

**Shared Waters Year Two:  
An Upstream-Downstream Collaborative**

Ann Cancilla Gaudino, Ed.D.

William McConnell, Ph.D.

Abdulsalami Ibrahim, Ph.D.

Nanette Marcum-Dietrich, Ph.D.

This paper is based upon work supported by the National Oceanic and Atmospheric Association (NOAA) under Grant No. NA21NMF4570498. Any opinions, findings, and conclusions or recommendations expressed in this paper are those of the authors and do not necessarily reflect the views of NOAA.

Millersville University of Pennsylvania (MU), Virginia Wesleyan University (VWU), Penn Manor School District, and Norfolk Collegiate School created a three-year upstream, downstream collaborative for the systemic implementation of Meaningful Watershed Educational Experiences (MWEE) in elementary schools that focused on protecting our shared Chesapeake Bay Watershed. The project highlighted this shared responsibility by bringing together schools in central PA (upstream) and coastal VA (downstream) to learn about local watershed issues and how local actions impact the overall health of the watershed. The health and future of the Chesapeake Bay Watershed depend on this generation of students cultivating a connection to local waters, gaining an understanding of how their choices impact the larger watershed, and learning how to be good watershed neighbors.

From 2021 to 2024, this three-year project systemically impacted elementary students through teacher professional development and classroom MWEE implementation, while simultaneously training the next generation of teachers by embedding MWEE instruction into undergraduate teacher education programs at MU and VWU. The Shared Waters project embeds MWEE professional development training and classroom implementation into existing university/school partnerships where teacher candidates (undergraduate teacher education students) work alongside classroom teachers in the implementation of the MWEE in the elementary classroom. This approach ensures the long-term sustainability of the project and its ability to institutionalize MWEEs at both the K-12 and university levels.

The following pages provide a summary of the findings for Year Two: 2022-2023 of the project. The reader may find it helpful to read the Year One summary in the NOAA repository before reading this second year summary.

The Year One summary is entitled:

**Shared Waters Year One: An Upstream-Downstream Collaborative**

For more information about the project or if you would like to implement this project in your university or school, please contact us.

Ann Cancilla Gaudino, Ed.D., Professor  
Millersville University of Pennsylvania  
Email: [ann.gaudino@millersville.edu](mailto:ann.gaudino@millersville.edu)

William McConnell, Ph.D., Associate Professor  
Virginia Wesleyan University  
Email: [wmmcconnell@vwu.edu](mailto:wmmcconnell@vwu.edu)

Abdulsalami Ibrahim, Ph.D., Assistant Professor  
Millersville University of Pennsylvania  
Email: [Abdulsalami.ibrahim@millersville.edu](mailto:Abdulsalami.ibrahim@millersville.edu)

Nanette Marcum-Dietrich, Ph.D., Professor  
Millersville University of Pennsylvania  
Email: [Nanette.marcum-dietrich@millersville.edu](mailto:Nanette.marcum-dietrich@millersville.edu)

## **Findings and Results from Teachers**

A professional development day-long session was attended by teachers in August 2022, and teachers attended subsequent sessions throughout the fall and spring semesters. Participants completed a Post-Professional Development survey following the day-long session and each individual session. Responses were indicated via a Likert scale with responses: strongly agree, agree, neutral, disagree, strongly disagree. There was also space for participants to write comments.

### **Day-Long Training Survey Results**

Thirteen teachers in Pennsylvania and two teachers in Virginia participated in the day-long professional development session and subsequent survey. Five Pennsylvania teachers and one Virginia teacher completed the survey. All responded either “strongly agree” or “agree” with all eight survey prompts including that they:

- Learned about the systemic implementation of Meaningful Watershed Educational Experiences (MWEE) in Chesapeake Bay.
- Learned how to integrate MWEE into the curriculum.
- Learned how to teach their students about things that contribute to the health or lack of health of our Chesapeake Bay watershed.
- Learned how to teach their students about local actions that impact the health of the Chesapeake Bay Watershed.
- Learned how MWEE connects to standards in science education.
- Learned how MWEE connects to standards across content areas.
- Learned how to create lesson plans about MWEE.
- Learned how to implement outdoor learning experiences to teach MWEE.

## **Comments**

Written comments from participants were positive and indicated some areas for improvement. Teachers overwhelmingly felt that the grant project held tremendous benefits for their students, including learning about the environment/real world, hands-on learning, and engagement in learning.

Specifically, all commented on the “huge” benefit of the hands-on learning that occurred with their students during the MWEE and how excited they, themselves, felt about MWEE. One stated, “the hands-on learning... it was riveting for even me!” and another commented, “Exploring the environment in which they live and understanding how we impact our water and water for others is very valuable.”

## **Monthly Professional Development Sessions Survey Results**

Twelve teachers in Pennsylvania and four Virginia teachers joined the monthly zoom check in. Pennsylvania teachers were sent a survey at the end of the session. The survey had five (5) prompts; two close-ended prompts which teachers rated on a Likert scale of strongly agree, agree, and disagree, and three open-ended which teachers could provide comments.

All teachers responded “strongly agree” or “agree” to the close-ended prompts:

- This meeting helped to provide clarifying information surrounding the project.
- I gained confidence about how to implement the MWEE from this meeting.

In open-ended prompts, participants expressed concern for time to implement the project and classroom management of their students. Looking ahead, participants requested to, “Discuss how the implementation is going in our classrooms and come up with solutions to any problems and/or share our successes” and suggestions on how to provide accommodations for lower-level

learners. One teacher summarized the benefit for students as "The impact they will have on the environment and the feeling that it will empower them with... a memory they will have forever."

### **Findings from School Visits, Administrator Interviews, Teacher Focus Groups**

In addition to these surveys, the grant evaluator conducted site visits to all four elementary schools involved with this grant. During these visits, the grant evaluator met with administrators and teachers involved with the grant, toured the facilities, and observed classes of elementary students engaging in MWEE learning and activities. Additionally, the grant evaluator conducted one-hour in-person or virtual interviews with principals at each elementary school surrounding the implementation. At one school in the fall, teachers also participated in the interview. This was unplanned, but the teachers at one school were excited to share their thoughts and the evaluator was pleased to listen. As a result, the Norfolk teachers were also interviewed in the spring. These interviews and site visits revealed valuable information about the locations. Discussion prompts for the administrators and teachers included:

- 1-How does environmental education exist now in your school?
- 2-Describe current teacher attitudes towards environmental literacy.
- 3-Describe current student attitudes towards environmental literacy.
- 4-How and when do classes about the environment include outdoor lessons and activities?
- 5-How does the outdoor environment at your school not support environmental literacy education?
- 6-How has environmental education changed as a result of this grant?

Results of the interviews and site visits revealed that:

- Involvement in the grant increased enthusiasm, participation, instruction, and study about MWEE among faculty and students.
- In the schools new to the program, administrators felt that while MWEE objectives had previously been "covered" in the science curriculum, they were now being implemented in more meaningful, hands-on, and engaging ways.

Administrators in PA felt that this was essential given the new science standards by which students will be tested. In schools in their second year of the program, administrators commented that MWEE objectives were a “regular part of instruction in the classroom” noting that in the first year it was viewed more as something “new or extra.”

- The most emphatic response from teachers and principals at all schools was their gratitude for the lesson plans and bins with pre-packed materials they could use for the experiments. Supplying these bins was a new addition to the grant work in this second year. This saved teachers considerable time of attempting to gather resources and figure out how to use them. All requested that they continue to receive lesson plans and pre-packaged materials for the experiments/activities in the next year.
- There was a clear difference in beliefs and actions surrounding classroom and outdoors learning on school property. Schools in their second year of the project had now identified and were actively using outdoor area resources on their property for MWEE and other science lessons/activities. These resources included land, forested area, and drainage/retention ponds. Schools in the first year of the project either asserted that they have little outdoor space or appeared to not know how to utilize the

outdoor resources they have on-site (including land, forested areas, streams). Outdoor lessons were viewed as ‘extras’ or discouraged due to principal concern that teachers and students would not be engaged in learning.

- Principals whose schools were in the first year of the grant commented about the helpfulness of the August training for teachers. One stated, “Whatever you did at teacher presentation, it was phenomenal. Teachers were so gung-ho!”
- Several teachers participating in the project for a second year served as mentors for teachers who were new to the project this second year. The new teachers commented on the helpfulness of the second year teachers’ guidance.
- Elementary students in all elementary schools participated in field trips or worked outside investigating the watershed. These outdoor, hands-on experiences were new to students in the first year of this grant whose learning was previously limited to reading and in-classroom activities. Schools in the second year of the grant were more frequently identifying outdoor spaces that could be used for teaching, coming up with ways to get students outdoors for education, and giving hands-on learning opportunities for students.
- The elementary students were readily engaged in MWEE activities and working in groups on experiments. The enthusiasm in the room was palpable as students were quick, attentive, and participatory. Students exclaimed how they could “actually see the results” of the experiments which they had studied about. Without exception, every student was fully engaged in the classroom.



- Schools with a dedicated science teacher (teaching science to all grades) or classroom teachers who teach science to all sections of a grade level appeared more invested in this project as well as science education, in general, compared with grade-level teachers who were teaching all subjects, one of which is science.
- School administrators and teachers expressed gratitude to NOAA and Millersville University for making the funding and opportunities possible.

### **Results from Survey of Preservice/Student Teachers**

In November 2022, a 12-question survey was administered to pre-service student teachers at Millersville University (MU) who participated in MWEE training during their coursework. Their courses took place primarily in face-to-face format, with some occurring in hybrid or online format. Twenty-six surveys were distributed and 23 responses were received for a response rate of 88%. Students completing the survey were mostly juniors; one student anticipated graduating in 2023, 19 in 2024, and 4 in 2025 and three did not respond.

In April 2023, a 12-question survey was administered to pre-service student teachers at Millersville University (MU) Virginia Wesleyan University (VWU) who participated in MWEE training during their coursework. Both MU and VWU offered these courses in the spring semester. Courses took place primarily in a face-to-face format, with some occurring in hybrid or online format. Thirty-two surveys were distributed and 32 responses were received for an overall response rate of 100%. Students completing the survey were mostly sophomores and juniors; five students anticipate graduating in 2023, 11 in 2024, 8 in 2025, 5 in 2026, and one didn't respond to this prompt. Ten students were from MU and 19 from VWU, and three didn't respond to this prompt.

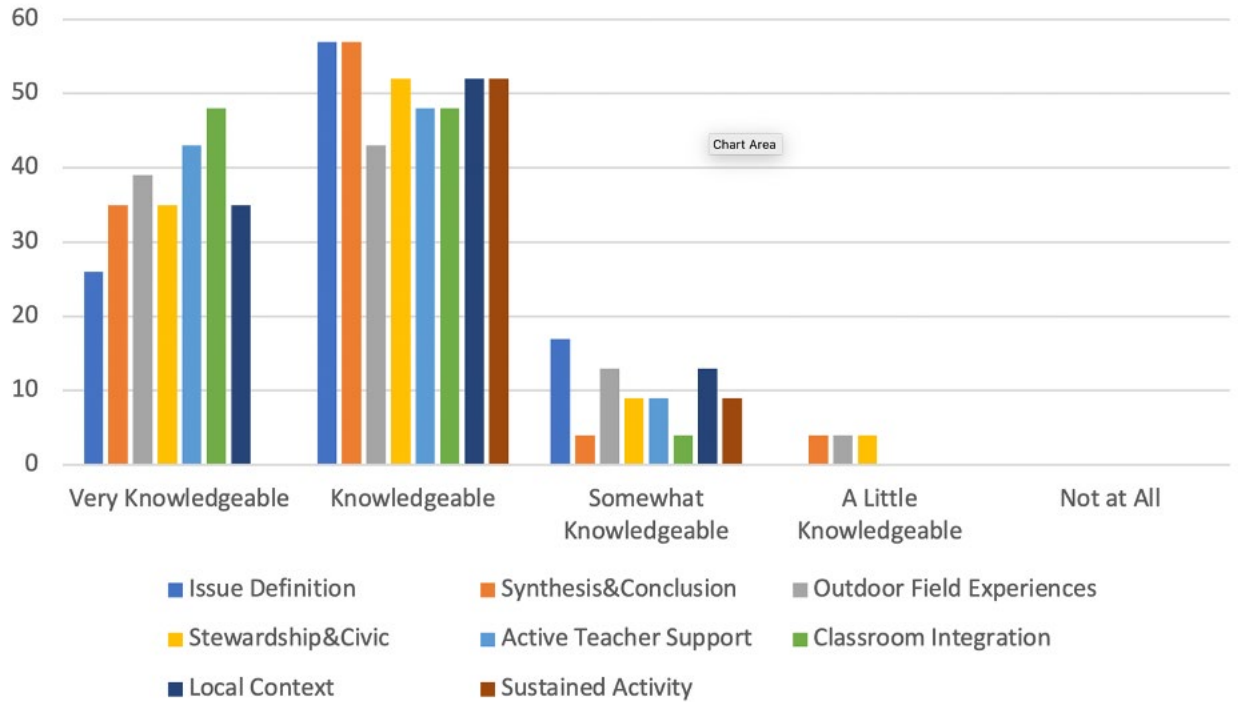
## **Result 1**

Pre-service teachers rated their current knowledge in the areas of Issue Definition, Synthesis and Conclusion, Outdoor Field Experiences, Stewardship and Civic Action, Active Teacher Support, Classroom Integration, Local Context, and Sustained Activity on a Likert Scale as Very Knowledgeable, Knowledgeable, Somewhat Knowledgeable, a Little Knowledgeable and Not at All Knowledgeable. Twenty-three responses were received from MU students and 28 responses were received from VWU students to this question. The greatest quantity of responses were in the Knowledgeable range for all prompts at both universities. At MU, in the area of Classroom Integration, there was an equal percentage of responses (48%) for both Knowledgeable and Very Knowledgeable. Additionally, Very Knowledgeable was a close second to Knowledgeable in two areas: Outdoor Field Experiences (39% Very Knowledgeable, 43% Knowledgeable) and Active Teacher Support (43% Very Knowledgeable, 48% Knowledgeable). Students expressed the most knowledge (Very Knowledgeable) in the areas of Classroom Integration and Active Teacher Support. In the Not at All Knowledgeable mark, no area received any responses (0%).

Figure 1 depicts the percentage response by students across the levels from Very Knowledgeable through Not at All Knowledgeable.

**Figure 1**

*Pre-Service Teacher Current Knowledge of MWEE Essential Elements Expressed in Percentage*



**Result 2**

Pre-service teachers utilized a variety of MWEE essential elements with their elementary students. The frequency of use of these elements varied between MU and VWU students.

At MU, the most frequently cited element was ‘Outdoor Field Experiences’ (12 responses), followed by ‘Issue Definition’ (6 responses), ‘Synthesis and Conclusion’ (4 responses) and ‘Stewardship and Civic Action’ (1 response). These results are shown in Table 1 below.

**Table 1**

*MWEE Essential Elements Used with Students (MU)*

<b>Element</b>	<b>Number of Responses</b>
Outdoor Field Experiences	12
Issue Definition	6
Synthesis and Conclusion	4
Stewardship and Civic Action	1

At VWU, the most frequently cited element was 'Issue Definition' (21 responses), followed by a tie with 'Outdoor Field Experiences' (17 responses) and 'Stewardship and Civic Action' (17 responses), and the fewest with Synthesis and Conclusion (12 responses). These results are shown in Table 2 below.

**Table 2**

*MWEE Essential Elements Used with Pre-Service Teachers (VWU)*

<b>Element</b>	<b>Number of Responses</b>
Issue Definition	21
Outdoor Field Experiences	17
Stewardship and Civic Action	17
Synthesis and Conclusion	12

Additionally, in their narrative responses, Pre-Service Teachers cited specific course activities as well as teaching the elementary students as the most memorable aspects from the course. MU Pre-Service Teachers mentioned the following specific activities: watershed activities, the online model of the watershed, using the watershed website, visiting classrooms, and helping students identify areas around their school where they can improve their watersheds. In contrast, VWU Pre-Service Teachers mentioned all experiences working in-person with elementary students and invasive species removal. These differences are likely due to the

existing opportunities, instructor preferences, as well as physical spaces accessed in the two different locations.

### **Result 3**

Pre-Service Teachers utilized a variety of materials that they received during their course with their elementary students. In their narrative responses, students cited specific materials received during the course which they used with elementary students including lesson plans, activities, books, online simulations, and websites. Some students at VWU interpreted this prompt more broadly and interpersonally. They responded that they learned "The need to do better as a society", "group work collaboration", "treat students with respect", and "learn to teach different students the same thing in different ways." This difference in interpretation and response to the prompt could have been due to an emphasis on service and character development present in the VWU philosophy.

### **Result 4**

Pre-Service Teachers students used various MWEE activities in their elementary classes. Many Pre-Service Teachers responded that they used or observed the use of the Enviroscape® with their classes and assisted students with the removal of invasive species on their school pond/property. Many also responded that they used or observed Model My Watershed with their classes. Several mentioned that the area of focus in the Model My Watershed was the school site identifying pervious and impervious surfaces.

### **Result 5**

Overwhelmingly, Pre-Service Teachers responded that they would implement MWEE in their classroom someday. Pre-Service Teachers mentioned most frequently the importance of children learning about environmental protection through hands-on learning as being essential.

Only two Pre-Service Teachers indicated that they would not be likely to implement MWEE as “it was disorganized.”

The thoughtfulness of the MU and VWU Pre-Service Teachers comments is best expressed in these quotations directly from them. There were not significant differences in content of comments among MU and VWU students.

- "The framework of MWEE is an effective method of teaching and approaching situations for all subject areas."
- "As a future special ed teacher, I think the hands-on discovery would work great with my students."
- "I would implement it because it keeps the students engaged."
- "I am likely to implement MWEE into my classroom because it engages students to important issues faced in our own world."
- "I would love to do something like that because it is very student-engaging and addresses local issues. The students get to see the impacts of pollution, climate change, and irresponsible behavior towards the environment first-hand."
- “I am likely to implement it because it was useful and interesting especially to students.”
- “I think it is super important to know what the environment is like around your neighborhood and school. Being able to physically experience what you see online, brings the lesson to life while making it very engaging for the students. It brings a new and realistic perspective to the students.”
- “I’m planning on implementing MWEE into my classroom so that my students make more environmentally friendly decisions.”

- “I would implement it because it gives children a reason for why they are learning what they are learning and the purpose for it.”
- “I would most likely not implement MWEE in my classroom because of the way it was disorganized and I would want it to be more interactive for the content learning.”

## **Result 6**

Overwhelmingly, both MU and VWU Pre-Service Teachers felt that their work on MWEEs helped them to develop technology skills and incorporate instructional technology in the classroom. There were not significant variations in responses among the two universities. Many Pre-Service teachers commented on how their own technology skills broadened and developed as a result of the project, although some cited poor internet connection as a barrier. In terms of classroom management, Pre-Service Teachers cited that the MWEE engaged elementary students and kept them attentive. Two Pre-Service Teachers mentioned learning how to alter lessons in the event of technology failure.

The thoughtfulness of the MU and VWU Pre-Service Teachers comments is best expressed in their own words:

- “Students use the technology to learn about the watershed at any point in the world. The power of technology allows you to reach further beyond what you already may know and see. Allowing the students to take initiative and be creative with their options, gives their minds a chance to be independent and grow as a student. In addition, giving the students hands on experience, allows the students to be engaged which helps to keep their focus longer and be more attentive in the lesson.”
- “It helped me learn that curriculum can get our students involved in the community. Using technology made it possible.”

- “It has helped me learn how to organize a lesson that is directed towards watershed. It has also helped me explore instructional technologies that I can use in the future.”
- “The work on MWEEs in this project helped me learn different classroom management skills to get the classes attention. Along with how to work with the flow since technology is not 100% reliable to work.”
- “I learned that sometimes technology does not work as planned and the lesson may need to be adapted.”
- "It was my first experience in the classroom, so I got to experience working with reactive and proactive management and finding effective ways to create beneficial and engaging lessons."
- "It has been positive because I learned more about how to conduct/manage outdoor learning experiences."
- "This has overall had a positive impact on me as a future teacher, and I have gained tons of strategies and influence on how I can use MWEE in my classroom and adapt my teaching style around MWEE to create a more engaging and collaborative environment."
- "This project has impacted me positively, and it increased my scope of knowledge for classroom management and has increased my confidence."
- "It has helped my learning of instructional technology by making sure I understand the tools available to me and how I can use them."

### **Result 7**

A seventh prompt was added to the survey during this second year as a result of informal feedback instructors received from students and the faculty desire to more formally measure the phenomena. However, due to a technology glitch, this seventh prompt was only available to the



VWU students for response. Therefore, the qualitative data herewith comes from VWU Pre-Service teachers only.

When asked, "What other types of environmental literacy and sustainability-related courses, trainings, and workshops have you attended?" almost all replied, "none." Only two students had taken such courses or trainings.

In contrast, when asked, "What other types of environmental literacy and sustainability-related courses, trainings, and workshops would you like the university to offer?" students had many suggestions, including locally focused environmental and/or water education, "how much water is used on campus", "recycling", "environmental literacy", and hands-on/field trip/or art related experiences. These results suggest that while pre-service teachers had not partaken in environmental courses prior to this project, they would like to partake in future courses, especially those offered surrounding certain topics.

### **Conclusion**

In conclusion, the second year of the project increased the quantity of school administrators, teachers, and elementary students exposed to MWEE. It was successful in improving participant knowledge, skills, and teaching behaviors surrounding MWEE for those teachers and administrators who are new to the project, while solidifying the same for returning principals and teachers. Returning teachers appeared more confident enacting classroom activities (working without script) while the new teachers to the project relied more heavily on the lesson plans, as might be expected. All principals and teachers lauded the lesson plans and pre-packaged material resources provided for classroom activities and requested that those continue. Returning teachers cited that attempting to create plans and secure resources was time consuming last year to the point of not being possible. Looking forward, it would be helpful to

continue providing lesson plans and materials and also plan how the same will continue once the grant cycle has finished.

Similarly, Pre-Service Teachers were gaining skills and knowledge on how to incorporate MWEE into the curriculum and classroom. This was the second group of Pre-Service Teachers to partake in this project and also to indicate their enthusiasm and desire to continue to learn about and implement MWEE into their classrooms. They saw the benefit of elementary students learning about the environment and how to protect it in this very, hands-on way.

Elementary students involved in the MWEE demonstrated tremendous engagement and enthusiasm. Without exception, every student was completely engaged in the observed lessons. Students demonstrated understanding of MWEE concepts and skills to investigate MWEE issues. They worked collaboratively on hands-on experiments, utilizing the scientific method successfully to make predictions and informed conclusions.

The most significant benefits cited by teachers, administrators, and Pre-Service Teachers were that elementary students gained hands-on, real-world experience learning and interacting with their environment to learn about MWEE. Returning schools learned how to utilize their school grounds for these and other science lessons, while schools new to the project still viewed outdoor science activities as “extras” and expressed concern about teacher and student management outdoor. Looking forward, it may be helpful to have on-site visits and conversations with these principals and teachers to examine grounds and provide suggestions for their utilization in the MWEE and beyond.

The structure of this project put great emphasis on establishing strong partnerships between K-12 schools and the Education Departments of MU and VWU. MU and VWU were developing and implementing a sustainable EE themed field experience for Pre-Service Teachers

with our partner schools throughout the Penn Manor School District (PA) and Norfolk Collegiate School (VA). In the fall, faculty continued to institutionalize environmental education into the curriculum in teacher education programs via course on instructional technology (MU) and in a course on classroom management (VWU). This evaluation concludes that participating principals and teachers welcomed and enjoyed the collaboration and collaboration from pre-service teachers. Similarly, professors and pre-service teachers found the context of MWEEs to enhance their learning of content across the courses.