model how and under what conditions science should be taught, more space is needed to safely accommodate the number of students enrolled in undergraduate science education courses, display student projects, conduct research, display and store resources in an accessible manner, use a secured technology teaching station, and provide secured cabinets for equipment.

As a result of these facility concerns, formal requests have been made to relocate the BEP science education facility to the Natural Sciences Center when the new science building is complete or to another more adequate space on campus (See Appendix F). More recently, avenues have been pursued to determine the possibility of renovating the current facility.

Future Plans

Plan to continue and further develop the activities accomplished by this project include the following:

1. Develop and disseminate a brochure about new Mathematics/Science Education Graduate Program Option;
2. Complete and maintain a comprehensive database inventory of science education resources which can be accessed by teachers, undergraduate education majors, and faculty ;
3. Complete the development of a storage system that allows resources to be readily accessible to faculty and students;
4. Devise a system to loan resources to students and faculty;
5. Maintain and further expand the services provided through the NKU Science Education website (www.nku.edu/~scienceed);

6. Refine the use of new resources in the design and teaching of EDU 308, EDU 640, & EDU 646;
7. Design the following courses to incorporate the use of new resources: EDU 330 *Teaching Secondary Science*, EDU 346 *Teaching Middle Grades Science*, & EDU 693 *Special Topics in Science Education*;
8. Collaborate with science education and science faculty to plan increasingly effective ways to use the resources for course instruction and the professional development of teachers;
9. Serve as a member of Curriculum Development and Implementation Team, U.S. Department of Education Technology Grant (PT3 Initiative), School of Education, Academic Year 2000/2001;
10. Continue efforts to improve the science education instructional facilities to better accommodate the use of the newly acquired resources;
11. Document the effectiveness of the resources used in helping teachers to become better prepared to address standards through their course instruction;
12. Participate in local, state, and national meetings to share and refine knowledge about the use of standards-based science and technology resources in the educational preparation of teachers.

References

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