



Evaluation: *Messages from the Mississippi* Student & Educator Assessments

During the 2021-2022 academic term, Public Lab worked with New Orleans-area secondary school educators to implement the *Messages from the Mississippi* program (herein *Messages*). Students had the opportunity to conduct community science research and learn about the environmental challenges within the local area. The *Messages* program sought to connect students to the real-world issues related to microplastics in nearby watershed ecosystems.

The following summarizes the mixed methods data collected from students who participated in the *Messages* programming between August 2021 and April 2022, including curriculum supplements, a field research experience, experience journaling, and art project creation. The data discussed here were acquired through pre-program and post-program assessments given to the students. These assessments and surveys were used to measure changes in students' knowledge, attitudes, and behaviors related to the environment. A total of 237¹ complete and partial responses were received for the student pre-program assessment, and 139 responses were received for the post-program evaluation. Participating educators also completed questionnaires related to their classes' in-field experiences. The responses detailed the successes of the program's implementation, as well as the areas where improvement was needed.

SECTION I: Changes in Knowledge Related to *Messages* Curriculum

Before the participating educators began to use the Public Lab materials in their classrooms, they administered an online pre-test that included questions to set a baseline for students' knowledge about microplastics in the environment. Nine true-or-false knowledge questions, based on the *Messages* learning materials, appeared on the pre-test. After teaching the program curriculum and attending the Public Lab field experience, the teachers administered a post-test containing the same nine knowledge questions to measure the difference in scores.

The average score on the knowledge questions was 69% correct responses on the pre-test. On the post-test, the average score was 72%. An independent samples *t* test of the results found that the difference between students' scores before and after the program was not statistically significant. **These results do not indicate a noticeable change in students' knowledge about microplastics in the environment following the program**

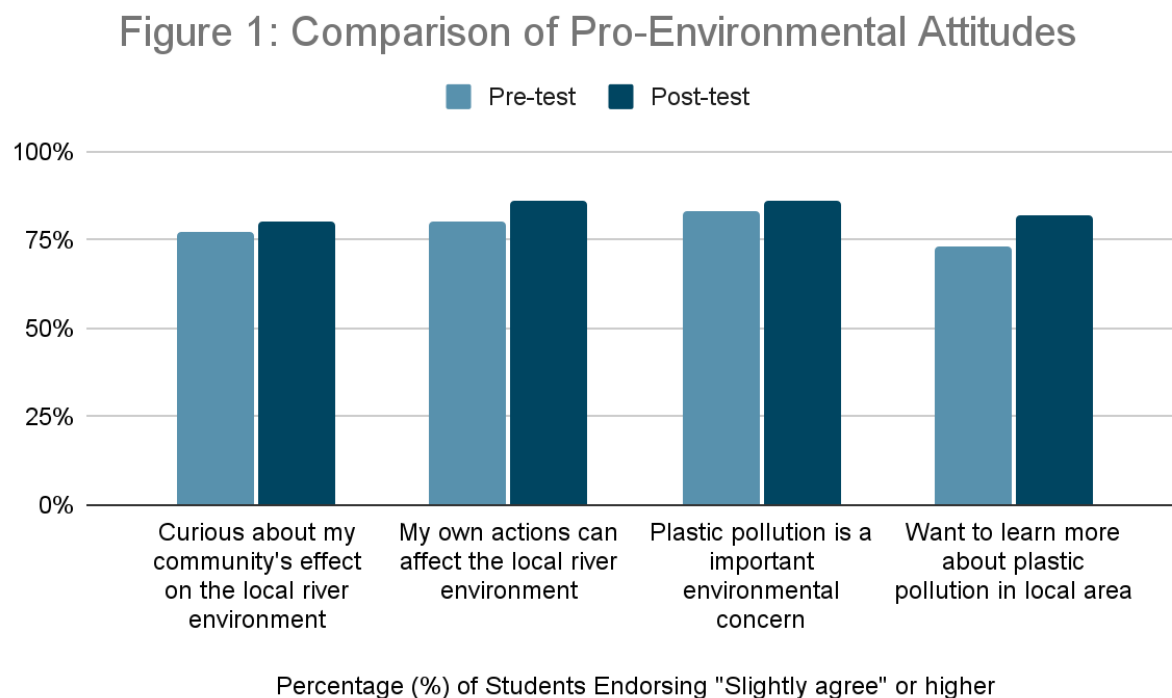
SECTION II: Changes in Students' Pro-Environmental Attitudes and Empowerment

Pro-Environmental Attitudes

The pre-test and post-test also asked students to report their attitudes about the importance of learning about and stewardship of the local environment. The students rated their agreement to a series of pro-environmental statements before and after the program. The six-point response scale ranged from "strongly disagree" to "strongly agree." On the pre-test, more than 75% of the responding students rated

¹ Changes in the primary method of analysis led to more pre-test respondents being included in this analysis and report than previously estimated.

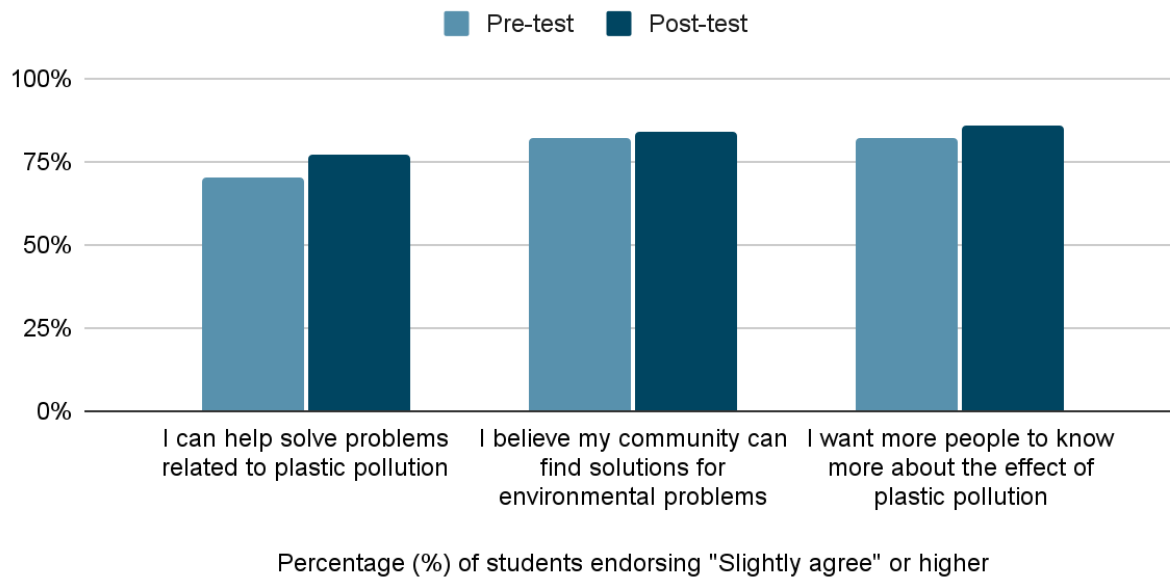
that they at least slightly agreed with the statements. An exception was for the statement “I want to learn more about plastics pollution,” to which 73% of students at least slightly agreed. On the post-test, more than 75% of students at least slightly agreed with all of the pro-environmental attitude statements. These differences are shown in Figure 1. An independent samples *t* test did not find a statistically significant difference in how students responded to this series of statements. **No discernable difference was found in students’ self-reported attitudes.**



Environmental Empowerment

The pre-test and post-test asked students to rate their agreement to a series of statements related to feelings of environmental empowerment. These items were used to measure if students felt more empowered to make changes to the environment after participating in the program. Again, the six-point response scale ranged from “strongly disagree” to “strongly agree”. On the pre-test, more than 75% of the responding students rated that they at least slightly agreed with the statements. An exception was for the statement “I can help solve problems related to plastics pollution”, to which 70% of students at least slightly agreed. On the post-test, more than 75% of students at least slightly agreed with all of the empowerment statements. The difference in response is outlined in Figure 2. An independent samples *t* test did not find a statistically significant difference in how students responded to this series of statements. **No discernable difference was found in students’ self-reported feelings of empowerment.**

Figure 2: Comparison of Responses to Environmental Empowerment Items

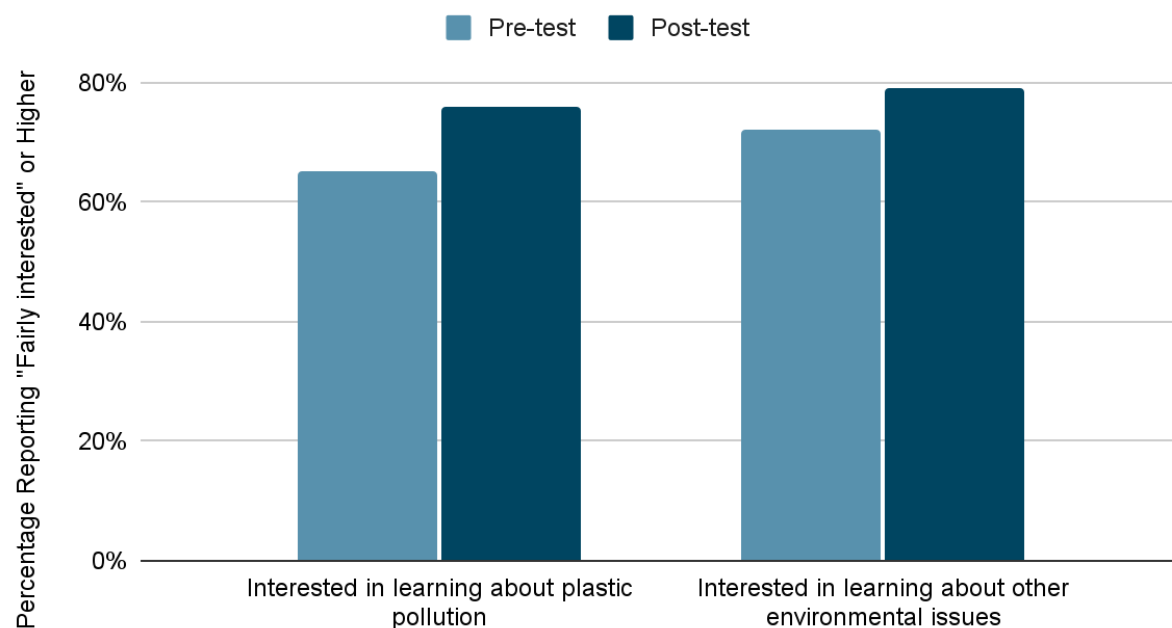


SECTION III: Changes in Students' Interest and Pro-Environmental Behaviors

Students' Interest

Students reported their interest in plastic pollution and learning about other environmental issues on both program assessments. Responses ranged on a scale from 1 ("not at all interested") to 5 ("extremely interested"). At the start of the program, 65% of students reported that they were at least fairly interested (3) in learning about plastic pollution. Seventy-two percent of students reported that they were at least fairly interested in learning more about other environmental issues. **After the program, 76% of students reported that they were at least fairly interested in learning about plastic pollution.** Seventy-nine percent of students reported that they were at least fairly interested in learning more about other environmental issues. An independent samples *t* test was used to compare the mean responses to the interest questions between the pretest and the post-test. A statistically significant improvement was found in students' interest in plastic pollution ($t = 2.07, p = 0.04$). **Students were discernibly more interested in plastic pollution after the program.** However, there was no statistically significant difference in students' interest in other environmental issues before and after the program.

Figure 3: Comparison of Reported Interest in Plastic Pollution



Change in Students' Reported Pro-Environmental Skills and Behaviors

To gauge if the program may have had any influence on students' actions related to environmental stewardship (such as using less plastic or working with their family to recycle), the pre- and post-tests asked students to rate their agreement with a series of statements about pro-environmental skills and practices. The pro-environmental actions included measuring pollution, avoiding single-use plastic, recycling, using less plastic as a family, and engaging in self-motivated learning about pollution. The six-point response scale ranged from "strongly disagree" to "strongly agree." **Of the comparative measures reviewed thus far in this report, these items showed the most apparent difference before and after the program.** For example, only 35% of students reported that they avoided single-use plastic on the pre-test. On the post-test, that figure rose to 48%. Similar notable changes were found for most of these items. Following an independent samples *t* test, **the increased reports of pro-environmental behaviors were found to be statistically significant.** Therefore, the improvements in students' self-reported actions were notable across all of these survey questions, shown in Figures 4 and 5. Table 1 shows the findings of these *t* tests.

Figure 4: Comparison of Students' Pro-Environmental Behaviors

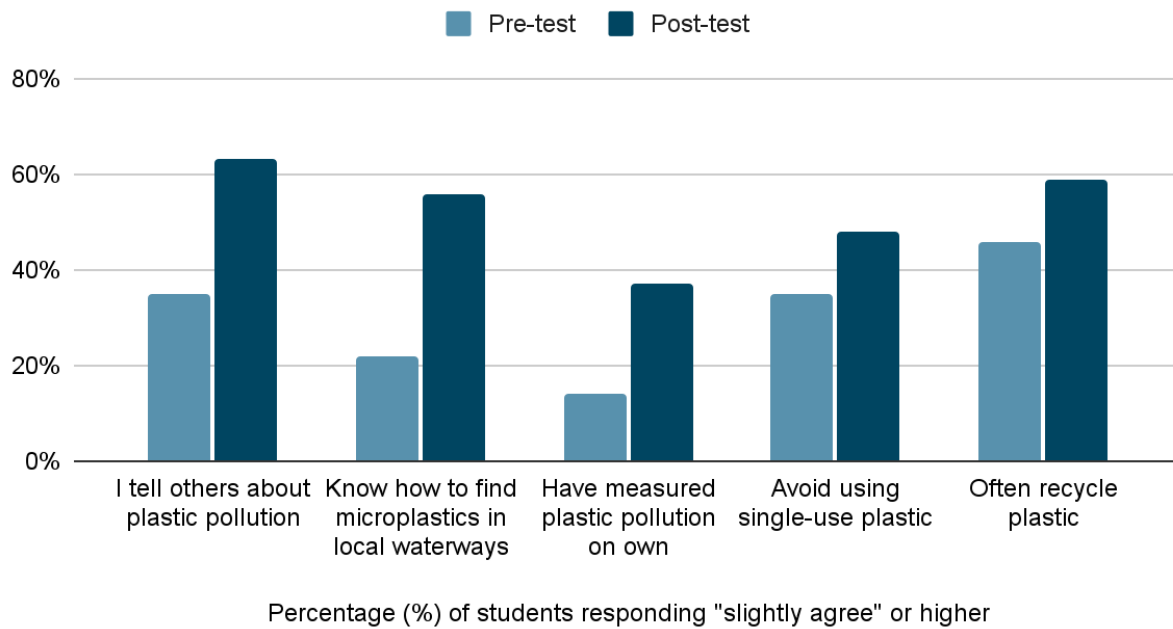


Figure 5: Additional Comparisons of Students' Pro-Environmental Behaviors

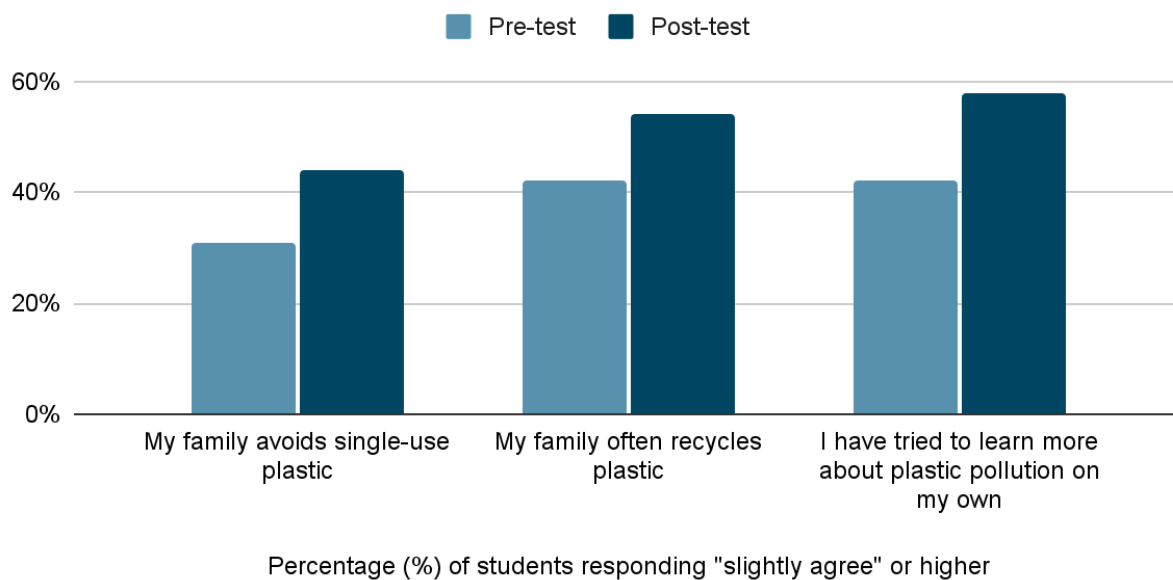


Table 1. Findings of Independent Sample *t* tests on Pro-Environmental Action Items

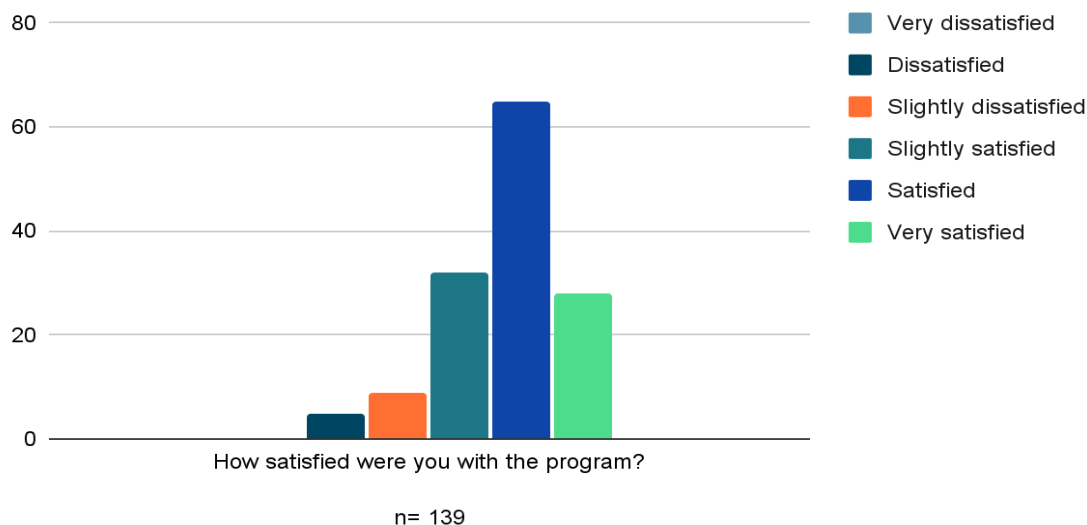
Item on Pre- and Post-Test	Difference in Mean	<i>t</i>	<i>p</i> - value
I tell others about plastic pollution	0.49	2.88	$p = 0.004$
I know how to find microplastics	1.09	6.82	$p \leq 0.000$
I have measured plastic pollution on my own	0.92	5.76	$p \leq 0.000$
I avoid using single-use plastic	0.52	3.38	$p = 0.001$
I often recycle plastic	0.60	3.56	$p \leq 0.000$
My family avoids using single-use plastic	0.48	2.89	$p = 0.004$
My family often recycles plastic	0.53	3.13	$p = 0.002$
I have tried to learn more about pollution on my own	0.68	4.08	$p \leq 0.000$

*Note: *p*-value indicated statistical significance when $p \leq 0.05$*

SECTION IV: Students' Satisfaction with Program

On the post-program assessment, the students rated how satisfied they were with the program. **The majority of responding students (65) reported that they were satisfied with the program.** Thirty-two responding students were slightly satisfied, and 28 were very satisfied. Fourteen reported that they were dissatisfied or slightly dissatisfied.

Figure 6: Distribution of Satisfaction with "Messages" Program



At the end of the post-test, the students had the option to provide additional feedback about the program—many of the students who elected to respond described the program positively. The field study was described as fun several times, and the students reported that they learned a great deal about environmental issues. A few examples are below:

“I wish there was a better system to recycle plastic waste in our city. They stopped recycling and it has a negative impact on our seafood industry and the people here.”

“Thank you for the fun collection experiment!”

“This has been a fun trip, although I'm not [a] scientist, I'm glad for this trip.”

“This class has taught me a lot about both microplastics and environmental science. It opened my eyes to the hazards of the world and its affects [*sic*] on every species in the environment.”

“I want to say that the experiment was very [educational] and interesting. I enjoyed a lot of it except the part where [my] clothes got dirty.”

“Originally I was not too interested in the science of the environment, but this project expanded my knowledge to be better.”

“I enjoyed the field trip and had fun.”

SECTION V: Educator’s Field Experiences and Implementation Feedback

Six educators volunteered to give feedback about their classes’ interactions with the *Messages from the Mississippi* program. Only four of the educators were able to have their classes attend the field day. **Of those who were able to attend the event, two described the event as *successful* and two described the day as *very successful*.** All of the responding educators (including those that engaged in the alternative recycling drive activity) stated that they intend to have their classes participate in similar activities in the future. The educators related that the students enjoyed being out of class and learning to engage in scientific activities:

“My student learned about micro plastics, macro plastics, keeping the environment safer, developed school wide measures to keep our school cleaner, built mini microscopes, took a field trip to troll at the Mississippi for micro plastics, wrote journal several entries (concerning recycling, addressing Senator/Congressmen, & the plastic experience), created a pledge using the Messages in a Bottle, and bonded using this project based learning approach.”

“At the STEM we encourage students to participate in real world problems. This project served as a catalyst for students to use critical thinking, collaboration and teamwork skills to study an important issue in our Community/world.”

“The students were excited about participating in the field trip and they enjoyed trawling into the river looking for microplastics. The students also conducted a water quality test to determine the quality of [the] Mississippi River.”

“The students really enjoyed getting to go out into the field and not be in a classroom. They were excited to use the various tools. The boots and gloves helped so that all students were willing to participate and I think it made them feel like scientists!”

Beyond describing the overall experience, the educators reported the most difficult aspects of the field day. **Four of the six educators reported that it was difficult to arrange for students to attend the event.** Arranging and scheduling school field trips was complicated by school COVID safety protocols. In the comments, the two non-participating stated that problems arranging for the field trip led to their classes being unable to attend. Educators reported that they had difficulty finding the time to participate in the program. One teacher stated that the pre-work and post-work for the field day were time-consuming:

“[Most] of the challenge was finding the time to fit all the pre-work and post-work for the students to get the most out of the field work. I am not sure that all of the students fully understood what we were doing and why.”

The educators were all given the opportunity to provide suggestions for how to improve the program and alleviate future challenges. Three of the educators suggested that this year was especially difficult for such programming because of the ongoing pandemic. Two other educators suggested that additional resources such as an expert speaker or prepackaged materials would be a welcomed improvement:

“I think that having an expert come in and talk about microplastics as well as someone who is working in finding solutions in the field would be amazing. Also having a community group who [is] already working on it here in New Orleans so we could connect with their project so that students can see how relevant it is to our community.”

“I would suggest that material/resources be packaged in advance so that teachers would have them on hand for the lessons.”

“I think the program was great, it's just difficult to complete with the current COVID procedures in my district. I think my students enjoyed the material and many of them will probably reduce their use of plastics or be more conscious of their use.”

“The biggest challenge is the pandemic. There is nothing we can do to schedule the field day earlier this year.”

“I think the program will be easier to do next year.”

Summary

From the data, the *Messages* program positively influenced students. After participating in the program, students reported to engage in more pro-environmental practices. More students indicated they avoided single-use plastic, measured plastic pollution on their own, told others about their experience, and encouraged their family to participate in recycling. These increases in habits and practices indicate that

the students were sparked to change how they used plastic, as well as increasing positive connections to their natural environment. Students were also more interested in learning about plastic pollution after the program.

Beyond having changes in their behavior and interest, the students were also satisfied with the program and found it useful. In the qualitative responses collected at the end of the program, many students stated that they enjoyed the fieldwork and collecting samples. They shared thoughtful reflections about the effect of plastics on their local environment. However, it is worth noting that the student mainly reflected on the work in the field, and not the classroom-based curriculum.

The students, though, did not display significant changes in their knowledge about the microplastics in the environment, pro-environmental attitudes, or their feelings of environmental empowerment. The students matriculated into the program already highly interested in environmental issues with mostly pro-environmental perspectives. The program may do little to move the needle with students who already have strong, positive feelings about environmental stewardship. Moving forward, the program may benefit from strengthening the classroom curriculum to teach the fundamentals of ecological concepts. This revision would likely improve its influence on students' knowledge. Furthermore, the program may be better suited to focusing on affecting students' real-world behaviors rather than their values.

For the educators, the field day work was a worthwhile experience for their students. They felt that their students enjoyed the programming and that the event was successful. However, some educators found scheduling the field day to be challenging due to the ongoing COVID pandemic, which led to two educators performing alternative activities with their classes. Also, finding time to complete the field day was challenging. Notably, this is an ongoing challenge in Louisiana school systems, despite the added impacts of COVID-19 restrictions. Overall, the educators would seek to complete similar programs again in the future, with the recommendation that additional resources be provided as part of the program.