

THE MSEA AND STRIDE EDUCATIONAL COLLABORATION

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INTRODUCTION

With her rich soil, the Mississippi Delta is home to some of the most productive farmland in the world. Student and Teacher Research Institute – the Delta Experience (STRIDE) is a project that works in cooperation with the Mississippi Delta Management Systems Evaluation Area Project (MSEA) to involve, on a yearly basis, more than 20 Delta middle school students in environmental research in the Mississippi Delta. The project described herein offers an opportunity for ten groups of students, partnered with middle school science teachers, to connect science, engineering, technology, and agriculture while developing skills needed to prepare for future educational experiences. These research experiences enhance the teacher/student teams' knowledge in scientific methodology through participation in current MSEA projects. Such projects have been designed to study the agricultural effects on water resources and ecological processes at three Mississippi Delta oxbow lake sites.

Research experiences provide students with skills they need to compete in today's job market. Industry leaders consistently state that skills needed by their workforce include communication, creative problem solving, working in collaboration, decision-making, mathematical skills and computer skills. Involving teachers and students in research provides teachers with experiences that they subsequently transfer to the classroom and enhances students' opportunity to develop the necessary skills.

The primary objective of STRIDE is to train teachers and students of upper middle schools in the Mississippi Delta in research data collection and analysis techniques through scientific research experiences. Through their experiences, teachers understand the role of research in the classroom and enhance their scientific content knowledge. Students receive meaningful interdisciplinary research experience and learn how to design and evaluate best management

practices for improving water quality and ecology in the Mississippi Delta. Participants increase awareness of environmental and management issues relating to the Mississippi Delta rivers and lakes. STRIDE participants also increase their awareness of careers in science and engineering.

MSEA is part of a consortium of Federal, State, and local agencies involved in promoting good water practices. The MSEA/STRIDE collaboration provides an excellent opportunity for students to experience research that is important to the environment and economy of the Mississippi Delta. The collaboration also meets a primary goal of MSEA, providing education, research, and community service in issues of water and associated land-use problems, assuring that a valuable resource will be available to future generations.

The project focuses on three watersheds located in west central Mississippi in the Delta counties of Sunflower and Leflore, each utilizing a different farming management practice. The three practices are structural and cultural best management practices (BMPs), only structural practices, and no BMPs initially. The four major objectives of MSEA are: (1) to develop alternative farming systems for improved water quality and ecology in the Mississippi Delta rivers and lakes; (2) to increase knowledge of the design and evaluation of economical environmentally-sound BMPs as components of farming systems; (3) to assess the effects of agricultural activities on surface and shallow ground-water quality; and, (4) to increase awareness by farmers and landowners of alternative farming systems to reduce adverse agricultural effects on water resources and ecological processes. Teachers and students participate in research projects being conducted by scientists who are employed by the various agencies and institutions associated with the MSEA project.

This paper describes STRIDE as a cooperative effort between the Mississippi Delta Management Systems Evaluation Area project and Mississippi

State University, funded in part by the National Science Foundation. Student and teacher teams work with MSEA scientists in the field and/or laboratory on projects already in progress. These teams assist with various aspects of research including collecting, recording, and analyzing data.

MATERIALS AND METHODS

Teacher/Student Participant Recruitment and Selection

Teams consisting of one teacher and two high-potential/highly-motivated students from schools in the Mississippi Delta were selected to participate in a research experience with scientists from the MSEA project. To date, two summer workshops have been held. During the summer of 1998, ten teachers from Sunflower, Leflore and Washington counties, and twenty-two of their academically talented/motivated students, participated in the first of three summer institutes. During the 1999 summer, eight teachers from Sunflower, Leflore and Bolivar counties and twenty-two students participated. The superintendents of the identified school districts and school principals were asked to nominate a middle school science teacher and two high-potential/high-ability students from each school. Teacher nominees were to demonstrate ability in science teaching, commitment to hands-on experiences for students, and leadership qualities. Evidence of students' ability and potential included grades in science, science fair participation, aptitude/achievement tests, and/or essays on their interest in science and reasons for wanting to participate in this program. The project staff, with significant input and guidance from the school systems, selected the teacher and student participants. The schools' input was important in the selection process as they could best assess the potential for maximum benefit to the school system and the local area. School leaders committed to allowing research experiences to be implemented into the local curriculum and to allowing teachers to present inservice training to their faculty on research collection and analysis and subsequent connection to the classroom.

Participating Agencies and Other Partners

More than 16 agencies and 50 researchers contribute to make STRIDE a success. Participating research agencies, as well as participating faculty and staff from Mississippi

State University, are cited in *MSEA and STRIDE: A Cooperative Experience in Science Education* (Thibaut et al. 1999).

RESULTS

Four-Week Institutes:

During the four-week institutes held in 1998 and 1999, participants conducted research at three Mississippi Delta oxbow lakes, Deep Hollow Lake, Beasley Lake, and Thighman Lake. In addition to working at these watersheds, they also worked with scientists in the various MSEA labs associated with the three watersheds. Workshops 1998 and 1999 were conducted similarly implementing suggests from year 1 to year 2. In brief, activities of the first week of the summer programs took place in the Mississippi Delta at research sites associated with the MSEA project. During orientation sessions, all participating scientists were introduced to teacher/student teams. A discussion of the overall project and the contributions of various research components were provided. The entire group was then divided into two groups of five teams that visited laboratory and field sites of each of the scientists to learn different collection and analysis techniques. Teacher/student teams were exposed to each area of research in order for them to experience different data collection techniques and to understand the experimental design of the project and how each component fits into the overall experimental design of the MSEA project. They also gained an overall picture of the impact of the MSEA project on the local area and its economy. By the end of the first week, teams were assigned different scientists to work with during the last two weeks of STRIDE.

Week two of STRIDE was spent at Mississippi State University interfacing with scientists and engineers to increase awareness of careers in science and engineering, to learn to use technology as a tool of research, and to learn laboratory analysis techniques associated with state and university laboratories. The research focus of several on-campus laboratories deals with environmental issues. Participants were divided into four groups who rotated through labs in order to learn different research methods. Teacher/student teams worked with scientists from the Forest Products Laboratory, the Department of Agricultural and Biological Engineering, the Department of Industrial Engineering, the Diagnostic Instrumentation and

Analysis Laboratory, the College of Veterinary Medicine, and the Engineering Research Center. Presentations on conducting ethical research were made to groups by the Human Subject Regulatory Officer, Radiological Safety Officer and the Laboratory Animal Regulatory Officer. In addition, participants attended sessions designed to teach them how to use the Web and to conduct library background research, to use scientific graphing packages for data analysis, and to use e-mail and mailing lists.

For weeks 3 and 4, teacher/student teams returned to the Delta in order to work with MSEA scientists on location. The schedules differed for each group but a subset of places visited and activities performed during these two weeks are presented here. Groups went to the USDA-ARS National Sedimentation Lab or met the scientists in the field to participate in studies designed to determine shallow ground water quality in edge-of-field and within-field filter/procession systems (e.g. buffer strips, grass hedges, grassed waterways, and slotted board riser impoundments). They also learned to evaluate the ability of such systems to trap sediment and process pesticides. Teams also examined and evaluated watershed ecology and lake-water quality. They learned to evaluate the effects of riparian zones, forested wetlands and best management practices on physical/chemical stresses imposed on agricultural pollution. In addition, they investigated the impact of MSEA on fisheries characteristics and ecology on the Mississippi Delta oxbow lakes. Fisheries data collected to assess the ecological health of the lakes included growth rates, condition factors, length-frequency distributions and other stock-assessment measures. Studies in the field also included the evaluation of interacting effects of fall deep tillage, gypsum application, cover crop burn down date, and soil type on the growth and yield of cotton planted into a desiccated winter wheat cover crop without spring tillage. Students took sediment core samples and penetrometer resistance samples to test water infiltration. Teams traveled to the U.S. Geological Survey in order to process data collected in the field. Storm runoff samples were used to assess how agricultural activities affect surface-water quality and evaluate management practices that may reduce non-point source pollution. Researchers from the Yazoo Mississippi Delta Joint Water Management District (YMD) taught teachers and students the uses of GPS/GIS mapping equipment. Teams used GPS units to map fields

and surrounding areas within the different watersheds being investigated. Teams later imported this information into the GIS software and learned to manipulate map information while at the YMD. While at the Southern Weed Science Lab, teams participated in data collection and analysis involved in the determination of weed infestation levels, weed species identification, shifts in population levels over intervals and general plant communities in different cotton and soybean production systems. They were also exposed to new application technologies for more efficient methods of applying herbicides in crop production areas.

Four Saturday workshops were held throughout each following academic year. Teams met with project leaders and research scientists to update their particular project, learn of new research data, design new potential experiments, and be exposed to various forms of scientific presentation. Teachers and students discuss implementation of the research experiences in their local curriculum.

Results from STRIDE collaborations:

Student/teacher teams identified lead scientists and particular research problems associated with the scientist's research to work on during the year. Teams selected the following projects, scientists, and agencies with whom to work:

- *Amount of O₂ used by plants and animals*, Teacher Angie Abernathy, Scientist Jonathan Pote, Mississippi State University;
- *Comparison of basic water quality in an oxbow lake versus a commercial catfish pond*, Teacher Helen Beamon, Scientist Sammie Smith, USDA-Agricultural Research Service-National Sedimentation Laboratory;
- *Safe drinking water*, Teachers Teresatta Hodges and Carolyn Hood, Scientist Dean Pennington, Yazoo Mississippi Delta Joint Water Management District;
- *Which depth of sandy soil produces the most weeds*, Teacher Dorothy Lay, Scientist Charles Bryson, USDA-Agricultural Research Service-Mid South Area-Southern Weed Science Laboratory;
- *Inverness Bayou water quality testing*, Teacher Mary Brown McGee, Scientist Robert Zablutowicz, USDA-Agricultural Research Service-Mid South Area-Southern Weed Science Laboratory;

- *Best management practices on MSEA area lakes*, Teacher Betty Wagner, Scientist Scott Knight, USDA-Agricultural Research Service-National Sedimentation Laboratory;
- *Comparing water quality between Moon Lake and Deep Hollow Lake*, Teachers Sheri Bell, Catherine Climons, and Myra Coleman; Scientist Dean Pennington, Yazoo Mississippi Delta Joint Water Management District;
- *Comparing water quality between Thighman Lake and Beasley Lake*, Teacher Helen Beamon; Scientist Sammie Smith, USDA-Agricultural Research Service-National Sedimentation Laboratory;
- *Comparing abiotic factors in water in different sections of Indian Bayou*, Teacher Draughon McPherson; Scientist Robert Zablutowicz, USDA-Agricultural Research Service-Mid South Area-Southern Weed Science Laboratory;
- *Comparing water quality of Blue Lake and Deep Hollow Lake*, Teacher Ida Robinson; Scientist Richard Rebich, U.S. Geological Survey, Water Resources Division.

Scientists assisted with project plans, project design and data collection. Agency facilities were used for data analysis. Many of the students used their research projects as the basis for their science fair projects. Students were given the opportunity to present their projects at the annual spring STRIDE banquet and poster session.

Details of An Individual Project:

One example of the collaboration between teacher/student teams and MSEA scientists resulting from the STRIDE workshop through the individualized research projects was research done by Helen Beamon, science teacher at Moorhead Middle School in Moorhead, Mississippi, and her two students, Danitra Felder and Khadijah Ransom. As mentioned above, Beamon, Felder and Ransom worked with Sammie Smith, Jr., Research Chemist and MSEA Project Leader at USDA-ARS-National Sedimentation Laboratory. Their study investigated the comparison of basic water quality between two Mississippi Delta oxbow lakes, Thighman Lake and Beasley Lake. The objective of the project was twofold: to measure and evaluate basic water quality parameters in Thighman Lake and Beasley Lake; and, to compare measurements and reach conclusions about overall water quality of each water body.

Beamon and students collected water samples from Thighman and Beasley Lakes once a month from November 1999 through February 2000. Measurements including temperature, dissolved oxygen, turbidity, and pH were recorded. A compilation of the data collected by the teacher/student team is shown in Figure 1. To date, no significant differences were detected in the dissolved oxygen, temperature, or pH between water samples tested from Thighman and Beasley Lakes. Significant differences were detected, however, in the turbidity measurements of the two lakes. The turbidity of Thighman Lake was consistently lower than the turbidity of Beasley Lake. The turbidity of Thighman ranged from a low of 32 Jackson Turbidity Units (JTUs) in January to a high of 50 JTUs in February, whereas the turbidity of Beasley ranged from 78 JTUs in January to 88 JTUs in December. Data should be interpreted taking into consideration the topography of the areas and the best management practices of these two watersheds.

DISCUSSION

Evaluation of the project is an ongoing process. Focusing on the assessment of implementation and outcome objectives, the evaluation of the project is being handled by The SouthEastern Regional Vision for Education, SERVE, Inc., Greensboro, North Carolina. Specifically, SERVE is assessing the project for implementation of workshops and academic follow-up through the administration of interviews and survey instruments. Project staff and participating students and teachers have input into the evaluation process. Outcome objectives are being assessed on two levels: changes to students, from an increase awareness of science to attitudinal change to knowledge acquisition, and to teachers, from an increased awareness of environmental issues to acquisition of research and analytical skills. In addition to interviews and surveys, SERVE will also evaluate teacher notebooks of classroom lesson plans and activities impacted by their STRIDE experiences.

Feedback and preliminary data obtained from the STRIDE participants has indicated the project is achieving stated objectives. A majority of the teachers interviewed stated that their students were given a solid foundation in science to build on throughout high school, college, and career. Teachers identified improvements in skills such as critical thinking, cooperative learning, communication, and research. Teachers were

impacted in terms of having research scientists who are a resource in the sharing of knowledge, technology and equipment, and in gaining content knowledge in data collection and scientific methodology. Teaching has been impacted through an increase in use of cooperative work groups in the learning process, an increase in focus on research, an inclusion of field trips to provide opportunity for observation and hands-on activities, and science fair participation. Students indicate that they have an increase awareness of career opportunities available through the study of science and have a better understanding of the processes involved in conducting research. Students have also improved their communication skills through poster presentations at the spring 1998 STRIDE banquet. Students and teachers also have indicated an increase in the appreciation and knowledge of their local area and the agricultural practices that are environmentally friendly. They have information to build on and ultimately make better-informed decisions about agricultural and environmental activities in the Delta.

Beamon and her students presented an overview of the STRIDE project and their individual project concerning water quality comparison of a Mississippi Delta oxbow lake and a commercial catfish pond at the Mississippi Water Resources Conference in Jackson on April 1999 and 2000. Beamon and students presented the same paper at the spring STRIDE banquet and to the

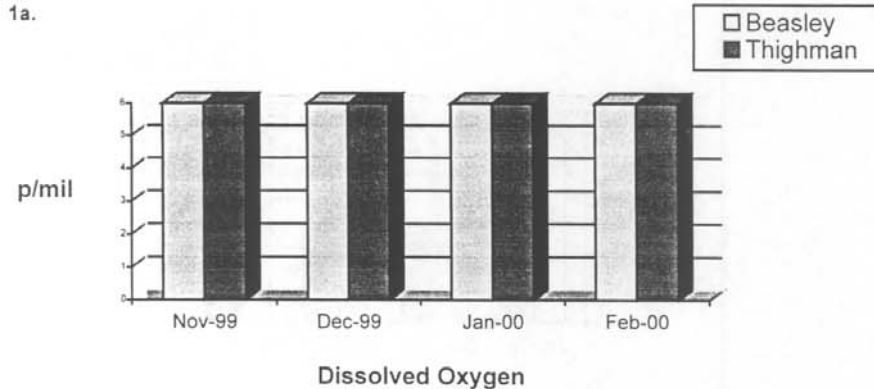
Sunflower County District School Board. The Board recognized the team's accomplishments by presenting them a certificate of achievement for their work with STRIDE.

The commitment to educational outreach by the agencies involved with the MSEA project indicates the likelihood of continued support of a successful model upon the completion of this project. STRIDE is providing the model for the Environmental Education Program at Noxubee/Starkville Conservation Education Center, developed at the Noxubee National Wildlife Refuge through a cooperative effort of Starkville Public Schools, the U.S. Fish and Wildlife Service, the Noxubee Refuge and Mississippi State University. Project staff will be working with Noxubee staff to incorporate research experiences for teachers and students in Starkville and Oktibbeha County schools.

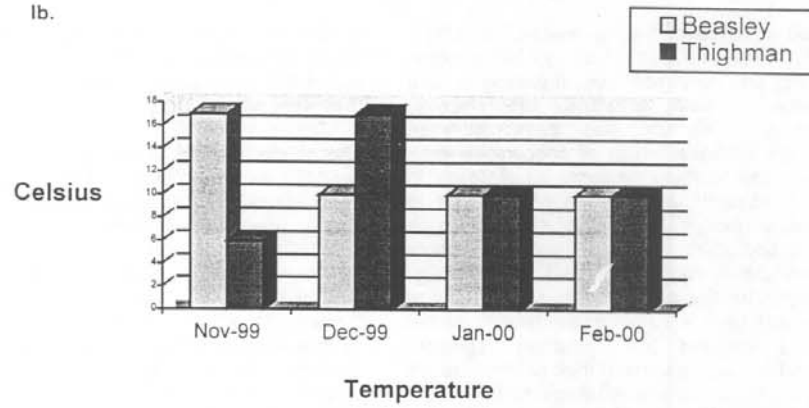
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Thibaudeau, Giselle, Helen Beamon, Jonathan Pote, Sandra Harpole, and Jean Bailey. 1999. MSEA and STRIDE: A Cooperative Experience in Science Education. In Proceedings of the 29th Mississippi Water Resources conference, April 7-8, 1999, by the Water Resources Research Institute: Mississippi State University, 147-150.

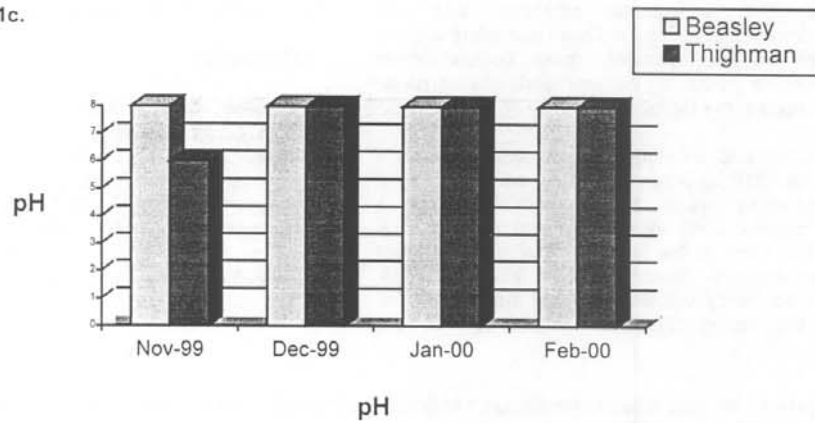
Figure 1: Monthly measurements taken at Beasley Lake and Thighman Lake from November 1999 through February 2000.



1b.



1c.



1d.

