

**An Evaluation of
National Oceanic and Atmospheric Administration
Chesapeake Bay Watershed Education and Training Program
Meaningful Watershed Educational Experiences**

Executive Summary



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EXECUTIVE SUMMARY

The National Oceanic and Atmospheric Administration (NOAA) funds Meaningful Watershed Educational Experiences (MWEEs) for students and professional development for teachers in the Chesapeake Bay watershed through its Bay Watershed Education and Training Program (B-WET). NOAA, with support from the Chesapeake Bay Trust and the Keith Campbell Foundation for the Environment, commissioned this evaluation to assess the effects of NOAA B-WET-funded Chesapeake Bay MWEEs on teachers' practices and students' environmental stewardship and academic achievement.

Data were obtained and analyzed from about:

- 500 MWEE professional development participants who completed a post-program questionnaire,
- 640 MWEE and comparison students who completed pre/post-test questionnaires, and
- 1,000 MWEE and comparison students who completed their state's standardized science tests.

Additional insights were derived from interviews with thirteen program managers from nine NOAA-funded organizations that provided MWEEs and professional development.

TEACHER PRACTICE

Do the professional development programs increase teachers' confidence in their ability and intentions to implement MWEEs?

Yes. On average, teachers reported increasing from "somewhat" to "very" confident in their ability and from "likely" to "very likely" to implement a MWEE as a result of their professional development.

Do the professional development programs result in teachers implementing MWEEs with their classes?

Yes. However, not all MWEE practices were implemented equally. Almost all of the teachers reported that they taught about the watershed or the Bay after the professional development, including the large majority of those who had not taught about the watershed or Bay in the past. Importantly, many teachers reported conducting more MWEE practices as a result of the professional development. However, about a quarter of the teachers reported that they were not teaching outdoors and about half reported that they were not conducting issue research or action projects with their students. About one third of the teachers implemented complete MWEEs that included Bay or watershed ecology instruction, outdoor learning, issue research, and environmental action.

It is likely that teachers' satisfaction with their professional development experiences contributed to the above outcomes. The majority of teachers reported having an "excellent" professional development experience. Teachers were most satisfied with the instructors, the quality of the information provided, and the usefulness of what they learned for improving their students' environmental stewardship.

What best professional development practices contribute to teachers' confidence in their ability and intentions to implement MWEEs?

Teachers expressed their degree of satisfaction with seventeen professional development practices. The six practices most strongly related to teachers' confidence and intentions to implement MWEEs were:

- Demonstration of how MWEEs will improve student academic achievement,
- Demonstration of how MWEEs will improve student environmental awareness, knowledge, and actions,
- Demonstration of the applicability of curriculum materials and activities to teachers' school district's learning standards,
- Follow-up support from professional development providers,
- Instruction and modeling of ways to guide students in conducting environmental action, and
- Instruction and modeling of ways to guide students in researching an environmental issue.

The following practices were also positively related to teachers' confidence and intentions to implement MWEEs:

- More professional development days,
- Time for hands-on learning,
- Time for practicing new skills, and
- Time for teachers to plan ways to integrate MWEEs into their curriculum.

What enables or limits teachers' use of MWEEs?

Teachers who participated in MWEE professional development in the past were asked about the extent to which they had a variety of resources (sixteen in total) to implement MWEEs with their students. In response, teachers most often reported having *sufficient*:

- Information on local watershed or Chesapeake Bay ecology,
- Information on local watershed or Chesapeake Bay environmental issues, and
- Knowledge and skills for teaching outdoors.

Teachers most often reported having *insufficient*:

- Flexibility in their curriculum,
- Funds for equipment, field trip fees, and transportation,
- Opportunities to collaborate with other teachers, and
- Professional development during the school year.

Recommendations

NOAA should continue to support high-quality MWEE professional development with priority given to multi-day programs. The professional development should include specific guidance on how teachers can incorporate MWEEs into their existing curriculum. Providers should allocate sufficient time for this during professional development. Teachers should be encouraged to bring their teaching guides to the professional development so that they can use this time to determine how best to integrate MWEEs. Providing teachers with sample lesson plans that illustrate how MWEEs can be incorporated into the existing curriculum is also likely to be helpful.

To address teachers' desire for collaboration, professional development should include sufficient time for teachers to learn from their peers and to partner with another or several teachers.

Providers should also consider offering MWEE professional development to teams of teachers from the same school to help ensure teachers will be able to support each other as they implement MWEEs.

Professional development providers should offer follow-up support in the form of instructional assistance, in the classroom and the field, to enable teachers to implement all components of a MWEE, especially environmental issue research and action projects. Teachers would benefit from funding to enable them to obtain the resources they need to implement MWEEs.

In collaboration with teachers, MWEE providers, and other stakeholders, NOAA should explore if and how school district standards can be revised so that MWEEs become an essential part of instruction (e.g., contained in curriculum pacing guides).

STUDENT ENVIRONMENTAL STEWARDSHIP

Do MWEEs increase students' characteristics associated with environmental stewardship?

Yes. Students improved in three of eight stewardship characteristics as a result of participating in B-WET-funded MWEEs. Importantly, students moderately increased in the characteristic most closely associated with future behavior, their intention to act to protect the Chesapeake Bay watershed. Students strongly increased in their knowledge of issues confronting the watershed or Bay and moderately increased in their knowledge of actions in which they can engage to protect the watershed or Bay. There is also some evidence that students moderately gained in their knowledge of watershed or Bay ecology, although this result was not statistically significant. All of these students' teachers agreed that their students knew more about the local watershed or the Chesapeake Bay. There was no evidence, however, to suggest that students improved in the remaining four environmental stewardship characteristics (environmental sensitivity, personal responsibility, or individual or group locus of control).

Which best MWEE practices result in the highest stewardship and engagement in learning?

Students scored higher in two or more stewardship qualities and engagement in learning when they experienced any of the following MWEE practices (listed in descending order of positive effects):

- Learning things that are important to them,
- Hands on learning,
- Collecting and analyzing data, and
- Learning outdoors.

In addition, reflecting on their learning had many positive effects on students' stewardship qualities. Participating in an action project and/or listening to talks and reading about issues also had positive, but more modest, effects on students' stewardship.

Importantly, students' sense of responsibility to protect the environment and their feeling that they can make a difference on their own (individual locus of control) appeared to be most positively influenced by (in descending order of positive effects) collecting and analyzing data, conducting action projects, and listening to talks and reading about issues. Because about a

quarter of the students in the pre/post stewardship analysis did not collect or analyze data and about a third of the students did not participate in an action project (only a small number did not listen to talks or read about issues), it may be that these particular stewardship qualities would have improved if more students had experienced these practices.

Recommendations

Encourage teachers and providers of MWEEs to learn what is important to students and to be sure to connect MWEEs to these interests to make learning about the watershed or Bay relevant for students. In addition, instructors should foster MWEEs that incorporate hands-on learning, reflection, and learning outdoors. Ideally, MWEEs should include collecting and analyzing data and issue research based action projects. These specific practices have positive effects on environmental stewardship characteristics that other practices are less likely to influence. When engaging students in learning about the watershed, Bay, or their community and in action projects, be sure that these are empowering experiences. Negative experiences have the potential to decrease students' environmental stewardship characteristics. To the extent possible, all students should be involved in all aspects of quality MWEEs.

STUDENT ACADEMIC ACHIEVEMENT

Do MWEEs increase students' academic achievement in science?

Potentially. MWEEs have the potential to increase students' academic achievement in science. This observation is based on a case study of one B-WET-funded Virginia program that provided MWEEs to students who also completed a state standardized science test, as well as on teachers' impressions. In this case, third grade students performed moderately better on the Science Investigation category (one of four categories) of the state standardized science test. In addition, most teachers who participated in MWEE professional development believed that their students were better prepared for the state standardized tests as a result of MWEEs. Almost all teachers believed their students' engagement in learning increased, a factor associated with student achievement. Our analyses, however, did not detect a change in students' engagement in learning.

Recommendations

Additional research and evaluations are necessary to determine to what extent MWEEs can increase students' academic achievement. This evaluation focused on assessing gains in achievement based on students' performance on standardized science tests and engagement in learning. Other standardized tests and ways to measure achievement can be explored. To generalize the effects of MWEEs on state standardized tests, B-WET providers would have to target students in grades that are tested and for whom districts and authorities are willing and able to provide test scores.

In collaboration with teachers, providers, and other stakeholders, NOAA should explore to what extent MWEEs should have student achievement, in addition to environmental stewardship, as a desired goal. If student achievement remains a desired goal, further study is needed on how MWEEs can best foster student achievement. If not, NOAA should explore alternative ways to promote MWEEs' educational value to teachers and administrators.
