

Conference Strand: Environment

A Placed-Based Course Model for Teacher Education
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ABSTRACT

The *Aquatic Ecology for Teachers* course is a graduate course offered during the summer, using a two-week workshop format. A place-based teaching approach made use of the local environment as a context to teach the relationship between environmental systems and human systems. Community-based field trips, field studies, and a canoe trip were integral components of the course. Teachers applied what they learned to the state academic standards and the *National Environmental Education Guidelines for Learning K-12* (NAAEE 2004).

The objectives of the course were to increase the level of confidence and degree to which the teachers a) use technology in their teaching, b) use standards-based teaching strategies, c) integrate the sciences, d) integrate science with other subject areas, e) use the local environment, f) conduct field-based investigations, g) use community-based resources, h) teach watershed topics, and i) teach real-world current issues.

Pre and post-course survey data, analyzed using MANOVA and ANOVA procedures, revealed positive statistical significance for all five confidence measures and on three of five intended classroom teaching measures. Participant responses to the post-course questions revealed the benefits of the course in regard to teaching content and using effective pedagogy, and the potential impact on student learning.

INTRODUCTION

The characteristics of place-based learning that make it a distinctive approach to education, as summarized by Woodhouse and Knapp (2000), are the emergence of education from the particular geography, ecology, sociology, & politics of a local community, a focus of study that is inherently multidisciplinary and experiential, and the connection of place with self and community. Place-based education is aligned with the goal of improving K-12 educational outcomes, as evidenced by an increasing number of studies reported in the literature. Lieberman and Hoody (1998) found that using a comprehensive set of place-based teaching strategies when using the environment as an integrating context yielded positive educational outcomes for K-12 students. These outcomes include improved performance on standardized tests in all academic subjects, a reduction of student discipline problems and absenteeism, an increase in student engagement and enthusiasm for learning, a greater pride of student in their accomplishments, and greater teacher job satisfaction.

The findings of other studies that focus on a less comprehensive set of place-based teaching strategies provide additional evidence in support of using these approaches to improve educational outcomes. These teaching strategies include the use of experiential education practices (Chawla 1998, 1999; Heimlich and Daudi 2002; Reeder 1998); using different expertise in program leadership, building relevancy into the program by using a local setting and involving community-based experts (Bouillion and Gomez 2001; Ciffone et al. 2002; Niesenbaum and Gorka 2001; O'Neill and Gomez 1998; Rhoton et al. 1999); and allowing time for participants to reflect on their learning (Clark 1994; Ginsburg and Clift 1990; Henson 1996; Reynolds 1992; Rhoton et al. 1999; Shulman 1986).

While the value of place-based education is gaining increased recognition, it is not yet a mainstream approach used to design K-12 curricula, nor is this approach yet a substantial part of teacher education. For schools to successfully implement place-based teaching approaches, it is

critical to provide teachers with training in the use of teaching practices that many have not experienced themselves.

COURSE DESCRIPTION

Aquatic Ecology for Teachers, taught during a two-week session during the summer of 2005, was designed to teach content and to model effective teaching pedagogy pertinent to place-based education. A one-day follow up session was held two weeks after the summer course for teachers to present the units of study they had developed to teach their students. Best practices in teaching related to place-based education that were used in this course included collaboration among interdisciplinary course instructors and community resource personnel; studies conducted in the natural environment; experiential learning; and the study of societal topics relevant to the local community. There were 16 K-12 teachers enrolled in the course. Funding for the course was provided by the Kentucky Council on Postsecondary Education.

The course was co-taught by a biology faculty and an education faculty. Content area specialists were scheduled throughout the course to share their expertise on topics related to the ecology of the Ohio River system. Environmental topics taught were aligned with the state academic standards and teachers were required to identify the state academic standards addressed in the course. The objectives of the course were to increase the level of confidence and degree to which the teachers a) use technology in their teaching, b) use standards-based teaching strategies, c) integrate the sciences, d) integrate science with other subject areas, e) use the local environment, f) conduct field-based investigations, g) use community-based resources, h) teach watershed topics, and i) teach real-world current issues.

During the two-week segment of the course, teachers were engaged in field-based studies of aquatic systems, field trips to community facilities, presentations made by community-based guest speakers, classroom discussions to reflect on what they were learning, and small group

work to apply what they were learning to their K-12 classrooms. Topics of the field studies used to investigate the local aquatic environment were microbiology, water chemistry, geology and chemical cycling, geologic history of the river watershed area, stream survey components (macroinvertebrate sampling, habitat assessment, chemical parameters, stream flow, and coliform and plankton sampling), terrestrial, wetlands and upland ecosystems, and fishes of the Ohio River. Topics that addressed the relationship between the natural systems and human systems included hydropower energy, the protection of water resources through a variety of community-based agency programs and industry, and current water resource laws and legislation.

All field-based studies were inquiry-based and utilized the monitoring protocols and scientific equipment used by the Kentucky Watershed Watch (Kentucky Division of Water, 2000a-c). Community site visits were made to an industry, the local water treatment agency, and a canoe and kayak business. Guest speakers represented county government, an Ohio River regulatory agency, two non-profit organizations, and the National Energy Education Development project. Field trip and classroom guest speakers described their role in protecting aquatic systems and presented information about programs that they offered for schools. Teachers took a 4-hour canoe trip as a means to experience the river which formed the watershed basin in which they teach.

COURSE EVALUATION AND IMPACT

A 5-point Likert Scale survey, administered prior to the course and immediately following the course, was used to evaluate the impact of the course on teachers' confidence levels and intended classroom practices which related to the program objectives. A MAVOVA analysis was performed to make a pre and post-course comparisons of the survey data, which was grouped into five areas: 1) the ability to use workshop demonstrated teaching technologies,

2) the ability to use workshop demonstrated teaching and instructional strategies, 3) the use of community resources, 4) the ability to conduct field-based investigations and 5) the ability to teach watershed topics and teach the connections between science and real life, social issues and science related careers.

The MANOVA analysis measuring changes in teacher's confidence levels revealed positive statistical significance on all five group measures and follow-up univariate analysis revealed positive statistical significance on 22 of the 28 item measures: see Table 1. The MANOVA analysis measuring changes in teachers' classroom practices (pre-course) and their intended practices (post-course) revealed positive statistical significance on three of five measures. The three areas of significant change were the use of technology, the use of community resources, and the ability to teach watershed topics, the connections between science and real life, social issues and science related careers. The univariate analysis revealed positive statistical significance on 17 of the 28 item measures, see Table 2.

An analysis of open-ended participant responses on the post-course survey revealed the overall strengths of the course to be hands-on learning, field studies, the classroom resources provided, diversity of topics, amount and depth of content, the practical uses of content, skills, lessons, pedagogy, equipment and resources, and the integration of social issues.

The single most beneficial aspect of the course related to "content", as reported by the greatest number of participants, was content learned and classroom resources provided. Other aspects identified were an understanding of all aspects of water quality, macroinvertebrates, water chemistry, biological assessments, connecting the local environment to state academic standards, river history, use of water testing equipment (Lamotte), and real life applications.

The single most beneficial aspect of the course related to "pedagogy", as reported by the greatest number of participants, was the hands-on instruction. Other benefits identified were

lesson ideas, environmental teaching approaches, hands-on resources, community resources, technology use, real life applications, and inquiry-based teaching.

The single most beneficial aspect of the course related to “classroom teaching” identified by teachers was a connection to real-life & current issues, using materials and community resources, integrating science topics with other subjects, hands-on experiences, developing lessons, knowledge of water quality, fresh ideas, classroom teaching becoming more in-depth and interactive, and a greater confidence to teach water ecology.

In response to the question of how their participation in the course would help improve their students’ learning, ten of the 16 teachers reported that their students would learn more content, five reported that their students would become more involved in activity-based learning and thus learn more, four reported that their students would experience more real life learning, three reported that their students would utilize an increased number of resources in their learning, and two reported that their students would learn more about human impact and responsibility and would become more excited and positive because their teacher was.

Suggestions to improve the course included providing more information about funding sources, and more time for peer discussion of state standards and assessment ideas and classroom resources review, and more ideas for elementary grades.

The results of this study adds to a growing knowledge base which is vital to improving education outcomes through environmental education and to achieve the goal of environmental sustainability. For place-based education to yield positive results for K-12 students, it is critical to develop teacher training programs which focus on the use of place-based teaching strategies and to evaluate the results of such programs.

WEBSITE INFORMATION

Information about the course and evaluation results can be found at

<http://www.nku.edu/~enved/aet.htm>.

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Table 1. MANOVA & Univariate Test Results: Confidence of Teachers

N=16 *Significant at .05 level. Likert Scale: 1-Very Low 2-Low 3-Average 4-High 5-Very High

Please rate your confidence in your own ability to Use the following technologies:				
MANOVA Wilks' Lambda	F=6.89	Sig. .023		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
1. Water quality test kits.	3.00	4.31	22.03	.000
2. Water study data probes.	2.56	3.87	24.07	.000
3. Excel spreadsheet program.	3.12	2.87	2.17	.165
4. Internet websites for research and support materials.	4.06	4.37	.80	.385
5. Microscopes.	3.81	4.00	.13	.720
6. Videoscopes and/or display monitor.	2.87	3.19	1.16	.302
7. Digital camera.	3.75	4.06	.38	.547
8. Geographic Positioning System (GPS).	1.87	3.73	32.45	.000
9. 2-way radio.	3.12	3.93	5.52	.035
Please rate your confidence in your own ability to use the following teaching approaches:	XXXX	XXXX	XXXX	XXXX
MANOVA Wilks' Lambda	F=8.57	Sig. .002		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
10. hands-on instructional strategies.	4.12	4.69	7.64	.014
11. inquiry-based teaching strategies.	3.94	4.56	6.82	.020
12. Teach in a field-based site (stream, wetlands, etc.)	3.12	4.31	40.11	.000
13. Integrate the sciences (physical, life, earth) in teaching.	3.81	4.37	9.57	.007
14. Integrate science as a subject with other subject areas.	3.69	4.37	15.25	.001
Please rate your confidence in your own ability to use the following community resources:	XXXX	XXXX	XXXX	XXXX
MANOVA Wilks' Lambda	F=12.79	Sig. .001		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
15. Guest speakers (local, university, county, and/or state).	3.56	4.12	3.91	.069
16. Natural environment field sites related to water studies.	2.87	4.25	43.10	.000
17. Field trips to water related community resource sites.	3.12	4.40	14.44	.002
Please rate your confidence in your own ability to conduct the following field-based investigations:	XXXX	XXXX	XXXX	XXXX
MANOVA Wilks' Lambda	F=16.33	Sig. .000		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
18. Geology study of water systems.	2.31	3.62	37.72	.000
19. Microscopic study of aquatic life.	2.81	4.12	19.90	.001
20. Macroinvertebrate study.	2.56	4.25	51.47	.000
21. Habitat assessment.	2.73	4.19	114.33	.000
22. Fish study.	2.50	3.94	42.87	.000
23. Terrestrial Ecology.	2.56	3.87	50.91	.000
24. Water chemistry.	2.87	4.44	42.08	.000
Please rate your confidence in your own ability to teach:	XXXX	XXXX	XXXX	XXXX
MANOVA Wilks' Lambda	F=15.31	Sig. .000		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
25. about water quality topics.	2.94	4.44	67.50	.000
26. about connections between science & real life.	3.75	4.62	23.71	.000
27. connections between science & societal issues.	3.62	4.62	24.00	.000
28. connections between science & science-related careers.	3.25	4.19	19.29	.001

Table 2. MANOVA & Univariate Test Results: Intended Classroom Practices

N=16, Significant at .05 level, Likert Scale: 1-Never; 2-1 or 2 times/year; 3-3 or 4 times/year; 4-5 or 6 times/year; 5-Over 6 times/year

To what extent do you intend to use the following types of technology in and/or for classroom instruction?				
MANOVA Wilks' Lambda	F=7.79	Sig. .032		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
1. Water quality test kits.	2.00	3.40	5.82	.033
2. Water study data probes.	1.85	3.00	7.31	.019
3. Excel spreadsheet program.	2.38	3.12	5.67	.035
4. Internet websites for research and support materials.	4.00	4.44	3.46	.088
5. Microscopes.	2.92	3.69	4.54	.054
6. Videoscopes and/or display monitor.	2.08	3.19	6.89	.022
7. Digital camera.	3.46	4.25	8.90	.011
8. Geographic Positioning System (GPS).	1.08	2.37	9.62	.009
9. 2-way radio.	2.08	1.87	.021	.888
To what extent do you intend to use the following teaching approaches?	XXXX	XXXX	XXX	XXX
MANOVA Wilks' Lambda	F=3.28	Sig. .076		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
10. Use hands-on instructional strategies.	4.69	4.69	1.69	.220
11. Use inquiry-based teaching strategies.	4.31	4.75	3.01	.111
12. Teach in a field-based site (stream, wetlands, etc.)	1.92	3.31	8.80	.013
13. Integrate the sciences (physical, life, earth) in teaching.	4.23	4.69	3.48	.089
14. Integrate science as a subject with other subject areas.	3.92	4.87	3.09	.107
To what extent do you intend to use the following community resources in your teaching?	XXXX	XXXX	XXX	XXX
MANOVA Wilks' Lambda	F=4.20	Sig. .036		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
15. Guest speakers (local, university, county, and/or state).	2.15	3.25	8.67	.012
16. Natural environment field sites related to water studies.	1.54	2.75	9.75	.009
17. Field trips to water related community resource sites.	1.46	2.25	4.46	.056
To what extent do you intend to incorporate the following types of field-based investigations in your teaching?	XXXX	XXXX	XXX	XXX
MANOVA Wilks' Lambda	F=1.33	Sig. .444		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
18. Geology study of water systems.	1.69	2.75	11.25	.008
19. Microscopic study of aquatic life.	2.08	2.81	2.94	.121
20. Macroinvertebrate study.	1.58	2.50	4.37	.066
21. Habitat assessment.	1.85	2.62	4.37	.066
22. Fish study.	1.77	2.25	10.76	.010
23. Terrestrial Ecology.	1.58	2.56	15.00	.004
24. Water chemistry.	1.92	3.12	9.99	.012
To what extent do you intend to teach about the following? Likert Scale: 1-Never 2-Rarely 3-Sometimes 4-Often 5-Always	XXXX	XXXX	XXXX	XXX
MANOVA Wilks' Lambda	F=9.66	Sig. .003		
Univariate Tests:	Pre Mean	Post Mean	F	Sig.
25. water quality topics.	2.85	3.75	13.00	.004
26. connections between science & real life.	4.23	4.75	6.25	.028
27. connections between science & societal issues.	4.08	4.62	14.00	.003
28. connections between science & science-related careers.	3.69	4.50	19.62	.001