

EVALUATION OF INNOVATEBIO NATIONAL BIOTECHNOLOGY EDUCATION CENTER

2024-2025 Grant Year

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Sound Research Center

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EXECUTIVE SUMMARY

Evaluation of InnovATEBIO National Biotechnology Education Center:

Grant Year 2023-2024

Candiya Mann and Dr. Caroline Freitag

August 2025

InnovATEBIO is the National Biotechnology Education Center, which is funded by the National Science Foundation's Advanced Technological Education ATE program. On September 1, 2024, InnovATEBIO began a new, five-year funding cycle, with three overarching goals:¹

Goal 1 – Sustain, grow, and empower the community of biotechnology educators by strengthening the national InnovATEBIO network infrastructure..

Goal 2 – Build on existing processes for supporting community college faculty in educating the skilled biotechnology workforce.

Goal 3 – Prepare community colleges and state teams to shape the future of biotechnology workforce education.

The evaluation provides evidence on how well InnovATEBIO is meeting these goals and offers recommendations for improvement. This report covers the first year of the grant period, including Center activities from September 1, 2024, through June 30, 2025.

Overall Outcomes: The Center as a Whole

Across all InnovATEBIO events in year one, respondents (N=114) rated the events highly and reported significant learning. Ninety-two percent (92%) learned new information or skills, and 75% intended to apply what they learned. Respondents planned to share information with an estimated 5,669 students and 336 colleagues, demonstrating wide diffusion of knowledge. Most respondents agreed (60% *strongly agreed*; 23% *somewhat agreed*) with the event goal statements, indicating that the events met their goals, such as learning about innovative models and feeling part of a supportive community. The InnovATEBIO community primarily consists of instructors (79%), workforce development representatives (22%) and administrators (16%) from two-year colleges (57%) and K-12 institutions (32%).

Goal One Findings

In year one, the Center strengthened the infrastructure supporting the biotechnology education community through upgrading the website and adding content (~45,000 monthly visits), producing monthly newsletters (2,523 subscribers with a ~50% open rate), and maintaining active social media feeds (e.g., over 5,000 LinkedIn group members). In addition, InnovATEBIO supported the community through webinars and online meetings. InnovATEBIO's membership is

¹ NSF DUE #2349809.

considerable (and growing), with 964 faculty, 138 postsecondary bioscience programs (122 of which are at two-year or state colleges), and 134 K-12 schools.

The website, monthly newsletter, social media presence, and webinars served to bring together the biotech education community. Participants place a high level of importance on the community and the Center as a hub for information and resources, as well as engagement with a network of like-minded individuals invested in biotechnology workforce development. After the fall Community Conversation online meeting, participants wrote comments like, “I truly appreciate the strength and support of this incredible community of dedicated educators.” The 2024 InnovATEBIO Annual Community Survey found that 69% of the community respondents (N=143) used the InnovATEBIO website for information about the Center’s resources and activities.

Suggestions for improvement in year two include implementing a targeted engagement strategy to boost webinar attendance and considering alternate communication strategies, such as developing short videos to introduce resources and creating a plan for new community members to better understand how the Center can help them.

Goal Two Findings

InnovATEBIO supported faculty aligning their courses and programs with industry needs by first defining current workforce needs. The seventh iteration of the biennial *National Life Science Workforce Trends Report* was released in June 2025. This report is based on extensive data collection, including A) a hiring survey completed by over 500 companies, B) interviews with over 200 industry executives, and C) analysis of almost 3 million job postings. Roughly one-quarter of the InnovATEBIO community (26%, N=154) relies upon this report for up-to-date labor market information.

InnovATEBIO helped biotech-related ATE projects disseminate their materials to the broader biotech community by running the spring 2025 ATE Project Talks: a series of 10 webinars with 22 presenters representing 15 biotechnology ATE projects. Through this webinar series, participants learned about innovative models, curriculum, or ideas to use in their classrooms (90%, N=50) and better understood the types of projects funded by ATE (90%). Over half (55%) became more likely to apply for an ATE grant after attending at least one of the ATE Project Talks. Respondents plan to share information from the webinar with approximately 3,950 students and 271 colleagues. In year two, InnovATEBIO could consider offering a certificate to document attendance in the ATE Project Talks, since 58% of the respondents were at least *somewhat interested* in receiving a certificate.

Additional work in this goal has been launched but not yet evaluated. This includes the Undergraduate Research (UR) Hub, which selected a cohort of seven institutional partners to receive mentoring in implementing UR. The UR Institutional Partners attended a strategic planning workshop in April 2025. In addition, the Supply Chain Hub added Canvas modules on industry audits, among other topics, and the InnovATEBIO leadership team provided

individualized support for biotech-related ATE proposals in the 2024 and 2025 submission rounds. Finally, the Summer of Nanopore professional development series delivered in-person workshops to faculty in five cities across the country.²

Goal Three Findings

InnovATEBIO helped prepare the next generation of leaders in biotech workforce education, through delineating biotech career pathways from high school forward, holding the Bioscience Leadership Institute, and supporting state teams.

InnovATEBIO sponsored the 2025 BABEC Biotech Boot Camp at Southeast Community College in Lincoln, NE. Educators attending the event gained proficiency in a range of technical skills and confidence teaching these skills to their classes. Follow-up on the 2024 Boot Camps showed that 81% of the participants (N=38) implemented the full set of lessons they learned in the workshops to more than 1,800 high school students. Teachers felt well prepared to teach the lessons and lead the lab. High school students (N=1,091) reported that the lessons helped them better understand what biotechnology is (86%), what biotech jobs look like (80%), and how to continue their biotech studies at their local community college (56%).

Through the Bioscience Leadership Institute (BLI), InnovATEBIO supported bioscience instructors learning to be leaders in bioscience education. Participants gained skills that are transferrable to their daily lives (100%, N=11). Detailed descriptions of what they learned included how to change their mindset, do a thorough analysis, and create a clear plan. They are confident applying what they learned in the BLI and anticipate that their BLI experiences will be useful in current or future leadership roles. They plan to apply what they learned in the BLI to improve and expand bioscience programs, build and support teams, present their ideas persuasively, and support bioscience education statewide.

Follow-up with the 2022 BLI cohort in 2024 found that 92% (N=12) had applied something they learned at the BLI to their professional work life. Respondents reported that through the BLI, they developed skills (e.g., leadership, conflict resolution, and time management), recognized and leveraged their strengths, expanded their views on industry, strengthened their networks, and gained confidence. The BLI contributed to their accomplishments, including attaining new leadership positions, taking on new responsibilities, earning tenure, being awarded grants, and developing new initiatives. All of these are indications that the BLI helped participants transition towards being leaders in the biotechnology education space.

InnovATEBIO state teams were formed prior to the 2023 InnovATEBIO Summit, with the goal of tackling biotech workforce challenges unique to each state. In the 2024-2025 grant year, InnovATEBIO supported state teams by holding an online meeting, mentoring them in preparing ATE conference proposals for in-person team meetings, and sending teams of high school and community college educators to the National Career Pathways Network conference and

² The Summer of Nanopore was co-funded by both InnovATEBIO grants. Evaluation of these workshops is included in the evaluation report for the prior grant.

workshop. Suggestions for improvement include applying a structured framework and schedule of regular communication and support for state teams.

Conclusions

In sum, the evaluation found strong engagement and learning among the biotechnology education community in year one of the grant. InnovATEBIO's events fostered a sense of community and provided valuable resources and training, as reflected in the strong learning outcomes among faculty and students, as well as faculty implementation of new ideas. The Center effectively disseminated industry trends and innovative teaching models through the workforce report and ATE Project Talks, encouraging faculty to adopt new practices and pursue ATE funding. Professional development programs, including the Biotech Boot Camp and the Bioscience Leadership Institute, produced substantive gains in technical skills, confidence, and leadership capacity. In sum, InnovATEBIO has used the first year of this grant to launch promising initiatives that support the biotechnology education continuum in meeting the biotech industry's technical workforce needs.

INTRODUCTION

InnovATEBIO is the National Biotechnology Education Center, which is funded by the National Science Foundation's Advanced Technological Education (ATE) program. The Center's mission is to advance the education of highly skilled technicians for the nation's biotechnology workforce, by providing leadership in biotechnology technician education, including support for best practices and emerging technologies.³

On September 1, 2024, InnovATEBIO began a new, five-year funding cycle, with three overarching goals:⁴

1. **Goal 1 – Sustain, grow, and empower the community of biotechnology educators by strengthening the national InnovATEBIO network infrastructure.** InnovATEBIO seeks to strengthen a nationwide community of biotechnology educators by maintaining a robust web presence, newsletters and social media communications; creating thematic hubs; and broadening biotechnology career awareness.
2. **Goal 2 – Build on existing processes for supporting community college faculty in educating the skilled biotechnology workforce.** The Center will support faculty professional development and workforce alignment, through gathering workforce needs data, delivering faculty development, expanding undergraduate research and work-based learning opportunities, and providing mentoring for ATE grant applicants and dissemination support for grantees.
3. **Goal 3 – Prepare community colleges and state teams to shape the future of biotechnology workforce education.** Activities include developing biotechnology career pathways, cultivating leadership through a Bioscience Leadership Institute, and assisting state teams in developing biotech workforce ecosystems.

The evaluation provides evidence on how well InnovATEBIO is meeting these goals and offers recommendations for improvement. It is intended to inform InnovATEBIO leadership and the National Science Foundation, so the center can refine its strategies and maximize its impact on the biotechnology workforce pipeline.

This report covers the first year of the grant period, including Center activities from September 1, 2024, through June 30, 2025.

³ InnovATEBIO's mission is stated on the About InnovATEBIO page:

<https://innovatebio.org/about-innovatebio>.

⁴ NSF DUE #2349809.

METHODOLOGY

The general approach to the evaluation is described here. For the full details of the data sources, please see Appendix A. The evaluation mapped each InnovATEBIO goal to specific evaluation questions and expected outcomes. A mixed methods design was used, combining quantitative survey data with qualitative insights from interviews and observations. Key data sources include the following:

- **Event surveys.** The evaluation team administered post-event surveys at InnovATEBIO webinars, online meetings, the Biotech Boot Camp, and the Bioscience Leadership Institute. Surveys collected participants' ratings of the usefulness of the events, learning gains, intentions to use and/or share information, and open-ended feedback. For example, across all InnovATEBIO events in year one, 114 respondents rated the events positively (77% *excellent*) and most (92%) reported learning new information or a new skill.
- **Implementation Follow-up.** The evaluation draws upon BABEC's implementation follow-up of the 2024 Biotech Boot Camps, which collects information from the teachers (N=31 of 38 participants, 81% response rate) and their students (N=1,091 of an estimated 1,815 students, 60% response rate).
- **Workforce trends report analysis.** The evaluation considered data from the 2025 *Life Sciences Workforce Trends Report*, which included a hiring survey of over 500 companies, interviews with more than 200 industry executives and analysis of nearly 3 million job postings. This report, produced every two years, provides context on industry needs and is used by 26% of InnovATEBIO community respondents (N=143) for up-to-date labor-market information.
- **Annual community survey.** The evaluation also refers to findings from the 2024 InnovATEBIO Annual Community Survey (ACS), which gathered data from 154 members of the community. The 2025 ACS questionnaire was updated in consultation with the entire InnovATEBIO team. Updates reflect the greater emphasis on hubs in the second Center grant. The revised survey has been programmed and will be deployed in the fall of 2025.
- **Interviews and observations.** Evaluators conducted interviews with principal investigators, observed events, and participated in weekly leadership meetings to gather qualitative insights.
- **Document review.** The evaluation reviewed project records, annual reports, and proposal documents.

Limitations of the evaluation: It is difficult to draw definitive conclusions about the impact of specific initiatives, since many InnovATEBIO community members interact with the Center in multiple ways. The evaluation was limited by low attendance and survey response rates for some fall webinars. Several program activities (e.g., podcast production, hub governance development) were scheduled to begin in year two, so no evaluation data were available for those areas.

OVERALL FINDINGS: INNOVATEBIO AS A WHOLE

InnovATEBIO Events: Webinars, Workshops, Community Meetings and Leadership Institute

The surveys distributed at InnovATEBIO events were designed with common elements, so the information could be rolled up to report on InnovATEBIO as a whole. The results below represent the results of five individual webinars, the ATE Project Talks series (10 webinars), one Community Conversation online meeting, the Biotech Boot Camp workshop, and the Biosciences Leadership Institute.

Across all of the InnovATEBIO events in the first grant year, the respondents (N=114) rated the events positively (77% *excellent*). The vast majority (92%) reported that they learned new information or a new skill. Three-quarters (75%) planned to use something they learned at the event.⁵

The information from the event will likely impact a much larger number of individuals than attended the events, as most respondents planned on sharing what they learned with colleagues (83%) and/or students (47%). Respondents estimated that they will share the information with a total of 5,669 students and 336 colleagues.

The survey for each event included between two and four “goal statements,” and respondents marked the extent to which they agreed or disagreed with the statements. Examples of goal statements include the following:

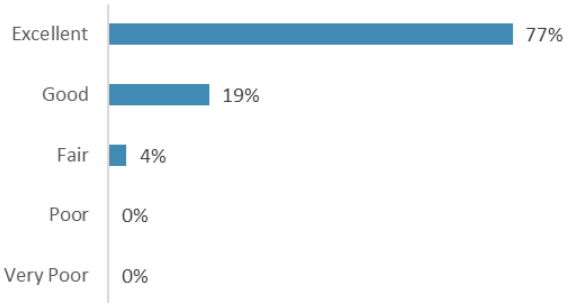
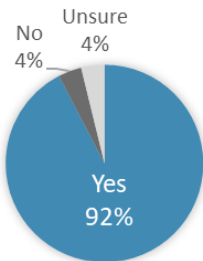
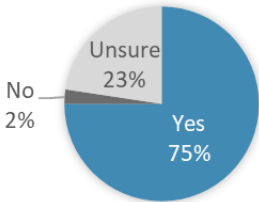
- Due to this ATE Project Talks webinar, I learned about innovative models, curriculum, or ideas that I can use in my program.
- Due to today’s State Teams meeting, I am inspired to cultivate relationships with other organizations in my state ecosystem.
- Due to participating in the BABEC Biotech Bootcamp, I better understand how to introduce Biotechnology career options to my students.

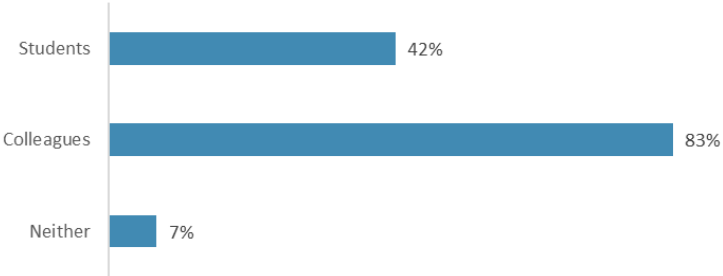
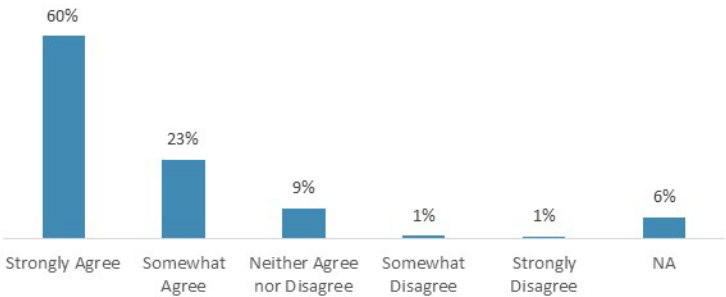
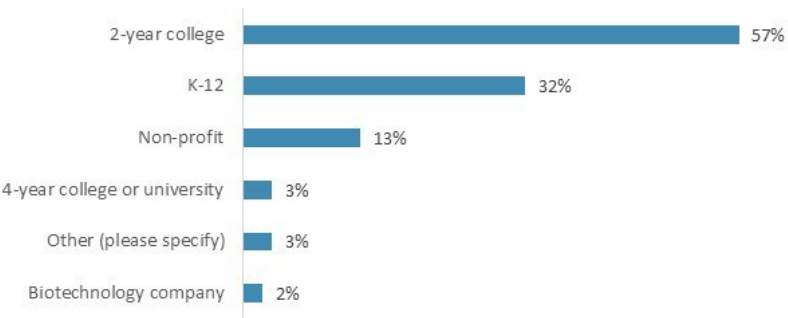
Most respondents agreed (60% *strongly agreed*; 23% *somewhat agreed*) with the goal statements, indicating that the events met their goals.⁶

The InnovATEBIO events mainly served instructors (79%), workforce development representatives (22%), and administrators (16%). The attendees were mostly affiliated with 2-year colleges (57%), K-12 (32%), and non-profits (13%).

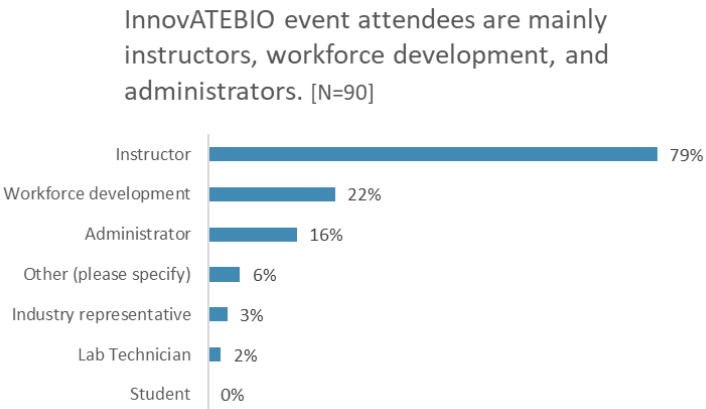
⁵ Note that the surveys ask respondents what they learned and what they will use. The responses are generally specific to the events, so they are shared with the event leads but not included in this high-level summary.

⁶ See Appendix for full list of goal statements used in the surveys.

Satisfaction and Engagement	InnovATEBIO's events were rated positively by almost all respondents. [N=114]  <table border="1"><thead><tr><th>Satisfaction Level</th><th>Percentage</th></tr></thead><tbody><tr><td>Excellent</td><td>77%</td></tr><tr><td>Good</td><td>19%</td></tr><tr><td>Fair</td><td>4%</td></tr><tr><td>Poor</td><td>0%</td></tr><tr><td>Very Poor</td><td>0%</td></tr></tbody></table>	Satisfaction Level	Percentage	Excellent	77%	Good	19%	Fair	4%	Poor	0%	Very Poor	0%
Satisfaction Level	Percentage												
Excellent	77%												
Good	19%												
Fair	4%												
Poor	0%												
Very Poor	0%												
Learning	InnovATEBIO's events were informative. The vast majority of respondents learned something. [N=105]  <table border="1"><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Yes</td><td>92%</td></tr><tr><td>No</td><td>4%</td></tr><tr><td>Unsure</td><td>4%</td></tr></tbody></table>	Response	Percentage	Yes	92%	No	4%	Unsure	4%				
Response	Percentage												
Yes	92%												
No	4%												
Unsure	4%												
Intention to Implement	Three-quarters of respondents plan to use something they learned in the InnovATEBIO event. [N=84]  <table border="1"><thead><tr><th>Response</th><th>Percentage</th></tr></thead><tbody><tr><td>Yes</td><td>75%</td></tr><tr><td>Unsure</td><td>23%</td></tr><tr><td>No</td><td>2%</td></tr></tbody></table>	Response	Percentage	Yes	75%	Unsure	23%	No	2%				
Response	Percentage												
Yes	75%												
Unsure	23%												
No	2%												

Information Diffusion: How far does the information travel?	Most InnovATEBIO event attendees planned to share what they learned with students and/or colleagues. [N=71]  <table border="1"> <thead> <tr> <th>Category</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Students</td> <td>42%</td> </tr> <tr> <td>Colleagues</td> <td>83%</td> </tr> <tr> <td>Neither</td> <td>7%</td> </tr> </tbody> </table> Event attendees planned to share what they learned at the InnovATEBIO events with an estimated 5,669 students and 336 colleagues.	Category	Percentage	Students	42%	Colleagues	83%	Neither	7%						
Category	Percentage														
Students	42%														
Colleagues	83%														
Neither	7%														
Event Goals	Most respondents agreed (strongly or somewhat) with the event goal statements, indicating that the events accomplished their goals. [N=112]  <table border="1"> <thead> <tr> <th>Response</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>Strongly Agree</td> <td>60%</td> </tr> <tr> <td>Somewhat Agree</td> <td>23%</td> </tr> <tr> <td>Neither Agree nor Disagree</td> <td>9%</td> </tr> <tr> <td>Somewhat Disagree</td> <td>1%</td> </tr> <tr> <td>Strongly Disagree</td> <td>1%</td> </tr> <tr> <td>NA</td> <td>6%</td> </tr> </tbody> </table>	Response	Percentage	Strongly Agree	60%	Somewhat Agree	23%	Neither Agree nor Disagree	9%	Somewhat Disagree	1%	Strongly Disagree	1%	NA	6%
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Neither Agree nor Disagree	9%														
Somewhat Disagree	1%														
Strongly Disagree	1%														
NA	6%														
Attendees: Institutional Affiliation	InnovATEBIO event attendees are mainly affiliated with 2-year colleges and K-12 schools. [N=90]  <table border="1"> <thead> <tr> <th>Institutional Affiliation</th> <th>Percentage</th> </tr> </thead> <tbody> <tr> <td>2-year college</td> <td>57%</td> </tr> <tr> <td>K-12</td> <td>32%</td> </tr> <tr> <td>Non-profit</td> <td>13%</td> </tr> <tr> <td>4-year college or university</td> <td>3%</td> </tr> <tr> <td>Other (please specify)</td> <td>3%</td> </tr> <tr> <td>Biotechnology company</td> <td>2%</td> </tr> </tbody> </table>	Institutional Affiliation	Percentage	2-year college	57%	K-12	32%	Non-profit	13%	4-year college or university	3%	Other (please specify)	3%	Biotechnology company	2%
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Attendees:
Roles



GOAL ONE FINDINGS

Goal One: Sustain, grow, and empower the community of biotechnology educators by strengthening the national InnovATEBIO network infrastructure.

Evaluation Question: To what extent does InnovATEBIO engender a vibrant and growing community of biotechnology educators and others invested in biotechnology workforce development?

Key Findings: In year one, the website, monthly newsletter, social media presence, and webinars served to bring together the biotech education community. Participants place a high level of importance on the community and the Center as a hub for information and resources, as well as engagement with a network of like-minded individuals invested in biotechnology workforce development.

Suggestions for Improvement in Y2: The Center would benefit from a targeted engagement strategy to boost webinar attendance. Possible alternative communication strategies include developing short videos to introduce InnovATEBIO resources and hubs and creating a plan to help new community members understand how the Center can help them.⁷

In year one of the grant, InnovATEBIO carried forth a variety of activities designed to strengthen the Center's infrastructure and support the biotechnology education community. InnovATEBIO transferred its extensive website to a new platform, produced monthly newsletters, maintained an active social media presence, and produced several online events to increase interest, awareness, and engagement with the Center.

Objective 1.1. Maintain and expand the website, program database and related services.⁸

Y1 Progress: InnovATEBIO made progress in a number of areas related to strengthening the infrastructure that supports the growing community of biotechnology educators.

Website: In 2025, the InnovATEBIO.org website migrated from Drupal 7 to Drupal 10 to improve accessibility, findability, and navigation. This effort involved transferring more than 3,000 webpages and 1,000 user accounts.

⁷ See the Recommendations section at the close of this report for further detail.

⁸ The wording of the objectives in this report is condensed from the full titles of the objectives in the proposal.

In addition to the website migration, a wide variety of content was added to the website in this grant year, including 62 articles/blogs, 15 community events, 32 InnovATEBIO events, 12 newsletters, 14 presentations, five ATE project pages, and one Course in a Box.

The website averaged 45,000 visits per month since the beginning of InnovATEBIO, with approximately 10,000 visits per year from returning visitors.

Social Media: InnovATEBIO's Facebook group has 1,053 members. The InnovATEBIO LinkedIn group has 5,106 members, and the InnovATEBIO LinkedIn page has 776 followers.

Newsletter: InnovATEBIO produces a monthly newsletter, which is sent to 2,253 subscribers, about half of whom open the newsletter each month.

Database Reports: The InnovATEBIO website extracts information from the program pages and other content to produce over 90 database reports, which provide summary information about bioscience education across the country.

Membership: InnovATEBIO membership is considerable, with 964 faculty, 138 postsecondary bioscience programs (122 of which are at two-year or state colleges), and 134 K-12 schools.

Evaluation Findings: The 2024 InnovATEBIO Annual Community Survey found that 69% of the community respondents (N=143) used the InnovATEBIO website for information about the Center's resources and activities.

Objective 1.2. Develop hubs.

Y1 Progress: InnovATEBIO has eight hubs, which offer targeted support on specific topics related to biotechnology education. In grant year one, the hubs website was updated, and several webinars were run to increase community awareness about the hub services.

Evaluation Findings:

Through the webinars, *Learn about InnovATEBIO 2.0* and *InnovATEBIO Hub Report-Outs and Next Steps*, along with the virtual *Community Conversation*, the community learned about InnovATEBIO's goals, hubs, and resources. For the attendees, **the webinars were effective means of learning about InnovATEBIO and coming together as a community**, with an average of 93% agreeing (*strongly* or *somewhat*) with the webinar goal statements (N=22). The goal statements included the following:

"I truly appreciate the strength and support of this incredible community of dedicated educators."

- **Learn about InnovATEBIO 2.0:** After the webinar, respondents had a better understanding of InnovATEBIO's goals, activities, and how InnovATEBIO could help them (83% *strongly* or *somewhat agreed*).
- **InnovATEBIO Hub Report-Outs and Next Steps:** After the webinar, 100% *strongly* or *somewhat agreed* that they knew more about how the hubs could benefit them.
- **Community Conversation:** Due to the Community Conversation, 100% *strongly* or *somewhat agreed* that they felt part of a supportive community and felt that there was an open line of communication with InnovATEBIO leadership.

In written comments, respondents stressed how important they found this community to be, especially with the stresses of an uncertain funding environment. Quotations include the following, in the respondents' own words:

It was great to see everyone and feel supported. InnovateBio is so important for the success of my program and its visibility. I could not have done any of the work on my grant without Innovate Bio's support and mentorship.

I was able to ask questions to both guests and to InnovATE BIO leadership. I appreciate the support!

Support of the community, great new information and assistance in creating new paths forward

A chance to ask questions was very helpful. I greatly appreciate the sharing of information in these uncertain times.

Objective 1.3. Broaden biotechnology career awareness.

Y1 Progress: Podcasts are scheduled to be produced beginning in grant year two.

Evaluation Findings: Since work on this objective has not begun, there are no evaluation findings.

Goal One: Objectives, Activities, and Evaluation Questions

Below (and at the end of each chapter) is a table showing the InnovATEBIO goal with the related objectives and supporting activities. It denotes which activities were active in the first year of the grant, both with blue highlight and “Yes” in the column, “Active in Y1.” The evaluation plan includes evaluation sub-questions for each objective; which will be explored further in later years.

Goal 1: Sustain, grow, and empower the community of biotechnology educators by strengthening the national InnovATEBIO network infrastructure.			
Evaluation Question 1.A. (Goal 1 Overall) To what extent does InnovATEBIO engender a vibrant and growing community of biotechnology educators and others invested in biotechnology workforce development?			
Objective	Activity	Active in Y1?	Evaluation Sub-Questions
1.1 Maintain and expand the website, program database and related services that support biotechnology educators.	1.1.1 Prepare the monthly newsletter & social media communications.	Yes	1.B. To what extent does InnovATEBIO both 1) collect information reflecting the state of biotechnology education across the country and 2) share it with the community? How is the information used?
	1.1.2 Regularly update program, NCES data, and hub pages, add a skills database	Yes	
	1.1.3 Recruit individuals from biotech programs, industry, and other places to join InnovATEBIO.	Yes	
1.2 Develop a hub governance model for engaging and adding new hubs.	1.2.1 Create a hub guidebook with a rubric for evaluating, creating, and sustaining hubs.	No. Starts in Y2	1.C. How well does the hub governance model function to ensure that hubs enable 2-year biotech programs to offer cutting edge techniques and align with industry needs?
	1.2.2 Monitor hub activity and assess community need.	Yes	
	1.2.3 Conduct hub webinars to inform about hubs and recruit.	Yes	
1.3 Prepare and disseminate outreach communication to broaden biotechnology career awareness to help increase interest in technician education programs. ⁹	1.3.3 Create content about biotech careers (podcasts, blogs, posts) to share on popular web platforms and social media.	No. Starts in Y2	1.D. To what extent does InnovATEBIO’s outreach communication reach the public? How does it influence awareness of and interest in biotechnology careers?

⁹ Activities 1.3.1 and 1.3.2 were discontinued.

GOAL TWO FINDINGS

Goal Two: Build on existing processes for supporting community college faculty in recruiting and educating the skilled biotechnology workforce.

Evaluation Question: To what extent does the Center help biotech programs stay up to date with cutting edge technical content, aligned with industry needs, delivered via effective pedagogy?

Key Findings: InnovATEBIO supported the seventh iteration of the biennial *National Life Science Workforce Trends Report*, which one-quarter of the InnovATEBIO community relies upon for up-to-date labor market information.

Through InnovATEBIO's ATE Project Talks webinar series, participants (N=50) learned about innovative models, curriculum, or ideas to use in their classrooms (90%) and better understood the types of projects funded by ATE (90%). Over half of them (55%) became more likely to apply for an ATE grant after attending at least one of the ATE Project Talks. Participants plan to share information from the webinar with approximately 3,950 students and 271 colleagues.

Suggestions for Improvement in Y2: Consider providing a certificate to document participation in the ATE Project Talks. Fifty-eight percent (58%) of the respondents were at least *somewhat interested* in receiving a certificate.

Objective 2.1. Gather input from industry on workforce needs.

Y1 Progress: InnovATEBIO supported the 2025 *National Life Sciences Workforce Trends Report*, which included extensive data collection: A) a hiring survey completed by over 500 companies, B) interviews with over 200 industry executives, and C) analysis of almost 3 million job postings.¹⁰ The report was released in June 2025.

Key Finding: 26% of the InnovATEBIO community relied on the *National Life Sciences Workforce Trends* reports for up-to-date labor market information.

Evaluation Findings: This workforce report has been produced every two years and is currently in its seventh iteration. The 2024 InnovATEBIO Annual Community Survey found that 26% of the community respondents (N=154) relied on this series of

¹⁰ Life Sciences Workforce Collaborative and TEconomy Partners. 2025 *Life Sciences Workforce Trends: Evaluating Industry Talent Dynamics amid Slower Growth and Rapid Technology Advances* <https://www.lifesciencesworkforce.org/national-workforce-trends>, accessed July 27, 2025.

reports for up-to-date bioscience workforce data. The upcoming 2025 Annual Community Survey will follow up in further detail about how the community uses this detailed workforce analysis.

Objective 2.2. Deliver faculty professional development.

Y1 Progress: The InnovATEBIO biomanufacturing and emerging technology workshops are scheduled to take place in grant year two.¹¹ In year one, InnovATEBIO's current and prior grants co-funded the DNA Learning Center's Summer of Nanopore professional development series. Evaluation of this series is included in the evaluation report from the prior grant.

Evaluation Findings: The biomanufacturing and emerging technology workshops will be held and evaluated in year two.

Objective 2.3. Develop industry-relevant undergraduate research and work-based learning.

Y1 Progress: *Undergraduate Research (UR) Hub:* InnovATEBIO launched an application process and selected a cohort of seven UR Institutional Partners to receive mentoring in undergraduate research over the five years of the grant. These partners attended the UR Strategic Planning Workshop in Dallas, TX, in April 2025 and are currently preparing to incorporate UR into their institutions. A UR skills workshop will be delivered in-person in August 2025.

Supply Chain Hub: InnovATEBIO's Supply Chain Hub added Canvas modules on industry audits and batch records and SOPs. Several batch records were reviewed by an industry consultant.

Evaluation Findings: Since the Undergraduate Research Institutional Partners are still in the preparatory phase, no evaluation of this objective has been completed yet. The Supply Chain resources will be evaluated as part of the workshop offered in year two.

Objective 2.4. Provide mentoring for biotech programs and dissemination support for ATE projects.

Y1 Progress: InnovATEBIO supported biotech programs applying for ATE grants in two grant cycles. A few weeks after being funded in September 2024, InnovATEBIO held an online meeting to answer questions about proposals being submitted in October 2024. Since that date, InnovATEBIO has worked with several different programs preparing submissions for the October 2025 ATE submission date.

¹¹ The Center ran a number of faculty workshops in 2024-2025, which were funded by the prior grant (NSF DUE #1901984) and were assessed by the evaluation team for that grant.

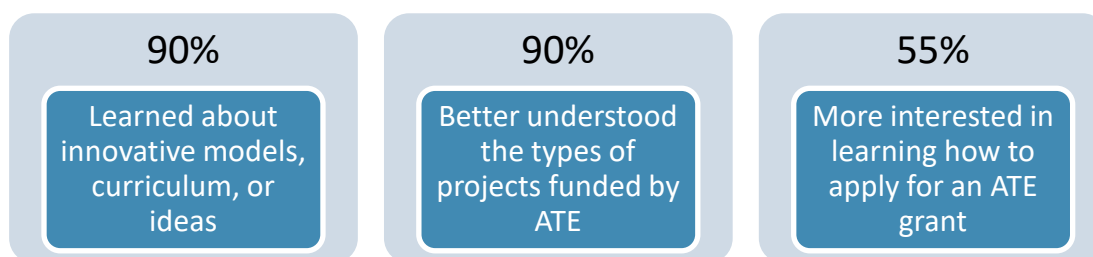
InnovATEBIO provided a venue for ATE project dissemination by running the spring 2025 ATE Project Talks webinar series: a series of 10 webinars with 22 presenters representing 15 biotechnology ATE projects.

Evaluation Findings

2025 ATE Project Talks Webinar Series

After each webinar, attendees completed an online survey. Results were returned to the presenters the following week. A total of 50 attendees completed the survey.

Due to the ATE Project Talks...[N=49]



92% Learned Something

- "Learned what others are doing around the country."
- "Knowledge about grants and projects that are engaging and student friendly."
- "Presentations were tight and informative. Having an instructor talk-about how he implemented the project brought it to life. Very inspiring."

71% Plan to Use Something

- "As chair of my science department, I plan to share what I have learned with my faculty members. I also feel better versed in the workplace expectations."
- "I am excited to dig into this for classroom use."
- "Excellent, usable info! Great links and connections, got me excited about teaching Biotech. Will enhance my 11-year-old, self-updated curriculum. And this will energize the students."

54% Plan to Share Info with Students

- ~3,950 Students

79% Plan to Share Info with Colleagues

- ~271 Colleagues

Goal Two: Objectives, Activities, and Evaluation Questions

The table below shows that, in 2024-2025, there was activity in all four objectives of goal two.

Goal 2: Build on existing processes for supporting community college faculty in recruiting and educating the skilled biotechnology workforce.			
Evaluation Question 2.A. (Goal 2 Overall) To what extent does the Center help biotech programs stay up to date with cutting edge technical content, aligned with industry needs, delivered via effective pedagogy?			
Objective	Activity	Active in Y1?	Evaluation Sub-Questions
2.1 Gather input and data from industry on workforce needs. ¹²	2.1.1 Produce the life science workforce trends report.	Yes	2.B. How do the workforce trends identified by the CSBI report inform the Center's materials and initiatives, ensuring that they are aligned with current industry needs?
2.2 Develop and deliver a model for providing faculty professional development that includes hubs, industry partners, projects, and Center leadership.	2.2.1 Develop guidance document detailing how the Center partners with industry, a hub, or ATE project to deliver a faculty workshop or webinar.	No. Starts in Y2	Objectives 2.2.-2.4: 2.C. Educators. To what extent and how do educators incorporate what they learn from InnovATEBIO into their courses and programs? 2.D. Students. To what extent and how do students benefit from information educators learn through InnovATEBIO, including PD, UR, and mentoring? How does UR impact student recruitment, retention, inclination to pursue a biotech career, and student learning outcomes (compared to pre-UR implementation)? 2.E. Programs. How are biotech programs strengthened through Center mentoring?
	2.2.2 Deliver faculty professional development in partnership with hubs, industry, and ATE projects.	Yes	
2.3 Expand opportunities for preparing faculty to implement industry-relevant undergraduate research and work-based learning in emerging technologies.	2.3.1 Develop industry-relevant UREs, recruit CC partners, and deliver faculty workshops.	Yes	
	2.3.2 Provide WBL Experiences through BioScope.	Yes	
2.4 Provide mentoring and dissemination support for ATE biotech projects and programs	2.4.1 Provide dissemination support for ATE biotech projects through the spring webinar series.	Yes	
	2.4.2 Center and hubs assist biotech programs with ATE grant proposal writing.	Yes	

¹² Activity 2.1.2 was discontinued.

GOAL THREE FINDINGS

Goal Three: Prepare community colleges and state teams to shape the future of biotechnology workforce education.

Evaluation Question: To what extent does the Center implement innovative initiatives to solve current challenges and shape the future of biotechnology education?

Key Findings: InnovATEBIO delivered the 2025 Biotech Boot Camp; educators attending the event gained proficiency in technical skills and confidence teaching these skills to their classes. Follow-up on the 2024 Boot Camps showed that 81% of the participants (N=38) implemented the full set of lessons they learned in the Boot Camps to more than 1,800 students. High school students (N=1,091) reported that the lessons helped them better understand what biotechnology is (86%), what biotech jobs look like (80%) and how to continue their biotech studies at their local community college (56%).

Through the Bioscience Leadership Institute (BLI), InnovATEBIO supported bioscience instructors learning to be leaders in bioscience education. Participants gained skills that are transferrable to their daily lives. They are confident applying what they learned in the BLI and anticipate that their BLI experiences will be useful in current or future leadership roles. They plan to apply what they learned in the BLI to improve and expand bioscience programs, build and support teams, present their ideas persuasively, and support bioscience education statewide.

Suggestions for Improvement in Y2: There are no strong themes amongst participant suggestions for the Boot Camp or BLI. These were mainly logistical suggestions, which have been provided to the leads of these initiatives for consideration in future iterations. The state teams have been supported by individual mentoring, upon request. InnovATEBIO could consider applying a structured framework and schedule of regular communication and support for state teams.

Objective 3.1. Delineate biotechnology career pathways: High school (CTE and non-CTE), 2-year, and 4-year institutions of higher education.

Y1 Progress: In collaboration with the Bay Area Bioscience Education Community (BABEC), InnovATEBIO delivered a Biotech Boot Camp at Southeast Community College in Lincoln, NE, June 3-5, 2025. The program included two and a half days of hands-on biotechnology laboratory lessons aligned with the Next Generation Science Standards.¹³ Nineteen (19) educators participated in the workshop, 18 of whom were high school teachers.

¹³ NGSS: <https://www.nextgenscience.org/>

Additionally, during Y1, BABEC followed up with participants of the two 2024 Biotech Boot Camps to learn how participants implemented what they learned in the workshops and to gather feedback from their students.

Evaluation Findings: Evaluation results are available for two separate efforts: feedback on the 2025 Biotech Boot Camp and implementation follow-up of the 2024 Biotech Boot Camps.

2025 Biotech Boot Camp

At the conclusion of the 2025 Biotech Boot Camp, the participants were surveyed. All 19 participants completed the survey, which is a requirement to earn their stipend, for a 100% response rate.

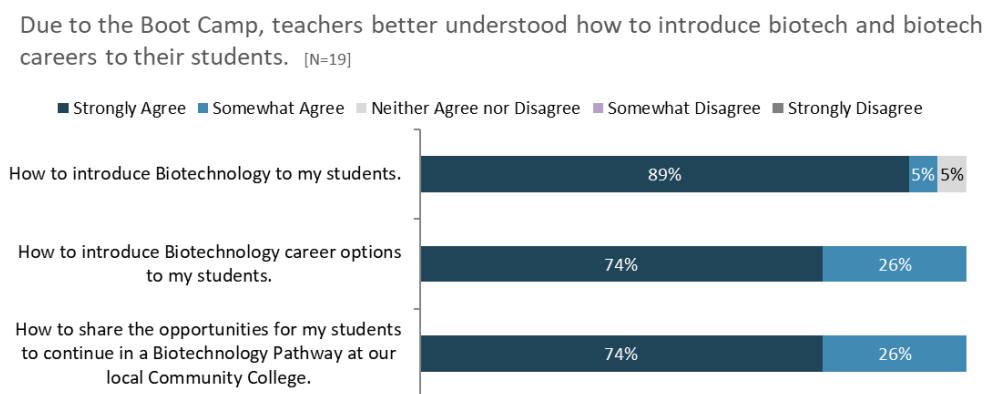
Usefulness of the Boot Camp / Most Valuable Aspects

All Boot Camp participants (100%) rated the workshop's usefulness as *excellent*. In explaining their high ratings, participants highlighted the *valuable materials* that were provided to them, the focus on including *content that promotes student engagement* and success, the fact that the materials could be *swiftly implemented in their classrooms*, the valuable tips and *solutions to common problems*, as well as the impact of *hands-on learning* that allowed them to experience the curriculum as students might. They also reported that they enjoyed *making connections* with others in their cohort and the community college presenters. Finally, the teachers said that the boot camp increased their sense of *comfort and confidence instructing the content* and *reignited their excitement* for the material. Teacher comments include the following:

It was well run and full of useful information. The way the materials are set up makes implementation a breeze. I left feeling much more comfortable using the materials and equipment and now have contacts if I need further help.

Learning to Introduce Biotechnology and Career Pathways

A majority of teachers *strongly agreed* that at the Boot Camp they learned how to introduce biotechnology (89%) and careers in the field (74%) to their students. They also learned how to share the opportunities for their students to continue in a Biotechnology Pathway at a local community college (74% *strongly agree* and 26% *somewhat agree*).

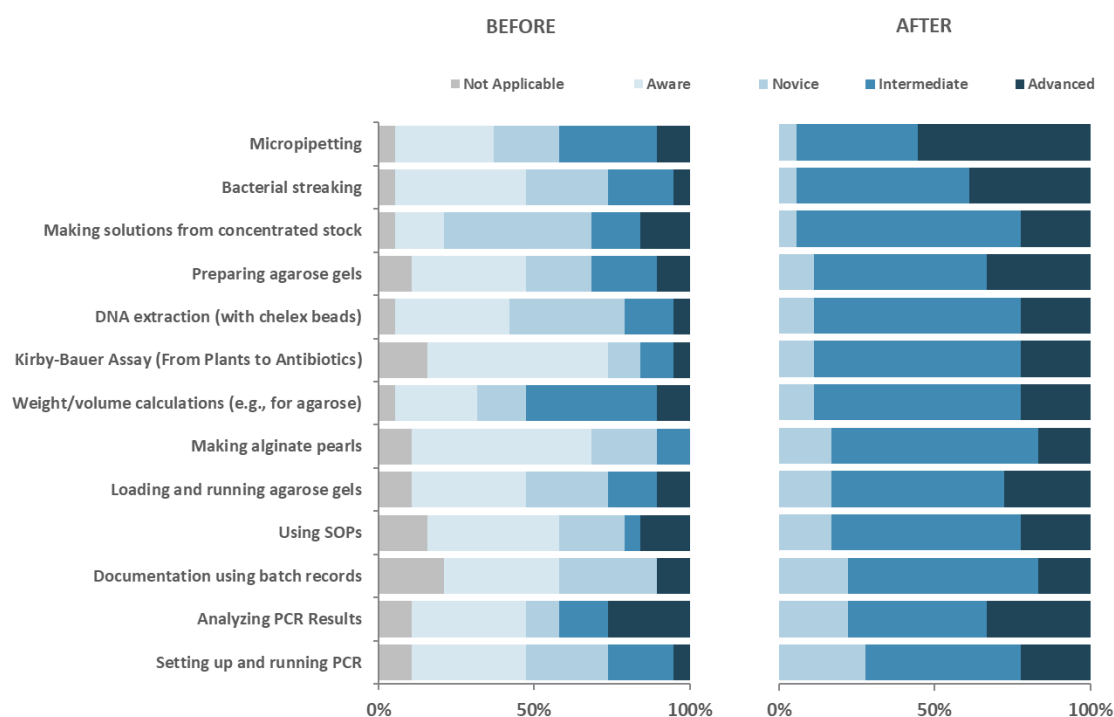


Learning Technical Skills: Gains in Proficiency

An important element of the Boot Camp was training the teachers in technical laboratory skills. This training aimed to equip teachers to implement the lessons in their own classrooms the following year. Overall, participants reported pre-post improvement in every skill that was taught (Appendix D: Table 8). Before the workshop, the participants rated their proficiency lower; only three of the 13 skills were rated as *intermediate* or *advanced* by at least one-third of the teachers. After the workshop, between 72% and 94% rated themselves as *intermediate* or *advanced* in all skills.

Key Finding: Teachers gained proficiency in all 13 technical skills and confidence teaching the skills to their students.

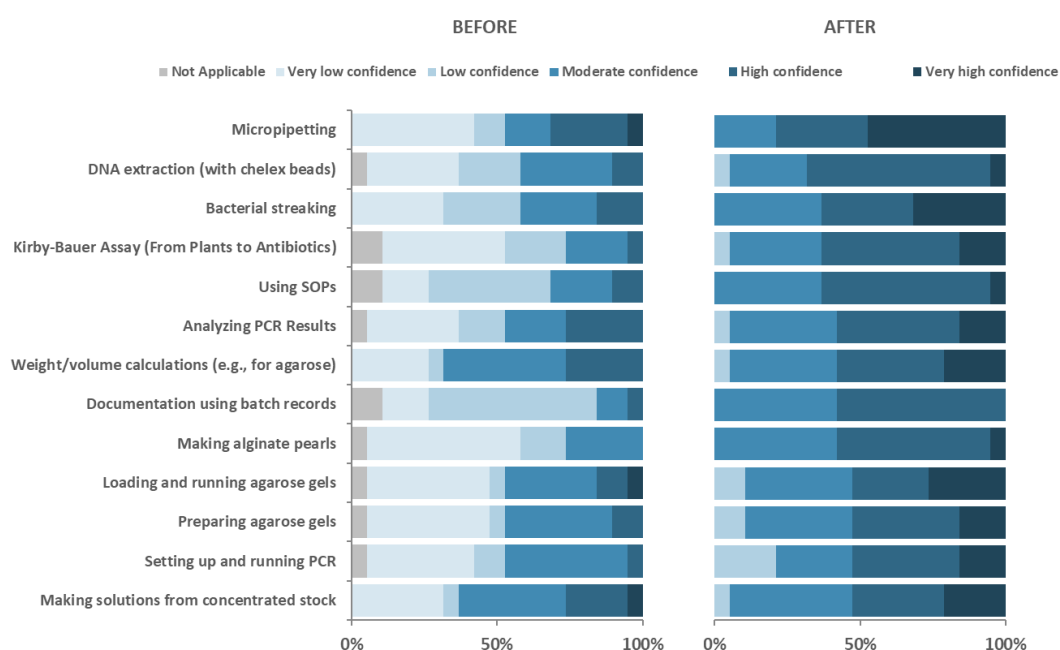
Technical skills proficiency increased through the Boot Camp. Over 70% were *intermediate* or *advanced* in each skill afterwards. [N= 19]



Gains in Confidence Teaching Technical Skills

Teachers reported pre-post gains in their confidence teaching all of the technical skills to their students. Before the Boot Camp, the only skill that at least one-third (33%) of the teachers had *high* or *very high* confidence teaching was micropipetting. After the Boot Camp, over half (53%-79%) of the teachers rated their confidence as *high* or *very high* in teaching all 13 of the skills to their students. (Appendix D).

Confidence teaching technical skills increased through the Boot Camp. Over 50% had high or very high confidence afterwards. " [N= 19]



Suggestions for Improvement

Participants also identified a few areas for improvement of the Boot Camp for future iterations. Several of them expressed a wish that more content had been covered, even as they acknowledged that the Boot Camp had been fully scheduled with activities, to the point where more time (including break time) would have been appreciated. Some participants also said they would have benefitted from some additional clarification and depth of information about the content, how different lessons connected together, and how the materials could best be taught in their own classrooms. The full set of responses have been shared with the BABEC leads, for consideration in updating the content of future Boot Camps or providing additional technical support or professional development.

2024 Biotech Boot Camps: Implementation Follow-up with Teachers

In June of 2024, InnovATEBIO / BABEC delivered a pair of Biotech Boot Camps: one at Montgomery Community College in Germantown, MD, and one at South San Francisco High School in South San Francisco, CA. A total of 38 high school teachers participated in the two workshops.

The content was very similar to the 2025 Boot Camp and involved training teachers to implement a sequence of three lessons and a lab in their high school classrooms: 1) What is Biotech? 2) Career Exploration in Biotech, 3) Biotech Spotlight and Pathways, and 4) a Hands-on Biotech Lab (they were trained in five labs and were expected to select one to implement).

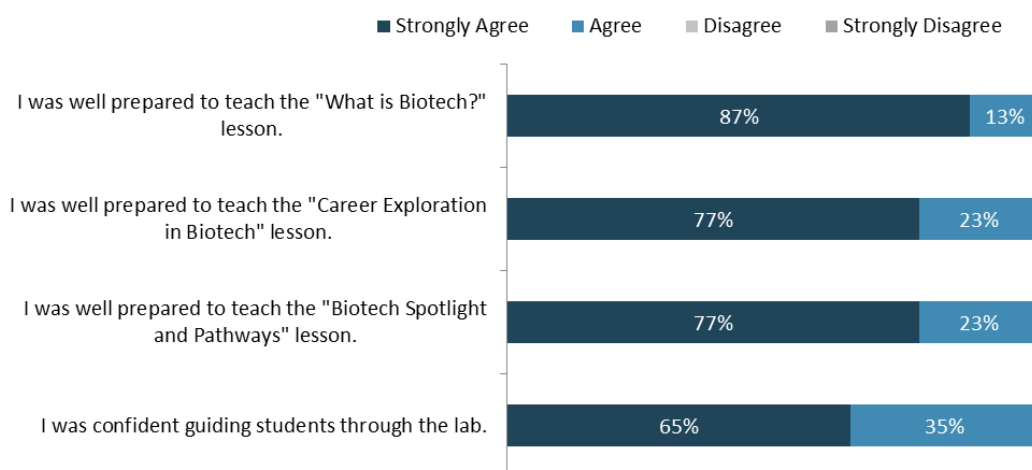
In the 2024-2025 school year, BABEC surveyed the participants about their experiences implementing the four lessons they learned in the Biotech Boot Camps.

Eighty-one percent (81%) of the high school teachers (N=38) implemented the sequence of three lessons and lab.

Teachers indicated that they were well prepared to teach the lessons and lead the lab. All teachers *agreed* or *strongly agreed* that they were well prepared and confident.

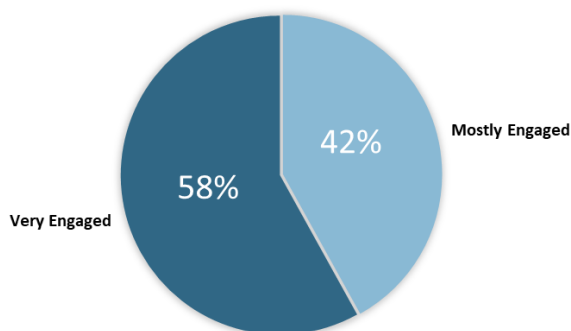
Key Finding: 81% of the Teachers implemented the 3 lessons and lab

Teachers were well prepared to teach the lessons and confident leading the lab. [N=31]



An estimated 1,815 students completed one of the labs. Teachers reported that their students were engaged by these lessons, with over half (58%) of the teachers noting that their students were *very engaged* and 42% indicating that their students were *mostly engaged*.

Teachers reported that students were engaged by the lessons. [N=31]

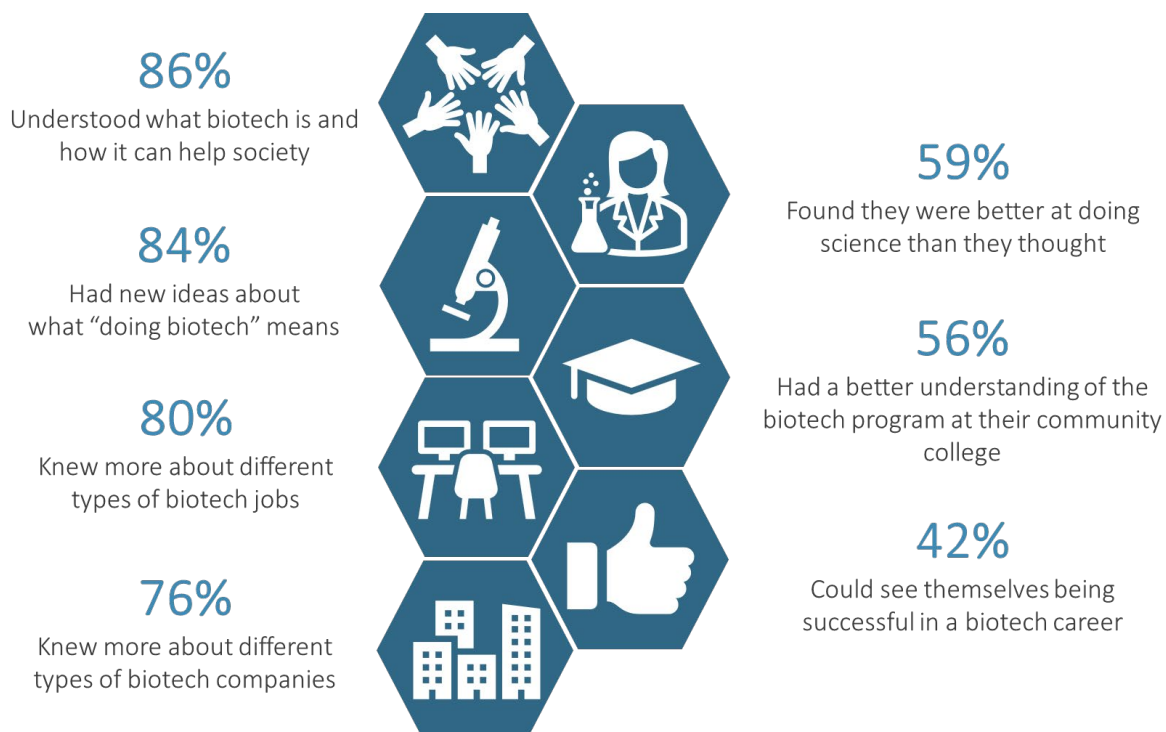


Key Finding:
~1,815
 Students
 Completed the Lab

2024 Biotech Boot Camps: Implementation Follow-up with Students

After the high school teachers implemented the lessons they learned at the Biotech Boot Camp, they asked their students to complete a survey about their understanding of biotechnology and pathways to a biotech career. A total of 1,091 students completed the survey, as of July 15, 2025.

Student Feedback: After Completing the Biotech Lessons and Lab... [N=1,091]



Objective 3.2. Foster biotech community college leadership.

Y1 Progress: In the first year of the grant, InnovATEBIO hosted the six-month Bioscience Leadership Institute (BLI), a professional development program designed to train and support community college and K-12 bioscience instructors who are interested in joining the next generation of leaders in bioscience education. The BLI was held over six months, from December 1, 2024, through June 5, 2025.

The BLI consisted of two parts. Part A was a virtual experience where participants worked in teams to generate solutions to business cases. The goal of this experience was to learn strategy, problem solving, teaming, and leadership. Part B was an in-person event June 3-5, 2025, at the National Center for the Biotechnology Workforce at Forsyth Technical Community College, in Winston-Salem, NC. This event included participant presentations, debriefing, engagement with experts, and program graduation.

Evaluation Findings

Bioscience Leadership Institute

The BLI participants were surveyed at the conclusion of the program, and all 11 responded, for a 100% response rate.

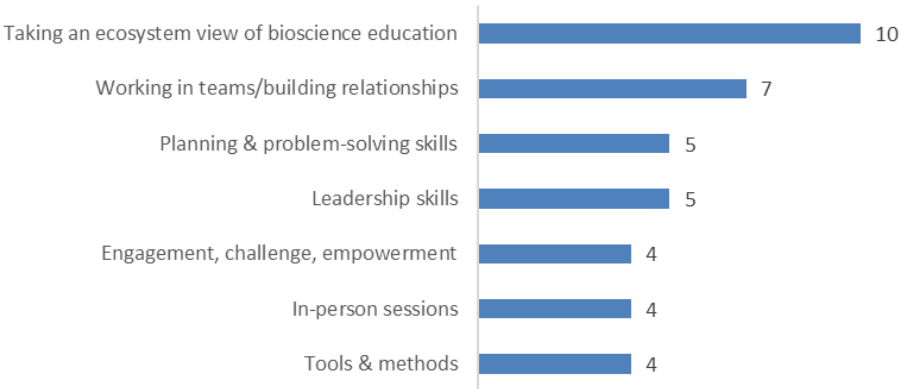
Rating of Experience / Most Valuable Elements

Feedback about the BLI was overwhelmingly positive. Ten (10) of the 11 participants reported that

“I feel more empowered to take on larger challenges in support of bioscience education within my state.”

their experience overall was *excellent*, and the final member of the cohort indicated that their experience was *good*. Participants described in detail the value they gained from taking part in the BLI. They identified changes in themselves, confidence in their ability to apply that they learned, and optimism that their experiences would be useful in leadership roles.

Most Valuable Elements of the BLI Experience [N=11]



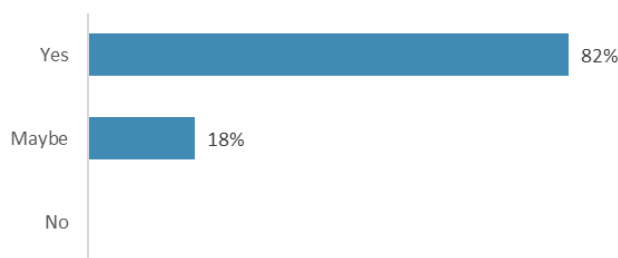
Learning: Application to Daily Activities & Changes Participants Have Seen in Themselves

All of the participants (100%) indicated that through completing the case studies, they learned something transferable to their day-to-day activities. Detailed descriptions of what they learned included how to change their mindset, take a wholistic approach, do a thorough analysis, create a clear plan, establish and maintain relationships with industry partners, identify stakeholders, work smoothly as a team, and delegate.

Key Finding: All participants (100%) learned something transferrable to their lives.

Nine (9) of the 11 participants (82%) reported that they saw changes in themselves due to taking part in the six-month program. They commented on changes in their thought processes, enthusiasm for new ideas and challenges, a deeper understanding of effective industry

Participants saw changes in themselves due to taking part in the BLI. [N=11]



collaboration, increased appreciation for their own and others' working styles (e.g., through the DiSC analysis), and committing to a human-centered approach in their work, emphasizing trust and relationships building.

Selected responses are below, in the respondents' own words:

I started to approach problems differently by thinking more broadly.

The mindset and my priorities. Mindset being how I approach the audience of communication. My priorities being how I need to establish my rapport for increased trust.

Understanding my DiSc helps me understand others better and appreciate my strengths and the strengths of others in a different way.

Think strategically in way to work with industry partners and create a win-win situation.

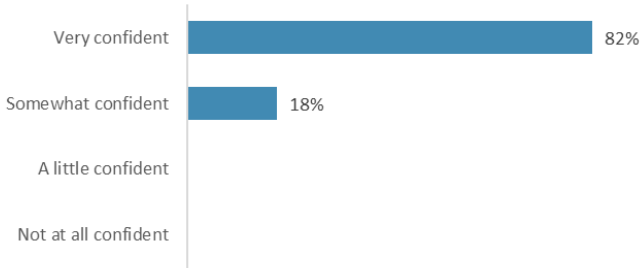
Now, I feel more confident planning and running my courses using the concepts I learned from this program.

Building Leadership Capacity

A key goal of the BLI is to build the leadership capacity of attendees, empowering them to join the next generation of leaders in bioscience education. To better understand the participants’ growth over the course of the program, the survey asked participants a number of questions about the impacts and further applications of what they learned.

All participants reported that they are at least *somewhat confident* in their ability to apply what they learned in the program, and nine of the 11 participants noted that they are *very confident*.

Most participants are very confident applying what they learned in the BLI. [N=11]



Finally, speaking to the ultimate goal of the BLI program, participants said that they anticipate that their experiences will or may be useful in current or future leadership roles. When asked to

Participants expect their experience in the BLI to be useful in current or future leadership roles. [N=11]



say more about how their learning might be applied, they wrote about the value of the network they built during the BLI and how they hoped to rely upon and contribute to it in the future. They hoped to use their new skills to obtain support for expanding current bioscience programs. They envisioned themselves as better builders and leaders of teams, and empowering those teams to do stronger work using

the tools taught during the BLI. They also wrote about having a clearer vision of how to present their ideas to create buy-in with key stakeholders.

How BLI Will Be Useful in Leadership: Themes from Written Comments					
Leverage BLI Network	Present Ideas Persuasively	Expand Bioscience Programs	Support Bioscience Education Statewide	Build & Lead Teams	Use BLI Tools

Participant explanations of how the BLI will be useful to them in current and future leadership roles include the following, in their own words:

I learned how to present my ideas clearly to colleagues and administration in a way that persuades and builds support. Moving forward, I plan to use this skill to lead new initiatives and bring positive changes to my program and team.

I am in the process of building my team. I will take what I have learned to make sure I have a strong team that will be able to work well and productively together.

BLI helped me tailor my messages to various stakeholders and leverage their involvement. This will help me expand my Biotech training program and getting support from my administrator.

Suggestions for Improving the BLI

Participants provided a variety of logistical and content suggestions for improving the BLI. Suggestions included mitigating scheduling and time zone conflicts, providing the opportunity to work with more cohort members (across teams), clarifying the time commitment up-front, suggestions for specific content for the business cases, and a request for opportunities to stay connected with the current and past BLI cohorts through events and an alumni network. The full set of suggestions has been provided to the BLI lead for consideration when planning the next iteration of the program in 2027-2028.

Follow-up with 2022 BLI Cohort

Follow-up with the 2022 BLI cohort in 2024 (48% response rate, 12 of 25 participants) found that 92% had applied something they learned at the BLI to their professional work life. They reported that through the BLI, they developed skills (e.g., leadership, conflict resolution, time management, teamwork, communication, and management), recognized and leveraged their strengths, learned to set expectations, expanded their views on industry, better understood the workforce needs, strengthened their networks with educators and industry, and gained confidence and comfort presenting to industry. The BLI contributed to participants' accomplishments, including attaining new leadership positions, taking on new responsibilities, earning tenure, being awarded grants, developing new initiatives, and hosting workshops. All of these are indications that the BLI helped participants transition towards being leaders in the biotechnology education space.

Objective 3.3. Assist state teams in developing biotech workforce ecosystems.

Y1 Progress: In grant year one, InnovATEBIO supported the state teams through running an online meeting in the fall of 2024 (*Creating a Biotechnology Workforce State by State: Forming and Running State Teams*), mentoring state teams in preparing ATE conference proposals for in-person state team meetings, and conducting a series of interviews, which contributed to state team case studies, which are currently in draft form. In addition, InnovATEBIO sponsored new teams of high school teachers and community college educators/administrators to attend the National Career Pathways Network Conference and pre-workshop.

InnovATEBIO is working towards a more structured definition of state teams by identifying three initiatives that state teams need to focus on moving forward: 1) a statewide BILT advisory board, 2) workforce ecosystem resource assessment, and 3) articulation agreements to better develop career pathways.

Evaluation Findings

Online Meeting:

Creating a Biotechnology Workforce State by State: Forming and Running State Teams

An online community meeting, *Best Practices: Creating a Biotechnology Workforce State by State: Forming and Running State Teams*, was held on October 17, 2024. This meeting had two aims: 1) share updates and information about current state teams and their accomplishments, and 2) encourage those from states currently without teams to consider forming a team and to position InnovATEBIO as a partner in this process.

Seventeen (17) individuals registered for the event; 12 attended; and four completed a post survey, for a 33% response rate. With only four responses, it is difficult to draw any strong conclusions; however, written comments suggest that the meeting achieved its goals.

"I learned about some funding opportunities and what other state teams were doing to increase interactions with industry partners."

"I will look into funding for a conference with state biotechnology members from academia and industry."

Goal Three: Objectives, Activities, and Evaluation Questions

The table below shows that, in 2024-2025, there was activity in all three objectives of goal three.

Goal 3: Prepare CCs and state teams to shape the future of biotechnology workforce education.			
Evaluation Question 3.A. (Goal 3 Overall) To what extent does the Center implement innovative initiatives to solve current challenges and shape the future of biotechnology education?			
Objective ¹⁴	Activity	Active in Y1?	Evaluation Sub-Questions
3.1 Delineate biotechnology-specific career pathways that integrate career, and technical education (CTE), non-CTE, and credentials that articulate between High School, 2-year, and 4-year IHEs with a focus on workforce education and policy.	3.1.1 Identify successful career pathway and recruiting strategies.	Yes	3.B. How do InnovATEBIO initiatives affect student recruitment into biotech programs?
	3.1.2 Educate HS teachers about basic biotechnology, emerging technologies, and career pathways.	Yes	
	3.1.3 Monitor discussions and activity about skill standards, credentials, and digital badging.	No. Starts in Y2	
3.2 Foster biotech CC leadership in providing biotechnology workforce education.	3.2.1 Hold Bioscience Leadership Program.	Yes	3.C. Do the Bioscience Leadership Institute and Bioscience Administrators Program develop leaders in the bioscience community (BLI) and build support of bioscience programs amongst administrators (BAP)?
	3.2.2 Hold Bioscience Administrators Program.	Y2	
	3.2.3 Conduct an ATE hackathon addressing problems shared across the ATE community.	Y2	
Objective 3.3 Assist state teams in developing biotech workforce ecosystems.	3.3.1 Conduct Fall community/state team webinars to socialize teams and facilitate dialog and solicit feedback.	Yes	3.D. Do the state teams make measurable progress towards addressing barriers to meeting biotech workforce needs?
	3.3.2 Assist teams with developing conference proposals for state meetings.	Yes	
	3.3.3 Conduct cross-state analysis to identify common problems and promising practices.	No	

¹⁴ Objective 3.4. was discontinued.

RECOMMENDATIONS

It should be stated from the outset that InnovATEBIO is highly effective and productive. That said, like most organizations, InnovATEBIO has areas that could be improved in order to maximize their impact.

In this new grant, the Center moved from a model of each goal being led by an individual to having multiple PIs responsible for each goal. The intention was for the team to pull together and be informed and responsible for the entire grant. However, most activities still have a single individual lead.

This new model has had mixed success. While a broader group of PI's has had input into the majority of activities (leading to greater awareness), in the cases where there is no individual lead, the activities have suffered from a lack of focus. This was evident in the low attendance rates for the fall webinars, which could be improved with a tighter focus, including identifying the target audience and how the event would help them. Quotations from participant surveys supporting this recommendation include the following:

"It would be great if there was more intentionality around these virtual events - with clear goals and an agenda (shared ahead of time). Topics should highlight "pain points" experienced by the InnovATEBIO community with a clear plan to provide training, support and/or community that will address that pain point. Or perhaps instead of doing more webinars, have hubs (or others) create simple templates/guidelines for a resource or tool they've developed and an accompanying short video to share it?"

"There were lots of opportunities shared, however it would have been great to make sure each of the presentations from the hubs were focused on what they can offer the community and specifically who they can help most directly (not a report out on project activities)"

"A more consistent format: What the hub does, what it offers, who could most benefit, who to connect with - would have been beneficial and then the recording would be more useful for future dissemination."

Specific suggestions from the community for improving webinars/outreach communication include the following:

- Create a website with contact info for all presenters and links for all resources, including slides. Share the website in advance of the event.
- Use clear language
- Provide specific examples
- Ensure that presenters have stable internet connection
- Provide an estimated time commitment for InnovATEBIO hub involvement

- Instead of webinars, consider creating videos: Have each hub create a five-minute video "highlighting what they can offer to the community"
- Create "QuickStart guides for new members and faculty that want to understand how to get started" with InnovATEBIO
- Provide a webinar or video introducing each hub

CONCLUSIONS

In the first year of the grant, InnovATEBIO made progress on all three grant goals, launching initiatives to strengthen the infrastructure that supports the bioscience education community, provide up-to-date bioscience labor market information, help bioscience educators gain new skills and knowledge to remain at the forefront of the field, and prepare rising community college leadership and state teams to solve state-level biotechnology workforce challenges.

Overall, the evaluation found strong engagement and learning among the biotechnology education community in year one of the grant. InnovATEBIO's events fostered a sense of community and provided valuable resources and training, as reflected in the strong learning outcomes among faculty and students, as well as faculty implementation of new ideas. The Center effectively disseminated industry trends and innovative teaching models through the workforce report and ATE Project Talks, encouraging faculty to adopt new practices and pursue ATE funding. Professional development programs, including the Biotech Boot Camp and the Bioscience Leadership Institute, produced substantive gains in technical skills, confidence, and leadership capacity. In sum, InnovATEBIO has used the first year of this grant to launch promising initiatives that support the biotechnology education continuum in meeting the biotech industry's technical workforce needs.

APPENDIX A: DATA SOURCES

The evaluation of InnovATEBIO in the 2024-2025 grant year relied on multiple data sources, as detailed below:

Online Event Surveys

In collaboration with InnovATEBIO leadership, the evaluation team created a model online event post-survey. This survey collected participants' ratings of the usefulness of the events, learning gains, intentions to use and/or share information, and open-ended feedback. The survey for each event included between two and four "goal statements," and respondents marked the extent to which they agreed or disagreed with the statements. Examples of goal statements include the following:

- Due to this ATE Project Talks webinar, I learned about innovative models, curriculum, or ideas that I can use in my program.
- Due to today's State Teams meeting, I am inspired to cultivate relationships with other organizations in my state ecosystem.
- Due to participating in the BABEC Biotech Bootcamp, I better understand how to introduce Biotechnology career options to my students.

The goal statements were designed in collaboration with the InnovATEBIO lead of each event. The full list of goal statements is in Appendix B below. Select events, such as the ATE Project Talks, had surveys that included additional questions that were unique to that event.

Online Event Name	Date	Attendees	# Surveys	Response Rate
InnovATEBIO Community: Q&A For Writing ATE Proposals	09/20/24	2	0	0%
InnovATEBIO Community: Learn about InnovATEBIO 2.0	09/26/24	11	7	64%
Best Practices: Creating a Biotechnology Workforce State by State: Forming and Running State Teams	10/17/24	12	4	33%
InnovATEBIO Hub Reports and Next Steps	11/07/24	12	7	58%
InnovATEBIO Webinar: Exploring Reproducibility with an Open Access Biotech Lab Manual	04/24/25	26	5	19%

InnovATEBIO Webinar: Apprenti: A simplified approach to registered apprenticeships	05/06/25	24	3	13%
InnovATEBIO Community Conversation	05/09/25	25	9	36%
ATE Project Talks: 10 webinars ¹⁵	01/17/25 - 05/23/25	122 unique participants	50	41%

Workshop Post-Survey: Biotech Boot Camp

Like the model online event survey, the evaluation team also created a model survey for in-person workshops, which can be specialized for the specific goals, learning outcomes, and technical skills of each workshop.

In the first year of the grant, his online survey was administered after the Biotech Boot Camp, which was co-sponsored by InnovATEBIO and the Bay Area Bioscience Education Community (BABEC). The Biotech Boot Camp was offered in Lincoln, NE, on June 3-5, 2025. Nineteen (19) educators attended this event. Survey completion is required in order for participants to receive their program stipend. All participants completed the survey, for a 100% response rate.

2024 Biotech Boot Camp Follow-up: Teacher Implementation Survey

In 2025, BABEC followed up with the high school teachers who had participated in the 2024 Biotech Boot Camp to learn more about whether they had implemented the three lessons and lab in their classroom. Thirty-one (31) of 38 participants completed the survey, for an 81% response rate.

2024 Biotech Boot Camp Follow-up: Student Survey

In 2025, BABEC invited teachers who had implemented the three lessons and lab to administer a survey to their students. As of July 2025, 1,091 students had completed the survey. In the implementation survey, the teachers estimated teaching the lessons to an estimated total of 1,815 students, which leads to an approximate response rate of 60%.

Bioscience Leadership Institute Post-Survey

The Bioscience Leadership Institute (BLI) was held over six months from December 1, 2024, to June 5, 2025. Eleven (11) people participated in the 2025 BLI program. A post-event survey was developed by the evaluation team, in consultation with the co-PI leading the BLI. The survey was administered at the close of the event. All 11 participants completed the survey for a 100% response rate.

¹⁵ See Appendix C for the full list of 2025 ATE Project Talks.

2024 InnovATEBIO Annual Community Survey

In the spring of 2024, the Social and Economic Sciences Research Center surveyed the InnovATEBIO community to learn about the impact of their interaction with the Center. The survey was distributed to the newsletter subscribers, as well as participants in all prior InnovATEBIO events, since the Center was established in 2020. The survey was open between February 23, 2024, and May 31, 2024. A total of 187 individuals responded to the survey. An unduplicated distribution list was not available, so it was not possible to create a response rate.

Interviews and Observations

Evaluators conducted interviews with principal investigators, observed events, and participated in weekly leadership meetings to gather qualitative insights.

Document Review

The evaluation also reviewed project records, annual reports, proposal documents, and deliverables, including the *2025 Life Sciences Workforce Trends Report*.

APPENDIX B: GOAL STATEMENT SURVEY QUESTIONS

Event	Goal Statement Survey Questions
Webinar: Learn about InnovATEBIO 2.0	• After this webinar, I have a better understanding of InnovATEBIO's goals for 2.0. • After this webinar, I have a better understanding of InnovATEBIO's activities. • After this webinar, I have a better understanding of how InnovATEBIO can help me.
Webinar: InnovATEBIO Hub Report Outs and Next Steps	• At today's meeting, I learned more about what InnovATEBIO Hubs offer. • After today's meeting, I know more about how InnovATEBIO Hubs can benefit me. • I plan to follow-up with one or more InnovATEBIO Hubs.
Webinar: InnovATEBIO Community Conversation	Due to this Community Conversation... • I feel part of a supportive community. • I feel that there is an open line of communication with InnovATEBIO leadership.
Webinar: State Teams	• At today's meeting, I learned more about the value of state teams. • At today's meeting, I learned about options to fund a biotech workforce conference in my state. • Due to today's meeting, I am inspired to cultivate relationships with other organizations in my state ecosystem. • Due to today's meeting, I am motivated to help organize a workforce conference in my state.
Webinar Series: ATE Project Talks	Due to this ATE Project Talks Webinar... • I learned about innovative models, curriculum, or ideas that I can use in my program. • I have a better understanding of the kinds of projects that are funded by the ATE program. • I am more interested in learning how to apply for an ATE grant. • I plan to follow-up with one of the presenters to discuss a possible collaboration.
Webinar: Apprenti	• This webinar helped me better understand apprenticeships. • I want to learn more about apprenticeships. • I would like to start an apprenticeship program.
Webinar: Open Access Lab Manual	• This webinar gave me a better understanding of practices for improving reproducibility. • In this webinar, I learned strategies to help students recognize, understand, and minimize variability.
Biotech Boot Camp	Due to participating in the BABEC Biotech Bootcamp, I better understand...

	• How to share the opportunities for my students to continue in a Biotechnology Pathway at our local Community College. • How to introduce Biotechnology career options to my students. • How to introduce Biotechnology to my students.
Bioscience Leadership Institute	• The Leadership Institute content was appropriate to help me develop leadership skills. • I have worked outside my comfort zone during the Leadership Institute. • I have developed strong relationships with my Leadership Institute teammates.

APPENDIX C: ATE PROJECT TALKS

Table 1: Spring Webinar Series: List of ATE Project Talks

Number	Project Talk Title	Date	Speaker	Institution
1	Advancing Bio-Technician Workforce Readiness in Northeast Florida: A Regional Initiative	05/23/25	Kasyapa Chita	Florida State College Jacksonville
2	Modules for Bioindustrial Manufacturing	04/25/25	Louise Petruzzella	BioMADE
	Work-based Biotech Education		Michael Fuller	Bay Area Bioscience Education Community (BABEC)
3	Expanding Hands-On Biotechnology and Biomanufacturing Experience to Engage More Students in Biosciences	04/18/25	Terri Quenzer	MiraCosta College
4	The NOBLE Project	04/11/25	David Fernandez, Xin Zhou & Vijaya Gandreti	Northern Virginia Community College
	Growing the Immunotherapy Workforce		Orlando de Lange	Shoreline Community College
5	Fulfilling the Promise of Anytime, Anywhere DNA Sequencing	03/28/25	Dave Micklos & Anna Feitzinger	Cold Spring Harbor Laboratories
6	Using Hackathons to Catalyze Research Projects in Antibody Engineering	03/07/25	Sandra Porter & Todd Smith and Margaret Byans	Digital World Biology Montgomery County Community College
7	Generative AI tools for personalized learning	02/21/25	Dylan Bulseco & Aarman Jamiluddin	Institute for Future Intelligence
	Cell Therapy and Flow Cytometry		Savita Prabhakar	Frederick Community College

8	Antibody Engineering and NexLAB	02/07/25	Dylan Bulseco & Andriy Kashyrskyy	Institute for Future Intelligence
	Increasing recruitment and retention through a network of alumni		Karen Leung	City College of San Francisco
9	How attached is your dog? An authentic research project to bring biotechnology career awareness to high school and college students	01/24/25	Misty Wehling, Tracy Niday & Gabrielle Johnson	Southeast Community College
10	Training the Future Biotech Workforce Through Authentic Research Projects and Internships	01/17/25	Aron Kamajaya	Los Angeles Pierce Community College
	Workplace Navigation: Empowering Student Success in the Workplace		Karen Leung	City College of San Francisco

APPENDIX D: BIOTECH BOOTCAMP PRE-POST RESULTS

Table 2: BABEC Biotech Bootcamp: Participant Skills Ratings, Before → After Bootcamp

Skill	Timepoint	Not Applicable	Aware	Novice	Intermediate	Advanced	Total %	N
Micropipetting	Before	3%	24%	21%	36%	15%	100%	33
	After	0%	0%	3%	32%	65%	100%	31
Bacterial streaking	Before	3%	30%	24%	27%	15%	100%	33
	After	0%	0%	3%	48%	48%	100%	31
Loading and running agarose gels	Before	6%	30%	21%	21%	21%	100%	33
	After	0%	0%	13%	45%	42%	100%	31
Analyzing PCR Results	Before	6%	39%	15%	15%	24%	100%	33
	After	0%	0%	16%	48%	35%	100%	31
Preparing agarose gels	Before	6%	30%	24%	24%	15%	100%	33
	After	0%	0%	10%	58%	32%	100%	31
Kirby-Bauer Assay (From Plants to Antibiotics)	Before	12%	58%	15%	6%	9%	100%	33
	After	0%	0%	10%	61%	29%	100%	31
DNA extraction (with chelex beads)	Before	6%	36%	36%	15%	6%	100%	33
	After	0%	0%	13%	61%	26%	100%	31
Making alginate pearls	Before	12%	52%	21%	12%	3%	100%	33
	After	0%	0%	19%	58%	23%	100%	31
Weight/volume calculations (e.g., for agarose)	Before	6%	21%	21%	39%	12%	100%	33
	After	0%	0%	13%	65%	23%	100%	31
Making solutions from concentrated stock	Before	3%	18%	36%	27%	15%	100%	33
	After	0%	0%	10%	68%	23%	100%	31
Using SOPs	Before	21%	36%	27%	3%	12%	100%	33
	After	0%	3%	19%	58%	19%	100%	31
Setting up and running PCR	Before	6%	48%	21%	18%	6%	100%	33
	After	0%	0%	23%	58%	19%	100%	31
Documentation using batch records	Before	24%	45%	21%	0%	9%	100%	33
	After	0%	6%	29%	48%	16%	100%	31

Table 3: BABEC Biotech Bootcamp: Participant Confidence Teaching Laboratory Skills Ratings, Before → After Bootcamp

Skill	Timepoint	Not Applicable	Very Low Confidence	Low Confidence	Moderate Confidence	High Confidence	Very High Confidence	Total %	N
Micropipetting	Before	0%	30%	18%	12%	30%	9%	100%	33
	After	0%	0%	0%	16%	41%	44%	100%	32
Bacterial streaking	Before	3%	24%	27%	24%	15%	6%	100%	33
	After	0%	0%	0%	31%	38%	31%	100%	32
Analyzing PCR Results	Before	3%	33%	12%	24%	21%	6%	100%	33
	After	0%	0%	3%	38%	34%	25%	100%	32
Loading and running agarose gels	Before	6%	33%	9%	27%	18%	6%	100%	33
	After	0%	0%	6%	28%	44%	22%	100%	32
Making solutions from concentrated stock	Before	0%	30%	12%	33%	18%	6%	100%	33
	After	0%	0%	3%	47%	31%	19%	100%	32
Kirby-Bauer Assay (From Plants to Antibiotics)	Before	12%	33%	30%	12%	9%	3%	100%	33
	After	0%	0%	3%	44%	38%	16%	100%	32
Weight/volume calculations (e.g., for agarose)	Before	3%	24%	12%	33%	27%	0%	100%	33
	After	0%	0%	6%	41%	38%	16%	100%	32
Setting up and running PCR	Before	0%	0%	13%	34%	41%	13%	100%	33
	After	0%	0%	13%	34%	41%	13%	100%	32
Preparing agarose gels	Before	9%	28%	9%	44%	6%	3%	100%	32
	After	0%	0%	9%	28%	53%	9%	100%	32
Making alginate pearls	Before	12%	45%	12%	21%	6%	3%	100%	33
	After	0%	0%	0%	39%	55%	6%	100%	31
Using SOPs	Before	18%	24%	27%	18%	9%	3%	100%	33
	After	0%	0%	6%	47%	41%	6%	100%	32
DNA extraction (with chelex beads)	Before	9%	24%	21%	36%	9%	0%	100%	33
	After	0%	0%	6%	31%	56%	6%	100%	32
Documentation using batch records	Before	18%	27%	36%	9%	6%	3%	100%	33
	After	0%	3%	6%	47%	41%	3%	100%	32

