

## **The Effect of Participation in Place-Based Environmental Education Programs on Student Affect toward Science: A Case Study of F.T. Stone Laboratory's Middle School Program**

Jennifer E. Malinowski

Rosanne W. Fortner

**Abstract:** This case study focuses on the effect of participation in a place-based environmental education program on the science affect (feelings) of current and former sixth grade students. The study is an effort to demonstrate how such programs influence learners. A second purpose is to establish whether F.T. Stone Laboratory (hereafter, Stone Lab) is meeting a portion of its stated objectives for the educational programs. The researcher's findings suggest that the Stone Lab experience has an influence on student affect, fostering more positive feelings toward science following student participation in the program. While this study shows some notable trends, future research on student affect toward science and on Stone Lab's effect on learners needs to be completed to further develop this theory base.

# **The Effect of Participation in Place-Based Environmental Education Programs on Student Affect toward Science: A Case Study of F.T. Stone Laboratory's Middle School Program**

## **Introduction and Background**

Merriam-Webster (2001) defines attitude as “a mental position with regard to a fact or state” or “a feeling or emotion toward a fact or state.” Attitude research has gone further by developing a general consensus that, while attitude is difficult to specifically define, it is comprised of three important components: affect (or feelings), conation (or behavior) and knowledge (or cognition) (Shrigley et al., 1988). Research treats these three personal attributes as integral to the development of a particular individual's attitude toward an issue or object. This study focuses primarily on the affect component of attitude toward science to determine whether it is influenced by participation in an outdoor environmental education program.

Previous research in science attitude change has shown mixed results. While some studies have shown a positive influence on science attitudes, others have shown environmental programs to have no effect or even a negative effect (Crompton & Sellar, 1981; Dettmann-Easler & Pease, 1999; Eagles & Demare, 1999). Thus a consensus has yet to emerge regarding the key factors that determine whether a program facilitates a positive attitudinal change toward science. This case study focuses on whether participation in a place-based environmental education workshop at F.T. Stone Laboratory (hereafter, Stone Lab) influences students' feeling about science in the short- and long-term.

## **Setting**

Stone Lab is The Ohio State University's Lake Erie environmental science laboratory. It is located on Gibraltar Island, at Put-in-Bay, Ohio and is a research and education site for

ecosystem research projects on the Great Lakes. In addition, Stone Lab provides educational and research opportunities focusing on fostering knowledge and appreciation for freshwater and marine resources. An educational facility dedicated to exposing students to environmental and scientific knowledge and experiences, Stone Lab's programs are highly hands-on and interactive. The students in this study experienced activities that focus on exotic species, science careers, ornithology, plankton and fish labs, and insect collecting. The goal of this study is to assess whether Stone Lab, a place-based environmental education facility, has an impact on student affect toward science.

## **Methods**

In order to assess both short- and long-term impact of Stone Lab on student affect toward science, data were collected in two phases. Phase One consisted of a pre-/post-test survey that was administered to sixth graders who participated in the Stone Lab workshop during the Spring of 2002 (n=90). The survey was adapted from the Attitude toward Science in School Assessment originally developed and published by Paul J. Germann (1988). The instrument used a Likert-type scale and included 30 questions that were broken down during analysis into four subscales: General Science Feeling (GSF), Science as a Class (SCL), the Value of Science (VS) and Science as a Career (SCR). Paired samples t-tests were run on each of the science affect subscales for the pre- and the post-tests. In addition, descriptive statistics were completed to compare differences in gender, ethnicity and other demographic information with the t-tests and student reported interest and success in science.

In Phase Two of the study, students in the seventh, ninth and twelfth grades, during fall of 2002, responded to a questionnaire that featured both open- and close-ended questions addressing their recollection of their sixth grade Stone Lab experience. The seventh graders in

this phase of the study were the same students who completed the survey in Phase One. Due to the qualitative nature of this phase of the study, a descriptive analysis of student responses was completed.

## Results

In Phase One (n=90), using  $\alpha=0.05$  and  $t^2$ , paired samples t-tests showed significant change between pre- and post-test administration for two of the four subscales: GSF and VS. T-test values for GSF and VS respectively were  $t=-3.049$  (df=89,  $p=0.003$ , 2-tailed) and  $-2.329$  (df=89,  $p=0.022$ , 2-tailed). However, student affect seemed to vary between gender groups. Paired samples t-tests run using  $\alpha=.05$  and tabled  $t^2$ , showed more significant change for males (n=36) than for females (n=51). Males also showed significant positive change in two subscales (GSF and VS), whereas females did not show significant change in any subscale.

Predominant ethnic groups in the sample were Caucasian (n=50) and African American (n=16) with remaining ethnic groups categorized as Other (n=9). Within the ethnic groups, only GSF was found to have a significant change in the Caucasian ethnic group with  $t=2.172$  (df=49,  $p=0.035$ , 2-tailed); no significant change was found in any subscale for the African American group or Other ethnic group between the pre- and post-tests.

Phase two results were interpreted with caution because of low response rate from students. While 81% of seventh graders receiving the questionnaire responded (n=73), only 6 ninth graders and 10 twelfth graders returned a completed or semi-completed questionnaire. Responses to the questionnaires indicated that while students overwhelmingly enjoyed the Stone Lab experience they were split on whether they felt it influenced how much they like science.

## Discussion

Preliminary findings suggest that the Stone Lab experience does have an effect (albeit a small one) on students' affect toward science for the subscales of General Science Feeling and Value of Science. However, there seem to be some differences between gender and ethnicity on the level to which affect is changed. Females and non-white individuals showed less change in affect toward science than male and white students.

Across the entire sample there was a small but consistent change in student response on all of the subscales, even though this change was significant on only two of the subgroups. General Science Feeling increased significantly as did the Value of Science. This indicates that participation in the Stone Laboratory workshop is followed by positive effects on general affect toward science. It also suggests that students' opinion on the value of science increases as a result of the workshop. However, Stone Lab seems to be less related to how students feel about science class or their pursuing a career in science

In Phase Two, while it is interesting to note that Stone Lab seems to have a long-term impact on some individual students' feelings about science, it is difficult to make a conclusive statement about the long-term influence of Stone Lab because of the lack of response from older students.

While this study indicates that Stone Lab has at least a small short-term effect on student affect toward science, more research needs to be completed to accurately assess the impact of place-based environmental education programs on student feelings toward science. Additional studies looking at these types of long- and short-term influences could also factor in changes in instructors and variation in composition (gender and ethnicity) of student groups. Ideally, a long-term study following one group of students over a number of years could also be conducted.

## References

- Crompton, John L. & Christine Sellar. (1981). Do Outdoor Education Experiences Contribute to Positive Development in the Affective Domain? *The Journal of Environmental Education*, 12(4), 21-9.
- Dettmann-Easler, Detra & James L. Pease. (1999). Evaluating the Effectiveness of Residential Environmental Education Programs in Fostering Positive Attitudes Toward Wildlife. *The Journal of Environmental Education*, 31(1), 33-9.
- Eagles, Paul F.J. & Robert Demare. (1999). Factors Influencing Children's Environmental Attitudes. *The Journal of Environmental Education*, 30(4), 33-7.
- Germann, Paul J. (1988). Development of the attitude toward science in school assessment and its use to investigate the relationship between science achievement and attitude toward science in school. *Journal of Research in Science Teaching*, 25(8), 689-703.
- Merriam-Webster, Inc. (2002). Definition of Attitude. In Merriam-Webster Collegiate Dictionary OnLine, [Online]. Available: <http://www.m-w.com/cgi-bin/dictionary?book=Dictionary&va=attitude>, (September 25, 2002).
- Shrigley, Robert L., Thomas R. Koballa, Jr., & Ronald D. Simpson. (1988). Defining Attitude for Science Educators. *Journal of Research in Science Teaching*, 25(8), 659-78.