Effectiveness of Environmental Education Programs

This summary presents sample studies documenting the impact of environmental education programs with youth. The summary is prepared to assist Jefferson County, Wisconsin determine how it prefers to move forward with waste reduction education in county schools.

Measuring education impacts

Education is generally described as the mechanism for teaching people *how* to think, rather than *what* to think. Formal education for children usually focuses on cultural and content knowledge along with a variety of thinking skills that can be broadly applied. Schools measure the impact of their work by testing knowledge of underlying concepts, reading and math skills relevant to the content area, and application of thinking skills (such as data interpretation, analysis and synthesis).

Outreach and marketing are terms used to describe communication which is intended to encourage consideration of or change behavior about a specific topic. While youth may be the target of outreach or marketing activities, these are generally not directed at the formal school curriculum unless the content and/or skills address community priorities and are presented in a relatively value-free manner. If directed at the formal setting, impact measurements usually focus on content knowledge and thinking skills. Exceptions to this general rule are in-school programs on topics significant to the local economy or well-being, such as restoration of the salmon fishery, where the community has made environmental improvement a priority and invested public money in a variety of communication efforts. In these situations, impact measurement may also address attitudes and skills related to the environmental concern.

When outreach and marketing are applied in a community setting, such as through public media, a museum display, or summer day camp activities, impact is more likely to be measured by observing changes in behavior than in the school setting. Service-learning activities are likely to be monitored via volunteer hours invested in relevant activities. Youth program impacts are sometimes measured by contacting parents after an event to determine what messages youth brought home and what changes have been implemented in the home.

Where does youth education about waste reduction fit with formal education goals?

Education about solid waste management addresses the following education themes. Impact evaluation by schools is most likely to consider progress in these areas.

- National and Wisconsin science education content standards[1]
    - Science as inquiry
    - Earth and space science
    - Science in personal and social perspectives

[1] The National Academies Press Web site, http://books.nap.edu/openbook.php?record_id=4962&page=103; The Wisconsin Department of Education Web site, http://dpi.wi.gov/standards/sciintro.html

- National environmental education content standards[2]
    - Questioning and analysis skills
    - Knowledge of environmental processes and systems
    - Skills for understanding and addressing environmental issues

- Engaging youth in their community and as citizens[3]
    - Youth grow as active citizens in the community
    - Youth develop a sense of place and learn to take responsibility for their impacts on the environment
    - Youth learn how to apply the process of problem solving in their lives
    - Youth learn about career opportunities

Sample impacts with youth audiences

Long term impacts of environmental outreach and education with the youth audience have not been extensively documented or studied. Mechanisms to determine how to investigate impacts among youth, such as how to anticipate what behaviors will lead to increased stewardship or improved environmental management, are still under investigation. Nevertheless, recent studies inform us about the kinds of strategies that educators are testing, and give us some indication of what strategies seem to result in desired impacts. Below are sample studies which demonstrate the state of the research and the kind of impacts which have been documented.

Elements identified as significant to improving content knowledge; analysis and application skills; and motivation to make changes include:

- A comprehensive program which incorporate opportunities to practice skills along with improving understanding of the problems to be addressed
- Teacher preparation and professional development
- Resources for teachers
- Community cooperation and support

The studies included in this report are largely drawn from *My Environmental Education Evaluation Resource Assistant" (MEERA)***,** an online "evaluation consultant".[4] Other studies were identified through the UW Environmental Resources Center target audience research study.[5] The fact that only one study about waste reduction education is included with the sample is not an indication that this topic has not been studied. There are at least a few other studies evaluating the impact of waste reduction education, but it is not an area that has been addressed in depth.

Sample studies summarized, in brief, below include:

- Four Rs Action Program

[2] The North American Association for Environmental Education Web site, http://www.naaee.org/programs-and-initiatives/guidelines-for-excellence/materials-guidelines/learner-guidelines
[3] See *Give Water a Hand* Leader Guide for national service learning objectives, http://www.uwex.edu/erc/gwah/
[4] http://meera.snre.umich.edu/
[5] http://wateroutreach.uwex.edu/beps/TargetAudienceResearch.cfm

- Chesapeake Bay Foundation Conservation Education Programs
- Assessment of 4th, 8th, and 11th grade student's marine science knowledge
- Effects of fishing education programs on environmental behavior
- The Rouge River education project: implementation challenges
- A Park/School Program
- The Environmental Education Program at the New Jersey School of Conservation
- Elementary School environmental education field trip
- Place-Based Environmental Education Programs
- City Farmers: inner-city youth gardening program

The Four Rs Action Program impacts are described in a bit more detail since the study applies directly to questions raised in Jefferson County. The Chesapeake Bay program impacts are also described in some detail in order to provide an example of another type of in-depth study of environmental education impacts.

KIDS for the BAY: Four Rs Action Program[6]

KIDS for the BAY Four Rs Action Program is a hands on environmental education program for third, fourth, and fifth grade students and their teachers (in San Francisco). The program includes five two-hour long lessons focusing on reducing, reusing, recycling, and composting waste; in-class mini-action projects that reduce waste and conserve resources; a year long waste reduction action project that students choose, plan, and implement; and meetings with the teacher for program planning and evaluation. In addition teachers receive hands-on training in the curriculum, a curriculum guide, and an equipment kit to ensure they have the skills to teach the curriculum to future students once the year long program ends. Following the first year KftB follows-up with teacher to provide additional instruction and support as they implement the program on their own.

The goals of the Four Rs Action Program:

1) Thirty teachers learn to use the Four Rs message as an educational resource to stimulate students' learning. (The 4 Rs are reduce, reuse, recycle, and rot).
2) Nine hundred students increase their awareness of the issues of resource conservation and waste reduction and change their behaviors to help conserve resources and reduce waste.
3) The Four Rs message is integrated into the curriculum and culture of our target schools. Principals, teachers, students, and parents learn the value of reducing, reusing, recycling, and composting and practice these behaviors in their schools and at home.

Results: Highlights and Conclusions

Overall, results indicate that the goals of the Four Rs Action Program were achieved. The Four Rs Action Program provided professional development for teachers and meaningful, exciting, hands-on education for students in solid waste management and the Four Rs message.

[6] Shankar. S. (2007). Four Rs Action Program: Reduce, Reuse, Recycle, & Rot Program Evaluation. KIDS for the BAY. http://meera.snre.umich.edu/reports-and-case-studies/browse/four-rs-action-program-reduce-reuse-recycle-rot-program-evaluation/

- Students showed an overall increase in knowledge of the program content through results from the pre- and post- program surveys. The individual question results reveal that students learned key vocabulary terms and learned about solid waste management, resource conservation, the storm drain system, and the Four Rs.
- Both first and second year teachers shared that their students' awareness of and concerns about solid waste management increased as a result of the program. A few teachers reported a positive change in attitude towards solid waste management, not littering, and practicing the Four Rs.
- Most follow-up teachers reported that their students increased waste reduction behaviors as a result of participating in the program. First year teacher participants wrote many examples of how their students engaged in Four Rs behaviors during and after the program.
- Teacher participants increased their comfort level in teaching about solid waste issues, teaching about the Four Rs, and facilitating a waste reduction action project with their students due to participation in the program.
- Many teachers reported professional development and increased teaching skills as a result of the in-class modeling of the program. A few teachers indicated that they appreciated learning how to connect children to science in a way that is relevant to their lives. Teachers also reported an increase in their own knowledge about solid waste management and the Four Rs as a result of the program.
- All teachers felt prepared to teach the Four Rs Action Program the following school year. Teachers felt that the resources we provided to them (curriculum guide, in-class modeling, and equipment kit) contributed to their ability to teach the program lessons and activities. Follow-up teachers remained confident teaching about the Four Rs, facilitating a waste reduction action project, and teaching the Four Rs Action Program in their second year.
- Teachers shared the ways that their school communities had been influenced by the program. Many teachers reported that the Four Rs Action Program helped to reinforce, and in some cases increase, the school's efforts to recycle and reduce waste. A few teachers also said that their students completed projects through the program that educated the students' schoolmates and the school community about the Four Rs message.
- Teachers shared examples of how students' families have been influenced by the program. Many teachers reported that the Four Rs Action Program has contributed to waste reduction behaviors and an increase in awareness about the Four Rs in students' homes. A few teachers felt that, because they do not regularly interact with their students' families, they could not properly assess the impact the program has had on students' home environments. KIDS for the BAY could work to improve the evaluation process to better assess the impact the program has on students' families.

Chesapeake Bay Foundation Conservation Education Programs[7]

The Chesapeake Bay Foundation (CBF) asked the authors to conduct an evaluation of five youth and two teacher education programs. The main goal of the evaluation was to determine to what extent these programs influence participants' level of environmentally responsible behaviors. In light of this goal, data were collected on variables that have been linked to environmentally responsible behaviors. These variables included participants' environmental sensitivity, perceived knowledge of ecology/issues/action strategies, personal responsibility, perceived skill, and intention to act. Information about teachers' perceived barriers to teaching about the Bay was also obtained. Based on the evaluation's results, CBF decided to adapt each program to target a smaller number of specific ERB characteristics instead of attempting to influence all ERB characteristics through each one of its programs. CBF also focused on encouraging teachers to use multiple activities and programs which build on one another. Last, more effort was put into helping teachers implement the curriculum as intended and reducing their barriers to teaching about the Bay.

Pre and post surveys evaluated the impact of youth and teacher education initiatives in the Chesapeake Bay area. Youth initiatives included a 2-week field trip, a 3-day field trip, a 1-day field trip, a shad restoration project, and classroom use of a curriculum. Teacher programs included a 5-day summer field course and 2-day school year curriculum training.

- Findings seem to confirm that education programs need to be focused, provide multiple experiences over extended periods of time, and be coordinated with other interventions to reach their full potential in promoting Environmentally Responsible Behaviors (ERB).
- Each of the nine ERB characteristics (knowledge of issues, skill in actions, knowledge of ecology and actions, group locus of control, intention to act, environmental sensitivity, personal responsibility, individual locus of control) was affected by at least one of the five programs, with all groups increasing in knowledge of issues.
- Curriculum groups scored higher than comparison groups on only knowledge of issues. This result may be explained in part by the fact that teachers used only about one third of the recommended activities and few implemented the recommended service-learning project.
- Programs that showed an impact with a large number of ERB characteristics should have also led to an increased intention to act, but not all did..
- Personal responsibility and locus of control improved only among field trip participants. This suggests that programs are not providing youth with enough opportunities to develop self-confidence in their abilities.
- It is likely that some youths' ERB increased as a result of participation in outdoor programs, but the results are less clear for the curriculum and restoration project youth.
- Teachers who participated in the 5-day field inservice improved in all ERB characteristics. Teachers who participated in the 2-day curriculum inservice improved

[7] Zint, M., Kraemer, A., Northway, H., & Lim, M. (2002). Evaluation of the Chesapeake Bay Foundation's conservation education programs. Conservation Biology, 16(3), 641-649.

in all ERB characteristics except environmental sensitivity, not surprising given the indoor setting of the workshops.

Assessment of 4th, 8th, and 11th grade student's marine science knowledge[8]

This study investigated student knowledge of geological, ecological, physical, & chemical processes and natural resources related to Oregon's marine resources. Results indicate that students exhibited an understanding of concepts that correspond to American Association for the Advancement of Science Benchmarks for Scientific Literacy, including: geological structure and process, energy, nutrients, and food webs. But it was clear from the study that student understanding of physical and chemical characteristics, processes and effects did not progress beyond the early grades. The study concluded that meaningful learning in formal education settings requires that the teacher determine what the learner already knows. Teachers should continue to: identify relevant real-world events that can help form the focus of instruction and that can offer students the opportunity to conceptually analyze science knowledge related to those events.

Effects of fishing education programs on environmental behavior[9][10]

A 2001 and 2007 study examined *Hooked on Fishing – Not on Drugs*, a comprehensive fishing curriculum for 4th through 12th grades. In the 2001 study, the authors surveyed participants in Grades 6 – 8. The study found that:

- Participation in fishing can influence entry-level stewardship variables.
- Use of the full *Hooked on Fishing – Not on Drugs* program is more likely than a partial programs (with no fishing activities) to influence entry-level stewardship variables including environmental sensitivity (more likely to want to fish more; high importance to thinking about or going fishing; more likely to believe their skills were strong and that their skills had improved; higher overall knowledge of fishing and specific concepts such as those related to ecology or regulations; believed their understanding had increased)
- Full programs were more likely to stimulate some ownership level stewardship skills (how humans affect fish; importance of caring for habitat)
- Neither group was confident about some ownership level stewardship skills (whether their actions affected the environment; whether it was their responsibility to take action to protect the environment; what they could do personally)
- Students in full programs were more likely to know to: fish without bothering others; limit impact on the environment while fishing; learn things they can do to help
- Because students in the control group fished and few full programs involved multiple fishing experiences, it is difficult to draw definitive conclusions about the affect of full programs on environmentally responsible behavior compared to the control group.

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[8] Brody, M. J. (1996). An assessment of 4th-, 8th-, and 11th-grade students' environmental science knowledge related to oregon's marine resources. Journal of Environmental Education, 27(3), 21-27.

[9] Siemer, W. F., & Knuth, B. A. (2001). Effects of fishing education programs on antecedents of responsible environmental behavior. Journal of Environmental Education, 32(4), 23-29.

[10] Fedler, A. J. (2007). A Test of Aquatic Education and Stewardship Relationships among Youth in *Aquatic Stewardship Education I Theory and Practice*, B. A Knuth and W. F. Siemer, eds. Baltimore: American Fisheries Society.

A 2007 study investigated changes in student perceptions of skill competency, interest in fishing, and aquatic stewardship attitudes in grades 4 – 12 physical education classes. The study found that as student fishing skills improved, their interest in fishing and in aquatic stewardship also increased. Skill level, skill change, and interest were all positively related to stewardship attitudes.

The Rouge River education project: implementation challenges[11]

The Rouge Education Project is a school-based environmental education program that uses water monitoring, telecommunications, and student actions to improve water quality. The author carried out a program evaluation to better understand the challenges generated by this type of program. Results indicated that the program met its goals of increasing awareness and concern about the Rouge River and developing a supportive curriculum in science classrooms. Inservice workshops and curriculum resources were important to the program success.

- More than half of the teachers used the full 10 days of curriculum; water quality testing was the most widely used component, community surveys were the least used component
- 84% of schools logged into computer conference but some only logged data
- 77% of teachers reported behavior changes in their work including modifying curriculum exchanging text books for real world activities, and initiating small group collaboration
- Half of the teachers did not report the student action component
- 71% of teachers noted that the program effectively increases student knowledge base about the watershed
- Students and teachers have successfully enacted small- and large-scale environmental change across the Rouge River basin
- Students and teachers have become more actively involved in other activities sponsored by Friends of the Rouge.
- Teachers and students benefit from professional development that provides teachers with awareness, knowledge, and skills to overcome perceived program barriers
- Explosion of the Internet has facilitated program conferencing among teachers and eliminated many of the logistical challenges of classroom computer use.

A Park/School Program[12]

This study investigated the effectiveness of an urban resources initiative to introduce 5th graders to natural resources in a neighborhood park and to develop their social skills. The study found that:

- Knowledge gained by treatment group was significantly greater than the control group
- No conclusive improvement in attitude was observed in either treatment or control groups.

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[11] Talsma, V. (2001). The rouge education project: Challenges of implementation. The Journal of Environmental Education, 32(3), 26-30.

[12] Milton, B., & Cleveland, E. (1995). Changing perceptions of nature, self and others: A report on a park/school program. Journal of Environmental Education, 26(3), 32-39.

- Qualitative observations indicated improvements in social skills of students in treatment group. No comparison was made to improvements in social skills of students in the control group.
- Parents were impressed by student outcomes (student "interpretation" of park ecology); teacher interns enjoyed teach the class; museum staff noted knowledge and enthusiasm of students when they visited

Overall, the program appeared to have met its goals. The children felt connected to the park, the park rangers, the interns and their university, the project coordinator, and their teachers. They not only announced that the park was theirs, but encouraged their younger schoolmates to feel ownership, too. Signs of their growing sense of efficacy included the increasing rapidity with which they took on new challenges and the fact that students continued to volunteer for work in the park two years after completing the program.

Evaluation of the environmental education program at the New Jersey School of Conservation[13]

The New Jersey State School of Conservation serves elementary and middle-school students in New Jersey Schools. The four curricular areas taught include environmental sciences, humanities, outdoor pursuits and social sciences. The external evaluation of this program included quantitative and qualitative components aimed at examining the extent to which the program successfully impacted affective, cognitive and conative outcomes among student participants. Pretests and posttests around student visits were administered using the Children's Attitudes Towards the Environment Scale (CATES) to measure changes in students' attitudes towards the environment. The evaluation instrument had been validated in previous research studies. In addition to analyzing the pretests and posttests, the evaluators conducted a qualitative examination of the match between NJSOC lesson plans and program mission objectives.

The paper summarizing findings for this study was not readily available at the time of writing this summary.

Elementary school environmental education field trip[14]

This evaluation sought to assess the long-term effects of short environmental education field trips on students, with the goal of assessing the usefulness of such programs. The National Parks Service wanted to know how participants in its programs react to and interpret their experiences in the parks. The study was not intended to produce results that can be generalized across the population, but rather to identify potential trends for further study. This evaluation is one of thirteen similar studies that the same group of researchers has been/is conducting at major national parks and historical sites. The participants in this study were from a class of 30 fourth-grade students.

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[13] Smith-Sebasto, N.J. and H. Semrau. (2004). Evaluation of the Environmental Education Program at the New Jersey School of Conservation. The Journal of Environmental Education, 36 (1): 3-18

[14] Farmer, J., Knapp, D, & Benton, G (2007). An Elementary School Environmental Education Field Trip: Long-Term Effects on Ecological and Environmental Knowledge and Attitude Development. Journal of Environmental Education, 38(3), 33-42.

The paper summarizing findings for this study was not readily available at the time of writing this summary.

Place-Based Environmental Education Programs[15]

The Place-Based Education Evaluation Collaborative (PEEC) provides evaluation support to member organizations with the goal of improving place-based education program models and evaluation techniques. PEEC member organizations focus on sustainability. The four PEEC programs evaluated were the CO-SEED Project, the Community Mapping Program, the Sustainable Schools Project, and A Forest for Every Classroom Program. CO-SEED and the Sustainable Schools Project are whole school improvement projects focusing on sustainability. The goals of PEEC are:

1. To serve as a learning organization for program developers and to fuel internal growth and program development for the individual organizations;
2. To develop, identify, and disseminate evaluation techniques, tools, and approaches that can be applied elsewhere; and
3. To contribute to the research base underlying the field of place-based education and school change.

The paper summarizing findings for this study was not readily available at the time of writing this summary.

City Farmers inner-city youth gardening program[16]

City Farmers is an inner-city youth program established in 1994 through the sponsorship of 4-H. The program is open to youth from all backgrounds to engage in gardening, learn about plant science, and hone entrepreneurial skills. Youth meet three mornings a week for eight consecutive weeks during the summer. The eight weeks are divided into 2-week "activity settings," each focusing on a different aspect of gardening in the context of a market economy. The 2-week cycles include: (a) nurturing, (b) harvesting, (c) marketing, and (d) special projects. The main goal of the evaluation was to investigate how informal, experiential education programs, whose primary goal is not to teach science, can lead to meaningful science learning for participants.

The paper summarizing findings for this study was not readily available at the time of writing this summary.

[15] Powers, A. L. (2004). An Evaluation of Four Place-Based Education Programs. The Journal of Environmental Education, 35(4): 17-32.

[16] Rahm, J. (2002). Emergent learning opportunities in an inner-city youth gardening program. Journal of Research in Science Teaching, volume 39 (2), 164-184.