Fostering Bay Stewardship via Outdoor and Online Learning

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George Mason University
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School2Bay Project Aims

- Increase **watershed stewardship** for the Chesapeake Bay

- Provide **MWEE** — **Meaningful Watershed Educational Experience** — for all students in Prince William County, VA:
  
  - 16,000+ Middle School Students in 2009-2012
  - 2500+ High School Students in 2010-2012

  through a team of 50+ trained teachers &
  50+ college science students, alumni & retired teachers
Project Approach

1. Create adaptable lesson plans to address state’s learning objectives. (see school2bay.pbworks.com)
2. Train & technically assist teachers to implement lesson plans.
3. Bring students on-line, outside and to natural areas to investigate watershed status and impacts.
4. Foster student stewardship projects.
Middle School Lesson Plans

29 Lesson Plans for 6th Grade Science:

- What is a watershed? (11)
- Why is the state of the watershed important to people? (16)
- How can we improve water quality in the watershed? (2)
Middle School Teacher Training

- 3 days in August learning, practicing and refining lesson plans, participating in field investigations

- Professional Learning Community (PLC) meets in January & late Spring for ongoing peer-to-peer learning
Middle School Field Investigations

E.g., Manassas students study wetlands on field trip. 9NEWS NOW and wusa9.com, April 23, 2010:

1. What is a watershed?
   • +6% defined as a body of water - (68% / 74%)
   • +16.5% “ as an area of land (1.5% / 17%)
   • +11% “ as a drainage area (3% / 14%)

2. What is your watershed?
   • +13% correctly identified Chesapeake Bay or tributary basin (12% / 27%)

3. What are the top 3 pollutants in your watershed? (and how do you know?)
   • +10.5% correctly identified N, P & Sediments (0.5% / 11%)
   • +24% learned in school (45%/69%)
   • Post-MWEE, ~ 2/3 identified at least one of these
   • Other notable responses:
     – TV - 17% / 19%
     – Someone told me – 20% / 31% (...us?)
   • Over half identified other pollutants:
     Trash – 76% / 59% | Oil – 62% / 49%
     Plastic Bags – 47% / 25% | Gasoline – 45% / 35%
4. What can you do to prevent pollution?
   • -9% said pick up or clean up trash (56% / 47%)
   • Other notable responses
     • +1% Recycling (11% / 12%)
     • +6% Use less chemicals / fertilizer (2% / 8%)
     • +11% Build buffers (2% / 13%)

5. What grade would give the Chesapeake Bay?
   • -12% gave it a C – 45% / 33%

   (Most recent report card (2009 - University of Maryland Center for Environmental Science (UMCES)) gave it a C)

   • “B,” “C,” and “D” responses decreased while “F” responses increased from pre- to post-MWEE:
     B – 21% / 17%  |  D – 19% / 17%  |  F – 9% / 28%
Middle School: Online vs. Outdoors?
Middle School: Online vs. Outdoors?

<table>
<thead>
<tr>
<th>Location</th>
<th>Effectiveness</th>
<th>Lesson Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Classroom</td>
<td>87% Modeling: A drop in the bucket</td>
<td></td>
</tr>
<tr>
<td>On-line</td>
<td>80% What is a watershed?</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>80% Watershed boundaries</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>77% Stewardship project ideas</td>
<td></td>
</tr>
<tr>
<td>On-line</td>
<td>64% Watershed address using Google Maps</td>
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<tr>
<td>Classroom</td>
<td>60% Topographic map investigation</td>
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<tr>
<td>On-line</td>
<td>56% Introduction to water quality</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>48% Data collection and analysis</td>
<td></td>
</tr>
<tr>
<td>Outside</td>
<td>48% Stream table investigation</td>
<td></td>
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<tr>
<td>Classroom</td>
<td>42% On-line Games for Students</td>
<td></td>
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<tr>
<td>On-line</td>
<td>Using watershed models to demonstrate</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>38% importance of riparian buffers</td>
<td></td>
</tr>
<tr>
<td>Outside</td>
<td>38% Schoolyard mapping</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>33% Water conservation</td>
<td></td>
</tr>
<tr>
<td>Outside</td>
<td>Exploring the watershed: Cacapon Institute e-School</td>
<td></td>
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<tr>
<td>Classroom</td>
<td>Calculating the amount of impervious surface in</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>28% your schoolyard</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>19% Role playing: A river runs through it</td>
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<tr>
<td>Outside</td>
<td>15% Intro to Vernier probeware</td>
<td></td>
</tr>
<tr>
<td>Outside</td>
<td>15% Vernier probeware activities</td>
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</tr>
<tr>
<td>Mixed</td>
<td>Collecting and submitting schoolyard water quality</td>
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</tr>
<tr>
<td>Mixed</td>
<td>11% data, &quot;The State of Our Schoolyard&quot;</td>
<td></td>
</tr>
<tr>
<td>On-line</td>
<td>Data in the classroom / discovering water quality in</td>
<td></td>
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<tr>
<td>Classroom</td>
<td>11% Belmont Bay</td>
<td></td>
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<tr>
<td>Classroom</td>
<td>Water quality: What happens when things go wrong?</td>
<td></td>
</tr>
<tr>
<td>Classroom</td>
<td>6% Mosquito larvae demo</td>
<td></td>
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</tbody>
</table>
Middle School Results

- ~20 teachers trained in multi-day workshops

- 10,500+ students participate in field investigations.

- Enthusiasm high among kids for field trips, but teachers less psyched about outdoor lessons.

- Lack of access to computer rooms limits on-line lessons.
High School Lesson Plans

1. Boundaries of our Watershed
   - Understanding Topographic Maps & Incorporating GPS
   - Connecting to the Chesapeake

2. State of the Bay
   - Issues Affecting the Chesapeake Bay Watershed
   - Data from the Field

3. Human Impacts
   - Creating Your Own Water Filter
   - Making a Difference- Local Stewardship Projects
High School Teacher Training

Format parallels MS teachers, but ...

- Teachers from varied subject areas (Earth Sci., Env. Sci., Biology, etc.)
- Fewer, more analytical lessons
- Teachers advise improvements to curriculum.
High School MWEEs
High School Results

- ~30 teachers trained in multi-day workshops
- Over 1,000 students participate in field investigations.
- Broad range of students’ stewardship projects, e.g., Stonewall Jackson HS...
High School: Online vs. Outdoors?

Stonewall Jackson HS teacher:

“The Ecology Club worked building trails & learning stations at the pond behind our school & our next door neighbor, Ellis Elementary. On Earth Day, all of 5th grade students came [to our opening …] members took the young students through a series of stations, teaching about their local environment.

“I asked one of my students why she thought so many of her peers participated in the Ecology Club. She said, ‘Because we actually do stuff…outside …that matters.’ ”
Conclusions

- Varied teaching and learning styles at both MS and HS levels.
- Blending classroom, IT and outdoor field experiences is effective at engaging varied learners.
- Need more longitudinal study to see how stewardship attitudes of kids participating in MWEEs develop vs. their non-participant peers.