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# From Curiosity to Action: Evaluation of a Place-Based Youth Research Mentorship Program

RESEARCH AND EVALUATION

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## ABSTRACT

Environmental education programs can cultivate youth curiosity, confidence, and connection to place, yet many schools face systemic barriers to implementing inquiry-based, locally relevant learning. The Louisiana State University EnvironMentors (EM) program, hosted by Louisiana Sea Grant, is a year-long, near-peer research mentorship initiative designed to address these gaps by engaging high school students in hands-on environmental exploration, place-based field experiences, and authentic science communication. This mixed-methods study examined the program's influence on student confidence, research skills, environmental literacy, and career outlook through post-program surveys and a focus group following students' presentations at the National Marine Educators Association (NMEA) conference. Findings indicate that students strongly valued the relationships formed with mentors and peers, reporting increased confidence as learners, researchers, and public speakers. Participants described feeling "chosen," "supported," and part of a "family," highlighting the central role of community in identity development. Students' ability to choose research topics they cared about also strengthened motivation and ownership of learning. While survey data showed mixed initial interest in STEM careers, focus group discussions revealed that presenting at a national conference significantly expanded students' sense of possibility. This study highlights the EM framework, which is adaptable and transferable, offering practical guidance for educators seeking to center curiosity, place, and mentorship in nonformal learning contexts.

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# 1. INTRODUCTION

## 1.1 PROGRAM CONTEXT AND RATIONALE

The United States is undergoing profound environmental and societal changes, including intensifying climate impacts, increases in extreme weather hazards, and rapidly shifting coastal and ecological systems (Summers et al. 2022). At the same time, people, especially youth, experience decreasing access to natural environments, weakened emotional connections to nature, and more frequent negative or fear-based encounters with natural systems (Beery et al. 2023). This duality of changing environments and changing human–environment relationships underscore the urgent need for environmental education as a positive connector that can rebuild relationships between people and place.

Louisiana exemplifies this tension. Residents hold a deep connection to water and nature, which provide critical ecosystem services, cultural identity, recreational opportunities, and support for coastal livelihoods. Yet Louisiana also faces some of the nation's most extreme risks—coastal flooding, land loss, subsidence, saltwater intrusion, and the erosion of cultural lifeways tied to the landscape. Despite these threats, place attachment remains strong. As Simms (2017) summarizes through resident narratives: "*I live here. I die here.*"

Environmental education plays a unique role in mediating relationships between people and place. Connection to nature is complex, shaped not by simple cause–effects but embedded within sociocultural, institutional, political, and material dimensions of life (Beery et al. 2023). When thoughtfully designed, environmental education can cultivate students' ability to see themselves as part of, rather than apart from, natural systems. In addition, these experiences show students that they are part of the solution to our most pressing human and ecological challenges.

Yet several systemic barriers limit the potential of environmental learning. Classroom instruction is often curriculum-driven but disconnected from local context. Teachers face pressure to meet federal, state, and district mandates that rarely incorporate place-based examples (Demarest 2014). Since No Child Left Behind, increased emphasis on standardized testing has narrowed curricular scope and reduced opportunities for hands-on and outdoor learning (Nichols & Berliner 2008). Although Every Student Succeeds introduced more flexibility and encouraged place-based approaches (Sobel & Larimore 2018), barriers to field-based learning persist. This is particularly concerning because environmental and place-based education measurably support student learning, well-being, and engagement (Ardoin et al. 2018; Dale et al. 2020; Kuo et al. 2019).

In addition, students need structured opportunities to engage in inquiry, which helps them connect classroom concepts to real-world questions and develop new understandings of their physical surroundings (Theis 2016). Creative, design-thinking, and other problem-solving approaches further strengthen civic literacy, empathy, cultural awareness, and willingness to take intellectual risks (Alberta Learning 2004; Panke 2019; Sharples et al. 2016).

Youth today also face an information paradox: access to information has never been greater, yet critical thinking skills are low (van Damme & Zahner 2022). Many students lack confidence in their ability to interpret, evaluate, and apply information to real-world environmental questions without hands-on approaches to education (Anderson et al. 2020). The result is a growing gap between information access and the skills needed to turn information into actionable knowledge.

Nonformal educational programming provides a needed connection for students to not only understand local phenomenon but also build their critical thinking skills to ask and answer their own questions about nature, especially with existing limitations for student engagement with locally relevant learning in classroom environments. Nonformal environmental education programs provide experiences for youth that have increased their connection with nature (Lieflander et al. 2012). Additionally, high intensity programming, such as camps or year-long programs, are significantly more effective in promoting nature connectedness than single-day programming (Braun & Dierkes 2016). Investing in youth's curiosity, exploration, inquiry, and relationships with the world around them is key to reconnecting people with the world that they are very much a part of.

## 1.2 THE ENVIRONMENTORS (EM) PROGRAM

The LSU EM program is a year-long research mentorship initiative based at Louisiana State University (LSU), hosted by Louisiana Sea Grant and in partnership with the LSU College of the Coast and Environment and the Mississippi River Delta Transition Initiative. LSU EM is a chapter of the national EM program hosted by the Global Council for Science and the Environment. The LSU EM chapter started in 2010 and has run annually since its inception. Historically, this program has worked in partnership with two public high schools in Baton Rouge, Louisiana: Scotlandville Magnet High School and McKinley Senior High School. Each school has a teacher sponsor that serves as the liaison between the program and the school. Typically, the program includes between 5 and 15 high school students who participate during the academic year.

The LSU EM program embeds student learning within the local environment, and a key feature of this program is the intentional connection between students' scientific understanding, their local ecosystems, and the socio-cultural factors that influence human decision-making. The students meet weekly on LSU's campus. They participate in group activities and field-based learning trips to explore issues related to environmental science, while promoting college and career readiness.

Near-peer mentoring is at the foundation of LSU EM program. Participating high school students are paired with a mentor who is an upper-level undergraduate, graduate student, or postdoctoral researcher. Each week, the high school students work alongside their LSU near-peer mentors to better understand the environment and their role in influencing it. As the year progresses, the university mentor guides the high school protégé through an individually selected research project and supports them as they prepare and present their findings at an academic conference.

## 1.3 PEDAGOGICAL FRAMEWORK

The EM pedagogical framework is built on the integration of research, science communication, and environmental literacy, using hands-on, inquiry-driven experiences that foster confidence, identity development, and meaningful connections to place (Figure 1). Rooted in near-peer mentorship, the program positions high school students (protégés) as emerging researchers by engaging them in the full research process—from first understanding what it means to be a researcher, generating their own project ideas to collecting data, analyzing results, and presenting at professional conferences. Through these scaffolded, mentor-supported experiences, students learn the scientific method, develop technical skills, and gain a sense of ownership over their learning, leading many to articulate the identity outcome: *"I am a researcher."*

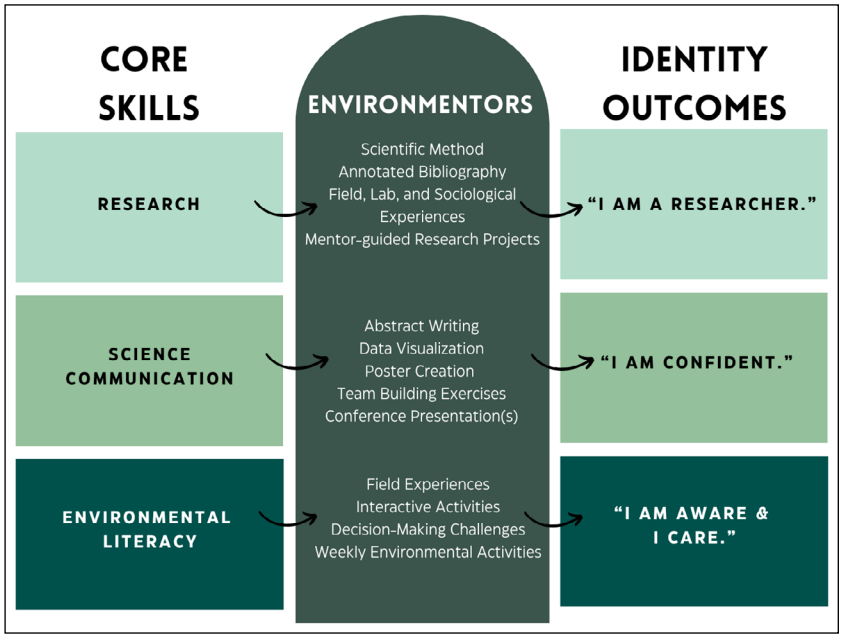



**Figure 1 The EnvironMentors Program framework**. Core skills, activities that fit within the skills, and the protégé identity outcome from participating in the program.

Science communication is cultivated through repeated and authentic practice. Students learn how to communicate science through working with their mentor(s). They also teach younger children at public outreach events in conjunction with this program, leading public-facing environmental activities. As part of their research project process, they write a conference proposal abstract, visualize their data to communicate their research narratives, create research posters, and present to scientists and educators at conferences. These skills are built through the collaborative nature of the program. These experiences build public-speaking confidence, collaborative skills, and an ability to translate complex concepts clearly supporting the identity outcome: *"I am confident."*

Environmental literacy is strengthened through hands-on and place-based activities and immersive field experiences that deepen students' understanding of Louisiana's ecosystems. Activities such as canoeing in local waterways, night hikes, species identification with Master Naturalists, environmental decision-making challenges, and arts-based reflection help students explore both ecological systems and their personal connections to them. By linking lived experience, cultural context, and environmental knowledge, students cultivate the identity outcome: *"I am aware and I care."*

Together, these pedagogical components create a holistic learning environment where inquiry, mentorship, and real-world engagement empower students to see themselves as capable contributors to science, nature, and their communities.

## 1.4 PROGRAM APPROACH

This program is essentially broken into two halves: the fall semester and the spring semester. In the fall semester, protégé and mentors engage in weekly meetings focused on building environmental literacy, scientific research literacy, communication skills, and connection with nature through environmental activities, place-based and science communication experiences all designed to build their research capacity. Community-building opportunities are integrated within all experiences, as the mentors and protégé work together. In the spring semester, mentors and protégé transition to working on their independent research projects, from determining the research question to creating their scientific research conference poster.

### 1.4.1 Environmental Activities

During environmental activities students explore the importance of the intersection between the various dimensions of science. Both mentors and protégé embark on a journey to discover that each discipline is incomplete without the other, meaning that no matter the focus, all science is interconnected. Considering this, the pedagogy in our program takes a holistic approach to reflect these dynamics.

Protégé explore community-centered challenges and are supported by their mentors to find scientific solutions. Participants analyze and interpret data through place-based education experiences and engaged in dialogues grounded in empirical evidence, sociological theory, and creativity. For example, protégés learn about the LSU lakes renovation project through a physical, natural, and social science lens. Protégés rotate through stations where they explore different focal points of the renovation process, and their possible environmental impacts. During the place-based experience, students learn how to test water quality variables and sediment attributes through mentor-led instruction.

Program participants are also exposed to how different learning styles present themselves through human interactions. Students develop an understanding of the way connecting with individuals on a creative and cultural level can exceed examining data sets on the topic. As an example, protégés gained insight into environmental issues in the human and non-human world by creating a metaphoric art collage (Figure 2); and, by dissecting environmental-centered children's literature. By integrating shared experiences in natural spaces with research and creative outlets for self-expression, we observed that mentors and protégés realize that environmentalism is a thriving ecosystem that needs an equally diverse set of outlets for engagement.

While shared experiences are a program's cornerstone, it is equally important to provide ample opportunity for students to form their own opinions and express themselves.

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**Figure 2 Student Made Photo Collage**. This collage was made by a high school student protege to metaphorically portray land loss (a football field every 100 minutes) in Louisiana with zero AI involvement.

Participants in the program work alongside one another and formed their own individual analysis of social-environmental challenges in the state of Louisiana by critiquing historical power hierarchies, examining case studies, and then identifiing possible solutions to strengthen community resilience. As an example, protégés learned about how making small shifts in daily life choices, such as choosing to eat from home rather than order take out, when done in large groups, can collectively contribute to a more sustainable lifestyle. Students reflected on this concept by assessing private, state, and individual responsibilities as well as the dynamics of these relationships. Utilizing small group discussions, participants were able to engage in honest conversations, ask questions, and grapple with challenging topics in a safe and supportive space. The lesson drew tight connections between the entanglement of human decision making and the impact on natural processes.

### 1.4.2 Place-Based Experiences

Place-based field experiences are central to the program, as they ground the students within the place where they live and are reliant upon. Each year, either during the weekly meetings or as a weekend field trip, participants are provided with experiences that engage them in outdoor environments. This year, students spent an afternoon with the Louisiana Master Naturalists at a local city park. Students used field guides, iNaturalist, and binoculars to identify native plants and wildlife. They also learned how to safely lift logs and rocks to search for reptiles and amphibians. Students also embarked on a guided canoeing experience at the University of New Orleans' Coastal Education and Research Facility through the wetlands southeast of New Orleans. During the trip, students practiced using a refractometer and Secchi disk for data collection. For many of the students, protégés and mentors, this was their first time being in a Louisiana waterbody. During this formal research field experience, we observed that when students are out of their comfort zone and doing something intentional together, they naturally build community. These experiences not only grounded the program in place, but the mentors and protégés with each other.

### 1.4.3 Science Communication Experiences

In the LSU EM program, participants strengthened their understanding of the importance of science communication, and they also gained experience by putting concepts into practice. This year, participants served as exhibitors at two large educational outreach events. Program participants exhibited at Louisiana Sea Grant's annual Ocean Commotion event, a day where 2,000 K-8 students descend on the LSU campus to learn all about the ocean and environment in Louisiana. The protégés and mentors led three activities: teaching about native and invasive species with Touch Boxes, diurnal vertical migration of plankton with the Plankton Drop, and the traditional art of Gyotaku with Fish Prints. Additionally, the mentors and protégés exhibited at the US Fish and Wildlife Service's Wild Things event, a community event in a nearby town, which welcomes over 7,500 adults and children in a single day. At this event, the participants led the same Touch Boxes activity. These high intensity, low stakes experiences, while taxing, showed program participants the commitment, mentally and physically, which is necessary to educate others. Through these outreach experiences, we observed participants recognizing

that sparking curiosity in their audience is key to keeping their attention – a skill that should be instilled in every science communicator.

### 1.4.4 Building Research Capacity

The fall semester introduces high school students to the mechanics behind research:

1. Being curious about the place/phenomenon,
2. Experiencing the place/phenomenon you are researching,
3. Asking a question about the place/phenomenon,
4. Building the skills to find the answer.

At the end of the fall semester, high school students and LSU students are partnered to conduct their research project in the spring semester. This partnership is based on high school student interests, LSU students' experience and expertise, personality types and team dynamics, and partner preferences. Through the activities, place-based and communication experiences in the fall semester, protégé enter the spring semester with the background knowledge to begin planning their research projects. This year, student led investigations and research to answer questions regarding zooplankton richness in the LSU Lakes, nutrient distribution between lake water and sediment, turtle habitat analysis, the correlation between electric vehicles and air quality, how soil pH influences flora, examining Very Low Sulfur Fuel Oil (VLSFO) toxicity on brine shrimp, the potential for metal leaching in LSU lakes sediment, and assessing awareness, attitudes, and misinformation on snakes. Each protégé created an academic research poster and presented it at the LSU undergraduate research symposium in April 2025.

### 1.5 THE NATIONAL MARINE EDUCATORS ASSOCIATION CONFERENCE

While the program introduces protégé to various research fields, it is limited in providing students with the opportunity to fully explore careers in STEM related fields. The National Marine Educators Association conference was hosted in Lafayette, LA in 2025. With funding from the National Academy of Sciences, Engineering, and Medicine Gulf Research Program, the LSU EM students were able to attend and present their research at the conference. This conference provided students with the opportunity to move beyond the LSU campus and share their work with a larger scientific audience. On July 1, 2025, all 8 students and 2 program alumni presented their research at the NMEA conference for Student Day. They also attended several concurrent sessions and keynote speeches. That evening, the participants went on a night hike in the Palmetto Island State Park, where they identified nocturnal arthropods, arachnids, mammals, and birds. The combination of professional engagements and collaborative place-based learning provided valuable enrichment to the program.

## 2. METHODS

This case study employed a complimentary mixed methods approach (Ivankova 2015). Post-program reflexive surveys, which included open-ended questions and Likert items, provide insight into the impact of the overall program design and aligned program outputs. In addition, focus group interview data shed light on the benefits of students attending a national conference to present their research. This study was approved by the LSU Institutional Review Board (IRBAM-25-3093).

### 2.1 LIMITATIONS TO STUDY

This case study does have methodological limitations. Foremost, students self-select into participating in the EM program, increasing the risk for self-selection bias. To mitigate this risk, the researchers discussed the need to provide honest responses during the research process without consequence. The EM program is a high intensity program which meets weekly throughout the academic year. The relational nature of the program increases the risk of potential positive response bias. To mitigate positive response bias, McMillan, who was not directly involved with the EM programming, conducted the focus group interview. Another limitation of convening a focus group was the small sample participant pool. The focus group interview was limited to students who attended NMEA. Of that group, students who were not

18 years of age were excluded, leaving two current participants and two alumni, one who had just completed her freshman year at LSU and another who was finishing her sophomore year. The EM alumni did not serve as mentors in the program but rather, they presented their research with the high school students at the conference and as full participants in the program and conference presentations, they were included in the focus group interview.

## 2.2 POST-PROGRAM SURVEY

Current students in the EM program were invited to complete the post-program reflexive survey. Post-program retrospective surveys were disseminated on the last day of the program meeting (April 2025). Retrospective surveys were used rather than traditional pre/post surveys based on Levinson et al. (1990)'s findings that a single-point retrospective survey provides a greater comparison between pre and post student change than a traditional pre/post survey. Data responses were collected anonymously through Qualtrics. Participants self-identified as male (n = 3) or female (n = 5). 38% of participants were 9$^{th}$ graders (n = 3), and 62% were 12$^{th}$ graders (n = 5). One hundred percent of the participants were Black. High school students can participate in the program for recurring years throughout their high school career. Two participants were returning EM students, and 6 were new students.

Survey questions were adapted from established instruments focused on STEM education, environmental self-efficacy frameworks, and STEM career interest measures (Frechtling 2010; Stern 2002; Carlone & Johnson 2007; Chemers et al. 2011). Survey questions targeted how the EM program impacted students' confidence in speaking in front of others, confidence with problem solving skills, building research skills, understanding of science, research, and its contribution to community and society, and the role of mentorship in building their confidence. Close-ended questions on the survey followed a 5-point Likert scale response (strongly disagree to strongly agree). The complete survey instrument can be found in Appendix A, Table 1. There were also several open-ended questions to invite more depth into the Likert responses (Appendix A, Table 2). Likert scale responses were coded from 1–5 (Strongly Disagree = 1, Disagree = 2, Neither agree nor disagree = 3, Agree = 4, Strongly Agree = 5). Descriptive statistics were run on the coded responses to provide mean response values. While there are limitations to reporting mean Likert scores with a small sample size, in this instance, participant responses were clustered together with no outliers. Thus, the mean values are representative of the true findings. Student responses were extrapolated from open-ended questions for additive information regarding student experiences.

## 2.3 NMEA FOCUS GROUP

While the use of post-program reflexive surveys provide insight into the overarching outcomes of this program, they lack detailed complexity and depth of the participants' sociocultural experiences within the program. To provide more insight into student experiences, a focus group was conducted following the EM students' poster presentations at the NMEA conference. This focus group interview was conducted with four EM participants. Two participants in the focus group were alumni of the program, both self-identified females, Black, and currently at college studying in STEM fields. The other two participants in the focus group were current 12$^{th}$ grade EM students. One self-identified as male, and 1 self-identified as female. Both self-identified as Black. The focus group was semi-structured utilizing guiding questions which sparked generative discussion. The focus group interview data was coded through a combined inductive and deductive approach (Fereday & Muir-Cochrane 2006). The first cycle of qualitative data analysis was coded inductively utilizing in-vivo and descriptive codes (Saldana 2021) to fully explore participant experiences. Subsequently, a deductive approach was taken to group data thematically aligned with the Gulf Research Program funded project goals of expanding students' exposure to STEM careers and professional networking. Ivankova (2015) recommended attending to at least two trustworthiness measures to ensure validity in qualitative coding. Van Heerden and McMillan met regularly for peer-debriefing and coded segments of student interviews together to align methods and refine code definitions for purposes of inter-coder agreement and consistency validation. Through an iterative process, each researcher coded a segment of the data, then we met and discussed our codes to find alignment of interpretation and code use. This process was repeated until consistency was reached.

# 3. RESULTS

## 3.1 POST-PROGRAM RETROSPECTIVE SURVEY

**General Evaluation:** Overall, the protégés asserted that the EM program increased their understanding of science communication, their ability to conduct research, and their environmental literacy. In the category of general program evaluation, all respondents were in strong agreement across the four questions (Figure 3). Students felt that this program showed them that environmental literacy was important within their community ($M$ = 5). Students strongly agreed that the program increased their understanding of science and research ($M$ = 4.9). Students strongly agreed that the program inspired them to explore their curiosities and provided the research foundation ($M$ = 4.7). Finally, the weakest response in this section, still in strong agreement, was that the program made them want to be more active about researching the environment ($M$ = 4.5).

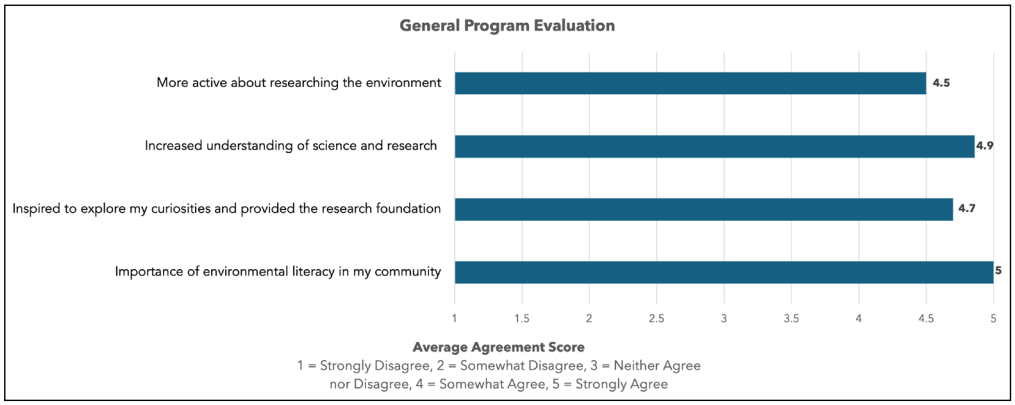



**Figure 3 Protégé Responses to General Evaluation Questions**. A graph of the protégé's average agreement scores evaluating the general aspects of the EnvironMentors program, including research, communication, and environmental literacy.

**Increasing Confidence and Building Skills**: Overall, the protégés in the EM program were satisfied with their experience in the program, agreeing that their experiences in the program built their confidence across multiple areas (Figure 4). Protégé agreed that their time in the EM program this year increased their confidence in public speaking ($M$ = 4.4), research ability ($M$ = 4.7) and their confidence in researching community related issues ($M$ = 4). Protégés also stated that this program built their problem-solving skills ($M$ = 4.2). With the highest level of agreement, all the protégés strongly agreed that the program increased their confidence as a learner ($M$ = 5). One protégé noted in an open response: "*I gained a skill of being able to ask more questions and discovering new things with a new curiosity.*"

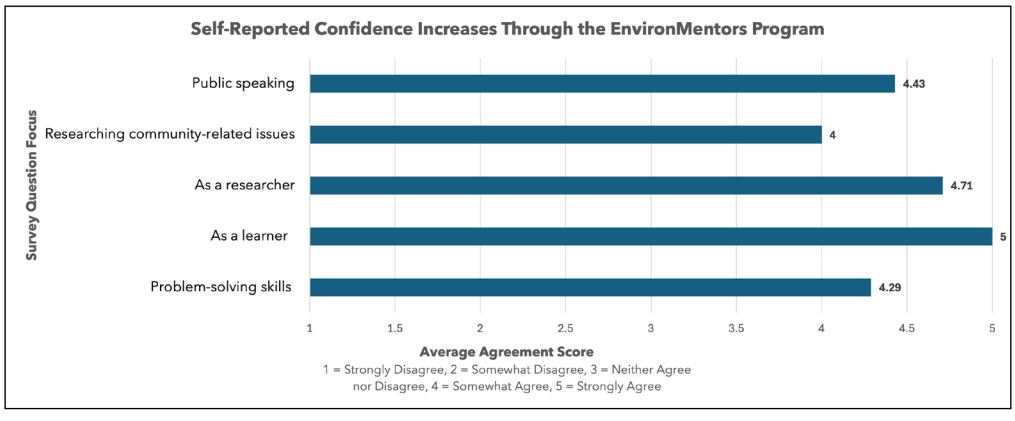



**Figure 4 Protégé Responses to Confidence Related Questions**. A graph of the protégé's average agreement scores concerning how their confidence grew in the following areas during their time in the program.

**The Role of Mentorship on the Protégé**: Overall, the protégés in the EM program stated that their mentors were the highlight of the program (Figure 5). Participants agree that mentors provided a positive and safe learning environment ($M$ = 5), kept them engaged and helped grow their confidence ($M$ = 5) and were respectful and caring about the protégé's learning ($M$ = 5). Participants also agreed that the mentors' support expanded their knowledge of STEM fields ($M$ = 4.7). In an open response on the impact of mentorship in the program, a protégé wrote: "*Being able to have open conversations about anything, even if it didn't pertain to my research project.*"

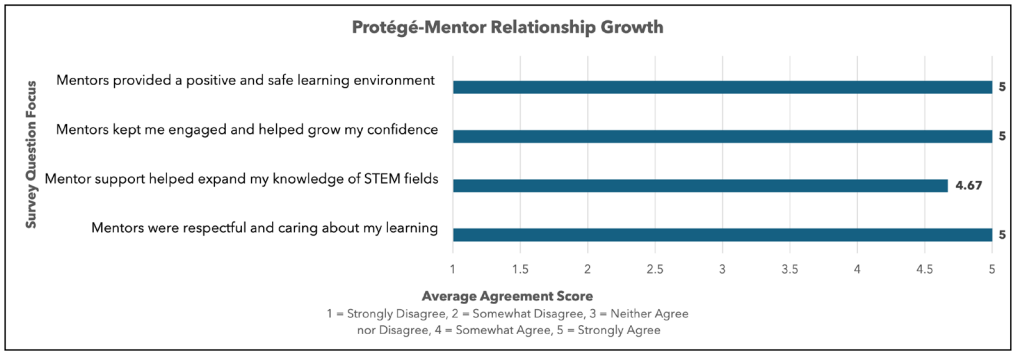



**Figure 5 Protégé Responses to Mentorship Related Questions**. A graph of the protégé's average agreement scores on their relationship with their mentors and how it impacted their experience in the program.

**Career Exploration & Outlook**: Overall, the protégés in the EM program stated the program gave them ideas about possible futures in education and the workforce and increased access to STEM, Career/Education opportunities (Figure 6). Most notably, protégé strongly agreed that the program provided them with ideas of future education and career possibilities ($M$ = 4.8). Participants agreed that the program expanded their knowledge of STEM fields and STEM future careers ($M$ = 4.3). The weakest response in this section was that this program inspired them to study a STEM field or other environmental programs ($M$ = 3.9).

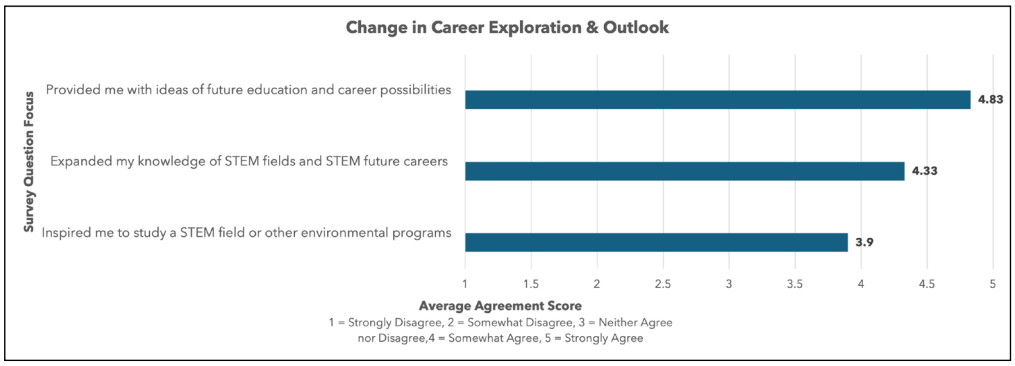



**Figure 6 Protégé Responses to Career Exploration Related Questions**. A graph of the protégé's average agreement scores as it relates to their evolving perspectives on career exploration and outlook.

The EM program provided high school students the ability to build their confidence, understand their connection to Louisiana, and their role within that place, as stated by a protégé: "Being a part of this program has significantly impacted my presentation skills, public speaking abilities, and environmental awareness. It has equipped me with a deeper understanding of the various environmental challenges we face along the Louisiana coast…I had the privilege of being mentored by incredibly supportive individuals who guided me every step of the way. They helped me build my confidence…"

## 3.2 NMEA FOCUS GROUP

Three key themes emerged from the focus group data following students' presentations at the NMEA conference in July 2025: *confidence, professional networking, and a sense of community among peers, mentors and the conference attendees.* These themes align with program goals to enhance exposure to STEM careers and professional networking.

### 3.2.1 Confidence

Students reflected that they had a lot of emotions about presenting their research at a national conference. They reminisced that it was at times, "stressful" and they felt "nervous" about being at a national convening. However, they drew confidence from an intentional aspect of the EM program design, freedom to choose their research topic. One student explained, "I guess some of us would say [we are] passionate because we picked the topic. We was [sic] able to sit there, go through and actually learn the topic hands-on because we wanted to." This motivation and passion enhanced their confidence in presenting at the conference.

After presenting, several students reported that their confidence in public speaking had grown. This was captured by one student who shared that she found her own "voice." They recalled, "I used to be like so quiet." Students reflected on the idea that attending and presenting at professional conferences was a unique and powerful opportunity. Several shared key takeaways:

"A big takeaway for me, was that like I shouldn't be scared to put myself out there to people I don't know." Another shared "[the conference was] a really good opportunity to just come here and just explore everything."

### 3.2.2 Professional Networking

Students' enhanced self-confidence translated into a willingness to fully engage in all the opportunities offered by a national convening of researchers and environmental educators. Students noted all the "interesting types of people" and how "passionate" they were about their areas of interest. The reciprocity was also highly impactful. Students reflected on how attendees were "actually willing to listen" to them and "them being willing and open to like, teach us things that they know."

The idea that so many attendees were willing and wanted to help them was deeply meaningful to these young adults. One student reflected on this "I was surprised by how open everyone was. I've never been in an environment like that…I'm really liking the communication. I'm loving this!"

The students' excitement from all the positive engagement reverberated throughout the interview and the group shared specific examples of people they met, opportunities that were presented to them, and all of the contacts they had acquired. Young adults need exposure to unfamiliar audiences. The networking opportunity expanded these young adults' belief about what was possible in their future and that is a powerful lever for youth in their high school years.

### 3.2.3 Sense of Community

At the conference students discovered a vast network of professionals outside of their home community with common interests, and this enhanced their sense of community in the space. They used familial terms to describe encounters with attendees, mentors and peers. One student described the attendees as "open and loving." Another described "amazing energy." A third student took away, "I think the best thing about it is people cheering your research on."

This feeling of support came from conference attendees and from their peers and near-peer mentors. They described the mentors as people "in their corner" who provided emotional support during those stressful moments. They discussed the way their mentors made them feel, with one student saying, "It's like a sense of [being] chosen." The group activities that the EM engaged in that week also enhanced the students' relationships with peers and their near-peer mentors.

One student realized, "I found friends here." Another said, "they almost feel like family."

The sense of belonging within the professional community coupled with the enhanced relationships within their home community led these students to see themselves in aligned career fields. One student who went through the program in high school and who is now a college student explained, "you couldn't tell me I like biology freshman year [in high school]. But here I am, going to school for a biology degree. Who would have thought." Another student emphasized, "they [program mentors] helped me find my passion in forensic psychology." Then, the student sitting next to her had a realization and added, "being in EM made her realize she enjoyed more stuff than what the previous career path entailed."

Students willingly gave up time during the summer to attend the NMEA conference and present their research. They were asked if they would recommend the experience to peers. A student exclaimed, "We be [sic] having the time of our life up in there. Learning about something we ain't [sic] never know about." They were grateful for the opportunity. One student shared, "I just feel like, you know, I'll always appreciate, like the small things." These statements indicate the way these students saw value in this program and the personal impact the program and experience presenting at a national conference had on them as learners and as emerging researchers within the scientific community.

## 4. DISCUSSION

Systemic barriers exist in the United States's K-12 educational system for student inquiry-based, nature-embedded, and real-world influenced learning, especially in Louisiana. After-

school programming provides unique opportunities for students to combat these systemic challenges. Students must want to do the program and have the drive to complete it: a buy-in. The LSU EM program provides high school students from underrepresented backgrounds real-world and locally relevant learning in a fun, hands-on, and messy way. In this program, the students are centered within the community. Their interests and excitement are central to the programming. Each year, the programming changes to meet the needs of the students, the challenges they are facing in their community, and the expertise of the mentors. This adaptive approach to the program is what we argue makes it incredible and unique.

### 4.1 DATA ALIGNED TO PEDAGOGICAL FRAMEWORK

The framework of this program is based on protégés building skills that are not only central to being more environmentally aware and introducing them to scientific research, but more so to support students in pursuing their self-determined aspirations and future pathways. The pedagogical framework centers core skills: research, science communication, and environmental literacy. Environmental literacy, while not traditionally framed as a skill, is one. You must know how to ask and answer questions about the environment, but first, you must be curious. This program embraces those curious questions that students' ask: Do you think apple snails like hot Cheetos? These questions lead to research decisions – how can we test this hypothesis? A consumption behavior study. What supplies do we need? Something for us to contain them and keep them alive. What other foods should we test? Lettuce, dog food, fish food, and tomatoes. How can we understand their behavior? Qualitative observation, video footage analysis. Ultimately, through a food consumption and behavior study, the student can answer their own question and determine that the answer is: No, the apple snails do not like hot Cheetos. They die instantly. Then, the students can make connections to the real-world applications of their curiosity and form ideas such as Louisiana crawfish farmers and rice harvesters could put hot Cheetos in their crawfish ponds to limit the apple snail populations. While silly, this student recognized that the ingredients in common foods can be a starting point in developing population management techniques. And ultimately, what do we do when we are done with the experiment? We humanely kill them. They are an invasive species. Protégés recognize that they can scientifically find answers to any question they seek to learn about by moving through a scientific process. The data from the post-program surveys and focus group confirm this hypothesis and support the framework. Through the process the protégé progresses from being curious to being a researcher.

The students' development as a researcher also teaches them how to solve problems, collaborate, learn from others, and embrace their relationships within the socio-ecological system. One of the central tenants to this program is the near-peer mentorship. A space where these high school students can be open to ask questions, seek guidance, feel respected, and be shown what it means to be a researcher. The mentors are central to the framework. They make the protégé feel safe and that they are cared for. They provide them with positive learning experiences, which is not always the case in classroom environments. They are the ones working with them each week and fostering the protégé's confidence growth. Protégé that entered the program quiet and guarded leave the program ready to be a leader: they are confident.

Confidence is built through persistence. The weekly meetings and connections between the mentors and protégés are pivotal in developing these connections. During the meetings, the activities bring them together, they learn together. Over 30 percent of the mentors in the program are international students. Less than 5 percent of the mentors are native Louisianans. This stands in contrast to the homogeneous group of protégés who for many have limited experiences beyond their local neighborhoods. The community formed in the program is rich in perspective due to this diversity of lived experiences, backgrounds, and approaches to understanding and exploring the world each member brings to the group. Environmental activities center connections, collaboration, and exploration. Protégé confidence as a learner is central in developing their environmental literacy. The weekly activities, such as the collage, provide the protégés new avenues to not only understand local environmental challenges, but use innovative methods to communicate the relationship between society and nature, central to those challenges. The protégés not only increase their awareness of local issues, but they complete the program stating: "I care."

While overall post EM program survey responses indicated a strong alignment between program goals and students' perceptions of the way they benefitted from the program, mentor support to enhance knowledge of STEM, survey questions related to career exploration yielded lower responses respective to other survey items. Exposure to STEM aligned careers and opportunities to engage in professional scientific communities were a pre-identified opportunity for programmatic growth which prompted the National Academies of Sciences, Engineering, and Medicine Gulf Research Program funded project to enhance the EM program by providing opportunities for students to share their research at a national conference.

Science communication within a new area of professionals enhanced students' self-confidence and expanded their professional networks. Although communicating research to peers or even to others within normal social networks is valuable, the challenge and opportunity of presenting at a national conference is an increased level of vulnerability and these students persisted through the levels of uncomfortableness with this endeavor and reflected about those levels of discomfort, ultimately feeling a huge sense of accomplishment from the experience at the NMEA conference.

Students need exposure to explore STEM career pathways, they need opportunity to engage with others in related fields, and they need to see that it is possible for them to be a positive contributor within these STEM fields. Presenting at the NMEA conference provided all these elements and the findings from the focus group discussion, which occurred directly following their NMEA presentations, illuminated both the immediate and long-term impacts of providing youth with real-life experiences that span research and science communication.

## 4.2 OUTCOMES AND CHALLENGES

As with most non-formal educational programs, there are challenges. The LSU EM program is a high-capacity program, with staff time, logistical coordination, and funding. The program relies on a graduate student coordinator and a Louisiana Sea Grant staff director. Transportation is provided to all students who participate in the program. Mentors are compensated to drive university vehicles to and from the high schools. Food is provided at each weekly meeting for the entire program. The largest challenge that this program faces is consistent and continued funding. Mentors are compensated for their time, and the coordinator is paid a graduate assistantship and receives a tuition waiver. The teacher sponsors for the program are also compensated. All field trips are provided free of charge to the program participants. The funding for this program is pieced together from various sources and relies heavily on partnerships at LSU. Appendix B details the program timeline for the 2024–2025 academic year and highlights the complexity of providing field experiences, weekly meetings, and conference opportunities for students.

The LSU EM program and its impact on urban high school students fills a need to provide high intensity locally relevant STEM programming in response to systemic challenges that persist in formal education spaces. Providing high school students with access to undergraduate and graduate students as well as professionals working in related fields strengths the very fabric of these students' community capitals (Flora et al. 2018). Their social capital, their connections with other people and originations expands; while simultaneously affirming and validating the cultural capital they bring into the professional spaces and that which they take back into their home community. Through these experiences, students' identity as scholars evolved and their view of future career options expanded in new and unexpected ways.

## 4.3 IMPLICATIONS FOR MARINE AND ENVIRONMENTAL EDUCATORS

### 4.3.1 Transferability to Other Regions or Contexts

Although this case study represents a very specific program and a small sample size, the EM pedagogical framework is inherently adaptable to a wide variety of educational contexts. Even programs without the resources to support a weekly, year-long structure can integrate these core components in meaningful and impactful ways. A central lesson from the LSU EM model is that relationships are the primary drivers of student engagement and growth. As one protégé reflected, *"Being able to have open conversations about anything, even if it didn't pertain to my research project,"* made them feel valued and supported in their learning. These relational

elements—feeling listened to, respected, and encouraged—are transferable to any setting, regardless of scale.

The program's responsiveness to student interest also strengthens transferability. Students repeatedly emphasized how choosing their own research topics made them feel motivated and confident. One student explained, *"We was able to sit there, go through and actually learn the topic hands-on because we wanted to."* Educators implementing shorter or smaller programs can similarly center student choice, encouraging youth to explore questions that emerge from their own curiosity and lived experience.

Further, even modest opportunities for science communication can mirror the powerful experiences that students described. After presenting at the NMEA conference, one student shared, *"A big takeaway for me was that like I shouldn't be scared to put myself out there to people I don't know."* Others described attendees as *"open and loving"* and felt energized by the sense of community: *"They almost feel like family."* These reflections underscore that science communication does not require a national conference; local showcases, community nights, or sharing sessions among peers can offer similarly transformative experiences.

Ultimately, the flexibility of the framework allows educators to select components that fit their context—a single field trip, a short workshop series, or a semester-long mentoring initiative. The identity outcomes the program cultivates, *"I am a researcher. I am confident. I am aware and I care."* can emerge in any environment where youth are supported, engaged, and encouraged to connect their experiences to the places they call home.

### 4.3.2 Recommendations for Educators

Even if educators do not have the capacity to implement a high-intensity, year-long research program, the framework behind EM can guide the development of effective, student-centered nonformal learning experiences. The following recommendations draw from student and mentor reflections and highlight key practices that other educators can adopt:

Center Curiosity as the Driver of Learning: Students repeatedly emphasized how meaningful it was to pursue topics that emerged from their own interests. One student noted that the greatest skill they gained was *"being able to ask more questions and discovering new things with a new curiosity."* Supporting students' natural wonder does not require extensive resources—just structured opportunities to notice, question, and explore.

Use Place as a Living Classroom: Place-based learning helped students connect with their environment and their community. After program activities, one protégé shared that the experience "*equipped me with a deeper understanding of the various environmental challenges we face along the Louisiana coast*." Regardless of location, educators can draw on local phenomena, environmental issues, or community stories to ground learning in relevance.

Leverage Near-Peer Mentorship: Protégés described mentors as the highlight of the program—*"They helped me build my confidence…they were respectful and cared about my learning."* Near-peer mentors do not need to be university researchers; older students, volunteers, or community members can play similar roles by providing encouragement, modeling curiosity, and validating student identity.

Build in Opportunities for Science Communication: Whether teaching younger children or presenting to professionals, students gained confidence by sharing their learning. As one participant stated after presenting, *"I found my own voice."* Educators can create low-stakes opportunities for students to practice science communication—through posters, conversations, art, or demonstrations.

Prioritize Community and Belonging: Students in EM described the program community as *"open and loving"* and said peers and mentors *"almost feel like family."* Simple routines such as shared meals, regular check-ins, collaborative activities can cultivate belonging, which in turn builds persistence and confidence.

## 5. CONCLUSION

The LSU EM program illustrates the transformative potential of curiosity-driven, place-based, and relationship-centered environmental education. Through hands-on research, science communication, and mentorship, students developed confidence, deepened their environmental awareness, and discovered new possibilities for their futures. As one protégé summarized, "Being a part of this program has significantly impacted my presentation skills, public speaking abilities, and environmental awareness." Although the program is intensive, its core principles are widely transferable. The impact of mentorship, and how belonging, confidence, and identity development were shaped in this context are avenues for future investigations.

By centering student interests, fostering meaningful relationships, and grounding learning in local environments, educators across diverse contexts can cultivate similar identity outcomes: "I am a researcher. I am confident. I am aware and I care." Such outcomes demonstrate the lasting value of creating spaces where youth feel supported, empowered, and connected to science, people, and place.

## DATA ACCESSIBILITY STATEMENT

The data of this project has not been made available as student responses are anonymous and align with the requirements of the LSU IRB. Informed consent was collected from participant guardians to participate in this study.

## ADDITIONAL FILES

The additional files for this article can be found as follows:

- **Appendix A.** Survey Instrument. DOI: https://doi.org/10.5334/cjme.153.s1
- **Appendix B.** Program Timeline. DOI: https://doi.org/10.5334/cjme.153.s2

## ETHICS AND CONSENT

This study was approved and designated exempt by the LSU Institutional Review Board (IRBAM-25-3093). Informed consent was received for all participants.

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## COMPETING INTERESTS

The authors have no competing interests to declare.

## AUTHOR CONTRIBUTIONS

V. van Heerden developed the pedagogical framework for the program and contributed to the conception and design of the program and evaluation protocol; the acquisition, analysis, and

interpretation of the data; drafting and critically revising the manuscript; and final approval of the version to be published.

A. McMillan contributed to the conception and design of the evaluation protocol; the acquisition, analysis, and interpretation of the data; drafting and critically revising the manuscript; and final approval of the version to be published.

C. Beeding contributed to the analysis and interpretation of the data; drafting and critically revising the manuscript; and final approval of the version to be published.

N. Black contributed to the design of the program and evaluation protocol; drafting and critically revising the manuscript; and final approval of the version to be published.

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