

Final Report on the Evaluation of the BELONG in STEM Scholars Program

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EXECUTIVE SUMMARY

“Majority of my life I haven’t had anyone to have my back or want better from me until this program. I am so shocked and grateful I honestly don’t know what to say. All I can say is thank you, thank you, thank you!” - Cohort 2 Scholar (with permission)

The Building Engagement in Laboratories, Networking, and Peer Groups in Science, Technology, Engineering, and Mathematics (BELONG in STEM) program at Northern Illinois University provides financial need-based scholarships for talented undergraduate students in STEM disciplines. Students with junior-level status or above receive \$5,000 each academic year for up to three years. BELONG in STEM Scholars participate in professional development events, a peer group, PI/Co-PI check-ins, outreach, and other activities such as internships and undergraduate research experiences. BELONG in STEM is funded by a grant from the National Science Foundation’s Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program.

During Year 5, 23 BELONG in STEM Scholars continued the program (two Scholars from Cohort 2, eight Scholars from Cohort 3, and 13 Scholars from Cohort 3). In Year 5, one Cohort 4 Scholar changed their major to education before the Spring 2023 semester and withdrew from the BELONG in STEM Scholars program; and another Cohort 4 Scholar transferred out of NIU. Thirteen Scholars graduated during Year 5 (8 in Spring 2023, 1 in Summer 2023, and 4 in Fall 2023). There were 12 active Scholars in Fall 2023 (one did not register for Fall 2023 courses) and Year 5 ended with 8 active Scholars.

Professional development events in Year 5 included panel discussions with NIU S-STEM alumni, workshops from NIU Career Services and about elevator pitches, a discussion of salary expectations, and a site visit to Argonne National Laboratory. The attendance rate for the professional development events ranged from 38-83%, and the attendance rates for the peer group meetings ranged from 57-100% (the average peer group attendance rate was 84%). Participation rates for the PI/Co-PI check-ins were 95% in Spring 2023 and 83% in Fall 2023. In Year 5 100% of Scholars indicated that the program overall was “Good,” “Very good,” or “Excellent.” For individual program components these percentages were 100% (for the peer group component), 81% in Spring 2023 and 100% in Fall 2023 (for the professional development component) and 83% (for the PI/Co-PI check-in component). These percentages were also 65% or higher for each of the Spring 2023 and Fall 2023 professional development events.

Across five program years, there were 55 Scholars who were selected for the program. Forty-nine (89%) persisted in the program and at NIU as of this writing, 33 of whom were current NIU students at program entry (67%) and 16 of whom were CC transfer students (33%). These Scholars were socio-demographically and academically diverse. Students from seven eligible BELONG in STEM majors at NIU were represented. Only 55% self-identified as White; 10% identified as Black or African American, 18% self-identified as Hispanic/Latino and 31% self-identified as first-generation college students. A total of 41 Scholars graduated during the five project years.

100% of Scholars rated the BELONG in STEM Scholars program as “Good,” “Very good,” or “Excellent” in each project year. During the project, Scholars consistently indicated a variety of perceived outcomes, most notably “Interaction with NIU peers,” “Interaction with NIU

STEM faculty,” “Increased knowledge of NIU STEM faculty,” “Increased knowledge of STEM careers, professions, and employers,” and “Increased professional skills (e.g., collaboration, leadership, or critical thinking).” Modest but positive growth was observed in Scholars for three psycho-social factors over the course of the program: science task self-efficacy, science identity, and affective belonging to STEM. All BELONG in STEM Scholar cohorts had higher grade point averages and completed their degrees at higher rates than did several other academic peer groups.

I. PROGRAM OVERVIEW

The Building Engagement in Laboratories, Networking, and Peer Groups in Science, Technology, Engineering, and Mathematics (BELONG in STEM) program at Northern Illinois University provides financial need-based scholarships for talented undergraduate students in STEM disciplines. Students with junior-level status or above receive \$5,000 each academic year for up to three years.¹ BELONG in STEM Scholars participate in professional development events, a peer group, PI/Co-PI check-ins, outreach, and other activities such as internships and undergraduate research experiences.

The project targets both current NIU students and potential community college (CC) transfer students. Year 5 began with 23 BELONG in STEM Scholars continuing the program (2 Scholars from Cohort 2, 8 Scholars from Cohort 3, and 13 Scholars from Cohort 3). There were 12 active Scholars in Fall 2023 and Year 5 ended with 8 active Scholars.

Professional development events in Year 5 included panel discussions with NIU S-STEM alumni, workshops from NIU Career Services and about elevator pitches, a discussion of salary expectations, and a site visit to Argonne National Laboratory. Designed in collaboration with an educational psychologist, the weekly peer group primarily provided social-emotional support.

Collectively these and other activities were intended to promote Scholars' academic and professional development, educational attainment (e.g., persistence, graduate school), and professional opportunities (e.g., jobs in government or industry).

BELONG in STEM is funded by a grant from the National Science Foundation's Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program.

II. EVALUATION OVERVIEW

A faculty member in the Educational Research, Evaluation, and Assessment program within NIU's College of Education evaluated project implementation and impact. The goals of the evaluation were to: 1) document participation of BELONG in STEM Scholars in program activities; 2) estimate the impact of program activities on the Scholars; and 3) provide periodic feedback to the PI/co-PIs to improve project design and implementation (e.g., recruitment procedures, program offerings).

The Year 5 evaluation addressed Scholar characteristics; Scholar attendance and attrition; and the professional development, peer group, and outreach program activities. In addition to required program activities, the Year 5 evaluation also documented Scholar participation in optional, but encouraged, activities including undergraduate research and internships.

As our reporting period centers around the calendar year, the present findings capture Cohort 2-4's experiences during the Spring 2023 academic semester, and Cohorts 3-4's experiences during the Fall 2023 semester. However, as this is the final year the evaluation also provides an overall evaluation of the project. This includes a summary of all Scholars and their characteristics during the five-year period. In addition, the evaluation also reports evidence for

¹ A surplus of scholarship monies was available during Year 5 because many Scholars graduated in fewer than the budgeted three years. Thus, in Fall 2023 the project provided additional scholarship support (up to \$10,000 for the year) for those students with a still-unmet need cost of attendance. One Scholar was also experiencing financial hardship. Additional scholarship monies remained available to support Scholars continuing into the project's no-cost extension period.

Scholar growth using an existing measure of psycho-social factors relevant to STEM education (Findley-Van Nostrand & Pollenz, 2017). The evaluation also presents overall data on Scholar perceptions of the impact of the program and Scholar academic performance data compared to those of an academic peer group at NIU.

The primary data source for the evaluation was electronic surveys of the Scholars. All surveys were reviewed by PI/co-PIs to ensure coherence with the project and program. Incentives were provided for Scholar participation in surveys to maximize response rates; response rates for the two surveys primarily used for the Year 5 evaluation were 82% in Spring 2023 and 67% in Fall 2023. A brief survey was also administered to S-STEM major Department Chairs and Advisors in Year 5 concerning the broader impacts of the BELONG in STEM program at NIU, however the response rate was extremely low ($N=3$).²

During Summer 2023 in Year 5, a follow-up survey was also distributed to 28 Scholars who had graduated in December 2022 or prior. The survey sought to solicit information about Scholars' academic and/or professional trajectories since completing the BELONG in STEM Scholars Program, including information about publications or presentations produced, or other accomplishments, awards, or honors. While the response rate was low (36%), the collected data were used to supplement other data maintained on Scholars and is incorporated where appropriate in the present report. An additional follow-up survey will be administered during the no-cost-extension year before project closeout.

The evaluation also relied on informal interviews with PI/Co-PIs, documents/artifacts (e.g., meeting agendas, notes, e-mails), and institutional warehouse data as available. The evaluator attended all project meetings and took field notes concerning topics discussed and implementation challenges, and liaised with NIU's Office of Institutional Effectiveness.

Quantitative evaluation data were primarily analyzed using descriptive statistical analyses and graphical methods, and qualitative data (i.e., open-ended survey responses) were primarily analyzed for patterns or themes using the constant comparative method (Glaser & Strauss, 1967).

III. EVALUATION FINDINGS

A. Evaluation of Program in Year 5

1. Scholar Attendance, Graduation, and Attrition

The evaluation leveraged attendance/participation data collected by program personnel. Attendance of general, professional development, and peer group events were tracked during Year 5.

Table 1 contains attendance data. The attendance rate for the peer group meetings ranged from 57-100% (the average peer group attendance rate was 84%). Students were allowed one absence from the professional development events and up to two absences from the peer group

² For those indicating they did have a basis for judgment, 100% indicated that the BELONG in STEM program had at least "a little" impact on each of the following: recruiting students, retaining students, exposing students to STEM careers, professions, and employers; facilitating students' engagement in research experiences; facilitating students' engagement in internship experiences; increasing students' professional skills (e.g., collaboration, leadership); facilitating students' acquisition of STEM jobs; and facilitating students' enrollment in STEM graduate programs.

meetings each semester. Absences from peer group meetings for academic and career activities were also permitted.

During Year 5, 8 Scholars graduated in Spring 2023, 1 Scholar graduated in Summer 2023, and 4 Scholars graduated in Fall 2023. In Year 5, one Cohort 4 Scholar changed their major to education before the Spring 2023 semester and withdrew from the BELONG in STEM Scholars program; and another Cohort 4 Scholar transferred out of NIU. One Cohort 3 Scholar did not return for Fall 2023. Year 5 ended with 8 active Scholars.

Table 1: Scholar Attendance

Event	N	%
General events	-	-
End-of-year event on May 5, 2023 ³	11 (of 21)	52
Welcome event on August 25, 2023 ⁴	-	-
Professional development events	-	-
Spring 2023	-	-
Fireside Chat: Redacted (optional)	-	-
Panel Discussion: NIU S-STEM Alumni	19 (of 23)	83
Workshop: NIU Career Services	13 (of 23)	57
Workshop: Elevator Pitches	8 (of 21)	38
Fall 2023	-	-
Discussion: Salary Expectations	9 (of 12)	75
Site Visit: Argonne National Laboratory	6 (of 12)	50
Peer Group meetings	-	-
Spring 2023	-	-
Week 1	-	-
January 16, 2023 (9)	-	-
January 18, 2023 (5)	5	100
January 19, 2023 (7)	7	100
Week 2	-	-
January 23, 2023 (9)	9	100
January 25, 2023 (4)	4	100
January 26, 2023 (7)	5	71
Week 3	-	-
January 30, 2023 (9)	8	89
February 1, 2023 (4)	3	75
February 2, 2023 (7)	6	86
Week 4	-	-
February 6, 2023 (9)	9	100
February 8, 2023 (4)	3	75
February 9, 2023 (7)	4	57
Week 5	-	-
February 13, 2023 (9)	9	100

³ End-of-year event was optional.

⁴ Welcome event was cancelled.

February 15, 2023 (4)	3	75
February 16, 2023 (7)	7	100
Week 6	-	-
February 20, 2023 (9)	8	89
February 22, 2023 (4)	4	100
February 23, 2023 (7)	6	86
Week 7	-	-
February 28, 2023 (9)	7	78
March 1, 2023 (4)	4	100
March 2, 2023 (7)	6	86
Week 8	-	-
March 7, 2023 (9)	7	78
March 8, 2023 (4)	-	-
March 9, 2023 (7)	4	57
Week 9	-	-
March 14, 2023 (9)	-	-
March 15, 2023 (4)	-	-
March 16, 2023 (7)	-	-
Week 10	-	-
March 21, 2023 (9)	7	78
March 22, 2023 (4)	3	75
March 23, 2023 (7)	6	86
Week 11	-	-
March 28, 2023 (9)	6	67
March 29, 2023 (4)	4	100
March 30, 2023 (7)	4	57
Week 12	-	-
April 4, 2023 (9)	8	89
April 5, 2023 (4)	-	-
April 6, 2023 (7)	6	86
Week 13	-	-
April 11, 2023 (9)	6	67
April 12, 2023 (4)	4	100
April 13, 2023 (7)	4	57
Week 14	-	-
April 18, 2023 (9)	9	100
April 19, 2023 (4)	4	100
April 20, 2023 (7)	5	71
Week 15	-	-
April 25, 2023 (9)	7	78
April 26, 2023 (4)	3	75
April 27, 2023 (7)	5	71
Week 16	-	-
May 2, 2023 (9)	8	89
May 3, 2023 (4)	4	100
May 4, 2023 (7)	6	86

Week 17		
May 9, 2023 (9)	8	89
May 10, 2023 (4)	4	100
May 11, 2023 (7)	-	-
Fall 2023	-	-
September 11, 2023 (12)	12	100
September 18, 2023 (12)	11	92
September 25, 2023 (12)	9	75
October 2, 2023 (12)	12	100
October 9, 2023 (12)	8	67
October 17, 2023 (12)	10	83
October 24, 2023 (12)	9	75
October 31, 2023 (12)	10	83
November 7, 2023 (12)	10	83
November 14, 2023 (12)	8	67
November 21, 2023 (12)	11	92
November 28, 2023 (12)	8	67
December 5, 2023 (12) ⁵	-	-
December 12, 2023 (12)	9	75

2. Welcome Event

A welcome event was planned for Friday, August 25, 2023 from 11:00 AM to 1:00 PM to feature introductions by project personnel, a description of program expectations (e.g., professional development and peer group activities), an introduction to research and evaluation activities, a question-and-answer session, and a group photo. However, this event was cancelled due to project team scheduling conflicts, familial obligations, and illness.

3. End-of-Year Event

An optional, face-to-face end-of-year event was held in NIU's Heritage Room at the end of the 2022-23 academic year on Friday, May 5, 2023 to recognize program graduates from both Spring 2023 and Fall 2022. The event featured a recognition of each graduate, a presentation of superlatives, breakout groups reflections, and opportunities to socialize. Graduates were also presented with BELONG in STEM cords to wear at commencement. A lunch was provided.

4. Professional Development

The professional development component of the BELONG in STEM Scholars program involves workshops and other events focused on professional skill development, career preparation, and networking. Held approximately monthly, this component is led by Dr. Hagen.

⁵ Peer group meeting cancelled due to illness.

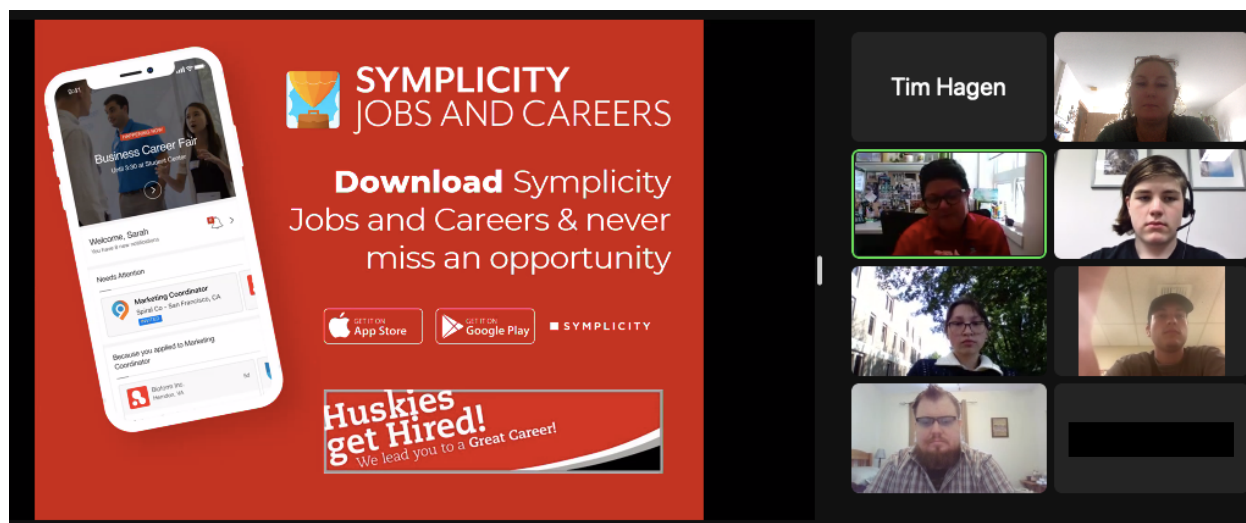
A Graduate Assistant ([Redacted]) assisted with coordination of and communications regarding the professional development events.

The Year 5 evaluation documented the number and nature of professional development events. In Spring 2023, there were four such events:

- i. **Fireside Chat:** [Redacted] – Friday, January 27, 2023 11:00AM-1:00PM - Zoom - [Redacted] is the Division Director for the Materials Research office at the National Science Foundation. She was retiring and hosted a farewell fireside chat on January 27th. She shared her thoughts and advice on navigating an early career in science. [Redacted] is an Alumnus of NIU. This was an optional professional development meeting held on Zoom, and was recorded for later viewing.
- ii. **Panel Discussion: NIU S-STEM Alumni** – Friday, February 3, 2023 3:00-4:30PM – Zoom - A panel of NIU Alumni from the S-STEM program shared their various experiences and offered advice, including how they positioned themselves for the next steps in their professional career, getting a job, and going to graduate or professional school. The session used Zoom and utilized break-out rooms, which allowed the panelists to meet with Scholars in a more private and interactive manner, and Scholars were encouraged to bring questions. The diverse group of panelists are below:
 - ☐ [Redacted], Geologist at Omya Mining in Alabama
 - ☐ [Redacted], Software Engineer 2 at Grainger
 - ☐ [Redacted], Professional STEM Tutor at Kishwaukee College
 - ☐ [Redacted], Chemistry Ph.D. Student at University of Wisconsin—Madison
 - ☐ [Redacted], Neelyx Labs
 - ☐ [Redacted], Anesthesiology Student at Medical College of Wisconsin
 - ☐ [Redacted], AbbVie
 - ☐ [Redacted], Volunteer Department Head at Pre-Health Shadowing
 - ☐ [Redacted], Quality Control Operations Leader at TAAG Genetics
 - ☐ [Redacted], Veterinary Student at the University of Missouri
 - ☐ [Redacted], Instructor at Proximity Learning
 - ☐ [Redacted], Physics Graduate Student at Northern Illinois University; Argonne National Laboratories
 - ☐ [Redacted], EMT, Advanced Medical Transport; preparing for MCAT
- iii. **Workshop: NIU Career Services** - Friday, March 3, 2023 3:00-4:30PM - 125 Altgeld Hall - An interactive and engaging in-person workshop with NIU Career Services included the following: 10-minute overview of how Career Services can students; 35-minute workshop

about resume writing; 15-minutes peer review activity; and a 15-minute question and answer activity. Participants were instructed to bring their resumes to allow on-the-spot editing., led by [Redacted], Interim Director, and [Redacted], Career Advisor, NIU Career Services.

Figure 1: Screenshot of Workshop with NIU Career Services



- iv. **Workshop: Elevator Pitches** - Friday, April 14, 2023 3:00-4:30PM - 304 Lowden Hall - [Redacted], The Mike and Kristina McGrath Professor of Entrepreneurship from NIU's College of Business facilitated an interactive in-person workshop on perfecting one's elevator pitch.

Figure 2: Photo of Workshop about Elevator Pitches



In Fall 2023, there were two professional development events:

- i. **Discussion: Salary Expectations** - Friday, September 22, 2023 3:00-4:30PM – 125 Altgeld Hall - [Redacted], NIU Alumni and Vice President Research & Innovation at McCormick Flavor Solutions & FONA International, joined Scholars for an in-person professional development event about entry-level job salaries. [Redacted] helped answer questions about the important and sensitive topic of salary expectations and how salary discussions arise during the application and interview processes. In addition, Professor Hagen collected a significant amount of data from the various S-STEM department chairs and NIU Career services that he shared at this meeting.

Figure 3: Photo of Discussion about Salary Expectations



- ii. **Site Visit: Argonne National Laboratory** - Friday, October 20, 2023
8:30-3:30PM - Lemont, IL - Scholars visited Argonne National Laboratory to learn about the Department of Energy (DOE) complex and Argonne's mission science research. Scholars explored Argonne's campus and research facilities, networked with Argonne researchers and engineers across the many different STEM disciplines, learned about summer and year-round research opportunities for undergraduate students, and connected with current and past interns. The event was coordinated with the Laboratory's *First Look@Argonne – A STEM Recruitment Event for Underrepresented Groups Conference*. Transportation was provided.

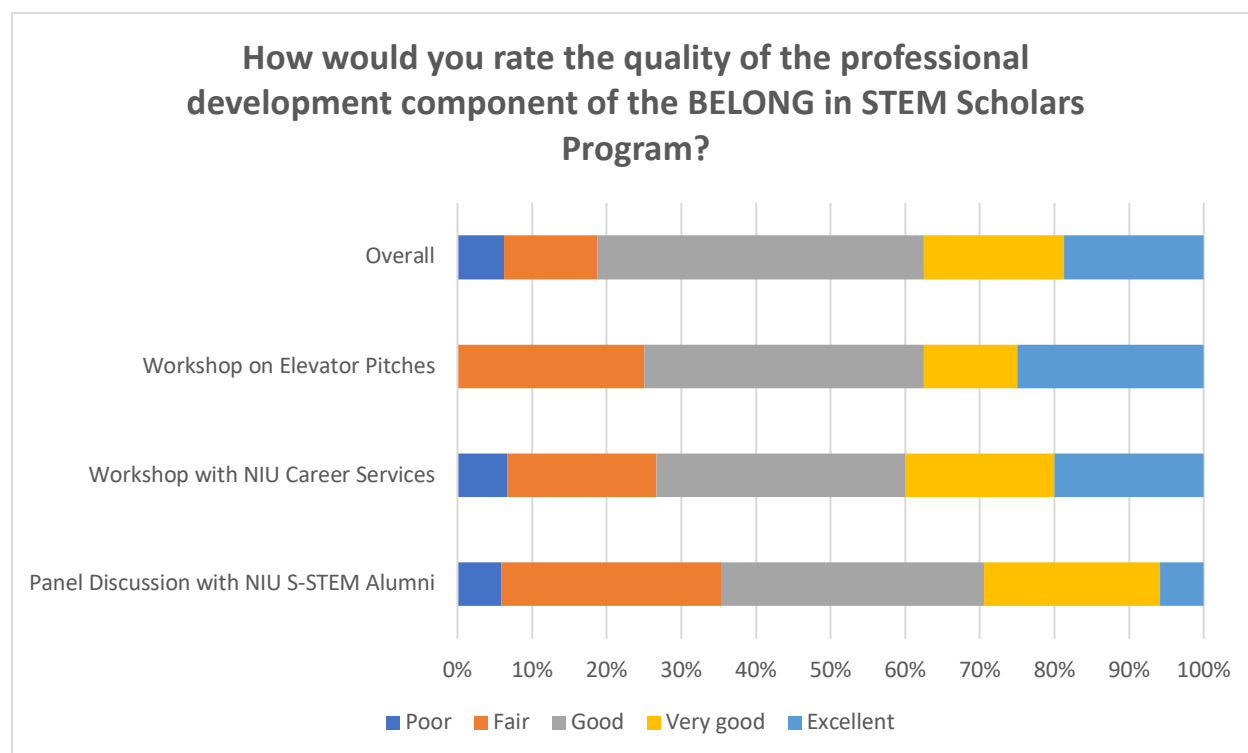
Figure 4: Photos of Site Visit at Argonne National Laboratory



There were regular communications, reminders, and calendar invites about the professional development events in Year 5. Scholars were encouraged or required to develop or submit questions in advance of professional development events, which were then supplied to panelists. As in Years 1-4, Scholars received an attendance note to give to their professors in case of a course scheduling conflict.

The Year 5 evaluation also solicited information from Scholars about the implementation and quality of the professional development component in Spring 2023, including barriers or challenges. Figure 5 presents the distribution of quality ratings ($Ns=8-17$) for this component. The percentage of respondents who responded that the Spring 2023 professional development component of the program overall was “Good,” “Very good,” or “Excellent” was 81%. For each of the three individual professional development events, these percentages ranged from 65 to 75%.

Figure 5: Distribution of Quality Ratings for Spring 2023 Professional Development Component

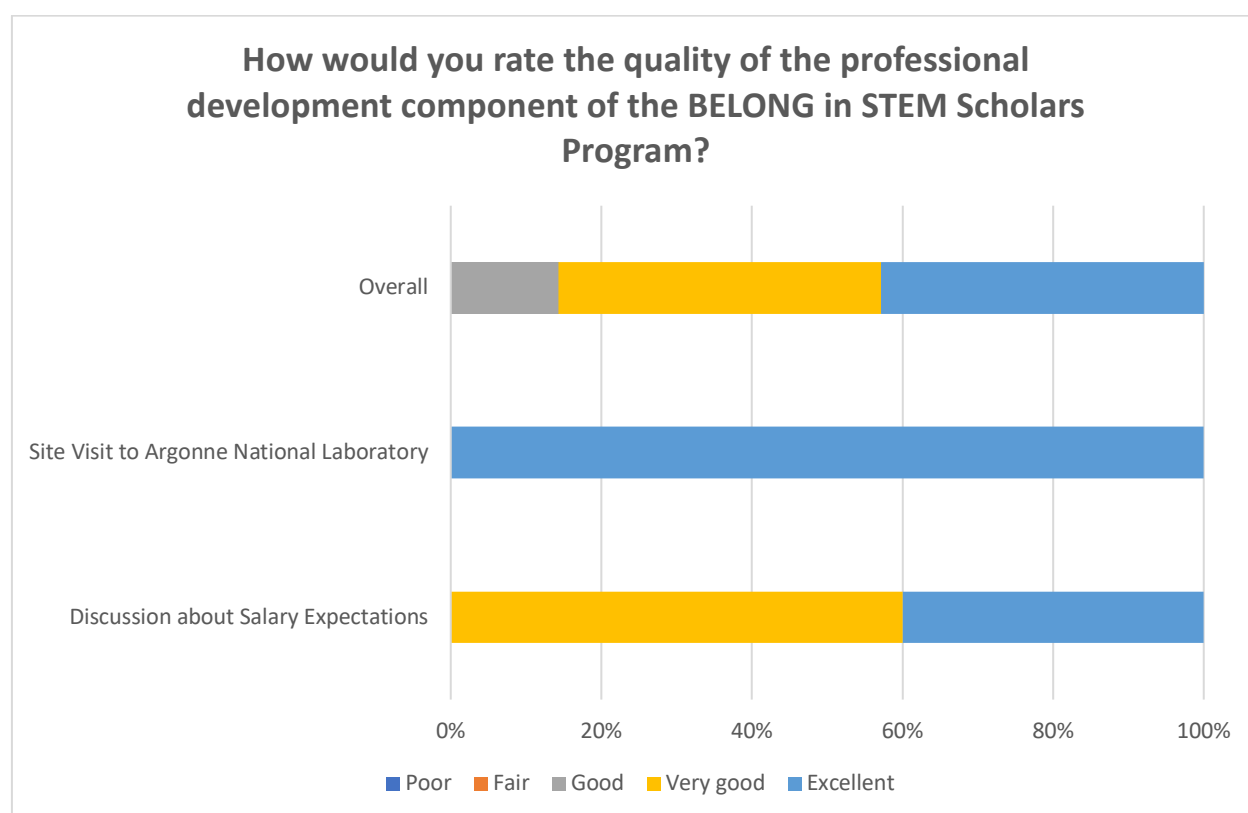


The BELONG in STEM Scholars were asked on the Spring 2023 survey to “Briefly indicate any problems, challenges, or barriers associated with the professional development component of the BELONG in STEM Scholars Program. Or write ‘None.’” Six Scholars provided substantive responses. Three Scholars mentioned the design of interactions during professional development sessions (e.g., “[stay away] from break-out rooms and [do] more of Ann open Q&A as a big group,” “talking to the alumni in an unstructured way led to plenty of silent time and awkward conversations”, “at times there was silence and not as meaningful interaction”). Another Scholar commented on the recurring challenge of making the sessions relevant for all Scholars (e.g., students of different majors).

The BELONG in STEM Scholars were also asked in Spring 2023 to “Briefly provide any other comments you have about the professional development component of the BELONG in STEM Scholars Program. Or write ‘None.’” Four Scholars provided substantive responses. Two Scholars commented favorably on specific activities, namely field trips to NIU research labs and companies such as Thermo Fischer Scientific. Two others commented on scheduling (i.e., “I would suggest weighing the schedule more toward the beginning of the semester”) or access issues (i.e., “it would have been nice to have remote access to all of them”).

The Year 5 evaluation also solicited information from Scholars about the implementation and quality of the professional development component in Fall 2023, including barriers or challenges. Figure 6 presents the distribution of quality ratings ($Ns=5-6$) for this component. The percentage of respondents who responded that the professional development component of the program overall was “Good,” “Very good,” or “Excellent” was 100%. For each of the three individual professional development events, these percentages were 100%.

Figure 6: Distribution of Quality Ratings for Fall 2023 Professional Development Component



Similar open-ended data were collected in Fall 2023 but responses were limited to four Scholars. Three of these four responses offered generally positive feedback about the professional development events (e.g., “I enjoyed learning about different careers in STEM,” “I like seeing how my classroom learning objectives can be applied in real life”). Two positive responses also specifically mentioned the site visit to Argonne National Laboratories (e.g., “connect with real researchers at Argonne,” “we learned about x-ray crystallography in my biochemistry class and we ended up touring the protein biology lab at Argonne”).

One challenge related to the professional development component was offering professional development events that were of relevance to Scholars of different majors and at different points in their academic trajectories. Another challenge was the arrangement of face-to-face site visits (e.g., with national labs or other employers) due to transportation, security, or public health issues. There were also some attendance issues associated with the professional development events in Year 5.

A small number of professional development events will be planned and implemented for Spring 2024, emphasizing preparation of Scholars for post-graduation (e.g., resume development, cover letter writing)

5. Peer Group

The peer group component of the BELONG in STEM Scholars program involves weekly meetings to provide a space for building connections among fellow peers. This component is led by the Graduate Assistants [Redacted] (Y1), [Redacted] (Y2-3), [Redacted] (Y2-5), and [Redacted] (Y4-5)].

The structure of this group was developed through collaboration with educational psychologist, Dr. Daryl Dugas. The group's weekly meetings were constructed as primarily social-emotional support and while academic issues may have been brought up by students during group meetings, the focus of these meetings was not driven by particular academic goals. As examples, peer group sessions addressed topics such as aspirations, supports available from NIU Counseling and Consultation Services, values, and desired lifestyles. Scholars also participated in social, stress-relief activities such as bowling and playing board games. During Year 5, the peer groups continued to serve to identify students experiencing personal or academic challenges or crises.

In Spring 2023, three peer groups comprising Cohorts 2, 3, and 4 Scholars met weekly on different days/times, continuing from Fall 2022. Program personnel retained peer group composition from semester to semester to preserve community, though the meeting times changed slightly to accommodate schedules. Each group featured a mix of individuals from different cohorts, and when possible, no Scholar was the only one of a given major in a particular group. One Scholar change peer groups early in the Spring 2023 semester, and another stopped attending peer groups shortly into the semester.

There were several students who did not participate in the Spring 2023 peer groups for various reasons (e.g., inconsistent attendance, personal) that in the judgement of Co-PI Dugas warranted them not participating.

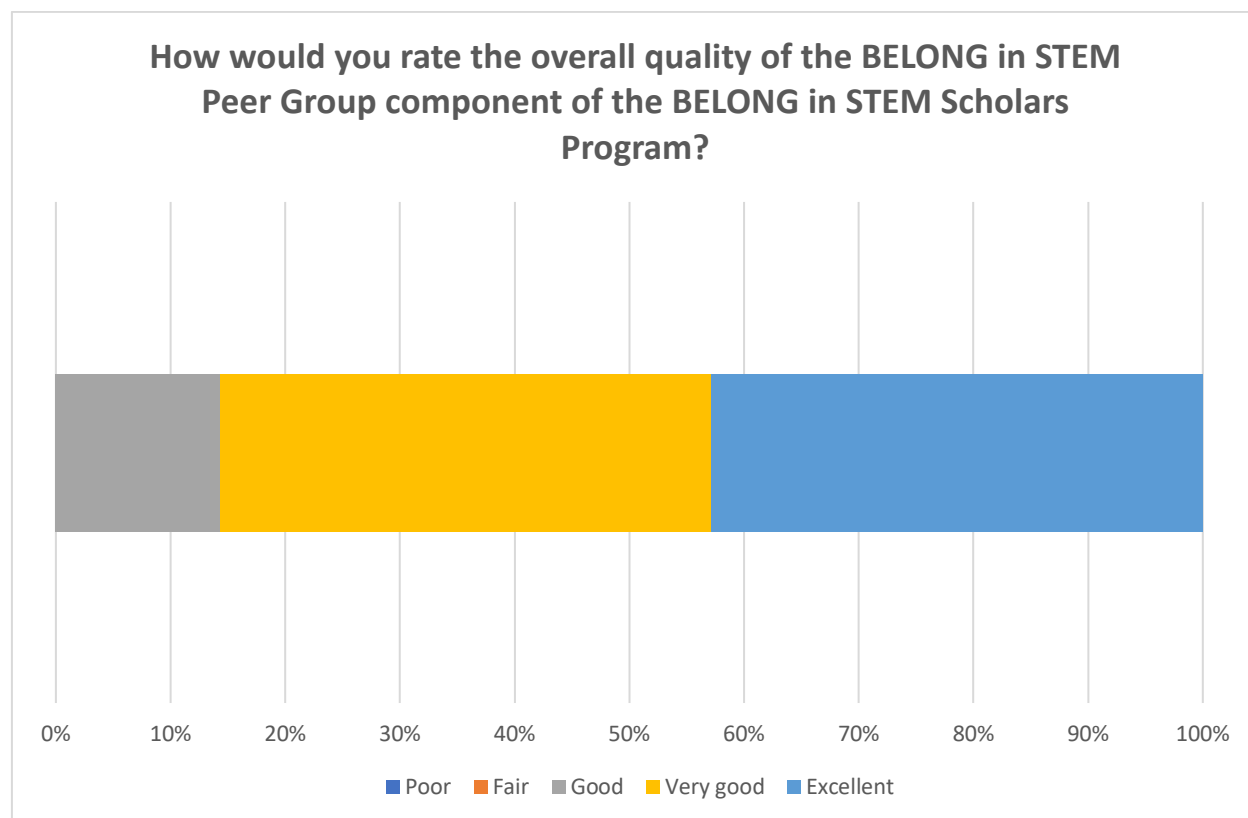
In Fall 2023, there was a single peer groups which met weekly. The Fall 2023 peer group featured a mix of majors. The final peer group meeting of the Fall 2023 featured a celebration of program graduates. Only [Redacted] facilitated peer groups in Fall 2023.

During Year 5, all Scholars who participated in the peer groups were again given a OneCard credit to pay for a meal prior to or after peer-group meetings and were encouraged to sit together in the Holmes Student Center Café to enjoy their meals and socialize together.

The Year 5 evaluation also solicited information from Scholars about the implementation and quality of the peer group component in Fall 2023, including barriers or challenges. Figure 7 presents the distribution of quality ratings ($N=7$) for this component. The percentage of

respondents who responded that the peer group component of the program overall was “Good,” “Very good,” or “Excellent” was 100%.

Figure 7: Distribution of Quality Ratings for Peer Group Component



Open-ended data collected from Scholars via the end-of-Fall 2023 were limited to three responses. However, one pattern in these responses pertained to how the peer groups promoted connections or friendships among students (2 responses).

There were also some peer group attendance challenges in Year 5.

The peer group component of the program will continue to support remaining Scholars through May 2024 during the project’s no-cost extension.

6. Outreach

The outreach component of the BELONG in STEM Scholars program involves participation in outreach, volunteer, or service activities. During Year 5, program personnel formally communicated at least two distinct outreach activities to Scholars: a podcast survey related to environmental change and sustainability; and the Huskies BELONG summer camp for high school students with disabilities (paid and unpaid).

Based on data gathered at the end of the Fall 2023 semester, an estimated 57% of Scholars participated in some form of outreach, volunteer, or service activity during 2023. Twenty-nine percent indicated volunteering in medical settings (e.g., hospitals) and 29% indicated

participating in other outreach, volunteer, or service activities. One such Scholar indicated that they served actively as Chair of the Northern Illinois University Student Chapter of the Association for Computing Machinery (ACM).

7. PI/Co-PI Check-Ins

The PI/Co-PI check-in component of the BELONG in STEM Scholars program involves semesterly meetings between each S-STEM Scholar and a PI/Co-PI. In general, Scholars checked in with the same PI/Co-PI each semester. In Year 5, the check-ins remained standardized in terms of topics discussed:

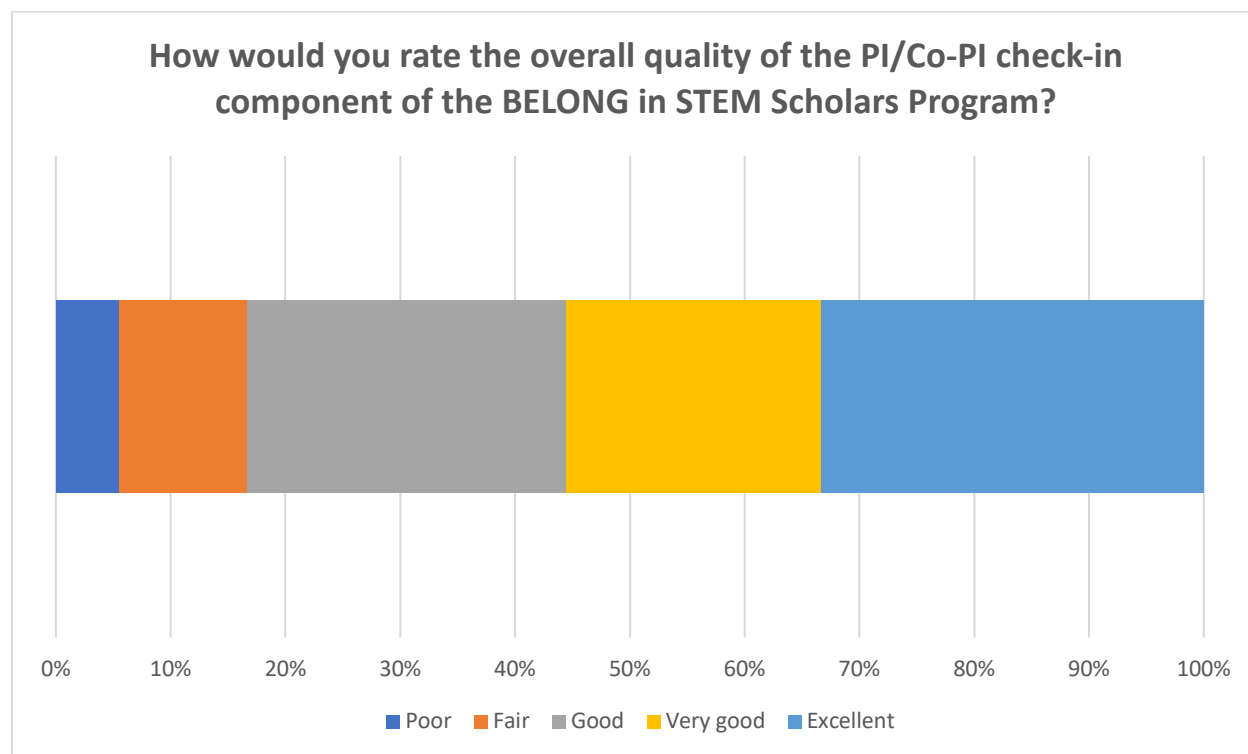
- ☐ What is your major or any changes to your major?
- ☐ Did you transfer from a community college or were you an NIU student previously?
- ☐ Any issues maintaining a 3.0 GPA?
- ☐ Anticipated graduation date and are you on track?
- ☐ What classes are you taking this semester?
- ☐ How are they going for you?
- ☐ Additional comments

During Spring 2023, 21 of 22 (95%) of Cohorts 2, 3 and 4 completed a semesterly check-in with PI Wheeler or Co-PI Hagen, either virtually or via e-mail (one unresponsive individual was transferring institutions). Some PI/Co-PI check-ins were completed electronically via email in lieu of a one-on-one. These check-ins identified limited academic challenges among some Scholars, but special intervention was deemed unnecessary.

During Fall 2023, 10 of 12 (83%) of Cohorts 2, 3, and 4 completed a semesterly check-in with PI Wheeler or Co-PI Hagen face-to-face, synchronously online, or via e-mail. Two students were contacted for a PI/Co-PI check-in but were unresponsive. Project staff reported some challenges responding to issues arising within PI/Co-PI check-ins as programmatic responses sometimes necessitated involvement of other actors or units (e.g., department or general education course stakeholders, Disability Resource Services).

The evaluation also solicited information from Scholars about the implementation and quality of the PI/Co-PI check-in component in Spring 2023, including barriers or challenges. 94% of Cohorts 2, 3, and 4 indicated in Spring 2023 that they had had a check-in meeting with the PI/Co-PI “once per semester or more frequently.” Figure 8 presents the distribution of quality ratings ($N=18$) for this component. The percentage of Cohorts 2-4 Scholars who responded that the PI/Co-PI check-in component of the program was “Good,” “Very good”, or “Excellent” was 83%.

Figure 8: Distribution of Quality Ratings for PI/Co-PI Check-In Component



Cohorts 2, 3, and 4 of BELONG in STEM Scholars were also asked on an evaluation survey in Spring 2023 to “Briefly indicate any problems, challenges, or barriers associated with the PI/Co-PI check-in component of the BELONG in STEM Scholars Program. Or write ‘None.’” Only one substantive response was provided, which centered on two issues: the difficulty of finding time to schedule a PI/Co-PI check-in, and the relevance of the discussions for upper-level undergraduate students (although this individual’s response also noted that the PI/Co-PI check-ins might be useful for some Scholars).

PI/Co-PI check-ins will be implemented in Spring 2024 with the remaining Scholars during the project’s no-cost extension.

8. Internships

Internships are an optional, but encouraged, component of the BELONG in STEM Scholars program. For context, our best estimate of Scholar *intent* to participate in an internship during the BELONG in STEM Scholars program is that 44% of Scholars intended to do so (based on data collected from active Scholars in Spring 2021).

During Year 5, program personnel formally communicated two distinct internship opportunities: the URA-Fermilab Program: Undergraduate Women in STEM, sponsored by the Universities Research Association (URA) (paid); Technology Commercialization Internship at the Illinois Science and Technology Coalition (ISTC) with the DOE’s National Lab system via Evergreen Climate Innovations. In Year 5, several professional development sessions partly

addressed internships, including participation in Argonne National Laboratory's *First Look@Argonne – A STEM Recruitment Event for Underrepresented Groups Conference*.

The Year 5 evaluation also documented participation in internships among active Cohort 2, 3, and 4 Scholars in Spring 2023. Of 18 respondents, four (22%) indicated that they had applied for, been accepted to, or participated in an internship. Three Scholars provided specifics as to their internship activities during Year 5:

- ☐ A Scholar applied to and served as a Spring 2023 Learning Assistant for [Redacted]'s BIOS 208 course that yielded internship credit for BIOS 490
- ☐ A Scholar completed a paid internship at Hamra Enterprises in the area of information technology/computer science
- ☐ A Scholar applied to multiple internship opportunities in the areas of software engineering and Android mobile development, including at Aldi, which yielded one interview

No major challenges were noted for this component.

9. Undergraduate Research Experiences

Undergraduate Research Experiences (UREs) are another optional, but encouraged, component of the BELONG in STEM Scholars program. For context, our best estimate of Scholar *intent* to participate in undergraduate research during the BELONG in STEM Scholars program is that 83% of Scholars intended to do so (based on data collected from active Scholars in Spring 2021).

During Year 5, program personnel only communicated to Scholars information about one URE: a paid student research program opportunity at Thermo Fisher (Summer Science Research Program 2023).

The evaluation documented participation in UREs for active Cohorts 2-4 Scholars in Spring 2023. Of 18 respondents, 5 (28%) indicated that they had applied for, been accepted to, or participated in an Undergraduate Research Experience (URE) in Year 5:

- ☐ Undergraduate research with [Redacted] in NIU's Biological Sciences Department on parasites in ducks
- ☐ Undergraduate research with [Redacted] in NIU's Biological Sciences Department
- ☐ Undergraduate research with [Redacted] in NIU's Biological Sciences Department on antimicrobial resistance spread
- ☐ Undergraduate research with [Redacted] in NIU's Earth, Atmosphere, and Environment Department
- ☐ Undergraduate research with [Redacted] in NIU's Biological Sciences Department on production of biofuel with algae

In Year 5, a Scholar received a grant from NIU to conduct undergraduate research. In addition, Scholars working with [Redacted] and [Redacted] in NIU's Earth, Atmosphere Department completed Senior Theses. Scholars working with [Redacted] in NIU's Biological Sciences Department and [Redacted] in NIU's Curriculum and Instruction Department also presented at the 2023 NIU Conference on Undergraduate Research and Engagement.

No major challenges were noted for this component.

10. Other Activities

Project personnel continued to use a Blackboard site to house documents and post resources and opportunities, including the Scholar contract and other program documents; contact information; schedule of meetings and events; jobs, internships, graduate school, and other opportunities; NIU resources and events, and photos.

In Year 5, Scholars were availed various job-related information and opportunities. Scholars were sent information about: summer field, laboratory assistant, and permanent positions at the Northwest Mosquito Abatement District (NWMAD) in Wheeling, Illinois; a paid student research program opportunity at Thermo Fisher (Summer Science Research Program 2023); a Research Chemist position at the National Center for Agricultural Utilization Research, Bio-Oils Research (BOR) Unit in Peoria, Illinois (paid); Huskies BELONG summer camp for high school students with disabilities (paid and unpaid).

Continuing and new Scholars were sent information about upcoming NIU Career Services events, including a virtual Career Fair Prep Workshop, a virtual All-Majors Internship and Job Fair, and a virtual Education job Fair. Information about the 2022-23 NIU Week of Welcome events were also disseminated to Scholars. An opportunity to have professional headshots taken by NIU Institutional Communications was also communicated to the Scholars.

Specific communications around internships, research experiences, outreach, and professional development are noted in the respective sections of this report.

In Year 5, three Scholars were selected to attend the inaugural S-STEM Scholars Meeting being held September 14-16, 2023 in Washington, DC, hosted by the AAAS S-STEM Resource and Evaluation Center (REC). However, only one Scholar attended and Dr. Wheeler spent a significant portion of one meeting day with this Scholar. One Scholar was unable to attend due to work commitments.

B. Evaluation of Program Overall

1. Participation and Scholar Characteristics

There were 55 individuals who were selected for the program, 49 (89%) of whom persisted in the program and at NIU as of this writing; 33 of those 49 Scholars were current NIU students at program entry (67%) and 16 of were CC transfer students (33%). The target number of program participants overall of 46 was thus exceeded, though the program served a higher percentage of NIU students than originally intended (the anticipated ratio of NIU students to CC transfer students was 40:60). A total of 41 Scholars graduated during the five project years.

Scholars were socio-demographically and academically diverse. Students from seven eligible BELONG in STEM majors at NIU were represented (biological sciences, chemistry, biochemistry, computer science, and geology and environmental geosciences, mathematics, and physics). Only 55% self-identified as White; 10% identified as Black or African American, 18% self-identified as Hispanic/Latino and 31% self-identified as first-generation college students. Table 2 below broadly characterizes the set of 49 Scholars who persisted in the program and at NIU.

Table 2: Scholar Characteristics

Characteristic	N	%	-	N	%
Student type	-	-	Gender	-	-
NIU undergraduate student	33	67	Male	18	37
Community college transfer student	16	33	Female	30	61
-	-	-	Other	1	2
Age	-	-	-	-	-
19	14	29	Race	-	-
20	14	29	White	27	55
21	9	18	Black or African American	5	10
22	1	2	Asian	9	18
23	2	4	Two or more races	8	16
24	2	4	-	-	-
25	2	4	Ethnicity	-	-
26	2	4	Hispanic/Latino	9	18
28	2	4	Not Hispanic/Latino	40	82
36	1	2	-	-	-
-	-	-	Employment status	-	-
Native language	N	%	Yes, employed part time (1 to 34 hours per week)	25	51
English	39	80	Yes, employed full time (35 or more hours per week)	4	8
Not English	10	20	No	20	41
-	-	-	-	-	-
Major	-	-	Prior research experience	-	-
Biological Sciences	17	31	Yes	34	69
Chemistry	7	13	No	15	31
Biochemistry	7	13	-	-	-
Computer Science	11	20	First-generation college student status	-	-
Geology and Environmental Geosciences	4	7	Yes	15	31
Mathematics	7	13	No	34	69
Physics	2	4	-	-	-

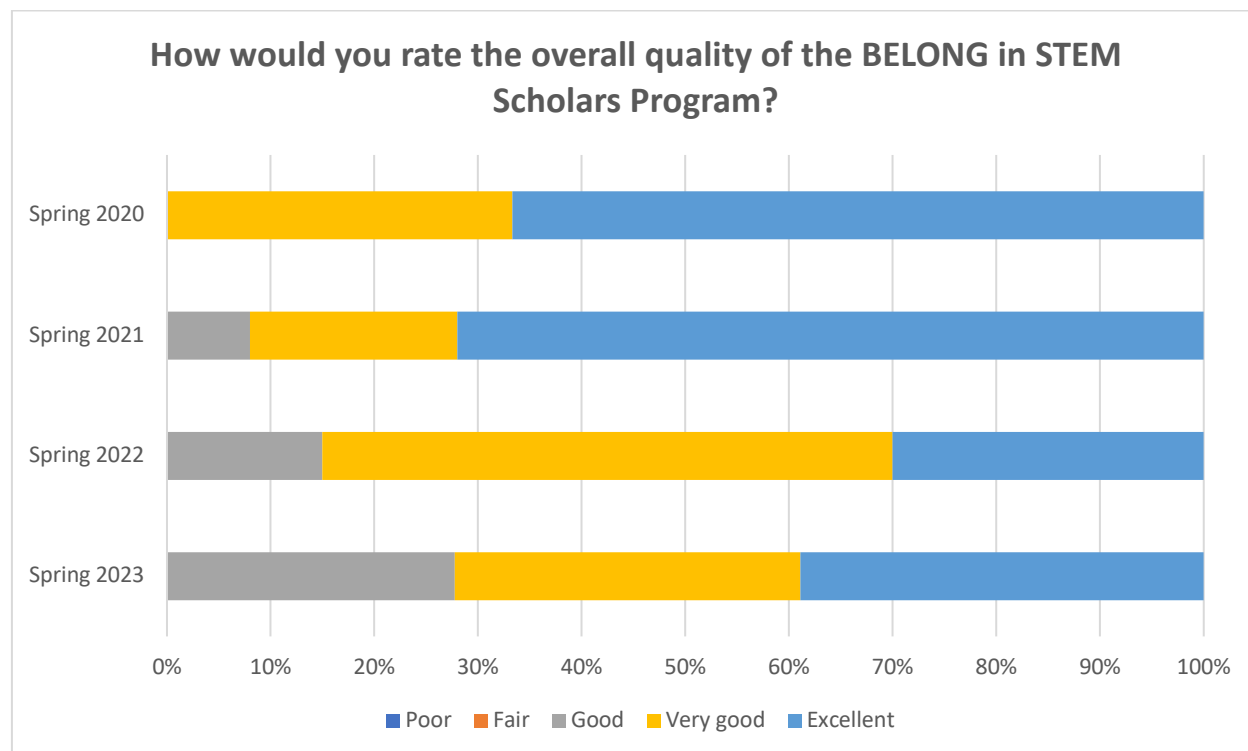
Note: Percentages may not sum to 100 due to rounding.

2. Program Quality

As in Years 2-4, the evaluation solicited information in Spring 2023 from Cohorts 2, 3, and 4 about the overall quality of the BELONG in STEM Scholars program. Figure 9 presents the distribution of quality ratings ($N=18$) for the program overall. The percentage of respondents who responded that the BELONG in STEM Scholars program was “Good,” “Very good”, or “Excellent” was 100%. For this Year 5 evaluation, equivalent data from Years 2 (Spring 2020), 3

(Spring 2021), and 4 (Spring 2022) are also included. The percentage of respondents who responded that the overall quality of the BELONG in STEM Scholars program was “Good,” “Very good”, or “Excellent” was 100% in all project years during which these data were collected.

Figure 9: Distribution of Quality Ratings for Program Overall



As in Years 2-4, Cohorts 2, 3, and 4 ($N=18$) also reported perceived outcomes of participation in the BELONG in STEM Scholars Program during Spring 2023. As shown in Table 3, the percentages of respondents indicating each of the 16 possible program outcomes ranged from 28% to 83%. In Year 5, the most commonly reported perceived outcomes were “Interaction with NIU peers,” “Interaction with NIU STEM faculty,” and “Increased knowledge of NIU STEM faculty.” The least commonly reported perceived outcomes were “Interaction with potential employers,” “Increased intention to attain STEM graduate degree at NIU,” and “Increased intention to attain STEM graduate degree outside of NIU.” For this Year 5 evaluation, equivalent data from Years 2 (Spring 2020), 3 (Spring 2021), and 4 (Spring 2022) are also included.

Table 3: Perceived Program Outcomes

Outcome	Percent			
	Spring 2020	Spring 2021	Spring 2022	Spring 2023
Interaction with NIU peers	100	92	85	83
Interaction with NIU STEM faculty	83	84	50	78
Increased knowledge of NIU STEM faculty	92	76	60	67
Increased knowledge of specific STEM content or topics	67	76	45	61
Increased professional skills (e.g., collaboration, leadership, or critical thinking)	92	84	55	61
Increased intention to attain STEM job after graduation	75	64	40	61
Increased knowledge of STEM disciplines or fields	83	80	45	56
Interaction with STEM experts outside of NIU	92	60	55	56
Support for academic achievement in courses	83	76	60	50
Increased knowledge of STEM careers, professions, and employers	100	80	65	50
Support for persistence through degree completion	83	84	65	44
Increased knowledge of STEM tools, methodologies, or techniques	50	36	30	39
Increased knowledge of interdisciplinary STEM work	75	60	30	39
Interaction with potential employers	58	44	35	33
Increased intention to attain STEM graduate degree outside of NIU	58	36	15	33
Increased intention to attain STEM graduate degree at NIU	25	32	15	28

Note: The question was: “As a result of participation in the BELONG in STEM Scholars Program, which of the following outcomes have you experienced? Please select all that apply.”

Also in Spring 2023, Cohorts 2, 3, and 4 were asked to “Please provide any other comments you have about the BELONG in STEM Scholars Program. Or write “None.” Four Scholars provided substantive responses. Three of these responses pertained to the scheduling or (for the peer group especially) time commitment required by events (e.g., “I don’t like that we have meetings during finals week,” “making to meetings a such was not easy or possible in most cases,” “[peer groups]... take away much needed time for homework after school and they are hosted so late in the day... [and] having the end oof year event... Ono reading day is really lame”). Three Scholars also provided generally positive feedback about the program (e.g., “I appreciated the staff of the program and my peers,” “I loved being a part of this,” “The peer group meetings every week have been beneficial to my mental health”).

3. Growth in Psycho-Social Factors

This section describes changes in the BELONG in STEM Scholars during the program vis-à-vis 10 psycho-social factors relevant to STEM education. Evaluation of growth relied on an existing self-report measure (Findley-Van Nostrand & Pollenz, 2017) that was administered at the beginning of the program and the end of each academic semester during which they were subsequently enrolled. The instrument is intended to measure various psycho-social factors including, but not limited to: academic self-efficacy for STEM, expectancy for STEM career, and science identity. The scales comprised between 4 and 10 items.

For 8 of the 10 scales, *higher* scores indicate more theoretically favorable levels of the respective factor; *Belonging in STEM: Desire to fade* and *Intention to leave STEM* are different in that *lower* scores are more theoretically favorable. Accordingly, the ideal situation would be increases in scores for most of the measures, and decreases in scores for the *Belonging in STEM: Desire to fade* and *Intention to leave STEM* measures.⁶

Table 4 presents means and standard deviations for each of 10 psycho-social factors assessed by Findley-Van Nostrand and Pollenz's (2017) instrument at each time point. All Scholars, including those who ultimately dropped out of the program or NIU, are included in these estimates. Before discussing growth across the three time points, it is notable that at program entry there was limited variation in some item and thus scale measures. In particular, Scholars generally already scored "high" on several of the scales for which higher scores are more favorable, and already scored "low" on one of the two scales for which lower scores are favorable. These initial values may constrain assessment of change.

Linear mixed-model growth analyses were conducted to examine growth in each psycho-social factor. These analyses provided evidence for growth in three psycho-social factors over the course of the program. First, there was statistically significant, positive growth over the course of the program in *science task self-efficacy*, $\beta(52.48)=.11, p<.01$. Second, there was statistically significant, positive growth in *science identity*, $\beta(45.69)=.08, p<.01$. Third, there was statistically significant, positive growth in *belonging to STEM: affect*, $\beta(35.43)=.10, p<.05$. In general the rate of growth was modest for all three psycho-social factors. The dearth of other statistically significant differences across time points may be due in part to the small sample size, limited statistical power, and/or initially high (or low) values.

⁶ Negatively-worded items were reverse-scored prior to analysis.

Table 4: Summary of Growth in Psycho-Social Factors

Scale		Time point					
		1: Program entry (n=55)	2: End of first fall semester (n=53)	3: End of first spring semester (n=47)	4: End of second fall semester (n=17)	5: End of second spring semester (n=21)	6: End of third fall semester (n=3)
Academic self- efficacy for STEM ^a	M	6.20	6.01	6.25	5.87	6.05	6.00
	SD	0.55	0.67	0.51	0.77	0.70	0.66
Science task self- efficacy ^a	M	5.32	5.30	5.67	5.19	5.53	5.67
	SD	0.91	1.16	0.94	1.22	0.63	0.73
Science identity ^a	M	5.42	5.41	5.74	5.33	5.76	5.80
	SD	1.11	1.19	0.99	1.21	1.02	1.06
Expectancy for STEM career ^a	M	6.47	6.25	6.39	6.44	6.61	6.33
	SD	0.75	0.91	0.68	0.62	0.49	1.15
Belonging to university ^a	M	5.33	5.33	5.32	5.40	5.42	5.50
	SD	0.99	1.05	0.96	1.21	1.22	1.64
Belonging to STEM: Membership ^a	M	5.56	5.67	5.73	5.41	6.01	5.25
	SD	1.17	1.16	1.18	1.29	0.85	1.64
Belonging to STEM: Acceptance ^a	M	5.24	5.36	5.45	5.28	5.44	5.53
	SD	1.08	1.09	1.11	1.01	0.89	1.40
Belonging to STEM: Affect ^a	M	4.67	4.79	4.89	4.51	5.13	4.25
	SD	1.15	1.29	1.05	1.29	1.01	0.63
Belonging to STEM: Desire to fade ^b	M	2.50	2.44	2.38	2.54	2.15	2.58
	SD	1.32	1.34	1.14	1.48	1.37	1.13
Intention to leave STEM ^b	M	1.57	1.78	1.43	1.42	1.49	2.14
	SD	0.70	1.11	0.56	0.56	0.60	0.99

Note: The item response format was a 7-point agreement scale: 1=*Strongly disagree*, 2=*Disagree*, 3=*Somewhat disagree*, 4=*Neither agree nor disagree*, 5=*Somewhat agree*, 6=*Agree*, and 7=*Strongly agree*. Scale scores were computed as the mean of the corresponding item responses.⁷ ^aHigher scores are more theoretically favorable. ^bLower scores are more theoretically favorable.

⁷ All items administered with same response format and prompt, exactly as they were published in Findley-Van Nostrand and Pollenz (2017), except that we added “I feel confident in my ability to” ahead of the 6 science-task self-efficacy items.

4. Comparison of Scholar and NIU Academic Peer Outcomes

The Year 5 evaluation compared Cohorts 1, 2, 3 and 4 of the BELONG in STEM Scholars' academic outcomes to those of several academic peer groups at NIU. Specifically, each cohort's last-available grade point average (GPA) and graduation status were compared to comparable figures for all STEM majors, all junior and senior STEM majors, as well as both continuing and transfer STEM majors who met the BELONG in STEM eligibility criterion for graduate point average.

As can be seen in Table 5, all BELONG in STEM Scholar cohorts had higher grade point averages and completed their degrees at higher rates than did all STEM majors, all junior and senior STEM majors, as well as continuing and transfer STEM majors. For example, after three years 100% of Cohort 1 had completed their degrees whereas the corresponding comparison group figures varied from 69-83%. The average last-available GPA for Cohort 1 was 3.66 whereas the corresponding comparison group figures ranged from 2.89 to 3.05.

Table 5: Comparison of BELONG in STEM Cohort Scholar and NIU Academic Peer Outcomes

Group	Count	Average GPA	Percent Degree Completed
Cohort 1 (Entry Fall 2019)	-	-	-
S-STEM (Cohort 1)	12	3.66	100%
All STEM Majors	1511	2.98	69%
Junior and Senior STEM Majors	940	3.05	83%
Continuing STEM Majors	1053	3.02	77%
New Transfer STEM Majors	241	3.00	69%
Cohort 2 (Entry Fall 2020)	-	-	-
S-STEM (Cohort 2)	14	3.52	93%
All STEM Majors	1465	2.89	56%
Junior and Senior STEM Majors	867	3.06	79%
Continuing STEM Majors	1018	3.05	70%
New Transfer STEM Majors	210	2.66	48%
Cohort 3 (Entry Fall 2021)	-	-	-
S-STEM (Cohort 3)	12	3.61	67%
All STEM Majors	1472	2.82	38%
Junior and Senior STEM Majors	812	3.08	65%
Continuing STEM Majors	983	2.98	52%
New Transfer STEM Majors	198	2.84	22%
Cohort 4 (Entry Fall 2022)	-	-	-
S-STEM (Cohort 4)	12	3.68	33%
All STEM Majors	1554	2.86	18%
Junior and Senior STEM Majors	830	3.02	32%
Continuing STEM Majors	1008	2.98	27%
New Transfer STEM Majors	184	2.61	0%

Note. Data obtained from Northern Illinois University's Office of Institutional Effectiveness. Average GPA is average of last-available GPA at NIU as of October 2023.

5. Summary of Scholar Achievements

Below are highlights of BELONG in STEM Scholar achievements during the project.

Internships

- ☐ Hamra Enterprises
- ☐ Nevada Gold Mines
- ☐ Nokia
- ☐ Discover Financial Services
- ☐ Thermo Fisher Scientific

- ☐ Argonne National Laboratory (multiple)
- ☐ Raytheon (offer)
- ☐ Disney (offer)

Jobs

- ☐ Research Aide for Physics Division, **Argonne National Laboratory**
- ☐ Research Scientist I, Protein Biology, **Thermo Fisher Scientific**
- ☐ Certified Nursing Assistant, **Silver Cross Hospital**
- ☐ Associate Scientist I, Process Chemistry, **AbbVie**
- ☐ Clinical Informatics Specialist, **Oak Street Health**
- ☐ Geologist, **Omya Mining**
- ☐ Medical Assistant, **Northern Illinois Foot & Ankle Specialists**
- ☐ Pharmacy Technician, **Jewel Osco**
- ☐ Mathematics Teacher, **Somonauk High School**
- ☐ Chemistry Teacher, **Aldeen Hebron High School**
- ☐ Online Teacher, **Proximity Learning**
- ☐ Mathematics Teacher, **Belvidere North High School**
- ☐ Professional STEM Tutor, **Kishwaukee College**
- ☐ Mainframe Systems Engineer, **Northwestern Mutual Insurance**
- ☐ Software Engineer, **Grainger**
- ☐ Emergency Medical Technician, **Advanced Medical Transport**
- ☐ Lab Analyst & Quality Control Operations Leader, **TAAG Genetics**
- ☐ Environmental Educator, **Red Oak Nature Center**
- ☐ Research & Development Lab Technician, **Tate & Lyle**
- ☐ PCR Lab Technician & Research Coordinator, **Neelyx Labs**
- ☐ Volunteer Department Head, **Pre-Health Shadowing**
- ☐ Credit Analyst, **Wintrust Financial Corporation**
- ☐ Medical Scribe, **Carle Health**
- ☐ Clinical Medical Assistant, **Midwest Cardiovascular Institute**
- ☐ Software Engineer, **Chamberlain Group**
- ☐ Fisheries Technician, **Illinois Natural History Survey**

Graduate School

- ☐ Acceptances
 - Johns Hopkins University
 - Brown University
 - Loyola University
 - University of Chicago
 - Northwestern University
 - University of Illinois—Chicago
 - University of Illinois—Urbana-Champaign
 - University of Wisconsin—Madison (multiple)
 - University of Minnesota—Twin Cities

- University of North Carolina—Chapel Hill
- University of California—San Diego
- University of Washington—Seattle
- Roosevelt University
- University of Arizona
- Washington University in St. Louis
- Purdue University (multiple)
- George Mason University
- University of Connecticut
- Virginia Tech

□ Attendances

- University of Chicago
- University of Wisconsin—Madison
- University of Michigan—Ann Arbor
- Medical College of Wisconsin
- Northern Illinois University
- University of Missouri—Columbia
- Roosevelt University
- Medical College of Wisconsin

6. Dissemination

To shed light on broader impacts, the evaluation documented dissemination processes, including efforts to disseminate findings in peer-reviewed scholarly journals, engagement of students in these efforts, and other dissemination activities (e.g., presentations to higher education faculty or administrators) and products. Dissemination activities were assisted by several NIU graduate students, including the Graduate Research Assistants and several College of Education students.

i. **Year 1**

1. Drs. Wheeler, LaDue, and Hagen presented an invited poster entitled “*BELONG in STEM: An educational partnership between Northern Illinois University and the NSF*” at a reception of the Coalition for National Science Funding in Washington, DC (April, 2019). Among the attendees were U.S. House member from Illinois Dr. Bill Foster and Dr. Diane Souvaine, Chair of the National Science Board (policy advisors for the National Science Foundation).
2. **Redacted**, Dr. LaDue, and Dr. Dugas presented a talk entitled “*Demystifying Theoretical Frameworks for a Study of Persistence in STEM*” at a meeting of the Geological Society of America in Phoenix, AZ (September, 2019).
3. Dr. LaDue presented an invited poster entitled “*Preparing the Next Generation of STEM-literate Citizens*” at the Northern Illinois University Congressional Poster Session and Reception for U.S. lawmakers, which in part addressed the BELONG in STEM Scholars program, in Washington, DC (March, 2019).

4. **Reeves, T. D. (2019).** *Annual report on the evaluation of the BELONG in STEM Scholars program: Year 1.* DeKalb, IL: Educational Technology, Research and Assessment Dept., Northern Illinois University.
https://www.researchgate.net/publication/353830087_Annual_Report_on_the_Evaluation_of_the_BELONG_in_STEM_Scholars_Program_Year_1

i. **Year 2**

1. **Redacted** presented a talk entitled “Qualitative Perspectives on the Strange Trails of Persistence in STEM” at a meeting of the Northern Illinois University Geology and Environmental Geoscience Graduate Colloquium seminar series in DeKalb, IL (February, 2020).
2. **Redacted**, Master’s Thesis, “Qualitative Perspectives on the Strange Trails of Persistence in STEM,” Geology and Environmental Geosciences, Northern Illinois University, 2020
<https://www.proquest.com/openview/825728c445964a889bec81d45105978c/1?pq-origsite=gscholar&cbl=18750&diss=y>
3. **Redacted**, Dr. Nicole LaDue, and Dr. Daryl Dugas submitted a manuscript entitled “Strange Trails: A Case Study of a Social Support Group Promoting Undergraduate STEM Students’ Persistence” to *Journal of Diversity in Higher Education* (August, 2020).
4. **Reeves, T. D. (2020).** *Annual report on the evaluation of the BELONG in STEM Scholars program: Year 2.* DeKalb, IL: Educational Technology, Research and Assessment Dept., Northern Illinois University.
https://www.researchgate.net/publication/353830143_Annual_Report_on_the_Evaluation_of_the_BELONG_in_STEM_Scholars_Program_Year_2

i. **Year 3**

1. Dr. Tim Hagen prepared and posted an online video presentation entitled “Building Engagement in Laboratories, Networking and Peer Groups (BELONG) in STEM Scholars Program” for the American Association for the Advancement of Science’s 2021 Virtual S-STEM Fall Forum (September/October, 2021).
2. Dr. Hagen was invited by the Co-Director and Coordinator of Oakton Community College’s Center for Promoting STEM to present about the BELONG in STEM Scholars program, research and internship opportunities (presentation to occur in January or February 2022).
3. The PIs shared lessons learned during the BELONG and STEM Program as part of an institutional self-study. The self-study was conducted to explore the possibility of submitting a proposal for the Howard Hughes Medical Institute (HHMI) Driving Change (DC) initiative.
4. **Reeves, T. D. (2021).** *Annual report on the evaluation of the BELONG in STEM Scholars program: Year 3.* DeKalb, IL: Educational Technology, Research and Assessment Dept., Northern Illinois University.

https://www.researchgate.net/publication/357222544_Annual_Report_on_the_Evaluation_of_the_BELONG_in_STEM_Scholars_Program_Year_3

i. **Year 4**

1. Dr. Tim Hagen attended the 2022 AAAS S-STEM Symposium in Washington, DC from September 29th to October 1st, 2022.
2. Dr. Nicole LaDue presented a poster “Peer groups as a mechanism to build social support for STEM majors from low-income backgrounds” co-authored with Dr. Dugas and two graduate students (Redacted and Redacted) at a geoscience education conference for practitioners (Earth Educators’ Rendezvous July 2022) in Minneapolis, MN.
3. GRA Redacted presented at the 2022 Annual Meeting of the Society for the Advancement of Biology Education Research (SABER July 2022) in Minneapolis, MN, a poster entitled “Using peer groups to improve sense of belonging in high-achieving, low-income STEM students during the COVID-19 pandemic” and co-authored with Dr. LaDue, Dr. Dugas, and two graduate students (Redacted and Redacted).
4. GRA Redacted presented an oral presentation entitled "Investigating sense-of-belonging in a scholarship program for high-achieving, low-income science and math students" and co-authored with Dr. LaDue, Dr. Dugas, and two graduate students (Redacted and Redacted) at the 2022 Geological Society of America (GSA) Connects annual meeting in Denver, CO.
5. Reeves, T. D. (2022). *Annual report on the evaluation of the BELONG in STEM Scholars program: Year 4*. DeKalb, IL: Educational Technology, Research and Assessment Dept., Northern Illinois University.
https://www.researchgate.net/publication/366595801_Annual_Report_on_the_Evaluation_of_the_BELONG_in_STEM_Scholars_Program_Year_4

i. **Year 5**

1. Three manuscripts were in preparation or under consideration by peer-reviewed journals at this writing. The statuses of these manuscripts are below:
 - a. A paper based on the thesis of a prior Graduate Research Assistant was being minorly revised for resubmission to a journal:
 - i. LaDue, N.D., Redacted, & Dugas, D. (accepted October 2023, pending minor revisions). “It just makes it feel like you're not alone”: A qualitative study of a social support group for high-achieving, low-income STEM majors. *Journal for STEM Education Research*. (Impact Factor: 1.3)
 - b. A paper led by a Graduate Research Assistant about BELONG in STEM Scholars’ sense of belonging was being revised for resubmission to a top-tier STEM education journal:

- i. [Redacted], LaDue, N.D., Dugas, D., [Redacted], & [Redacted], (in revision). ‘I feel listened to and heard’: How social support fosters a sense of belonging for low-income STEM majors. *Journal of Research in Science Teaching*. (Impact Factor: 4.6)
- c. A paper led by a Graduate Research Assistant about students' perceived challenges and supports while in the BELONG in STEM program was in preparation for submission to a journal in Spring 2024:
 - i. [Redacted], LaDue, N., Dugas, D., [Redacted], & [Redacted], (in preparation). Supporting low-income STEM students with financial, academic, and social support. To be submitted to: *The Journal of Higher Education* (Impact Factor: 3.1)
2. Data analyzed in relation to BELONG in STEM Scholars’ experiences during COVID may be written up during the no-cost extension year.
3. Dr. Ralph Wheeler presented a poster about the BELONG in STEM Scholars program entitled “Building Engagement in Laboratories, Networking and Peer Groups: BELONG in STEM Scholars Program” at the American Chemical Society Southwest Regional Meeting symposium on “Diversity in Chemistry and STEM” in Oklahoma, November, 2023.
4. Information about the BELONG in STEM Scholars Program was provided for inclusion in the American Association for the Advancement of Science (AAAS) Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) Resource & Evaluation Center’s (REC) 2023 report entitled “STEM Students & Their Sense of Belonging: S-STEM Programs’ Practices & Empirically Based Recommendations.”

IV. CONCLUSIONS

This section summarizes evaluation findings during Year 5 and overall. Across five program years, 55 Scholars were selected for the BELONG in STEM program. Forty-nine (89%) persisted in the program and at NIU, 33 of which were current NIU students at program entry (67%) and 16 of which were CC transfer students (33%). The program served a higher percentage of NIU students than originally intended (the anticipated ratio of NIU students to CC transfer students was 40:60). A total of 41 Scholars graduated during the five project years.

The Scholars were socio-demographically and academically diverse. Students from seven eligible BELONG in STEM majors at NIU were represented. Only 55% self-identified as White; 10% identified as Black or African American, 18% self-identified as Hispanic/Latino and 31% self-identified as first-generation college students.

100% of Scholars rated the BELONG in STEM Scholars program as “Good,” “Very good,” or “Excellent” in each project year. Scholars consistently indicated a variety of perceived outcomes, most notably “Interaction with NIU peers,” “Interaction with NIU STEM faculty,” “Increased knowledge of NIU STEM faculty,” “Increased knowledge of STEM careers, professions, and employers,” and “Increased professional skills (e.g., collaboration, leadership, or critical thinking).” Modest but positive growth was observed in Scholars for three psychosocial factors over the course of the program: science task self-efficacy, science identity, and affective belonging to STEM. All BELONG in STEM Scholar cohorts had higher grade point

averages and completed their degrees at higher rates than did several other academic peer groups.

Key challenges in Year 5 included Scholar attendance issues vis-à-vis the peer groups and professional development events, administrative delays in scholarship and/or incentive distribution, and programmatic responding to Scholar academic or personal challenges that involved other actors or units (e.g., department or general education course stakeholders, Disability Resource Services). General challenges during the project included recruitment of eligible community college transfer students, incomplete applications, making professional development relevant to Scholars of different majors and at different points in their academic trajectories, and encouraging outreach participation among Scholars.

V. RECOMMENDATIONS

This section outlines a set of recommendations for project personnel to advance project transportation and portability.

A. Scholar Recruitment and Selection

1. Archive all BELONG in STEM recruitment and selection processes, procedures, and mechanisms to support: sustainability and institutionalization of program; preparation for future programming or grant projects; and/or transportation and portability of program model to external higher education stakeholders.

B. Programmatic Issues

1. Archive all BELONG in STEM programmatic procedures and documents to support: sustainability and institutionalization of program; preparation for future programming or grant projects; and/or transportation and portability of program model to external higher education stakeholders.

C. Other

1. Disseminate overall research and evaluation findings to external academic audiences via peer-reviewed presentations and publications, higher-education practitioners, and NIU community stakeholders (e.g., other Colleges or STEM departments).
2. Archive all research and evaluation instrumentation, data, and other products.
3. Consider devising plan for longer-term follow-up with Scholars after project closeout, including collection of sustainable contact information via the evaluation follow-up survey.

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VII. REFERENCES

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