

NOAA's Pacific Northwest Meaningful Watershed Education Experiences

September 2012



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In 2008, the National Oceanic and Atmospheric Administration began supporting Meaningful Watershed Education Experiences (MWEEs) in the Northwest through the Bay Watershed Education and Training (B-WET) program. Since then, **Pacific Northwest** B-WET-funded educators have taught over 20,000 students about their local watersheds and oceans. In February 2012, NOAA, Salish Sea Expeditions and the Pacific Education Institute convened regional educators and administrators to confer on the current state of best practices in MWEE education and to identify and propose systemic and policy improvements to enhance the availability and efficacy of MWEEs. Three main solutions were proposed on how to improve MWEE education and overcome current barriers. These include:

- Use this paper's findings to advocate for continued Pacific Northwest B-WET funding
- Support and collaborate rather than compete for limited resources
- Remain committed to this process of convening partners and resources

Part I What makes good Meaningful Watershed Education Experiences?

Part II Success stories

Part III Good, Better, Best Practices

Part IV Integrating Meaningful Experiences into curriculum

Part V Next Steps



Part I - What makes good MWEEs?

NOAA's Pacific Northwest B-WET educators have reached over 20,000 students over the past three years through Meaningful Watershed Education Experiences. A broad survey of Washington State B-WET educators described what makes a good MWEE and how MWEEs engage students, teachers, and can be a useful tool for schools to meet STEM goals.

A. MWEE Students

...investigate their local watershed and beaches

...build outdoor investigations into action plans to develop healthy watersheds

...learn from professionals by working with them and through video, articles and other NOAA materials

...share what they learn with others in their school and community

Teachers told us why MWEEs matter for students

"Students are more engaged in their learning"

"[My] students have parents who depend upon the quality of our watershed for their employment in many cases...the value of all this, integrated with their own lives awakes in their study."

"Students learn how to treat their watershed to keep it healthy. They see their neighborhood creek as a necessary asset to their community and our state"

B. MWEE Teachers

...learn to use watershed and ocean literacy education materials

...increase their understanding of MWEE content and teaching skills

...find resources and mentors to support MWEE learning

...integrate MWEE into their curriculum



Teachers learn to integrate watersheds with their curriculums

“Up until this [B-WET] seminar, I have been uncertain about how to allow my students to embrace the importance of ocean science. I now feel equipped to begin the journey.”

“I will be incorporating the resources from NOAA into my curriculum. Specifically I like the buoy data information, which will tie in nicely to our weather and water unit.”

C. School Administrators can trust MWEEs

(i) MWEEs help teachers meet state and national learning standards

- WA State education standards

Washington State Requires Environment and Sustainability Education

WAC 392-410-115, Instruction about conservation, natural resources, and the environment shall be provided at all grade levels in an interdisciplinary manner through science, the social studies, the humanities, and other appropriate areas with an emphasis on solving the problems of human adaptation to the environment.
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- 2011 WA Environment & Sustainability Plan: Students should learn...
 - Standard 1: Ecological, Social and Economic Systems
 - Standard 2: The Natural and Built Environment
 - Standard 3: Sustainability and Civic Responsibility
- MWEEs support current curriculum, especially science, technology, engineering and math (example: field investigations, evidence-based problem solving)
- Support Washington State Grade Level Equivalency standards

(ii) MWEEs provide common structures

- Project Based Learning
- Inquiry and investigation models
- Showcasing of student work (presentations, symposiums, and online publishing)

(iii) MWEEs value

- Reaching diverse audiences
- Engaging multiple intelligences and learning styles



Figure 1. Words Educators use most often to describe MWEs

Part II- Success stories

Case studies were provided from several organizations who participated in the Roundtable and highlight examples of good MWEs in practice.

A. Examples of Student Research and Field Experiences

Several organizations provided examples of student research and field experiences to highlight examples of good MWEs in practice.

(i) “Schools come to Padilla Bay Reserve for a one-day field and classroom/lab experience. All field work is done from shore at an estuary beach, mostly sand, mud flat and eelgrass.”

(ii) “It’s not a field trip any more, it’s a field investigation. It’s science oriented or it’s social science oriented and there’s a purpose to it, and they understand it and bring skills to bear to it. I think that’s the transformation that the work with Pacific Education Institute has helped with. We feel comfortable as educators taking students into the field to do real field science. We have the tools to do it, we have the methodology to do it, we have the resources, we have a purpose for it. It’s not just a stand-alone [activity].”

(Teacher focus group, 2011)

(iii) “Salish Sea Expeditions provides the stepping-off point for my students to not simply learn about science, but to employ the skills of a real scientist as they engage in true and practical field research. The Salish staff enhances my ability to provide meaningful scientific hands-on inquiry-based learning opportunities for my students. I look forward to our continued partnership in the task of inspiring local youth to advocate for the health of the waters and watersheds of the Puget Sound.”



(iv) During a Foss Waterway Seaport program, Alfonso Gonzalez from Chimacum Middle School posted Stream Monitoring Journals on educatoral.com/moodle:

"Roses are red, violets are blue, our creek is clean, clear, and cool. Nitrates, Ph and others like DO, lead us to one thing that all of us know. Chimacum Creek is doing great, so jump off your chair and celebrate!!!

If you don't believe so, I'll prove it to you. All the sixth graders divided into water quality jobs and gathered this data:

- DO (disolved oxygen) average= 8.125 mg/l which is not too high or too low
- Ph (positive hydrogen) average= 6 which means that our creek is almost pure but slightly acidic.
- Turbidity average= 44.7 NTU which means our creek is clear.
- Nitrates average= 0.3 mg/l which means that there are enough nitrates for algae to grow but not enough for fish to be affected.
- Ammonium average= 1.6 mg/l which is the only average here that is bad.
- Flow rate average= 1972.8 gal/s which is slow enough for fish to rest but fast enough for the algae to not grow super big.
- Temperature average= 31.13 degrees F which means the creek is cool. (As in cold).

But, just because we know that the creek is clean and healthy, doesn't mean we can take it lightly. We still need to make sure it stays clean. So please stop doing anything that might pollute it, even littering on land can affect the creek.”



B. Students Increased their Focus

Several organizations noted increases in student attitude and career aspirations following participation in MWEEs.

In a Grays Harbor student survey following Pacific Northwest B-WET support:

Attitude to math and science

- Over 70% of students believed that math and science were important in everyday life and careers.
- Approximately 55% and 40% of respondents indicated that they would be willing to take more than the required amount of math and science, respectively.
- Approximately 30% of the students reported that they were thinking about a career in natural resources.

Changes in career plans

- Approximately 85% of students indicated that the programs helped them learn “a lot” or “some” about their career goals.

Over 30% of students considered green careers as interesting.

C. Stewardship Values and Communicating Findings

A key part of MWEEs is sharing one’s findings with others in the community. With increased attitudes and appreciation for the environment, students become stewards of the environment.

One teacher wrote, “The expedition that the Salish Sea Expeditions staff provides serves as a platform for my students to see themselves and their community in a broader scope than previously possible. Through this research experience, students develop a sense of stewardship for the Puget Sound as they learn to appreciate the consequences of human action on this complex ecosystem. Students bring home an enthusiasm for advocacy, encouraging their classmates to appreciate their own neighborhood as part of a delicate watershed that requires conscious management and tending. Once ashore, the Salish staff facilitates further inquiry-based student-led investigations around local watershed parameters. Students are taught the importance of sharing their findings and are taught methods for effectively communicating the results from their experiments. My students have worked to raise awareness about the importance of being benevolent stewards of the watershed that envelops their community.”

Part III- Good, Better, Best Practices

The Good-Better-Best examples show a progression of deepening impacts of MWEEs. Participants from the Roundtable and the Storming the Sound Conference in March 2012 contributed to the defining of each practice, which builds upon the previous practice, and leads to an ideal or “best” practice.

<p>Meaningful Watershed Education Experiences</p> <p>Progression of Deepening Impacts</p> <table border="0"> <tr> <td data-bbox="228 567 446 934"> <p>Good</p> <p>Examples of good practices</p> <p>Notes: (1) Each practice builds on the previous practice. (2) “Best” practices describes an ideal that may not always be possible to achieve.</p> </td> <td data-bbox="446 567 649 934"> <p>Better</p> <p>Describes best practices.</p> </td> <td data-bbox="649 567 878 934"> <p>Best</p> <p>Describes exemplary or the deepest MWEE practices.</p> </td> </tr> </table>	<p>Good</p> <p>Examples of good practices</p> <p>Notes: (1) Each practice builds on the previous practice. (2) “Best” practices describes an ideal that may not always be possible to achieve.</p>	<p>Better</p> <p>Describes best practices.</p>	<p>Best</p> <p>Describes exemplary or the deepest MWEE practices.</p>	<p>Project Based Learning</p> <table border="0"> <tr> <td data-bbox="878 567 1112 934"> <p>Good</p> <p>Student projects use all or most of the steps that describe high-quality Project Based Learning (example: OSPI Sustainable Design, Pacific Education Institute, Buck Institute for Education etc.)</p> </td> <td data-bbox="1112 567 1315 934"> <p>Better</p> <p>Students use community and internet resources to deepen their MWEE project based learning.</p> </td> <td data-bbox="1315 567 1549 934"> <p>Best</p> <p>Students are able to refine and replicate their PBL design.</p> </td> </tr> </table>	<p>Good</p> <p>Student projects use all or most of the steps that describe high-quality Project Based Learning (example: OSPI Sustainable Design, Pacific Education Institute, Buck Institute for Education etc.)</p>	<p>Better</p> <p>Students use community and internet resources to deepen their MWEE project based learning.</p>	<p>Best</p> <p>Students are able to refine and replicate their PBL design.</p>
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<p>Teacher Engagement</p> <p>Good Teams of teachers work to integrate MWEE into their curriculum.</p>  <p>Better Teachers and school administrators work together to integrate MWEE curriculum over time.</p> <p>Best Teachers are supported by school and state leaders to achieve academic excellence through MWEEs.</p>	<p>Community Connections & Program Mentors</p> <p>Good Mentors understand how to work with student and teacher needs.</p> <p>Better Mentors share their expertise, and help students understand how they can contribute to healthy systems.</p> <p>Best Mentors set high bars for student work and integrate student perspectives into their work.</p>
<p>Program Equity</p> <p>Good Students from underserved communities are engaged in MWEE experiences.</p> <p>Better Students work with and see <u>themselves</u> as scientists and natural resource managers.</p> <p>Best All students from an underserved school or district are engaged in MWEE through conversations in their community, including student voice, diverse mentorships and student leadership.</p>	<p>Students Demonstrate Learning</p> <p>Good Students demonstrate learning through classroom assignments and participation.</p> <p>Better Students present to other students and their communities.</p> <p>Best Students are motivated to present their best work to audiences that can affect a change.</p>



Part IV- Integrating Meaningful Experiences into curriculum

The following represents a compilation of barriers to MWEE implementation and systemic and policy improvements that participants believe will enhance the availability and efficacy of MWEEs. A list of resources of the best existing national and state resources and tools follows.

Barriers to MWEE Implementation (MWEE Educator survey responses):

“On the contrary, we find outdoor learning experiences exciting and engaging, with plenty of available resources, which makes them easy to implement if the funding is there. Finding ongoing adequate funding is our biggest challenge.”

1. No barriers
2. Time - curriculum content is dense and field experiences take time
3. “It's not hard, but transportation is expensive“
4. There is competition for time in schools because of pressure from testing
5. Funding

Support Community & Professional Partnerships: What do partners need?

Teachers please...

1. Keep up communications
2. Send final reports to your partners- this helps them justify their work to their bosses (pictures, with permission, are also helpful)
3. Stay involved

MWEE partners please....

1. Understand that teachers' planning and teaching time is extremely limited
2. Work with teachers to meet their students' learning objectives and integrate field experiences into their curriculum
3. If you take on all the work of a field experience, realize that the learning will not continue when you are not there

Funders please....

1. Consider supporting sustained programs not just pilot programs which sometimes go against the mission and vision of an organization
2. Recognize long-term student data is difficult/near impossible to track at this time
3. Attend a program and jump in. Passion inspires passion; we could use your influence to speak of the importance of MWEEs to others

Resources for MWEEs

The following is a compilation of the best existing national and state resources and tools for (1) student research and (2) curriculum resources. Tools are available

<http://tinyurl.com/mwee2012>

(i) Top websites for student or teacher research about watershed, environmental and marine science

- NOAA
- YouTube
- Puget Sound Partnership
- Olympic Coast National Marine Sanctuary

(ii) Top repositories for curriculum and educational resources

- | | |
|-----------------|--|
| National | <ul style="list-style-type: none">▪ NOAA website▪ The Bridge▪ National Science Teachers Association |
| WA State | <ul style="list-style-type: none">▪ E3 Washington▪ Washington Science Teachers Association (WSTA)▪ Pacific Education Institute▪ Washington Sea Grant▪ Education Service District websites▪ NW Aquatic & Marine Educators (NAME)▪ The Washington Coastal Atlas▪ Office of Superintendent of Public Instruction (OSPI)
Environmental and Sustainability Education |

WA OSPI Environmental and Sustainability Literacy Plan

Goal 1 Community Connections/Informal Learning

Populate and promote the E3 searchable database as a resource for finding high quality informal programs.

(iii) Tools to Communicate with K-12 Teachers

- E3 Washington (website, listserve, & Facebook). E3 is the network selected in the OSPI Environment and Sustainability Literacy Plan
- WSTA- (listserve)
- Puget Sound Partnership- (twitter & Facebook & ECONet networks)
- Pacific Education Institute-(website, twitter, Facebook & Free Resources)
- WA STEM- (Facebook)
- ESD 114- (Facebook)
- NAME- (Scuttlebutt listserve)

(iv) Funding Opportunities

- NOAA's Pacific Northwest B-WET
 - EPA
 - Dept of Ecology
 - WA STEM
 - Washington Fund for the Environment for small grants
 - Russell Family Foundation
 - State Farm
-

MWEE Evaluation practices- Focus on Student Impacts

- Measure Numbers – students, teachers, etc.
 - This is easy to measure, but it does not tell the whole story
 - Measure student and teacher outcomes using pre and post surveys:
 - Concepts – do students know more about systems, environmental literacy & human impacts?
 - Skills – STEM skills (science, technology, engineering and math), and other academic subjects. Example: Are students able to measure water quality?
 - Attitudes and behaviors – towards career options, sense of place, stewardship, confidence, leadership
 - Pre/post surveys provide quantitative evaluation. Open-ended questions capture rich information.
 - Student symposiums – students reflect and communicate what they learned
 - **Barriers for evaluation:**
 - Difficulty of longitudinal student tracking
-

92% of those surveyed assessed their student learning through authentic student work. Students demonstrated their learning through classroom participation, reports, journals, and presentations.

Part V- Next steps

The purpose of NOAA's Bay-Watershed Training (B-WET) environmental education program is to promote locally relevant, experiential learning in the K-12 environment, primarily through Meaningful Watershed Educational Experiences (MWEEs). The Pacific Northwest B-WET program recognizes that knowledge and commitment built from firsthand experience, especially in the context of one's community and culture, is essential for achieving environmental stewardship (<http://www.legislative.noaa.gov/NIYS/>). After convening and discussing the current state of best practices in MWEE education and identifying and proposing systemic and policy improvements to enhance the availability and efficacy of MWEEs, Pacific Northwest B-WET Educators want to...

- Continue to communicate and support- help each other to be efficient and effective
Learn to support rather than compete for resources, etc.
- Use one central website to share resources and stay in touch
- Remain committed to this process
- Be provided opportunities to come together to explore collaboration in person
- How can we collaborate to get funding?
 - Can we build this into a compelling model for other funders?
 - Advocate continued Pacific Northwest B-WET funding

Appendix

NOAA Definition of MWEEs

MWEEs are investigative or project oriented; they are an integral part of the instructional program; they are part of a sustained activity that stimulate and motivate students from beginning to end; they consider the watershed as a system; and MWEEs are enhanced by NOAA products, services or personnel.