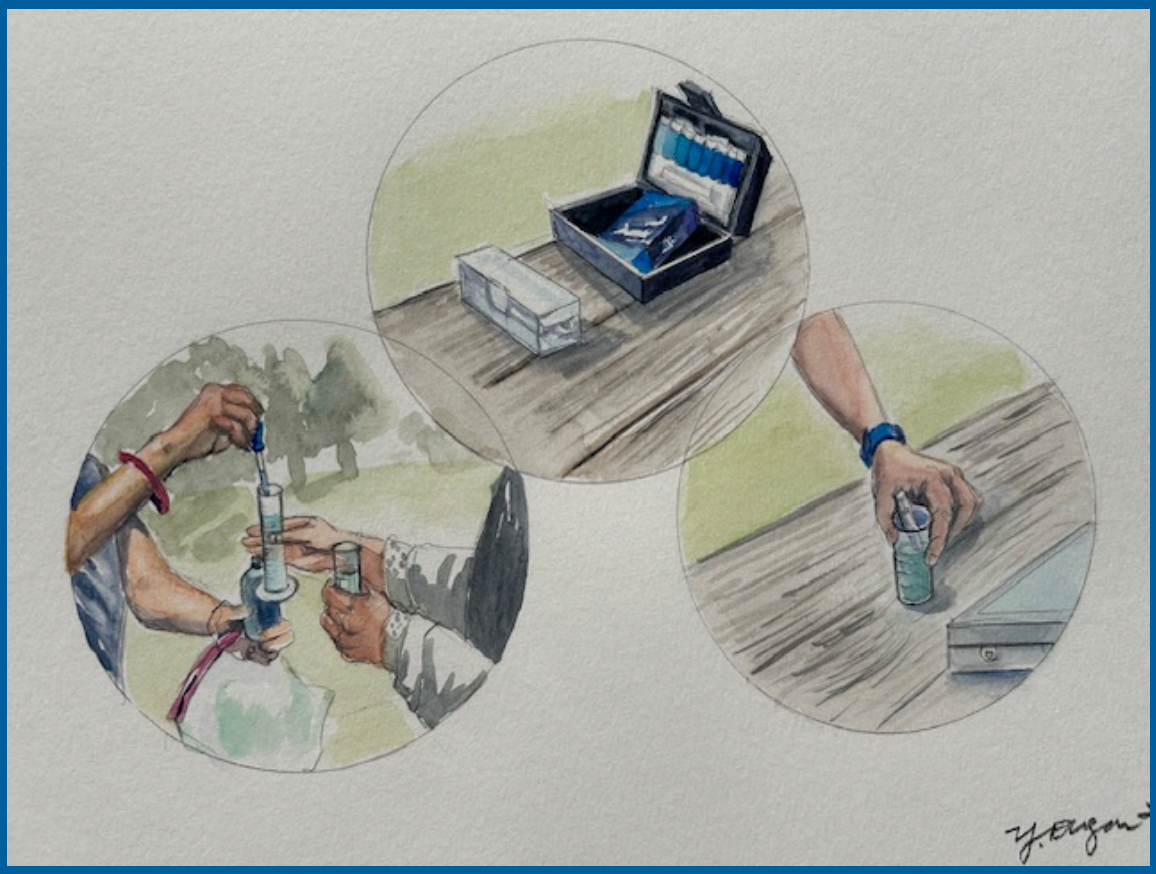
WATERSHED WIZARDS IMPACT REPORT, 2025



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BACKGROUND

During the summer of 2025, two, 2-day pilot workshops were conducted at the Claud E. Kitchens Outdoor Classroom at Fairview in Clear Springs, Maryland, as well as on an excursion to Licking Creek, the Conococheague Creek, and the Potomac River. In alignment with the Outdoor Network Learning Initiative funded by the Chesapeake Trust, the design of the workshop followed a 5E's constructivist format. In addition, the Veverka Family Foundation provided secondary funding to cover the cost of science equipment, supplies, and transportation.

The workshop corresponded with the professional teaching standards outlined by the National Board for Professional Teaching Standards (NBPTS; 2025), and Professional Standards for Educational Leaders (PSEL; National Policy Board for Educational Administration, 2015). The workshop reflected the Next Generation Science Standards (NGSS; n. d.) related to Science and Engineering Practices and Cross Cutting Concepts. Critical to the development of the needs of the partner school district in Washington County, Maryland, and the requirements by district administrators, the workshop was designed to provide an "adult experience" for the educators with the goal of increasing teacher confidence, self-efficacy (Bandura, 1997), for teaching about watersheds, water quality, and data analysis/interpretation.

WORKSHOP 1 OVERVIEW: ELEMENTARY TEACHERS, JUNE

The first of these workshops occurred on June 11-12, 2025 with elementary teachers (*n* = 19). On the first day of the workshop, elementary teachers (and one secondary teacher) learned about watersheds and water quality as well as collected data along local tributaries including two points at Licking Creek, the Conococheague, and the Potomac River in Williamsport. Data were then uploaded to an ArcGIS survey. Due to heavy rain, the team determined that floating on the river was unsafe, and teachers were transported by public school bus to each location.

On the second day, the same educators analyzed the data through visual displays, ArcGIS maps, and Google Sheets while learning some techniques on utilizing measures of central tendency and graphs. For this workshop, data were coded based on whether the river's edge was near an agricultural or natural environment. In this way, the type of setting served as an independent variable.

Next, the teachers learned about the local watersheds with a facilitated discussion from a watershed specialist, Alex Reed, with the Department of Environment in Washington County Maryland. In the afternoon, the participants learned about macroinvertebrates and stream health through a series of activities at Tom's Run. After each activity, the teachers reflected on the way the activity corresponded with the NGSS standards on data literacy by completing a large chart with three columns: (a) the way the activity reflected NGSS standards; (b) the ways teachers could use the activity with their students; and (c) new ideas teachers had for instruction.

WORKSHOP 2 OVERVIEW: SECONDARY TEACHERS, AUGUST

Washington County Public Schools requested that the second workshop be held on August 7 and 8 to accommodate teachers' schedules. While most teachers in this session taught middle or high school (n = 12), there were a few elementary teachers who could not attend the first workshop.

The second workshop differed in terms of weather conditions and the needs of the teachers. Both sessions started at the 100 ft fire tower at the Fairview location where educators could analyze the local watershed and human behavior from a high vantage point. For the second workshop, at the base of the fire tower, teachers analyzed topographic maps of the region in terms of water flow. This addition was made not only to account for the teachers' backgrounds as secondary teachers but was based on Blue Swallow Farm Foundation staff reflections after the first workshop.

Weather conditions were more suitable for floating down the river. In the morning, teachers floated down Licking Creek and took measurements along tributaries and at the confluence of water in the center of the creek. In this case, the location served as the independent variable. Teachers analyzed the data on the second day with ArcGIS and a variety of activities. In addition, a data analysis activity on correlation coefficients was added for the secondary level. As with the elementary educators, the teachers completed a progression table at each stage of Day 2.

To complete both workshops, educators engaged in formative assessments with story walks and a literacy activity as well as a Mentimeter word cloud. The collection of data through participant responses was overseen by a private institutional review board (IRB) for ethical procedures, and workshop attendees provided consent to participate in the survey. The following description provides an overview of findings.

OUTCOME EVALUATION

The overarching outcomes for *Watershed Wizards* included: (a; *Educating and Equipping*) educating and equipping teachers with the knowledge about effective, ecofriendly agricultural practices; (b; *Working with Students*) instructing ways to teach students about effective, ecofriendly agricultural practices; (c; *Modeling*) modeling how to lead students in community-based projects and (d; Networking) creating a network of education professionals interested in sustainability practices.

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Demographics

For the elementary workshop in June, there were 17-19 participants out of 19 who completed the survey items (depending on the question). These individuals had a range of teaching experience: 0-5 years (12%), 6-11 years (12%), 12-15 years (6%), 16-20 years (18%), 21-25 years (24%) and greater than 25 years (29%). For the August cohort of primarily secondary teachers (10/12 participants), the range of teaching experiences included: 0-5 years (10%), 6-11 years (10%), 12-15 years (20%), 16-20 years (30%), 21-25 years (20%) and greater than 25 years (10%)

Outcome 1: Educating and Equipping Teachers

At the end of each of the two workshops, participants were asked to use three words to describe *Watershed Wizards* with anonymous responses. The descriptions appeared in a word cloud through Mentimeter with the largest words having the most frequency. Figures 1 and 2 show the responses from both the June and August workshops.

Figures 1 and 2
June and August Mentimeters

In both cases, participants indicated that *Watershed Wizards* was "engaging, fun, and interesting," all factors typically associated with motivation. These teacher artifacts provided a glimpse into the ways in which *Watershed Wizards* educated and equipped teachers with the knowledge related to ecofriendly agricultural practices related to water quality.

When asked to describe their experience in the open-ended survey items, in general, participant comments were positive. Table 1 shows some examples of the participant responses as a broad reflection of the program with a follow-up narrative that outlines participants' perceptions of program needs and self-efficacy for teaching about water quality.

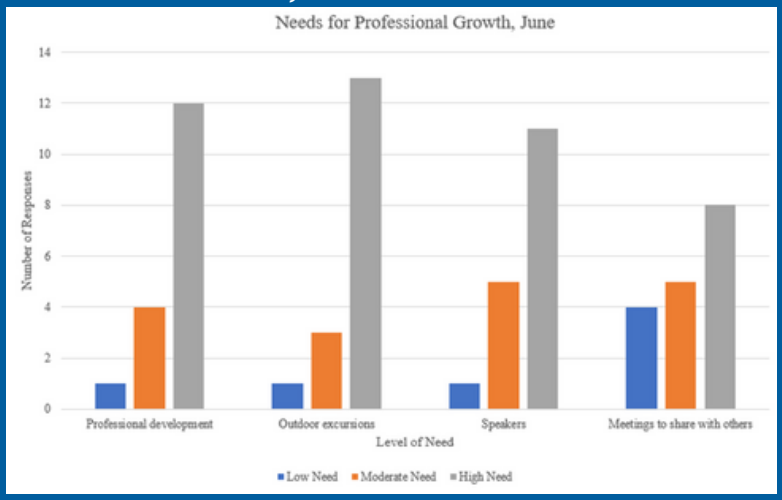
Table 1

Sample Teacher Feedback about Watershed Wizards

I got the chance to explore local water spots in order to self test, explore, and analyze their stats.
Felt included and able to make meaning of what I was learning
There were so many ideas I was writing down in order to try with my students . . .
Everything was wonderful! I feel as if I have much more knowledge about watersheds and how people positively and negatively impact them. I can bring this new knowledge to my students.
The hands-on lessons deepened my understanding of water quality tests & the tool boxes can then be used by students.

To begin the survey, participants from the June workshop were asked about the level of need for their own professional growth based on high, moderate and low need. Figure 3 shows that teachers viewed professional development and outdoor excursions as having high/moderate need (71% and 24% respectively) as well as outdoor excursions with a high/moderate need (76% and 18% respectively). These participants were less interested in meetings to share with others (high-47%, moderate-29%, and low-24%).

Figure 3
Needs for Professional Growth, June

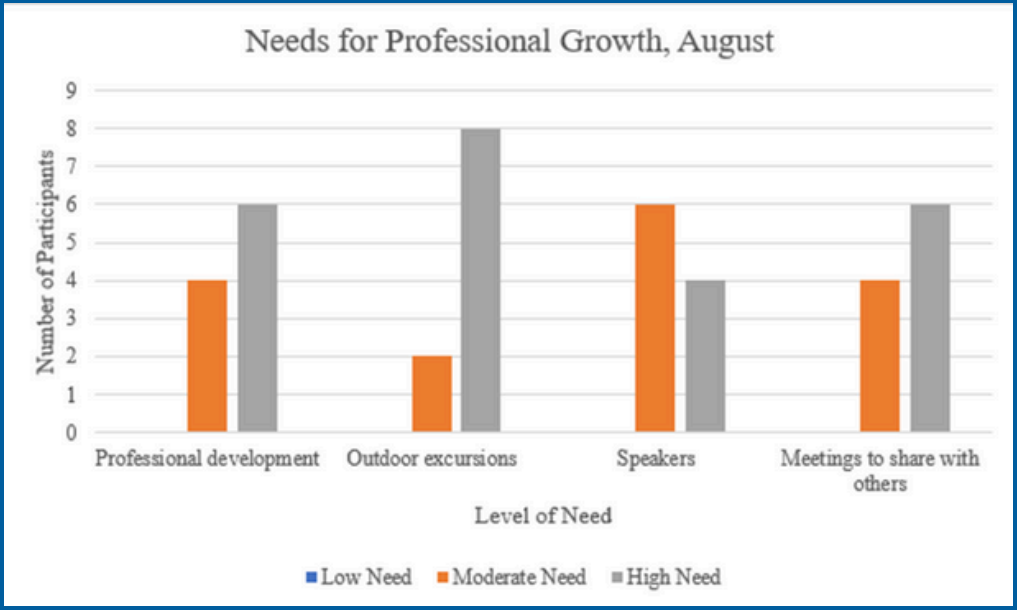


When asked about the ways in which *Watershed Wizards* helped teachers understand watersheds and water quality, responses reflected that participants had gained knowledge about relevant topics. Sample responses included, “I learned about the various ways to tests water quality and what impacts the health of the watersheds,” “very informative in understanding preventative ways to protect our watersheds, “how to determine the quality of a bed of water” and “I feel more knowledgeable about watersheds to bring this into my classroom and to my Green Team.”

Elementary teachers further expanded on how the program helped them to understand data analysis and interpretation. Sample responses included, “This opportunity gave me some experiences with looking at different types of data that I haven’t had a real-world experience with before,” “how to compare data in Google sheets and then generate a graph to further analyze data,” and “pulling everything together to see the overall impact on the region.” When asked about their experiences as a learner, teachers cited the use of hands-on learning, exploring local water systems, and analyzing statistics, while one teacher noted that they were excited to use water quality kits donated by the Blue Swallow Farm Foundation.

The teachers who attended the August workshop had varying views in comparison to the June cohort on the need for future workshops. As seen in Figure 4, secondary teachers noted presenters more often as a moderate need in comparison to the elementary teachers who viewed presenters as a high need. This difference could have been because the second group did not hear the presentation by the local watershed specialist. Both groups highlighted that professional development and outdoor excursions had the greatest need; however, members from the August workshop did not mark any of the options as a low need.

Figure 4
Needs for Professional Growth, August

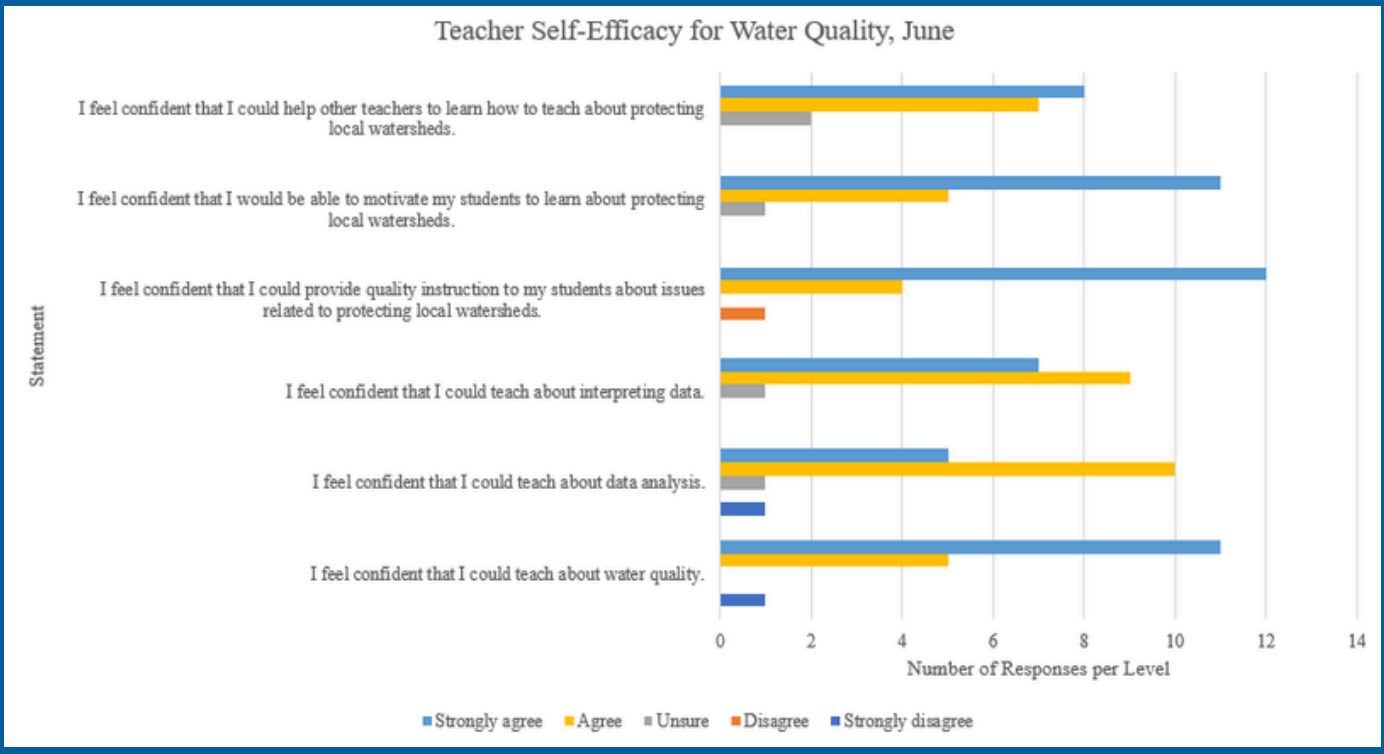


The secondary teachers found that the workshop increased their "own knowledge and provided me with tools to share with staff and students." Others appreciated "options for farming." Several secondary participants referred to math skills, like correlations, graphs, measures of central tendency, and measures of variability. Others indicated that they could look at "data analysis in different ways" and needed to revisit the difference between quantitative and qualitative data.

Teacher Self-Efficacy

One of the primary goals of the workshop outlined by the district leaders was to provide an "adult experience" on watersheds, water quality, and data analysis/interpretations and to increase teacher confidence. The survey response rate for the elementary teachers was 85-100% (17-19/20) and 83% (10/12) for the secondary teachers. For both groups, findings showed that teachers demonstrated positive self-efficacy for working with children to learn about watersheds, water quality, and data analysis/interpretation. For instance, in the elementary group, 16/17 respondents indicated that they agreed or strongly agreed that they felt confident that they "could teach about water quality; teach about data analysis/interpretation; provide quality instruction to students about issues related to protecting local watersheds; and could motivate students to learn about protecting local watersheds" as shown in Figure 5.

Figure 5
Teacher Self-Efficacy for Water Quality, June

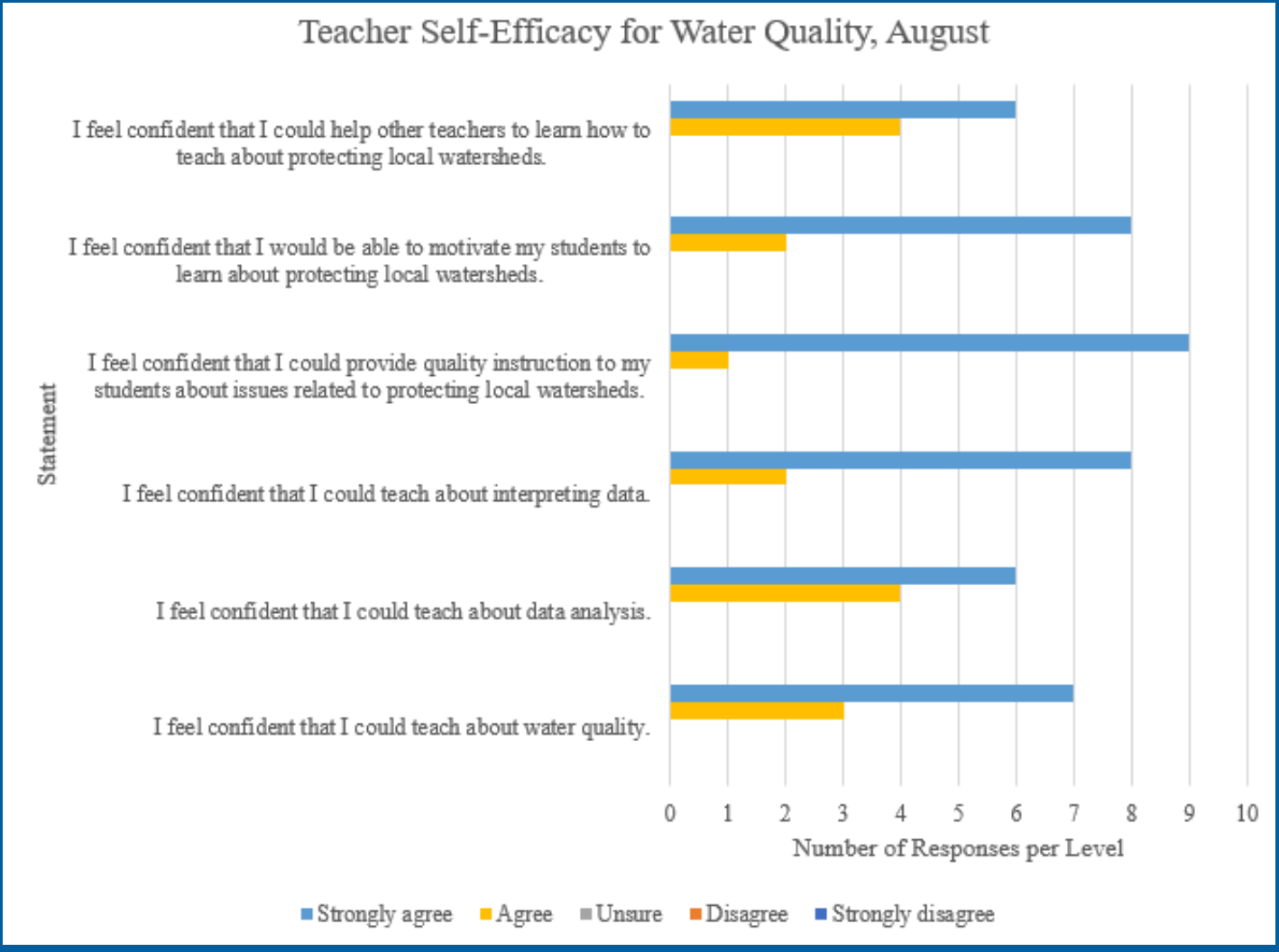


The graph shows that after the June workshop teachers felt confident about teaching most areas, notably on issues related to protecting local watersheds and on many on water quality in general. However, there are some topics that some participants were less comfortable with, such as motivating students to protect watersheds and helping other teachers.

In contrast, the participants from the August workshop as a group had stronger self-efficacy on teaching topics related to water quality (see Figure 6). For all items, respondents agreed or strongly agreed with all statements. There was particularly strong agreement on the ability to teach students to protect local watersheds, motivating students to protect the local watersheds, and teaching students to interpret data.

There seems to be a clear difference in teacher self-efficacy between the two groups. Notably, while these graphs provide descriptive support for the program, additional information is needed to draw correlations between teacher self-efficacy and the workshop and differences between groups.

Figure 6
Teacher Self-Efficacy for Water Quality, August



Outcome 2: Working with Students

The second outcome for *Watershed Wizards* was instructing ways to teach students about effective, ecofriendly agricultural practices that influence the Chesapeake Bay watershed. In order to gauge how the participants viewed the benefits of participating in the program, a series of questions focused on the ways in which *Watershed Wizards* would help their students (see Figure 7).

Figure 7
Student Benefits, June

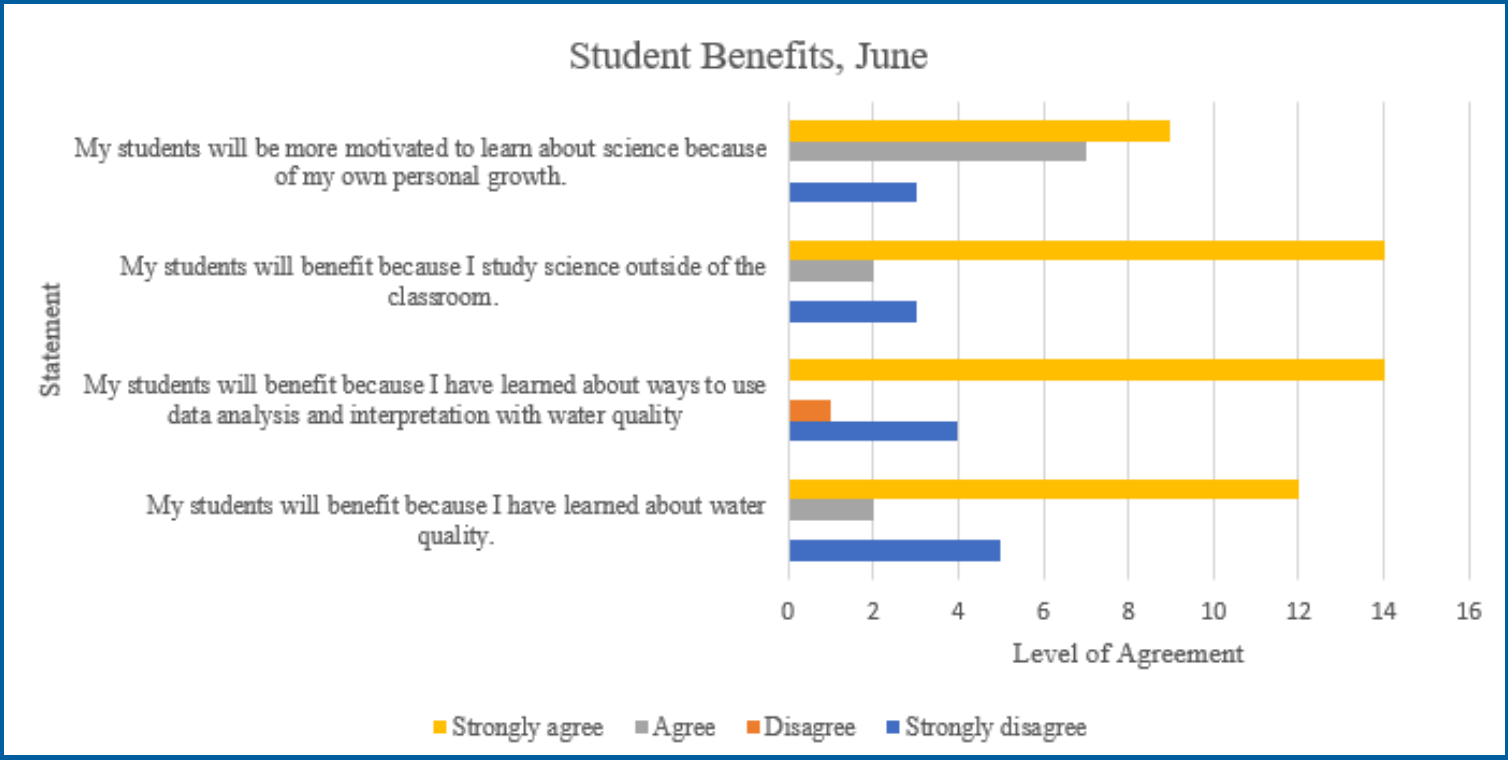
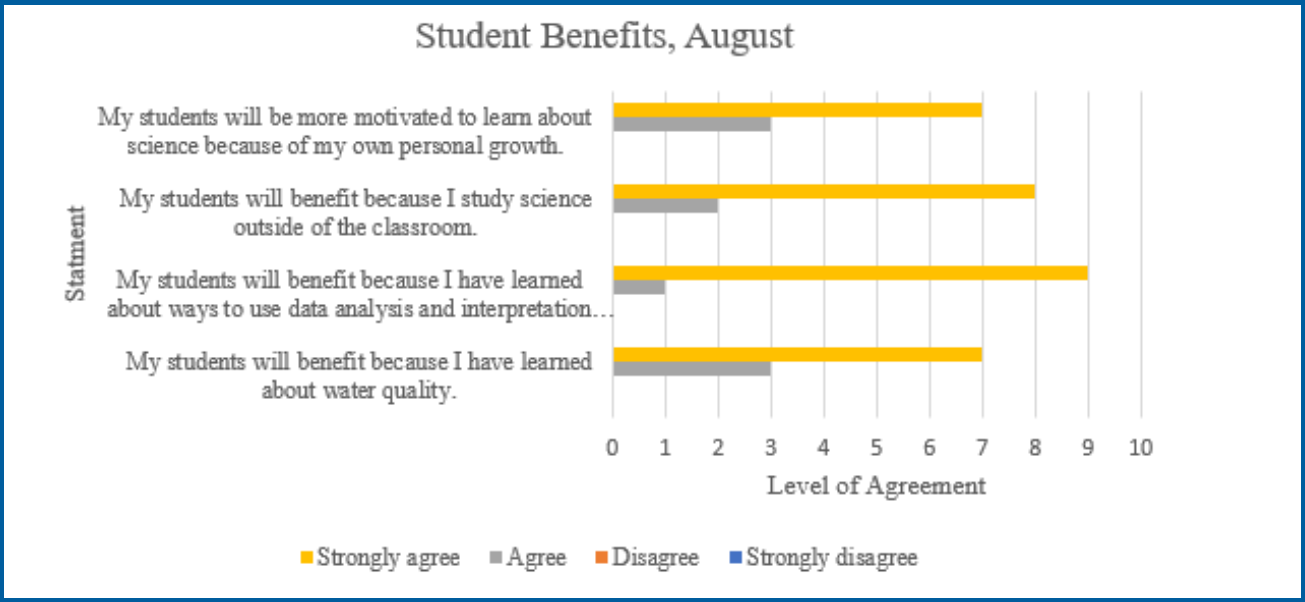


Figure 7 shows that while many June participants viewed *Watershed Wizards* as beneficial to their students, not all individuals felt the experience would transfer to student gains. For instance, when asked if students would benefit because their teacher studied science outside of the classroom, there were varying levels of agreement (74% strongly agree, 11% agree, 0% disagree, and 16% strongly disagree). While many individuals thought that learning about data analysis/interpretation with water quality would help their students (74%), 26% did not view that there would be a transference of skills. However, quite a few teachers viewed that they would be able to motivate students in science more readily from the *Watershed Wizards* experience.

In contrast, open-ended responses about the ways *Watershed Wizards* helped teachers often elicited responses related to students. One teacher noted that the program helped them to learn "how to make digital charts that I can teach my kids to do." Another teacher remarked that the workshop was a "positive way to jump start and extend thinking/learning and making connections for . . . students."

Figure 8
Student Benefits, August



Responses were different for the participants from the August workshop with participants agreeing or strongly agreeing for all statements (see Figure 8). For instance, participants strongly agreed (90%) or agreed (10%) with the statement that students would benefit from their training in data analysis and interpretation. These participants cited that strategies would be useful for their students.

It is unclear whether these differences were because of the grade level that participants taught or variations in the June and August workshops. The open-ended responses were indicative that the participants viewed the workshop as translating to instructional practices. For instance, one August participant wrote, "The work that we did to analyze data was really helpful to consider how we can incorporate more with students." One participant noted how the workshop helped them, and in turn, their students: "This workshop solidified knowledge that I had and added some depth. This well help me get students in the content and look closer at their world."

Outcome Evaluation 3: Modeling

In accordance with the district needs, the dominant goal of this program was to increase teacher knowledge and self-efficacy for water quality. The Blue Swallow Farm Foundation staff utilized effective instructional strategies in the form of modeling in the design of the program. The impact of this modeling was most apparent in open-ended responses. June participants often referred to utilizing the strategies: "understanding how to analyze data with kids," "understanding how to interpret and teach the data," and "learning how to make digital charts that I can teach my kids to do." Teachers also appreciated some of the instructional techniques like the cartoon evaluation, the book walk, and the use of QR codes with ArcGIS and Excel. One June participant remarked, "There were so many ideas I was writing down in order to try with my students . . ." Another was excited about having "kids create graphs."

During the August cohort, participants noted that *Watershed Wizards* "helped me build on practices I already use and ways to expand them." Others highlighted the variation in instructional strategies: "They showed new areas and comparative areas to bring ideas to students in an applicable way." Many participants cited relevant ways to work with students, such as "having a concrete method of assessing stream health was invaluable to making it accessible to students." Teachers liked "the teaching strategies [that they would] adopt into [their] classroom" and felt they had "other options to use to teach water quality with data." One teacher commented how the workshop framework influenced their teaching style: "It was extremely engaging, and I will work to create more engaging learning experiences for my students."

Outcome Evaluation 4: Networking

In open-ended responses, participants often expressed a connection with other individuals in the group. In the first workshop, one participant wrote that they "felt included" and another liked working with "experts while collaborating with colleagues in the district," and a third person wanted to share the information with colleagues at their school.

Members of the August cohort indicated that they would share strategies with colleagues and enjoyed working with a variety of field experts. While individuals from this group indicated a high or moderate need to share with others, there were less comments in the open-ended section of the survey in terms of collaborating and networking.

SUMMARY

Overall, these findings provide support that educators benefited from *Watershed Wizards* in terms of their own personal knowledge development, self-efficacy levels for teaching water quality, modeling instructional strategies, and benefitting from networking. Table 2 provides a summary of findings related to each outcome.

A strong level of support for this program centers on educating and equipping teachers to develop their personal knowledge of factors affecting stream health, including agricultural practices. Teachers regularly noted an increased level of understanding in survey items as well as open-ended responses. Further, many of the individuals noted high levels of self-efficacy for teaching topics related to water quality. Washington County Public Schools has a strong initiative for integrating environmental data literacy within its science program. Responses from participants often referred to their understanding and confidence in teaching about water quality/data analysis /interpretation following the *Watershed Wizards* program. In addition, participants indicated a future need for professional development and outdoor excursions with elementary teachers favoring presenters to a stronger extent.

Table 2
Summary of Outcome Evaluations

Outcome	Descriptive, quantitative support	Descriptive, qualitative support
Educating and Equipping	Participants indicated a high, moderate level of need for professional development and outdoor excursions. Some elementary teachers saw a greater need for presenters than secondary teachers. Secondary teachers appear to have stronger self-efficacy for water quality than some elementary teachers.	Participants from both workshops indicated that Watershed Wizards had increased the knowledge and self-efficacy. *"This opportunity gave me some experiences with looking at different types of data that I haven't had a real-world experience with before."*
Working with Students	Many teachers indicated the experience would benefit students, with secondary teachers indicated the transference more readily than some elementary teachers	Participants cited that the program would have beneficial consequences for students. *"Increased my own knowledge and provided me with tools and resources to share with staff and students."*
Modeling	n/a	Participants indicated that they would mirror instructional strategies in their classroom. *"It was extremely engaging, and I will work to create more engaging learning experiences for my students."*
Networking	Many teachers noted that they had confidence in helping other teachers learn and teach about protecting local watersheds.	Participants from both groups appreciated working with field experts. *"[I] felt included and able to make meaning of what I was learning."*

Secondly, many of the workshop attendees indicated that they would be able to transfer their knowledge to their students. Among the responses, teachers felt that they had a better understanding of the local watershed and could utilize data analysis skills to help students better understand factors in their area. Secondary teachers appeared to view the connection of attending *Watershed Wizards* and the benefits of students more often than some elementary teachers.

This program was developed using effective instructional practices as a form of modeling. Teachers in both groups indicated that they found the techniques engaging and informative and would utilize the strategies, tools, and resources in their classrooms.

Finally, members from both groups appreciated the time to network and collaborate with other teachers. Several of the participants noted that they wanted to share information with colleagues at school. Secondary teachers cited an interest in networking and sharing to a greater extent than some members of the first cohort.

RECOMMENDATIONS

Based on the findings from the outcome evaluations, the Blue Swallow Farm Foundation has recommendations for future workshops.

·Continue creating engaging activities on water quality, data analysis, and interpretation.

·Identify the needs of elementary and secondary teachers for future workshops.

·Analyze fidelity of workshop delivery across different groups of teachers.

·Create tiers of workshop experiences to increase teacher knowledge and self-efficacy as well as to lead student-directed projects on water quality.

RECOMMENDATIONS (CONTINUED)

Engaging Activities on Water Quality

A strength of *Watershed Wizards* is the engaging water quality activities that incorporate data literacy. The organization should continue to strive to develop novel and authentic experiences to increase teacher personal knowledge and student growth.

Teacher Needs

There is some preliminary evidence that teacher needs vary based on grade level. Blue Swallow Farm Foundation staff, in conjunction with Washington County Public Schools, should investigate the workshop experiences and needs of teachers at various grade levels. For instance, Grade 5 teachers in Washington County often take field trips with their students to Fairview. As a result, they may be familiar with some activities and need differing experiences.

Program Fidelity

Another possibility to account for differences between the varying workshops is fidelity in the program delivery. Weather conditions created the need for different options for collecting water quality. In addition, some alternate activities were utilized in the secondary workshop. It is unclear if these changes created different experiences among the participants and should be investigated in more detail.

Workshop Tiers

In order to accomplish the goals of improving teacher knowledge, the transfer to student experiences through instructional modeling, and networking, we recommend that the Blue Swallow Farm Foundation creates three tiers of workshops, with participants being invited to each tier for three consecutive summers. The first tier would be an introduction to water quality and data analysis. The second tier would encompass visiting a variety of industries in Washington County related to agriculture and water quality with a focus on leading student-directed projects. For the third tier, teachers would have the opportunity to work with professional scientists to analyze water quality.

LIMITATIONS

Some limitations in this work relate to the sample size, survey techniques, and the lack of pre-measures as well as group variations. First, due to the limited sample size, the findings of this evaluation are descriptive in nature and cannot be generalized to a larger population.

Secondly, the sample size limits the use of statistical procedures. In particular, it is generally preferable to analyze self-efficacy scales by creating one construct rather than analyzing each statement individually. For this work, items were referred to individually with percentages as a method to learn about the workshop descriptively. In addition, we chose not to use a pre- and post-survey design because of participants' lack of familiarity with our program/organization. Our perception is that utilizing pre-surveys with participants unfamiliar with an organization can be demotivating. We contend that creating positive relationships with participants supersedes the use of pre-surveys. As a result, we were not able to analyze the effect of the program with this information.

In terms of comparing the workshop groups, fewer individuals participated in the survey from the August workshop. Comparisons are descriptive in nature, and there may be some nuances that were not accounted for. Importantly, there was not enough information to make inferential comparisons across secondary and elementary teachers. Further information is needed to determine the needs and differences of these groups.

CONCLUSION

Findings from this evaluation indicate that *Watershed Wizards* has potential in improving water quality studies for teachers and students in Western Maryland. By addressing the recommendations in this report and expanding *Watershed Wizards* to a 3-year, consecutive program, our goal is to educate students in an authentic and engaging way that not only protects the Chesapeake Bay Watershed but provides students with a glimpse of professional career paths in environmentally-oriented occupations.

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