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Reviews

Strengthening the STEM Workforce: Outcomes From Louisiana's Post-Baccalaureate Program in Applied Evolution

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Abstract

While universities have traditionally trained undergraduate students for scientific careers, they often fail to equip them with the hard and soft skills necessary for success in STEM professions. Furthermore, the COVID-19 pandemic disrupted the ability of many students to gain research experience due to lockdowns, leading to a cohort with limited hands-on experience for their next career step. Training in evolutionary biology has the potential to enhance the workforce in STEM by equipping students with valuable, in-demand skills for a wide range of careers. The Louisiana Graduate Network in Applied Evolution (LAGNiAppE) is a one-year research training program aimed at strengthening scholars' scientific capabilities. After a month-long bootcamp, participants work on independent projects under the guidance of a mentor, co-mentor, and near-peer mentors. At the beginning of the 2023–2024 cohort, a baseline survey was conducted on nine scholars to assess science-related skills, knowledge, attitudes, scientific thinking, confidence, understanding and expectations. A follow-up survey at the end of the program measured program-driven changes and feedback on programmatic processes. Results from these surveys indicated an improvement in scientific thinking, confidence, and understanding among scholars. Participants also reported a strong sense of belonging within the scientific community, and seven scholars expressed interest in pursuing careers in bioscience. This program effectively builds career readiness in STEM by providing research opportunities that foster positive multi-network mentorship experiences and build connections within the scientific community.

Introduction

Universities have long prepared students for scientific careers, yet traditional academic curricula often fail to teach the hard and soft skills essential for success in pursuing a career in Science, Technology, Engineering and Mathematics (STEM; Bengu et al., 2020; Olaitan & Mavuso, 2022). Research experiences, however, have proven critical in bridging this gap by providing hands-on training and professional development opportunities (Bybee et al., 2021; Greene & Duckett, 2023). Moreover, the COVID-19 pandemic limited research experience for a generation of students due to reduced availability of hands-on research opportunities available in undergraduate programs (Sonbuchner et al., 2021). Further, research-related setbacks during lockdown were exacerbated by the lack of in-person mentoring meetings (Davis & Wilson-Kennedy, 2024). As scientific knowledge advances rapidly, well-designed training programs, particularly those preparing students for graduate studies and STEM careers, are more crucial than ever.

Evolutionary biology as a discipline has an integrative nature that can enhance STEM education. Training in the field equips individuals pursuing careers in STEM with high-demand skills, including molecular lab skills, bioinformatics, quantitative reasoning, data management, and critical thinking—all of which are assets across a diverse range of post-graduation job positions. Much work has demonstrated that early exposure to research can increase student success and retention in STEM graduate programs and careers (Kuh, 2008; Nerio et al., 2019; Savoca et al., 2023; Schneider et al., 2021; Wilson et al., 2018). Structured research programs that provide hands-on research experience, scientific and career development workshops are be-

coming widely recognized as a critical stepping stone for success in these STEM fields (Wilson et al., 2018). The National Science Foundation developed such a program for recent college graduates through the establishment of the Research and Mentoring for Postbaccalaureates (RaMP) in Biological Sciences[1] program. RaMP funded three-year programs supporting up to 30 postbaccalaureate scholars that are tailored to support full-time research, mentoring, and training for recent college graduates with little or no past research experience. The Louisiana Graduate Network in Applied Evolution (LAGNiAppE) is one such RaMP program (NSF 22-506). LAGNiAppE is a year-long research training program for ten scholars per cohort who are passionate about advancing their expertise and research capabilities in evolutionary biology. The program is designed to equip scholars with a wide range of skills in scientific methodology, proposal writing, and science communication, which prepares them for successful careers in STEM. Participants enhance their skills through independent research projects in evolutionary biology, complemented by regular professional development training. The mentors of the program, who are established researchers in their fields, form an informal mentor network available to the scholars, with primary research mentors based at Louisiana State University, while co-mentors are faculty members at other academic institutions across the Gulf South.

Here, we aim to test our hypothesis that a year-long, intensive postbaccalaureate training program can help increase preparedness, refine scientific identities, and advance volition for students that were undergraduates during the COVID-19 pandemic. We detail how the LAGNiAppE training program, through its design and selected activities, contributed to preparing, enhancing, and supporting the STEM workforce, particularly in terms of scholars' professional and personal development. Additionally, we (1) describe the LAGNiAppE training program structure and schedule, (2) explain specific activities developed in the program, (3) describe the findings from structured surveys, and (4) discuss the benefits and challenges of creating spaces for recent graduates to advance their careers in STEM while performing independent research in evolutionary biology.

Theoretical Framework and Method

Using an evidence-based approach, a postbaccalaureate training program was designed to address the limited opportunities for hands-on research experiences stemming from the COVID-19 pandemic. The mentoring framework integrates high-impact educational practices (Kuh et al., 2011), theories of community cultural wealth (Bourdieu, 1986; Yosso, 2005), and social cognitive career theory (Lent et al., 1994) into a training approach with a multi-mentor network.

A qualitative case study design was used to explore and convey the structure, activities, and impact of the LAGNiAppE training program as a model for enhancing the STEM workforce development in a post-pandemic context (Yin, 2018). Three primary sources of data were collected to build a comprehensive case profile: qualitative data in the form of textual materials for document analysis, program and activity mapping, and quantitative data in the form of surveys. Findings from the implementation of the program model are described below.

(1) The Louisiana Graduate Network in Applied Evolution

The primary goal of the program is to provide research and professional development training for recent college graduates (scholars here after) under the broad theme of evolutionary biology. The program uses a multi-mentor network scheme for mentoring scholars while they grow their self-confidence (see below more information regarding the multi-mentor network). To achieve these goals, the program recruits 10 scholars with no or limited research training annually. One specific goal of the program is to prepare them for careers in STEM by combining technical research projects with professional development in which soft skills are emphasized. While utilizing an integrated model this program aims to strengthen regional connections and broaden the STEM workforce.

We invoke evolutionary biology as the central theme for our program given its relevance as the primary unifying principle of biology. While the field has its roots in fundamental questions about the nature and origins of life on Earth, evolutionary thinking now permeates all aspects of biological inquiry, including those with obvious and immediate impacts on our lives. From pandemics to climate change, extinction crises to pioneering medical treatments, modern agricultural practices to forensics, evolutionary perspectives and frameworks are essential to tackling challenges humans face today. Evolution also engages the imagination of students and the public with studies of beautiful, dangerous, and fascinating organisms that have bizarre traits and live in exotic places. Evolutionary biology is an ideal discipline in which to train junior scientists to think broadly and develop a diverse toolkit for a variety of STEM careers. Evolutionary studies span scales from molecules to ecosystems, and leverage a wide variety of in-demand skills including genome sequencing, microscopy, physiology, comparative anatomy, behavior, field sampling, experimentation, bioinformatics, and statistics.

Mentoring plays a critical role by supporting scholars' learning, adaptation, and identity development. Our mentoring approach is a multi-mentor network based on mentors with roles of coaches and advocates, near-peer men-

1 Research and Mentoring for Postbaccalaureates (RaMP) in Biological Sciences: https://www.nsf.gov/funding/opportunities/ramp-research-mentoring-postbaccalaureates-biological-sciences/505965/nsf23-514

tors, and mentors with lived experiences (Fig. 1). At the center of our mentoring approach is the scholar, who belongs to a cohort that provides peer mentorship. Together, they learn the processes of research and work towards professional development while supporting one another. Each scholar is paired with a mentor and a co-mentor and creates an advisory relationship. Furthermore, the program coordinator provides advice, training in hard and soft skills, and advocates for the scholars. Finally, the scholars have the opportunity to extend their network through informal mentors, including early-career researchers (graduate students, postdoctoral researchers and research technicians) who become near-peer mentors while sharing their personal experiences. Additionally, career panelists, workshop coordinators, and seminar speakers who share lived experiences and backgrounds function as role models for the scholars. By intentionally recognizing and cultivating relationships, this mentoring framework supports scholars in building their research identity and achieving success across diverse professional and social environments. Mentors, co-mentors, graduate students and postdocs attended a one-day MarSci-LACE[2] mentor development workshop at the beginning of the program (future cohorts, not the focus of this manuscript, used CIMER Entering Mentoring training).

Research Collaboration Units

A research unit is composed of one scholar, a mentor based at Louisiana State University (LSU) and a co-mentor partnered at another institution across the Gulf South (primarily in Louisiana, Fig. 1). This integrated network model aims to strengthen the research community across the Gulf region and establish a strong foundation through which collaborative training and research can continue into the future. The mentor and co-mentor assume the role of guiding the research and professional development of the scholar. How exactly this mentorship is provided varies across research collaboration units; in some cases, the co-mentor is an active collaborator in the research project, while in others, they are matched to a scholar because they are an appropriate role model or have expertise in non-research area the scholar expresses interest in (e.g., teaching or scientific communication). Furthermore, mentors and co-mentors are expected to participate in evidence-based mentor training, which will help them strengthen their mentoring skills.

(2) Program Content

The LAGNiAppE program incorporated a structured professional and personal development curriculum designed to complement the core research experience and equip scholars with essential technical and professional skills (Fig. 2). The program started with an intensive four-week research "bootcamp" to establish a common foundation. The scholars met full-time for training in evolutionary theory, computational and scientific literacy, entry-level research practices, data collection with practicums in laboratory skills, data analysis in R programming, and museum-based research (Fig. 3a). During this time, they also developed numerous non-technical skills like communication, teamwork, conflict resolution, and developed CVs and personal statements. Mentor matching was one of the important outcomes of the bootcamp. Scholars met with prospective mentors, who shared the potential work the scholars could perform if they joined their lab. At the end of the bootcamp the scholars were allowed to rank their preferred mentor and according to their interest the leadership team decided which scholars will work with each mentor for the next 11 months.

At the program's core was an 11-month independent research project, during which the scholars developed or adopted a research question or hypothesis guided by the mentors. The projects covered main subjects in (1) biodiversity and evolutionary novelty, (2) evolutionary responses to changing environments, and (3) evolutionary epidemiology. For most of the project, the scholars learned techniques such as molecular approaches, computational work, data analysis, and disseminating their work as an oral presentation or written manuscript (manuscript preparation has been continued post program) and covered by the research funds. To foster integration and belonging, the scholars actively participated in their mentor's lab meetings and departmental seminars. Scholars also expanded their network through their independent research project by interacting with graduate students, postdoctoral researchers, research technicians, and other near-peer mentors.

A dedicated seminar series provided ongoing professional and personal development. The scholars met weekly with the program coordinator for workshops on skills essential for academic and career success, such as developing a scientific poster, writing a scientific manuscript, preparing motivational letters for graduate applications, and enhancing their computational skills. These seminars also involved other members of the Department of Biological Sciences at LSU, who were invited to share their knowledge.

Career development was further supported through several key initiatives. The scholars completed Individual Development Plans (IDPs) to align expectations with the mentors and co-mentors, plan milestones, and reflect on their professional next steps. Within the IDPs, scholars were asked about the skills they would like to learn with the independent project as well as experience budgeting a research project. Four IDPs were completely quaternary, and

2 https://mote.org/research/centers-of-excellence/marsci-lace/

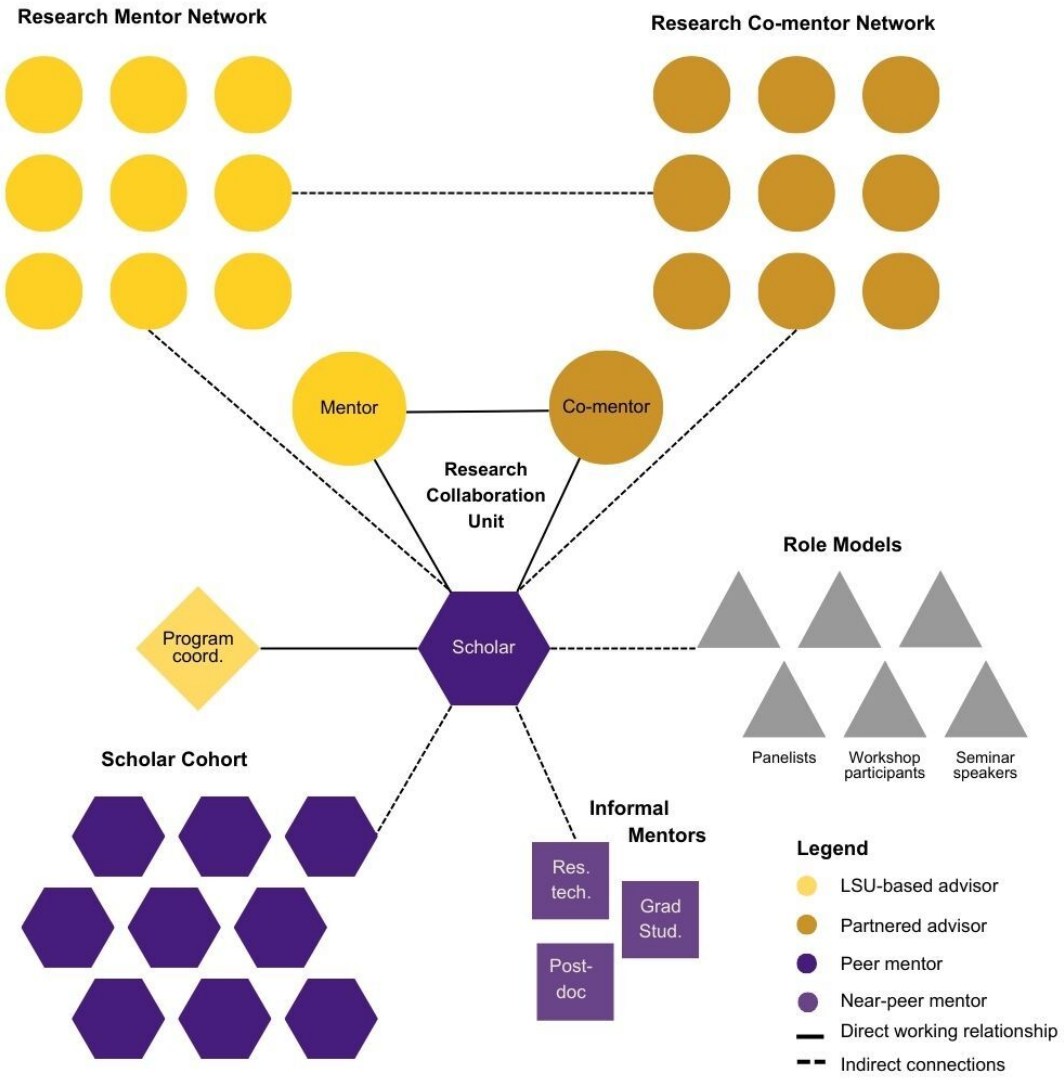

Figure 1. The LAGNiAppE multi-mentor network model.

This framework places the scholars at the center of a supportive network designed to foster research identity and professional development. The scholar is embedded within their peer cohort and maintains direct advisory relationships (solid lines) with their primary mentor and co-mentor. The program coordinator provides direct training and advocacy. The network is extended through indirect connections (dashed lines) to other mentors in the network, near-peer mentors (e.g.: graduate students, postdoctoral researchers and research technicians) and role models who share lived experiences (e.g.: seminar speakers, career panelist, and workshop coordinators).

each of the scholars discussed the changes in the IDPs with the program coordinator. The scholars also participated in the Graduate Research Fellowship Program[3] workshop to learn strategies on how to write a competitive proposal. This activity was led by two professors at LSU who were external to the program. Career round tables exposed scholars to diverse career paths by featuring scientists in industry and government jobs who obtained a degree in evolutionary biology and have since been working in sectors, such as the Center for Disease Control and Prevention, the World Wildlife Foundation, and startups.

Opportunities for community building and networking were introduced by attending national and local conferences. The entire cohort participated from the National Diversity in STEM Conference[4] as part of the 2023 Society for Advancement of Chicanos and Native Americans, in Portland, Oregon (Fig. 3b). The scholars attended a scientific conference in a welcoming and diverse environment, where they participated in skill-building workshops, learned

3 https://www.nsf.gov/funding/opportunities/grfp-nsf-graduate-research-fellowship-program

4 https://www.sacnas.org/ndistem2023

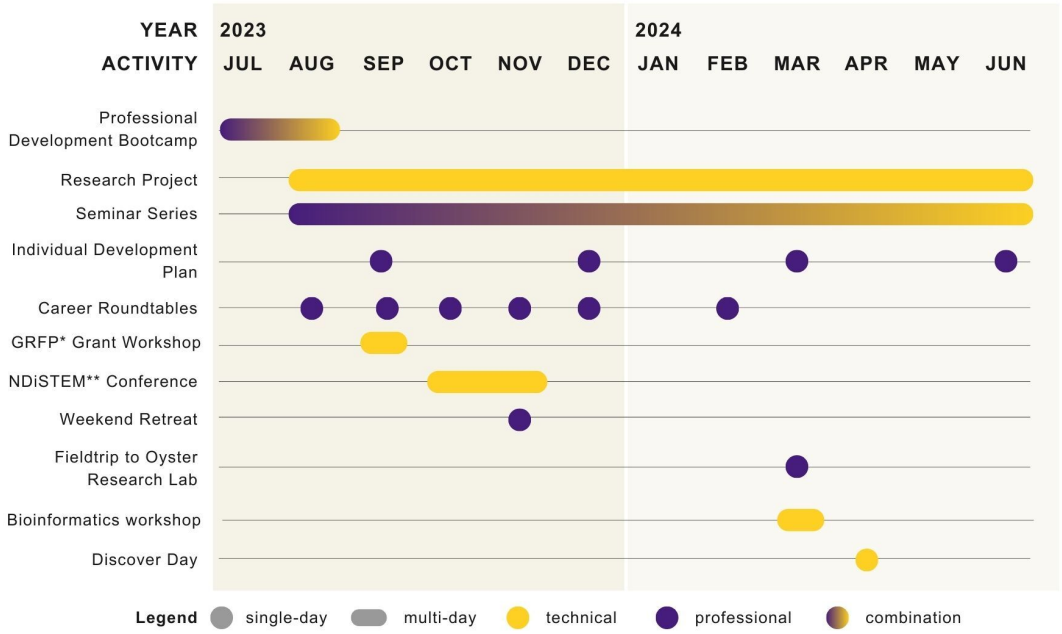

Figure 2. The LAGNiAppE programmatic activities.

The timeline highlights the variety of activities, including bootcamp, research projects, seminars, retreats, designed to develop both technical (gold) and professional (purple) skills crucial for a career in STEM. *Graduate Research Fellowship Program, **National Diversity in STEM Conference.

about research from other institutions, and connected with graduate officers at the program fair. Furthermore, this conference offered the opportunity for scholars to develop networking skills while meeting scientists of different backgrounds and fields of research. Beyond the required programmatic events, many scholars chose to use their research funds to attend additional conferences specific to their research topics, such as attending the 3rd Joint Conference in Evolutionary Biology in Montreal, Canada in 2024. At these conferences, scholars presented their research as posters to share the results of their independent work (Fig. 3c).

In addition to these external conferences, all scholars were required to participate in several programmatic events. They presented their research at the Undergraduate Research & Creativity Conference (LSU Discover Day), a campus-wide event organized by the Office of Undergraduate Research in conjunction with LAGNiAppE. At LSU Discover Day, scholars shared their findings as either posters or oral presentations, gaining valuable experience in scientific communication and building connections with the LSU community and other institutions across Louisiana.

Scholars also took part in required activities designed to strengthen cohort bonds and integrate them into the broader scientific community. These included field trips to research labs (Fig. 3d) and field stations, hands-on bioinformatics workshops (Fig. 3e), and social gathering with graduate students.

Practical and financial considerations

The program required a full-time program coordinator, not only for programmatic logistics, but also to help as a mentor to the scholars while they developed their professional and interpersonal skills. The program coordinator served as a point of contact to understand the development of the scholars as independent researchers. Furthermore, the program coordinator developed weekly sessions where scholars were taught about the hidden curricula of academia and work culture.

The scholars received a salary that covered the living expenses and health insurance. Scholars were required to live in Baton Rouge, LA for the year. The scholars were also provided with a physical space within the mentors' labs, and access to the main research equipment they required for their projects. They were also provided with an affiliated email address and a personal laptop for their work.

Furthermore, the program covered expenses for traveling to conferences, field trips, lab visits and additionally supplemented with $10,000 to cover the expenses of each of the scholar's research projects. Furthermore, the mentors and co-mentors received a stipend to recognize their work within the program. An independent evaluator was contracted to provide objective formative and summative feedback, allowing the program coordinator and other program administrators to concentrate on program implementation.

(3) Insights Derived from Structured Survey Data

Scholars' characteristics

The targeted population for this program was postbaccalaureate students (scholars) from broad backgrounds with an interest in biology as a career. The ten scholars in the 2023-2024 cohort graduated between 2021 and 2023.

Figure 3. The LAGNiAppE first cohort on different programmatic activities.

(A) The scholars collected data on museum specimens during the bootcamp. (B) Scholars at the National Diversity in STEM Conference in Portland, Oregon. (C) Scholar presenting her research project at the 3rd Joint Conference in Evolutionary Biology in Montreal, Canada. (D) Mentor explaining oyster physiology at the lab research visit. (E) Scholars and mentors finalizing the bioinformatics workshop at Southeastern Louisiana University. Photo credits: Ana L. Salgado.

Four scholars came from states other than Louisiana, five were first-generation students, and six were federal Pell grant recipients. Additional demographic information can be found in Table 1.

Scholar Impacts

A baseline survey was distributed to these individuals at the beginning of the program (July 2023). A second, follow-up survey was distributed at the end of the program period (May 2024). The baseline survey focused on participants' science-related skills, perceptions, and orientations, as well as hopes for the program. The purpose of the baseline survey was to inform LAGNiAppE mentors and leadership as to scholars' initial perspectives and experiences. The follow-up survey examined program-driven impacts on scholars and gauged their perspectives on the LAGNiAppE experience, thus the results presented below reflect the changes between surveys. Both surveys investigated STEM- and bioscience-related skills and comfort in the research environment, competencies, capacities, belongingness, and STEM identity. Though responses were collected on an ordinal scale, Likert responses can be understood as pseudo interval-level scales. As such, means are reported for the purpose of communicating the general sentiment among scholars, though we also present the percentage of responses in each response category–the preferred way of presenting Likert results.

The questions presented in these surveys were modified from the Undergraduate Research Student Self-Assessment (Weston & Laursen, 2015), the General Belongingness Scale (Malone et al., 2012), and the Mentorship Competency Assessment (Fleming et al., 2013). Additional questions were created for the follow-up survey, assessing the extent to which LAGNiAppE program participation impacted constructs of interest, and soliciting programmatic feedback. An in-person focus group was also conducted at the end of the program period to better understand scholars' experiences (eight scholars participated in this focus group). This study was approved by the Institutional Review Board and was conducted by the Social Research and Education Center, which developed the surveys and reported findings of this study to program stakeholders.

Below, we discuss key findings from the surveys and the main changes between the baseline and the follow-up survey, which explores experiences, accomplishments, and perceptions near the end of scholars' first year in the LAGNiAppE program. Nine of the ten scholars agreed to

Table 1. LAGNiAppE scholars' demographics. We report the count numbers for each category as well as their percentage. Notice that race is not mutually exclusive thus we do not provide the percentage. Nine of the ten scholars participated in this survey.

Demographics		Count	Percentage
Age	21-23 years	7	77
	24-26 years	1	11.1
	28 years and above	1	11.1
Gender	Female	8	88.9
	Male	1	11.1
Race (not mutually exclusive)	White	4	-
	African American	4	-
	American Indian	1	-
	Other – Hispanic	1	-
Sexuality	Straight or Heterosexual	3	33.3
	Homosexual (Gay or Lesbian)	2	22.2
	Bisexual	3	33.3
	Pansexual	1	11.1

participate. Note that due to the low sample size, we did not examine the data for statistically significant findings.

Based on the self-reported data, scholars experienced a number of positive improvements over the course of their time in the LAGNiAppE program. These include improvements in scientific thinking (Fig. 4a) and behaviors (e.g., analyzing data, problem-solving, formulating research questions, identifying research limitations, thinking creatively about research, feeling responsibility for their project, and understanding what everyday research is like), and increased confidence in their ability to succeed as a scientist (e.g., contributing to science, doing well in future courses, and working independently; see Little et al., 2024 for figures on these categories). In all but one indicator examined, each scholar reported at least some gain or level of engagement with the various indicators presented to them. One scholar communicated that they did not try out any new ideas or procedures in STEM on their own. Eight of the nine scholars also reported greater satisfaction conducting both STEM- and bioscience-related research following participation in this program (Fig. 4b).

Scholars were also asked about their development in the following areas: lab and technical skills (e.g., data collection, field safety, lab procedures, keeping a detailed lab notebook, conducting observations and taking measurements), general research skills (e.g., data reproducibility, research design, ethics, statistics, understanding articles, conducting database searches, Fig. 5), communication/writing skills (e.g., written and oral presentations, defending arguments, explaining their work), work/organizational skills (project and time management), and computer skills (e.g., using a browser, creating documents, writing code; see Little et al., 2024 for figures on these categories). In almost all cases examined, the majority of scholars reported at least some gain following participation in LAGNiAppE, with most typical (modal) responses being either "good gain" or "great gain".

When asked about feelings of belongingness, the majority of scholars also reported that they experienced gains following LAGNiAppE participation, feeling more like they were part of the scientific community and that they had a place at the table in their discipline. Further, eight of nine respondents indicated that they were more likely to pursue a career in a STEM discipline, while seven of nine indicated they were more likely to pursue a career in bioscience.

Scholars also provided qualitative feedback regarding factors that they felt contributed to positive program impacts through open-ended survey responses and focus group participation. Included here were mentorship support, collaborative work in the lab, resources provided by the program, and structured project management assistance. Identified barriers to success included time constraints, steep learning curves, and communication gaps with mentors. These are areas that LAGNiAppE leadership attempted to address with the following year's cohort.

The above findings were triangulated with results taken from a survey provided to mentors and co-mentors. This survey was provided at the end of the program year and asked mentors to relay feedback regarding scholar skills and performance. Five mentors responded to relevant survey questions (other questions investigated mentor self-assessed competencies and program impacts on these mentors and solicited program feedback). First, mentors were asked to gauge scholar skills in the following areas: conducting observations, searching databases, finding information online, and writing computer code. When it was known and applicable, each mentor survey respondent reported that their scholar experienced at least moderate improvement in each of these areas (the modal response for each was "Significant Improvement"). Secondly, mentors were asked to provide qualitative input regarding their experiences with scholars. Selected respondents mentioned that there was a notable improvement in confidence and abilities, and that new skills were developed despite initial difficulties. Though not necessarily impacted by the program, mentors also commented on several positive scholar characteristics, mentioning that they were committed, showed initiative and curiosity, were able to handle complex tasks, demonstrated enthusiasm for research, and displayed maturity. More details on the results of the surveys can be found in Samtani *et al.*, 2023 and Little *et al.*, 2024.

Finally, a third post-program survey was distributed in April 2025 to assess long-term program outcomes. Although only six scholars participated, the results indicated positive career impacts, including the development of technical and research skills and the identification of personal research interests. When reflecting on the most meaningful aspects of the program, scholars highlighted mentor relationships as a core component of their success, while the

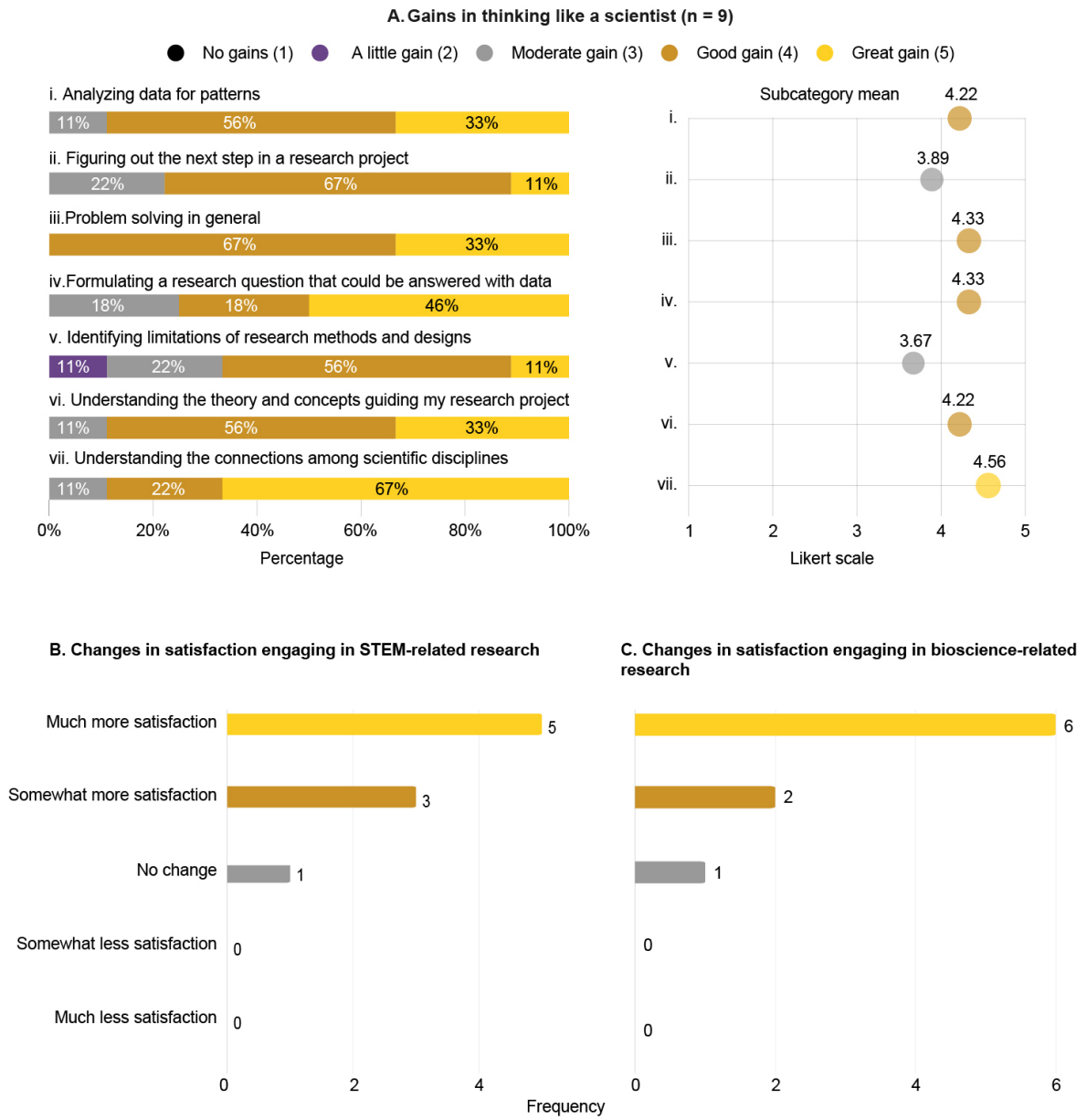

Figure 4. Gains in research aptitude and satisfaction reported by LAGNiAppE scholars after one year in the postbaccalaureate program.

(a) Self-reported gains in "thinking like a scientist." Most scholars reported "good" or "great" gains across subcategories, except for "identifying limitations of research methods and design." Means are shown to summarize overall respondent sentiment; however, response distributions (percentages in each Likert category) are also presented, which is the preferred approach for Likert-scale data. The mean response for this category was 4.17. (b) Change in satisfaction with engaging in STEM-related research. (c) Change in satisfaction with engaging in bioscience-related research. For both satisfaction categories, the majority of scholars reported increased satisfaction.

co-mentor relationship had less impact (see Little *et al.*, 2024 to access the full report).

(4) Impacts of Running a Postbaccalaureate Research Training Program

This study evaluated how the intentional design and activities of our training program prepared and supported scholars as they entered the STEM workforce. The positive outcomes observed likely derive from the program's design, which combined structured mentorship from a multi-mentor network, hands-on research projects, and professional development workshops. For instance, scholars reported significant growth in scientific thinking and behaviors, along with increased self-confidence in their ability to succeed as scientists. The majority of scholars gained research skills, a perception corroborated by mentor surveys indicating at least moderate improvement in this area. These benefits for scholars align with findings from other undergraduate support initiatives, such as Research Experiences for Undergraduates (Wilson et al., 2018).

The program's emphasis on weekly meetings, bootcamps, and writing sessions directly addressed scholars' self-reported improvements in research skills. Within STEM, such hands-on, communication-intensive experiences are known to promote discipline retention and career

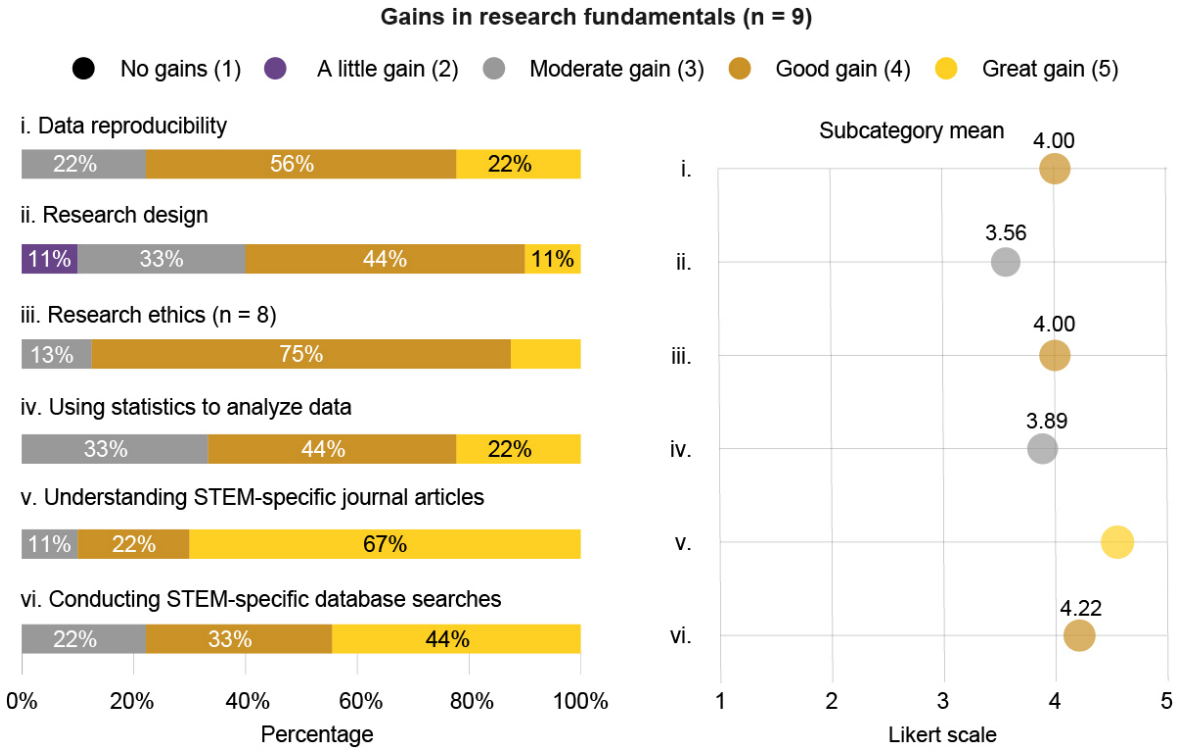

Figure 5. Gains in research fundamentals. Most of the categories show "good" and "great" gain, except for research design. Nine scholars respond to all the subcategories except for research ethics from which only 8 scholars answered. Means are reported to convey overall respondent sentiment, alongside the percentage of responses in each Likert category, the preferred representation for Likert-scale results. Mean of the category is 4.04.

readiness (Brownell & Swaner, 2012; Carey, 2012; Daniels et al., 2016). Research experiences, in particular, provide in-depth training beyond the classroom (Kuh, 2008), supporting science self-efficacy, identity, and competencies while exposing students to graduate studies and career pathways (Pender et al., 2010; Russell et al., 2007).

A key initiative was implementing a multi-mentor network approach to enhance scholar support. Our results establish that the primary mentor relationship was central to scholars' post-program success, while the co-mentor relationship demonstrated a more limited impact. Although prior research suggests such networks influence identity development through sociocultural interactions (Palmer et al., 2015), we observed high variability in co-mentor engagement. This variability may be attributed to weak connections between mentors and co-mentors, the physical distance of co-mentors at external institutions, and a lack of structured mechanisms to facilitate meaningful scholar engagement. While co-mentors were not explicitly required to provide project feedback, this flexibility sometimes resulted in disconnection.

In contrast, career panels featuring diverse STEM professionals helped scholars refine their educational and professional goals. Collectively, these tailored experiences fostered an ecosystem where learning, practical application, and community building converge. Mentors, co-mentors, and program coordinator functioned as a unified support system for career development, providing resources such as recommendation letters and guidance on grants and employment. This finding confirms that intentionally structured mentoring networks can sustain diverse scholars by offering varied perspectives and critical support (Trube & VanDerveer, 2015).

Scholars also reported an increased sense of belonging within the scientific community. These gains likely reflect the small-group mentoring circles that fostered peer support, as well as connections with seminar speakers who shared similar backgrounds with the scholars. Like the Research, Advising, and Mentoring Professional position, ours created a sense of belonging through dedicated advising and mentoring (Gildehaus et al., 2019), which is critical as postbaccalaureates transition from college to their first research position. The cohort model itself was a significant benefit, permitting scholars to navigate the academic research environment together. Building community, facilitating peer networks, and reducing barriers are known to increase belonging and persistence (Gildehaus et al., 2019).

Data from our first-year surveys also revealed areas for improvement. Some challenges, such as the slow pace of research and inability to complete projects, are inherent to year-long programs. Others, like steep learning curves in new fields, were mitigated by supportive mentors and the cohort structure, highlighting the program's resilience.

The program also yielded tangible academic outputs, including manuscript drafts, conference presentations, and successful grant applications (see Little et al., 2024 for details). In the long term, we anticipate these experiences will support success in graduate programs and contribute to institutional change in STEM (Wilson et al., 2018) by equip-

ping scholars with transferable skills to address modern societal problems.

Conclusions

In conclusion, our program's design effectively promoted career readiness in STEM by providing opportunities for independent research and multifaceted mentorship. The multi-mentor network model created a supportive structure that boosted scholars' confidence and sense of belonging in science. The lessons learned from this postbaccalaureate program can be transferred to mentoring other early-career researchers, preparing them with the hard and soft skills necessary to tackle current challenges in science and society.

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Authors Contributions

L.P.L., M.W.K, J.M.B., N.A.M & Z.S.W-K developed, proposed and were awarded funding for the program. A.L.S, L.P.L., M.W.K, J.M.B., N.A.M & Z.S.W-K detailed and organized programmatic activities. K.L, S.B.R., B.B & A.R.B developed the structured surveys with feedback from A.L.S, L.P.L., M.W.K, J.M.B., N.A.M & Z.S.W-K. K.L, S.B.R., B.B & A.R.B analysed and reported the results from surveys. A.L.S wrote the first draft of this manuscript while S.B.R wrote the results section. All authors contributed to developing this manuscript.

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