

Public Lab
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EPA Environmental Education Impact Report
Messages from the Mississippi

Impact Report

During the EPA Environmental Education *Messages from the Mississippi* program, Public Lab collaborated with students and teachers in the Greater New Orleans area to amplify the impact of plastic pollution in the Lower Mississippi River Watershed using place-based learning strategies and creative methods of communication. With 82% of registered students coming from economically disadvantaged backgrounds, it was important for Public Lab to develop a community science experience that created hands-on opportunities and field work experiences for students and schools that are disproportionately impacted by environmental and economical issues. Public Lab worked with educators to create, pilot, and implement a curriculum to engage students in experiential learning and encourage student-designed solutions to real world problems. This place-based framework challenged students to create “Message in a Bottle” artwork that illustrated the relationship between the residents of New Orleans and the Mississippi River, and encouraged better stewardship practices from upriver communities and microplastic polluters. Through this process, Public Lab and education staff worked to improve student’s science literacy skills, and increase their understanding of local and regional plastic pollution, and encourage stewardship and ownership in the knowledge and health of their communities.

Making Connections Through Place-Based Learning

New Orleans, Louisiana is situated along the banks of the Mississippi River, between Lake Pontchartrain and the wetlands that form a barrier between human settlement and the Gulf of Mexico. Over 1.2 million people reside within the metro region of New Orleans. The settlement patterns throughout the lower Mississippi delta region demonstrate communities were historically built on higher ground, natural levees built by fluvial sediment overspilling the banks of a waterway (The Data Center, 2019). New Orleans is located near the mouth of the Mississippi River, in a partial peninsular area with waterfront stretching around three sides of the city forming a bowl shape. More than half of the 350 square miles that make up Orleans Parish are covered in water due to rapid subsidence, turning wetland into open water outside of the primary boundaries of the city.

While the City of New Orleans is in one way threatened by its proximity to water, it is also economically and culturally dependent on the resources of the river. The majority of Orleans Parish is supplied with treated drinking water originating from the Mississippi River. Before the Mississippi’s water reaches the faucets of New Orleans residents, the same water has already been used to support the agricultural, industrial, production, and disposal needs of more than 70 million people living within the river’s watershed (U.S. Census Bureau, 2017). In addition to these uses, the river provides a transportation route that connects the United States with the global economy, resulting in the region’s environmental health being sacrificed in order to prioritize the economy and the needs of the many over the needs of the few. Over \$100 billion worth of goods pass through the Port of New Orleans annually, including a majority of the country’s grain, oil, and gas. The pollution caused by extracting, refining, and transporting these goods remains local while the benefits and proceeds are exported out of Louisiana (Restore the Mississippi River Delta, 2018).

This project employed a place-based pedagogical framework that encouraged students to engage with their environment directly through hands-on data collection and geographically bounded research goals. The intention of this approach was to illustrate the connections between the people of Louisiana and the waterways that we depend on for commerce, sustenance, and recreation, while simultaneously encouraging students to critically examine the processes that have rendered Louisiana uniquely vulnerable to floods, contaminants, and storm surges. By connecting the localized experiences of students in the greater New Orleans region to national and global processes, students were empowered to speak for themselves, their communities, and the natural environment that they interact with on a daily basis.

When asked about the role of the Mississippi River in their communities and the impact of place-based learning on their students, partner educators gave these testimonials:

- **Mary Phillips:** Being at the bottom of the river, you sort of see all of it. Everything that is done in the Mississippi River, you get the impression of that. It's also an industry, it's a lifeline for this community... It's such an important part of the city, that's how people give directions. It's either riverside or lakeside, it is embedded in New Orleans culture and community. ... But no one would drink from it, or swim in it directly. I think a lot of people don't think about why that is or how that came to be. So that's one of the amazing things is that people start focusing on, "Why does it look this way? How did it get to be this way?" And understanding that it is, it is a much bigger, larger picture than just us. The Mississippi connects so many of us, and all of our decisions, what other people or companies do, we get to see the end result of.
- **Sheila Lumod:** For most of my students, [the Mississippi River] is very significant to them, because that's what they see every day. ... That's their food source, where they get seafood, fish, and shrimp, and also where goods and services will come to New Orleans through the different businesses that come here. ... At the very beginning, before this project, we looked at the river as just a body of water. But when we started looking into the Mississippi River - really looking at this ecosystem, and finding out about the microplastics in the river, it changed our view of the river. So my students are now looking at the river as a place where pollution can be seen. There's a source of pollution for microplastics, and they are aware that these plastics will eventually go into the fish, and eventually may come to their body when they eat the fish. There's a chain reaction that will happen. So the students are looking at the river as not just a body of water, but part of their story. There's a lot of living organisms that must be preserved by taking care of the river.
- **Willette Menard:** I think my students originally had a fear of the river. When I was a kid, I was encouraged to go outside to play so I didn't have that fear and that stigma of "oh, something could happen." When we organized the original field trip, there was that fear factor: The river is a dangerous place, so don't look at it as though it is something that you can protect. You're sort of scared of it, so you stay away from the river. You actually don't cross the Mississippi River Bridge, or even ride the ferry. ... So for my kids, it broke down the wall, like "wow, all of this is sitting right on the river. I live 10 minutes away and I've never seen it before." Once we actually did the trip, and they were able to see some of the microplastics coming up from the river, now there's a sparked interest. "Okay, what else is going on in the river?" My kids became a little bit more engaged and aware about their environment. A lot of them said, "Okay, I came this time. I will come back and I'll bring a family member next time I come across [the Mississippi River Bridge]."... I think at the end of the day my students recognized that you can be a steward in your own right. You can experience something, and bring someone along the way and dispel a lot of the negativity associated with the river. It's a place where there is business; it's a place where there are resources; it's a place where pollution is having an effect, because one side of the river looks this way, then you go to another section of it, it looks another way. ... Being able to be a part of something that is community based, and it being relative to your experience, was the biggest clincher for my students. Making sure that each child has their own role, because everybody is not good at constructing a microscope, and everybody's not necessarily good

at being in nature. Or maybe one kid is not good at collecting specimens, but every kid can find a place in this project. ... So every kid found a place and a space in this project to shine, while also being able to connect with other kids. ... This gets you out of the room, this gets you in the field, this gets you connecting to nature, and then also owning what you do by bringing it back, explaining and making a connection to others.

Empowering Young People through Student-lead Learning

Through the creation of a meaningful and informed curriculum, Public Lab engaged students and teachers from underserved communities, and empowered these individuals to recognize their local knowledge and use their voices as direct witnesses to large scale environmental harms. To achieve this goal, the *Messages from the Mississippi* lessons sought to develop a framework for student-led project development by leading with a community identified concern, and then allowing educators and students to collaboratively design and adapt the methods prescribed in the lessons in order to answer questions posed by students in earlier focus groups. While each lesson in this curriculum was designed to be ready-to-use, the creators purposely left room for dialogue and discussion between classmates and educators. Open-ended journal prompts, and supplemental activities were utilized to encourage students to develop their own perspectives on the issues informed by the material covered in the lessons, rather than requiring rote memorization and singularly correct answers.

By employing the principles of community science in the classroom, these six lessons took students through an immersive scientific research process from identifying issues and sources associated with aquatic pollution, collecting and analyzing data in the field, and creating solutions for change within their own communities. As students and teachers progress through the different levels of the scientific method in each phase of this project, students are building their own environmental literacy around important local issues, and are able to apply new knowledge to advocate and implement changes within their communities and schools.

Over 48,000 students attend the 87 public schools in New Orleans, with 91% of those students identifying as persons of color, and 82% percent of students coming from economically disadvantaged backgrounds (Babineau, 2018). At the start of the program, most of the students responding to the intake survey reported being age 17 and female, and the students most frequently selected Black/African American as their ethnicity. The participant demographics of this program were primarily represented by students underrepresented in the sciences, and close to graduating from high school. Economic disadvantages, lack of resources and investments, and racial discrimination are known barriers for many students who would otherwise excel in college and further into the professional realm. These systemic barriers were addressed directly by providing the partner schools with tools and supplemental resources required to complete the *Messages from the Mississippi* project, as well as text books, sensors, and tangential project materials so that students investigations could follow their own interests beyond the framework of this specific project.

In addition to resource support, the curriculum illustrated a replicable process by which students can identify, examine, research, and report on environmental issues impacting their communities. This project-based, experiential, and student-led method of learning are not commonly employed in underserved schools, which are heavily dependent on test scores and more traditional success metrics in order to receive adequate support from federal and state education departments. This pedagogy worked in concert with the creative activities assigned to the students by creating workflows for developing one's own voice, and empowering students to actively engage within their communities and beyond to enact change. The creation of art bottles, with the explicit purpose of communicating a message to a potentially under-informed, distant individual, tasked students with educating others through non-traditional mediums and elevated their position from that of a student to a peer. Writing prompts asked

students to draft convincing letters to decision-makers seeking support for change and/or resources within their communities. Other prompts required students act out the role of an environmental engineer or urban planner in order to design solutions to microplastic pollution and possible implementation strategies. These strategies elevated the student's work to the level of professionals, and encouraged them to see the potential impacts of their work outside of the boundaries of the classrooms. This active, solutions-driven approach to learning prepares students for the realistic challenges that they will experience once they graduate from high school, and illustrates the steps required to identify problems, develop solutions, troubleshoot methods, and disseminate information to diverse audiences. This process works to empower students to see themselves as part of a larger community of scientists, educators, activists, professionals that do not seek to diminish the value of a student's contributions based on age, but rather highlight their testimonials as uniquely valuable reflections of a young person's experience.

- **Mary Phillips:** This [curriculum] was really nice because [it was] not part of a state test, so it was a lot more relaxed and fun to just let the students take the lead, and have them ask the questions. I think they were far more interested, because they were able to go out and actually collect the data in the field and understand that this is the kind of data used by scientists. We were able to create actual graphs and data from the data they collected. Whereas a lot of times the lab lessons we're doing are very teacher-led, where I am already giving them the procedure and the how to. This program is more like: here are the tools, here's the data we collected. Now, what do you want to do with it? How can we use this? How do you want to inform the public? ... I think they were more than invested in it and enjoyed the process more. I mean, it was definitely a little messier and chaotic, but I always enjoy that anyway. Some of them really struggled in that part. It was interesting. Some students were like, "oh, what am I supposed to do?" But so they had to go through that, being in that uncomfortable space of communicating to one another, "I don't know, what do you think we should do?" It really was interesting to see some students get really tech with it, and others just had to sit with the struggle. I think they were far more invested in the project, and enjoyed the whole process more because they had far more ownership over it, and could follow what interested them. ... I honestly think that struggle, and being uncomfortable, is hugely important. Success in science-based classes sometimes tends to be students who have traditionally done well at school, because it is more prescriptive and they're good at that. But that's not how science necessarily works. That's also not how life works.
- **Sheila Lumod:** Some of the students are advocating and writing letters to their council-members. some were also writing letters to the grocery store owners, asking for them to limit the use of plastics. ... I really see a big change in my students, they own their learning so much more. Most of the time when we teach them about a certain topic they just take a look at it, you know, they just take it and then we'll prepare for the test. But for this project based learning, it's sunk in, and that has created an impact on them. They have this commitment and a desire to really do something about the environment, and do something about the plastic issue in our environment.
- **Willette Menard:** For this program, I started with the microscope-build with the students. It's a technical piece, but there's some architecture and engineering elements in there, so that created an interest in "how can we use the microscopes?" So it was a huge buy-in: to challenge the students, because they are thinking "a microscope is extremely technical." I don't know if that's because of prior history with the old school microscope. I can think of all those technical parts we are not allowed to touch, a whole lesson on how to carry it around the lab safely. You learn how to look at a microscope, but you don't really actually know what it does. This program scaled it down and focused on what it actually does and what it is. ... So environmental science for my kids became about the amount of ownership: I built this microscope; I collected the samples; this is what my work looks like. My kids came up with new group names, everybody had a role. Some students were much better at building, others were better at collecting samples. Some were better at designing, so it really brought out a lot of talent in terms of what they thought they could do. Because if I would have just gone in and said, "look, we're trawling at the Mississippi, here's the mechanism

and here's the microscope,” there is no inquiry there. The thinking is not connected with the project. The thinking and exploration has to happen, and you design it. It's about student ownership. They bragged about it to the whole school. Everybody wants to be in my environmental science class now.

Communicating Scientific Experiences through Art and Action

Messages from the Mississippi works to bring ecological concepts and environmental concerns across social contexts - from peer to peer, to a student's family, to the larger community - and across social settings. As students worked through the curricular unit, students kept journals documenting their journey through the investigation and exploration of the impacts of plastic pollution on their community. Statements from their journals, along with the macro- and microplastic debris collected from their samples, were turned into an interactive art exhibit that showcased their project experiences. Students created “Messages in Bottles” using sealed glass brewer's bottles as snow globes containing plastics collected during their field excursions. In addition to plastics and other decorations found within their classrooms, students wrote messages that were sealed using modge podge, and placed these notes inside of their bottles, so that viewers would need to physically move and interact with the artwork in order to read the message. These messages were written from the perspective of the students, many opting to pull their messages directly from journal entries, with some students taking a creative approach and wrote their messages from the perspective of the Mississippi River personified. The appearance of collected plastic debris swirling within each jar provides a powerful visual of the largely invisible problem impacting their waterways, and the students' writings work to humanize and establish connections between the art viewer and the students who experienced this project.

Each classroom throughout each school interpreted the art component differently, with some classes collaboratively working to create a cohesive body of artwork representing the entire class's perspective. One class utilized their bottles comparatively, filling one bottle with plastic debris found in their samples, and another bottle with local plant life and other organic materials. Another class used food coloring to change the color of the water in their bottles in order to represent the land, the water, and the plastic waste created by humans. Other classes instructed students to work individually or in small groups to create artwork that reflected their friends, families, and communities, rather than assigning an artistic theme to the entire class's artwork. Without deciding on a collective message, many students across different classes expressed similar thematic elements in their art.

Many students' artwork depicted the wildlife that is impacted by microplastic waste in our waterways. Drawings of deceased fish, as well as shells and feathers were used to depict the harm caused by microplastic consumption upon the animals that live within the Mississippi River's watershed.

Other students used feathers and beadwork to represent the culture of their communities throughout New Orleans and South East Louisiana. The feathers on the bottle pictured below are representative of the tradition of Black Masking Indians, commonly referred to as Mardi Gras Indians, a working class costuming performance that is threatened as it has become difficult for aging culture bearers to parade and second line with their krewes, due to increasing summer temperatures and the lack of access to safe and clean drinking water.

Mardi Gras beads are a major source of plastic pollution within the city, as beads that are not collected by parade-goers are often left on the streets and in the gutters. While some are kept as souvenirs, Mardi Gras beads are generally considered a single-use item, and the cheaply made iridescent coloring is made using harmful chemicals and toxins such as lead, bromine, arsenic, mercury, and chlorine among others (Smithsonian Magazine, 2017).

On June 4th, 2022, Public Lab hosted a public exhibition of the student's artwork at our partner's community space, the STEM Library Lab in Metairie, Louisiana. The Art Exhibit opening event was attended by educators and students, both those who participated in the *Messages from the Mississippi* curriculum and other educators from the

STEM Library Lab's network, as well as multiple members of the community and their children. Following the opening event, the artwork was consolidated into a smaller area in the Library's workspace where it was displayed publicly. Our partners at the STEM Library Lab reported that many educators and guests that visited their space during the two week exhibition were excited and intrigued. Many expressed interest in replicating the *Messages from the Mississippi* program in their classrooms in the future.

Through this exhibit, students shared their changed perspectives on the impacts of plastics in their environment, articulating the value of the knowledge gained from their classroom and field experience. By sharing their perspectives with family, friends, and community in an open exhibit, students broadened the environmental and science literacy impact, and encouraged increased stewardship in those interactions beyond the walls of their classrooms and schools. This approach of science communication - knowledge sharing through art - provides new avenues to further contributions in the public dialogue, especially from those who feel excluded or lack the confidence to participate. Increasing environmental literacy through critical local issues, like water quality and waste management, provides opportunities for increased stewardship and advocacy from a community-led approach.



- **Mary Phillips:** What my students took from this experience is that it's up to them to take information, and problem-solve, and make decisions. Understanding that you can't make the best decision or make the best step forward unless you have really good data and information and understanding if your data and sources are valid. ... Do you become a reliable source, in that sense? That is such an important thing to understand, moving forward, to be able to make decisions. Because especially in this day and age, we're all bombarded with information, but it's the era of misinformation, and no one's checking that, so you have to be able to sort through that as an individual. In this project, understanding their data needs to be reliable so other people in the community can rely on it was a lesson they could take pride in, and feel like they're contributing to the larger whole.
- **Sheila Lumod:** The moment my students saw the microplastics they wanted to find a solution. After they went on their field trip to the river, they were writing letters to their local council-members, people in the government, and business owners to do something about the plastic. They were interested in sharing information with other people through their art...about the use of plastic. I was looking at them while they were writing the messages in the bottles, and [this project] had a great impact on them. When I look at their messages, they're really pleading to stop using plastic, or to be responsible about the handling of plastic. After all of this, they created the bottles, and they made beautiful art about their experience with microplastics.
- **Willette Menard:** There was an assignment where [the students] had to write a letter to a decision-maker. That brings in social studies; so now in an environmental science class, I'm not only touching on science, but I'm also including civics and some parts of English Language Arts, and so it becomes very real world. Then you start to say, well, look, you really could write a letter to your actual congressman to get something done. This is exactly how policy change happens. So you open up a different conversation, it becomes bigger than science, it becomes more of a movement. Some of the letters my kids wrote, I was really shocked. I'm like, "wow, you really thought about your impact, or how policies impact what is going on with microplastics, with pollution, and how you can be a part of that change." It starts with what you say, and what you write.

- **Ches' nique Phillips:** I have one student ... She loves to talk. That's what she's like, she wants to be a lawyer. So she's talking about policy, law, and changes she can make. So when you think about science, she's thinking, she didn't like science and she would let me know she didn't like it. She said the one thing that she could see herself doing in the future when she was an adult was to make changes in the way we do things, so she applied that to "in the future, she can see herself making the change by doing ____". One student wanted to be an architect, but his journal said he wanted to be a rapper. He said he would tell people on the stage why they shouldn't do things, and that if they were at his concert, that they can't use plastics. ... They were thinking long term, asking "how do I let other people know what changes that they should make?" Whether it's something to do with being an entertainer or an artist, I had a lot of students that were artistic, who just enjoyed making bottles and making posters. That was the best part for them. In thinking about the *how*, that pivots to the rest of their life: not just my grade, but how I tell my parents about this, my friends, and other people. ... Even for students that weren't interested in science, they still found a way to connect it to themselves.

Evaluation of Impact

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.

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 sample t-test was used to compare the mean responses to the interest questions between the pre-test 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.

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 sample 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.

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.

Program Challenges

Throughout the duration of this program, both teachers and students had to overcome extenuating circumstances and obstacles beyond the scope of a traditional school year. The ongoing COVID-19 pandemic resulted in extended periods of virtual learning with some students being unable to return to a consistent schedule of in-person instruction. Additionally, some school districts were prohibited from traveling off-campus as positive case rates were rising, causing Public Lab staff and teachers to come up with creative alternatives to replicate the hands-on experience. Outside of the ongoing public health crisis, the greater New Orleans area was heavily damaged by Hurricane Ida in September 2021. This category 4 hurricane caused significant flooding, structural damage, and long-term power outages to much of the region. The severity of the destruction resulted in many schools being left without basic functionality, such as water and electricity, for multiple months, with several school systems delaying the start of the school year. Additionally, many residents and students throughout the region, including educators participating in this program, were left without safe homes and were displaced during the Fall 2021 semester. Fortunately, despite notable complications and setbacks, the delay resulted in two additional educators from St. John STEM Magnet Program in Reserve, Louisiana joining the program, expanding the number of students exposed to the *Messages from the Mississippi* curriculum by approximately 40 students, increasing the impact of this work within heavily industrialized communities.

Educator Experience

Through the educator training workshops, Public Lab provided instructional opportunities to teachers on prevalent water quality issues impacting communities along the Mississippi waterway, and empowering them with the tools and knowledge needed to guide students through the exploration of local environmental issues. These training sessions provided teachers with the training and skills to teach relevant, localized water issues to students, as well as how to implement student-led investigation and community science in the classroom. These teacher workshops provided Public Lab staff with crucial feedback which was used to further enhance and fine-tune the final curriculum package.

In total, seven educators working in five different partner institutions implemented the *Messages from the Mississippi* curriculum in their classes during the 2021-2022 school year. Four of the five schools were located in Orleans Parish, while three participating educators worked in St. John the Baptist Parish, located to the northwest of New Orleans in the heavily industrialized Mississippi river corridor, commonly referred to as “Cancer Alley.” For successfully completing training and project work, each institution was provided a sub-award for classroom and school-wide environmental education materials. Educators requested science equipment, such as water sensors and testing kits, to provide experiential learning tools to enhance student-led inquiry in the classroom. Additionally, requests for in-school sustainability supplies, such as water bottle filling stations and recycling bins, demonstrated a commitment to showcasing solutions that the whole school can engage in to help reduce plastic waste and pollution.

In addition to the educational materials provided to each school, students were tasked with designing and implementing a schoolwide recycling program. Using sub-award funds, recycling bins were installed at Edna Karr and Young Audiences Charter schools and students who participated in the Messages from the Mississippi Program led recycling campaigns where they created signage encouraging their peers to use the new bins with instructions on how to sort materials. Students gave presentations during morning announcements, and visited other homerooms to spread awareness of the new resources available to all students. Four of the five partner schools decided to purchase water bottle filling stations to modify their current drinking fountains so that reusable water bottles could be refilled, in lieu of single-use plastic bottles. Students at the NET: Gentilly noted in their journal responses that following the onset of the COVID pandemic, their school provided the entire student population with at least one

water bottle each day, and when they questioned the administration regarding the number of bottles purchased, it equated to over one thousand per month. Following the installation of this device, the students regularly bring their own reusable water bottles from home, and the administration has scaled back their purchasing of single use plastic bottles.

Future Work

The STEM Library Lab, a partner organization for this project, will host an educator-specific workshop at their office space in the coming months, summarizing the successes of this implementation and providing a hands-on kit building session to encourage new educators to implement this curriculum in their classrooms. As a subaward for this grant, the STEM Library Lab was given the materials to replicate this project in four additional classrooms, as well as a selection of complementary build-it-yourself environmental monitoring kits so that students can expand on this methodology further. The STEM Library Lab provides free resources to teachers and non-traditional educators in the New Orleans area, making this workflow completely accessible at no-cost for up to four classes of 30 students.

Following the success of the student's artwork exhibition, a formal partnership with the Louisiana Children's Museum was established in order to extend the display of student artwork created through this project and expand access to the curriculum in a non-classroom setting. Working with the Director of Arts & Culture, as well as Sustainability Director of The Louisiana Children's Museum, the *Messages from the Mississippi* curriculum is being condensed into a one-day workshop for children of all ages. Amendments to the curriculum and methodology will be made by the Museum staff with support from Public Lab, with the intention of developing a workshop package that can be replicated by the museum on a recurring basis. Certain adaptations will be made to program methodology; for example, data collection using the BabyLegs Aquatic Trawls will occur at the City Park Lagoons and be compared to a reusable sample of debris collected from the Mississippi River. This workshop will be hosted in the coming months at the Museum, with the goal of having students from the initial Messages from the Mississippi cohort in attendance as mentors and community leaders. This programming will likely be conjoined with existing museum event programming in order to maximize attendance and exposure for the students and their art.

Public Lab is continuing to share the classroom and student messages through a video experience, highlighting student experiences and educator testimonials. Due to the uncertainty of the ongoing COVID-19 pandemic, this initiative was proposed as an adjustment to Public Lab's original goal of having the physical objects from the *Messages from the Mississippi* exhibit travel to partner galleries upriver. Rather than a traveling exhibit, a video series was produced for educators and project managers looking to replicate this project. The purpose of the video is to share the curriculum and its positive impacts throughout the Mississippi watershed and beyond, connecting with students in other regions to inspire the ripple effect of change and activism. The release of this video series is planned to coincide with the educator workshop that will be hosted at the STEM Library Lab in the near future.

Prior to the close of this grant, there are already multiple examples in which this project can be adapted for other watersheds and fluvial environments, scaled to suit various audiences. During the spring 2022 semester, Public Lab expanded its Babylegs programming to work with students throughout the Chesapeake Bay region. For this project, students were challenged to use and modify the Babylegs Kit to sample for biological indicators within bay tributaries. Students developed methods to modify the existing kit to make a smaller, more cost effective model to be used for plankton sampling purposes, in addition to microplastic collection. These students were inspired by the open-sourced community science pedagogy of the *Messages from the Mississippi* program, and utilized the program's framework to develop further monitoring projects in the Chesapeake Bay region utilizing their own

innovative tool designs. In May 2022, a representative from the Forsyth County Recycling & Solid Waste Department saw a presentation of student work at the Children and Nature Network conference, leading to a Public Lab collaboration with the department to implement a similar student project along the Chattahoochee River in Georgia and Florida. In this project, students at multiple checkpoints along the river, from headwaters to the mouth of the river, worked together to collect data using the Babylegs Kit to assess the health of their river. This data demonstrated how human impacts from urban to rural and residential areas can take a toll on their drinking water and aquatic ecosystems.