



Fostoria Middle School Teachers: Annette Griffin and Joan Strassbaugh

## H<sub>2</sub>ODDYSEY – WATER QUALITY IN FOSTORIA, OHIO

Joan Strassbaugh – Social Studies and Annette Griffin – Math

“We know how much water is used every day, but do we ever consider what it takes to make our water safe and healthy?” This is the question that Annette Griffin and Joan Strassbaugh asked during the implementation of their H<sub>2</sub>Oddysey last March. Throughout the project, over 85 eighth grade students explored a variety of problems and solutions related to water quality in their area.

water quality in the area. Additionally, a member of the Ohio EPA visited the students to discuss impacts of sewage overflow and other impacts on water quality in Fostoria. The team also visited the Fostoria Water Treatment Plant for a behind the scenes look at water treatment. To aid in their investigation, students conducted interviews, completed water tests, and researched Fostoria water quality through existing City reports.

The Fostoria team was excited to find that the Odyssey fostered motivation and excitement in students who weren't motivated by traditional class work, and look forward to implementing their H<sub>2</sub>Oddysey in the spring with this year's eighth graders. ✂

## H<sub>2</sub>ODDYSEY – WATER RESOURCES IN NORTH BALTIMORE, OHIO

Arica Matthes – Language Arts; Katie Smith – Science; Kevin Switzer – Special Needs; Julia Traver – Social Studies

Water is a resource that seems to be quite plentiful in Northwest Ohio. Students in North Baltimore, however, are finding that this is not always the case. In fact, water supplies can be a significant issue in many communities.

the water, as well as the environmental impacts of various means of sharing a water source.

The problem addressed by North Baltimore students in their H<sub>2</sub>Oddysey mimicked a situation that actually occurred in their town. A nearby community was in need of a water source, while the students' community had more than enough. The students were challenged to investigate what a water-sharing agreement would entail. They looked at the costs involved, who would cover these expenses, what kinds of jobs would be created, the processes and responsibilities involved in cleaning and testing

The culminating activity for students involved in North Baltimore's H<sub>2</sub>Oddysey was to design a pamphlet persuading an audience to share, or not to share, the existing water source. Recently, two students were chosen to present their pamphlets at an Ohio School Board Meeting. Many teachers and administrators were impressed by these students' findings, and were interested in learning more about Project EXCITE! ✂



North Baltimore Teachers: Arica Matthes, Kevin Switzer, Julie Traver, Katie Smith

## NEW FACE JOIN THE PROJECT EXCITE TEAM!

As Project EXCITE rolls through its fifth year, we're happy to introduce some new faces around the office. Although this is a transitional time, we hope to boost the program with new energy and enthusiasm.

Sara, our new Student Secretary is in her third year at BGSU. She's currently studying in the Liberal Arts field and has a great interest in Creative Writing. Sara started in the office in early October and ever since has been busy re-organizing files and compiling evaluation data. She is most EXCITED about helping to run the project efficiently and learning as much as possible because knowledge is power!

Also a part of the EXCITE team are our Graduate Assistants (GAs), Eva, Gina, and Beth. Eva and Gina, who started with EXCITE this August, are both in the final year of their programs, working on their M.Ed.s in Curriculum and Instruction. They are also both completing a secondary teaching credential in integrated science. Eva enjoys the opportunity to work with various schools and is interested in the prospect of developing future Odysseys. She will be working most closely with North Baltimore, Liberty Center, and St. Pius X. Gina looks forward to working with the dedicated team of scientists, teachers and students to discover how learning about EH issues can be fun and motivating when applied in a real life, interdisciplinary setting. Gina is working with Arcadia, Findlay Central, and Fostoria. Beth, who is returning for a second year with the program, will graduate in December with her M.Ed. in Curriculum and Teaching



EXCITE's New Faces from left to right: Eva, Sara, Gina, and Jennifer

with a license in Adolescent Young Adult Integrated Science. Beth's background in Environmental Health and her familiarity with the program make her a great asset to the team. Because of Beth's mid-year departure, we may gain as many as two new GAs in the new year.

We also have a new Program Manager, Jennifer Zoffel. Jennifer comes to EXCITE from California where she previously worked as the coordinator of environmental education programs for the local chapter of the Audubon Society. With a background in both Anthropology and Environmental Studies, the concept of a cross-disciplinary approach to learning greatly interests her. She believes that issues of environmental health can and should be investigated from a number of angles – the societal responses, economic impacts, legal ramifications, as well as the scientific or health-related outcomes. Jennifer hopes to bring to the project her understanding as a social scientist and her hands-on experience with environmental education.

The new office staff is here to support and guide those who are participating in or are interested in Project EXCITE. Please do not hesitate to contact our new staffers with any questions or needs. The entire EXCITE team can be reached at (419) 372-9135. ✂

### FEATURED IN THE UPCOMING ISSUE:

- FIELD REPORTS FROM ARCADIA AND ST. PIUS X
- INTERVIEW WITH DR. CHRIS KEIL
- FOCUS ON ASSESSMENT IN THE PBL CLASSROOM
- WELCOME COHORT 3

### Website Highlight

[www.groundwater.org](http://www.groundwater.org)  
An excellent resource for adults and students alike to learn more about the basics of groundwater. The website is divided into sections for adults and students with a separate "Take Action" section that details possible community service projects and conservation ideas. The Groundwater Foundation website is a phenomenal resource not to be missed.

### Project Team

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[www.bgsu.edu/colleges/edhd/programs/excite](http://www.bgsu.edu/colleges/edhd/programs/excite)



Environmental health science *eXplorations*  
through *Cross-disciplinary & Investigative Team Experiences*



## EXCITE YOUR STUDENTS - THE 5E WAY!

By Lena Ballone, Ph.D. and Jodi Haney, Ph.D., Bowling Green State University

Reform, reform, and more reform! Regardless of the subject area, grade level or local district, schools around the nation are amidst massive calls for educational reform. Standards now exist to pave the way, yet teachers are left with the challenging task of helping their students achieve these rigorous standards. Teachers often feel unprepared for this challenge, pleading for time, resources and quality professional development to enable them to "make it all happen."

Before 1900, most educators viewed the purpose of schooling as a means to learn isolated bodies of facts through memorization and direct instruction. However by the 1950's and 60's, an inquiry-based rationale became more and more visible (NRC, 2000). Research indicated that a curriculum focusing on pure memorization of facts would not be able to deliver the critical thinking and problem solving skills that were required for the real world demands of a new information age. Thus, schooling that was appropriate for the Industrial Revolution had to be revamped for the needs of the Information Revolution. Inquiry-based teaching became the chosen paradigm for such a shift.

Inquiry-based teaching is a technique that encourages students to discover information by themselves instead of having teachers directly reveal the information (Uno, 1999). In other words, inquiry requires students to be active creators of knowledge rather than passive recipients of information. So teachers have been searching for years for meaningful and realistic ways to transform their curricula into inquiry-based experiences. This goal seems daunting, as textbooks still deliver an outdated "body of knowledge" approach to teaching and learning and inquiry-based text experiences appear as "extras" rather than an organizing curricular themes.

Through Project EXCITE, teachers from across Northwest Ohio developed inquiry-based learning curriculum units focusing on locally relevant environmental health issues. These units span multiple disciplines and include lessons that follow the 5E Instructional Model – a learning cycle instructional model that is based upon cognitive psychology (Piaget, 1970)

### The 5E Instructional Model

The 5 E Instructional Model (Bybee & Landes, 1990) appears in Figure 1 and consists of learning cycle with cognitive stages of learning that include engagement, exploration, explanation, elaboration, and evaluation. Bybee (1997), in his book *Achieving Scientific Literacy-From Purposes To Practices* declares that,

“Using this approach, students redefine, reorganize, elaborate, and change their initial concepts through self-reflection and interaction with their peers and their environment. Learners interpret objects and phenomena, and internalize those interpretations in terms of their current conceptual understanding” (p. 176).

Teachers and curriculum developers can integrate or apply this 5E Instructional Model at several levels, so the model can be a useful organizational tool for daily lessons, individual units, or yearly plans. Each phase is described as follows:

*continued on page 3*

**Call for Participants 2005-2007**

Project EXCITE is currently taking applications from interested teacher teams for our 2005-2007 cohort. Benefits for participating teachers include: \$1000 stipend, 10 grant funded graduate credit hours, and release time.

Guidelines for applying as an EXCITE teacher team include:

- Four interdisciplinary team members
- At least one (no more than two) team members should teach science (others can come from various disciplines).
- The team, at some point in the school year, should teach the same students (we will work with your school to facilitate this)
- Support from a district administrator

During the two-year commitment, teacher teams will jointly design a problem-based learning unit focusing on a locally relevant environmental health topic, implement the unit with their students, and ultimately submit their unit for publication.

The application is available online at: [www.bgsu.edu/colleges/edhd/programs/excite/](http://www.bgsu.edu/colleges/edhd/programs/excite/)

Or by contacting the Program Manager at [jzoffel@bgnnet.bgsu.edu](mailto:jzoffel@bgnnet.bgsu.edu) 419.372.9132

The application can be mailed, faxed or e-mailed to the Program Manager by January 10, 2005.

Make it all happen

## INTERVIEW WITH DR. SILVERMAN

By Jennifer Zoffel, Project Manager

For the past eighteen plus years, Dr. Gary Silverman has worked at BGSU as a Professor and Director of the Environmental Health Program. Dr. Silverman was hired to bring the EH program to the BG campus (from Firelands) and to convert it into a four-year program. Prior to that, he worked for four years at the Association of Bay Area Governments (ABAG), a regional planning agency designed to address issues of common land, air, water, and economic development. He also taught part time at the University of San Francisco. He earned his doctorate in Environmental Sciences and Engineering (D.Env.) from UCLA.

**Q** Within the field of Environmental Health, what is your area of concentration or special interest?

**A** I actually have a few – water quality, the international perspective on the environment, and environmental education. With water quality, I'm looking particularly at municipal water systems. With more and more consumers drinking bottled and filtered water, is it worth it for municipal systems to invest in an upgrade? The City of Bowling Green made a major improvement to their system. We wanted to know if the upgrade made sense and if people were benefiting from it or if it added unneeded expense.

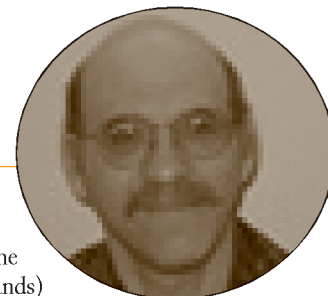
Secondly, there are amazing opportunities abroad to discuss issues related to environmental health. I've worked to build a network with other universities around the globe to establish teaching conferences between China, Russia, Mexico, Hungary, and Malaysia. We work together and look at comparative issues, such as global climate change or population growth. We discuss both environmental health and environmental protection, because it's often difficult to distinguish between the two. Generally, however, our main focus or motivation is to work on issues of environmental health. Next semester, I'm going to work in Costa Rica helping to develop an environmental health program there, and I hope to establish a permanent connection.

Another interest is environmental education, which, of course, leads me to Project EXCITE. I participate as a scientist helping to teach students methods and issues related to water quality.

## WHAT IS PROJECT EXCITE?



Project EXCITE (Environmental health science eXplorations through Cross-disciplinary & Investigative Team Experiences) is a 1.8 million dollar, seven-year grant partnership between The National Institute of Environmental Health Sciences, Bowling Green State University, and several area school districts. Project EXCITE provides professional development to interdisciplinary teams of middle grades teachers in order to develop locally relevant Environmental Health Science (EHS) problem based learning units. Each team implements their unit in the classroom to engage their students in valuable learning experiences across the curriculum. The project reflects current thinking about effective teaching and learning and is aligned with national and state education goals. Project EXCITE emphasizes critical thinking and problem solving skills, interdisciplinary connections, collaborative learning and the use of technology. During the unit, students investigate local EHS issues, explain fundamental concepts, and apply the knowledge and skills generated in a culminating service learning project. The ultimate goal of Project EXCITE is to enhance life long learning skills and encourage students to be active and well-informed citizens. Project EXCITE is directed by Bowling Green State University Associate Professors Dr. Chris Keil and Dr. Jodi Haney.



**Q** Why is Environmental Health such an exciting field?

**A** It's filled with such tremendous opportunities. Just as I mentioned my plans for Costa Rica, I also lived in Malaysia, working on a Fulbright Scholarship helping the government to consider the environment along with its economic development programs. There are many jobs and great internships in EH because it can be applied in so many ways. Because BG's program is just one of 24 programs recognized by the US Public Health Service, our students have great prospects once they enter the field. It's also exciting because what you learn is applied toward the betterment of the community. EH work is really important because it saves people and it saves the environment. It's even better being an EH professor because I can work with students and share the value of EH with them.

**Q** What first attracted you to Environmental Health?

**A** I was always interested in applied science. Rather than just solving a puzzle for the puzzle's sake, I wanted to do something where I saw the application. I entered my D.Env. program because that program prepared 'environmental generalists.' It introduced me to the broad range of work done by environmental scientists and to issues of human health. It was that interdisciplinary approach that led me to EH.

**Q** What resources would you recommend for students who are interested in learning more about EH?

**A** Project EXCITE! It's important to be involved in science in general. Students could focus science fair projects on EH topics. They could look at the effects of contamination, comparing sites that have it and sites that don't. Students could get involved in experiments and models, analyzing how our activities effect nature and ecosystems – there are a lot of fun things students can do.

**Q** What resources would you recommend for teachers who are interested in learning more about EH?

**A** One of the best things they can do is to read their own newspaper – to know what's going on in their own community. EH issues are often local issues. If you have an EH problem it effects you and your family. Interested teachers should look at the problems and try to find real solutions.

**Q** What areas of future research are you interested in pursuing?

**A** I have a two-fold interest in issues related to international environmental quality. One, I'd like to look at the politics of the U.S. to see if we can be reasonable in maintaining our standard of living without having such a large impact on the destruction of the planet. Two, I'd like to look at ways to help in the less developed world where people and land are suffering from exposure to contaminants. ✕

## EXCITE YOUR STUDENTS - THE 5E WAY! cont.

### Engagement

In this first phase of the cycle, the teacher aims to assess the students' prior knowledge and/or identify possible misconceptions. This phase should be a motivational period to create a desire to learn about the upcoming topic.

Students brainstorm after an opening question to get at, "What do I already know and why do I care about this topic?"

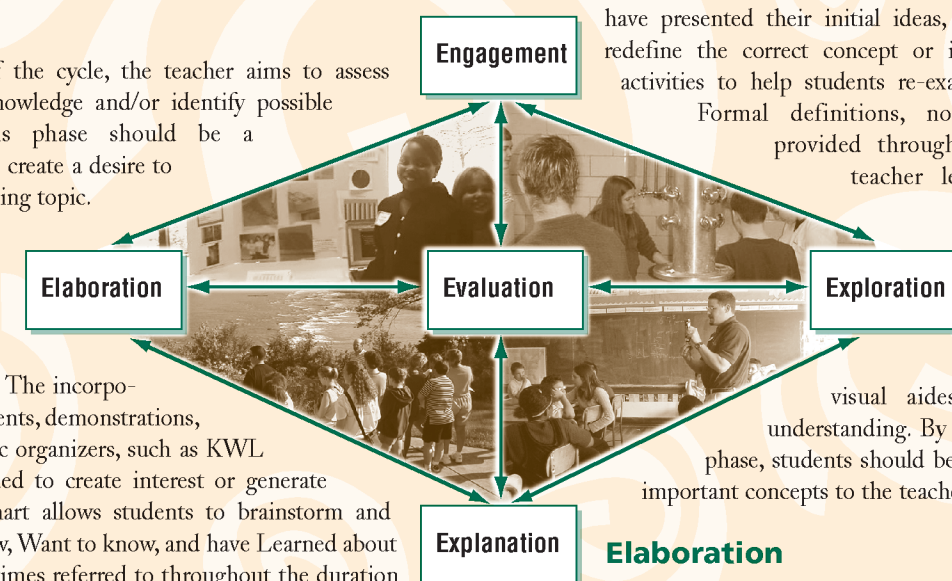
The incorporation of discrepant events, demonstrations, questioning, or graphic organizers, such as KWL charts, may be included to create interest or generate curiosity. A KWL chart allows students to brainstorm and record what they Know, Want to know, and have Learned about the topic and is oftentimes referred to throughout the duration of the lesson. The instructional task is then identified. Critically, this phase does not serve as a time to lecture, define terms, provide explanations, or record definitions.

### Exploration

Following the engagement phase, the exploration phase provides the students with a common, concrete learning experience. This phase is also student-centered and incorporates active exploration of concepts. Students are encouraged to apply process skills, such as observing, questioning, investigating, testing predictions, hypothesizing, and communicating with other peers. The teacher's role is one of a facilitator or consultant. Students often work in a cooperative learning environment without direct instruction from the teacher. Students are given a "hands-on" experience before any formal explanation of terms, definitions, or concepts are discussed or explained by the teacher.

### Explanation

A "minds-on" phase follows the exploration phase and is more teacher-directed and guided by the students' prior experience during their exploration phase. The explanation phase enables students to describe their understanding and pose questions about the concepts they have been exploring. It is likely that new questions will arise. The explanation phase is an essential "meaning-making" portion of the 5E lesson. Before the teacher attempts to provide an explanation, the students must FIRST have the opportunity to express their own explanation and ideas. Thus, the initial part of the explanation phase is a time for the teacher to serve as a facilitator and ask the students to describe and discuss their exploration learning experiences. After the students have had the opportunity to share their own explanations, the teacher introduces conceptual and technical information in a direct manner. This phase includes clarification of student misconceptions that may have emerged during the engagement or exploration phase. Importantly, student thought should not be interrupted if a misconception is found. Rather, a teacher should note the misconception and then after students



have presented their initial ideas, the teacher should either redefine the correct concept or introduce new exploration activities to help students re-examine the misconceptions.

Formal definitions, notes and labels can be provided through what we typically call teacher lecture or teacher-guided discussion. The teacher may also decide to integrate videos, computer software programs, readings or other visual aides to help with student understanding. By the end of the explanation phase, students should be able to clearly explain the important concepts to the teacher and to their peers.

### Elaboration

This phase of the learning cycle challenges the students to apply the SAME concepts targeted in the prior phases to new situations, while reinforcing the developed skills. The goal of this phase is to help develop deeper and broader understandings of the concepts. The students may conduct additional investigations, develop products, share information and ideas, or apply their knowledge and skills to other disciplines. This is a great opportunity to integrate content areas. Elaboration activities may also be a great time to integrate technology, such as web-based research or web quests. Introducing new information, concepts or skills should be avoided during this phase.

### Evaluation

Both formal and informal assessment approaches are appropriate during the evaluation phase and should be included. For instance, the use of non-traditional forms of assessment, such as portfolios, performance-based assessment, concept maps, physical models, or journal logs may serve as significant evidence of student learning. During an inquiry-based lesson, assessment should be viewed as an ongoing process and the teachers should make observations of their students as they apply new concepts and skills, looking for evidence that the students have changed or modified their thinking. Students may also have the opportunity to conduct self-assessment or peer-assessment. However, the evaluation may also consist of a summative experience such as a quiz, exam, or writing assignment.

Although the 5E Model was just explained in serial order, it is often necessary and more suitable to reverse back into the cycle before going forward. For instance, numerous explore/explain rotations may need to occur before the students are ready to transition to the elaboration phase. The teacher may move back and forth several times within the Es, or may include an additional engagement prior to starting an elaboration phase. The cycle is very flexible and dynamic. It may take many days to complete the lesson or unit. It is not necessary to complete one learning cycle each day (Bybee, 1997).

THREE



## EXCITE YOUR STUDENTS - THE 5E WAY! cont.

### It's a Matter of Ethics! – An Example Lesson

An example lesson using this 5E framework is "It's a Matter of Ethics." The major objectives of this lesson are to have students identify both stakeholders and their respective values regarding an environmental issue. Students use this information to propose a best-fit solution that considers all stakeholder points of view and justifies the solution based on Principles of Environmental Ethics.

In the first phase, the teacher engages the students by asking the class to read the book (or watch the video), "The Lorax" by Doctor Seuss (1971). The teacher then identifies the issue with the class (destruction of Trufula trees to make "Thneeds"). Students are asked to "Take A Stand" to depict their personal view of the issue presented in the video (should Trufula trees be allowed to be cleared to make Thneeds?). During the "Take a Stand" activity, students place themselves in the front of the classroom on a continuum of "definitely not" (Trufula trees should not be allowed to be cleared to make Thneeds) to "absolutely so" (Trufula trees should be allowed to be cleared to make Thneeds). The teacher continues the engagement phase by questioning students about their various viewpoints and by leading a discussion regarding why students have chosen their stance. No discussion of content should occur, as this is an activity aimed at gaining students' existing perspectives.

During the exploration, students are assigned to a community member group: The Lorax, the trees, the fish, the birds, the Oncler, etc. The student groups first meet to organize ideas and then take on the roles of the assigned stakeholder. For each community group, a randomly selected spokesperson offers a discussion of the values their community group holds and the issue at stake from their groups' perspective. Each group then offers what they believe to be the best solution to the problem. Individually, students record the values, defined issues and solutions as they are presented using a table such as:

Stakeholder	Values (Beliefs)	Issue (Define the problem according to the stakeholder.)	Solution (What would this stakeholder propose?)
e.g. The Lorax	Earth is sacred and all of earth's inhabitants have equal rights to exist and to be protected	Clearing the Trees is destructive to the habitat and the animals that live there. Moreover, the right to exist is being denied to the Truffula Trees.	STOP all clearing NOW! Fine the Lorax and make him replace what he's depleted.

During the explanation phase, the teacher summarizes the group information using the same table format and clarifies the differences between values, issues, and solutions and helps students generate formal definitions for these concepts. The teacher presents the principles of ethics as described next.

### Principles Environmental Ethics

- *Beneficence*: How can our solution be of benefit?
- *Nonmaleficence*: How can we minimize harm?
- *Respect for Life*: How can we treat living beings as if they matter?
- *Justice*: How can we act fairly?

During the elaboration phase, the teacher asks how the Lorax's community might develop more ethical policies to regulate the problem, while considering all stakeholders' views. Students work in small groups and propose a new law regarding the clearing of the Trufula Trees, keeping the Principles of Ethics in mind when developing the law.

During evaluation, student groups present their proposed law at a mock Ethics Advisory Committee Town Meeting. Students must justify how this law is ethical based on the Principles of Environmental Ethics. The whole class discusses each proposed law on the basis of its' ethical implications. Students can vote to either accept or defeat each of the proposed laws and offer a rationale for their decision.

It's a Matter of Ethics represents just one example of a 5E learning cycle lesson, however we hope it serves as a valuable model of how existing lessons can be restructured to promote higher levels of student engagement and inquiry. A highly reputable report published in the National Association of instructional models) result in better retention of concepts, higher achievement in superior process skills, improved attitudes toward learning and improved reasoning. Thus, the 5E Instructional Model serves as both an effective and flexible tool that assists curriculum developers and classroom teachers in creating inquiry-based lessons. So give it a try. Reconstruct your favorite lesson the 5E way!

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