

Evaluation of the First2 Network

Year 5

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I. Executive Summary

Since its launch in 2016, the First2 Network has served as a valuable West Virginia alliance to improve the early persistence of rural, first-generation science, technology, engineering, and mathematics (STEM) students in their programs of study. The network was established to help address a continuing problem identified by research, namely that attrition from STEM majors is most likely to occur during students' first 2 years of college and that first-generation students in STEM disciplines face considerable obstacles to their college success. Given that 70% of adults in the state do not have a postsecondary degree, many West Virginia STEM students matriculating to college are likely to be the first in their families to attend.

The First2 Network is supported by a National Science Foundation (NSF) grant under a program called Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES). The INCLUDES program supports projects that improve access to STEM education and career pathways, particularly for groups that are underrepresented in STEM.

1.1 Context in Which the First2 Network Operates

The context in which the First2 Network operates has remained consistent since the launch of the initiative. West Virginia continues to be poorer, less diverse, and less educated than the nation overall. West Virginia is still designated as an Established Program to Stimulate Competitive Research (EPSCoR) state, one indicator of limited STEM capacity. Despite these challenges, new efforts to improve and support STEM education have emerged since the grant's inception. Policymakers passed several STEM education bills during the 2022 legislative session; a new bill passed in 2023 will expand dual enrollment programs for high school students to earn college credit, a move that may impact the STEM pipeline in future years.

However, 33% of the state's 55 counties are considered *distressed*, with high unemployment, low per-capita income, and high poverty rates, while 22% are at risk of economic distress. Looking at educational achievement data, reading, math, and science performance on the West Virginia General Summative Assessment increased slightly from 2022 to 2023. However, despite small increases during each of the past 2 years, these rates are below the achievement levels prior to the coronavirus disease 2019 (COVID-19) pandemic. Nonetheless, the state boasts several new efforts to improve STEM education, and the state Department of Education also has partnered with West Virginia University (WVU) to offer professional development and other supports for computer science instruction in the state's schools.

1.2 First 2 Network Structures and Processes

The First2 Network includes 1,002 members, an increase of 15% from the 866 reported in Year 4. Students comprise 324 of the membership (33%), nearly identical to the Year 4 rate of 32%. Faculty/staff membership remained fairly stable at 30% in Year 5.

Overall, the network continued its efforts to establish and enhance a collaborative infrastructure, with data collection used to assess progress on these efforts. A survey of Steering Committee members produced several positive findings regarding the structure and processes of the program, as respondents found that, on most issues, the network fell into the range of "Making Progress" to "Fully Achieved." Steering Committee members who participated in a group interview indicated that having members from each institutional team serve on the Steering Committee helped promote a greater understanding of activities taking place across

the state, and broader Steering Committee membership has created more networking opportunities for staff.

In their surveys, institutional team members offered positive perceptions about the First2 Network and progress made by the respective teams, especially in supporting students. Feedback from team members who participated in site-specific interviews showed that members gained more understanding of how their teams are functioning—both within their respective team and across the First2 Network. Working within their respective institutions also led to a greater connection to students.

Two challenges were common across institutions—navigating the First2 Network website and responsibilities related to carrying out and documenting Plan-Do-Study-Act (PDSA) efforts. These results are based on feedback from four or five team members per site.

Group interviews with institutional team members highlighted several key themes across sites. For example, one member focused on how institutional teams are strengthening the connections within campuses and making the First2 work more relevant or aligned with individual responsibilities. In addition, interviewees from one site focused on having more interaction among faculty and students and more opportunities for students to focus on and be more involved with STEM, thereby creating a strong environment to support student achievement.

Participants also offered positive feedback to the two First2 Network conferences held during Year 5. The networking, industry panels, and keynote sessions received particularly high marks, and respondents cited scheduling/pacing issues as the main areas for improvement.

1.3 Systems Targeted by the First2 Network

Participants generally found that working on institutional teams resulted in a stronger connection to their student populations and greater alignment to their individual responsibilities. Each campus was charged with developing its capacity internally, which occasionally presented challenges but supported goals to establish broad participation and standardized processes. For example, at West Virginia University Institute of Technology (WVU Tech), members tried to recruit at least one faculty member from each department to seek to boost awareness about the team's STEM activities. Efforts at WVU Tech and other institutions also were bolstered by additional funding provided by a recent award to First2 to support institutional teams. Students cited high levels of involvement in First2 student clubs, internships, and working group PDSA activities.

In addition, findings from the Network Value Survey supported the value added by the institutional teams. For example, compared to prior years, members more strongly agreed that they are seeing evidence of improvement based on several data points, including STEM program persistence rates. Given this collaborative approach, student members stay engaged and value their participation as a way to promote institutional change. Members also said they gained insight and access to relevant information and people through their participation.

Backbone activities focused primarily on developing improvement science practices to support institutional team capacity and sustainability. This work provided support for institutional teams to complete PDSAs and submit to institutional review boards for use of shared data.

Students valued the connections, colleagues, and collaborative network available through the First2 Network. Some also described an increased sense of STEM identity, gaining a better

understanding and confidence related to their STEM experience and career. Faculty members cited a positive impact in understanding PDSA and its tools and resources provided through the network, with a particularly strong effect to support better teaching and course structure. Members also expressed an increased understanding of student needs and voices, particularly regarding students from rural, first-generation backgrounds.

Assessing a networking and community-building activity among respondents, 90% of students agreed or strongly agreed that they valued these activities greatly. Students said they made connections with colleagues around shared goals and interacted with students or student groups as contributing network members. In addition, nearly 3 or 4 non-student member respondents believed that the network could help them gain access to professional relationships that change their perspective or understanding. Overall, despite some changes in the structural elements of the network as evidenced by new institutional agreements and resources targeted at institutional team needs, both student and non-student members reported movement in their level of value of the network. Specifically, agreement levels nearing or above 3.0 out of a 4.0 scale indicated their use of knowledge or skills obtained through the network, and students agreeing that they observed evidence of improvement in the key student outcomes the network is pursuing. Finally, all members also agreed in how they reflected anew on what it takes to achieve systems change.

1.4 Impact of the First2 Network

Social network analysis (SNA) survey data showed that the First2 Network continues to become more collaborative year after year, with a higher level of collaboration engagement on this issue among members overall. Students also reported more involvement with PDSA activities compared with earlier years, and participants believed the degree of student voice in the network was sufficient.

Focus groups revealed that students most often joined the First2 Network for the research opportunities and the financial compensation. Participants noted the network's focus on leadership opportunities for students as well as the student-centric nature of the network.

Most interview participants who participated in a summer 2022 internship said the experience met or exceeded their expectations. Students generally perceived that the internship had improved their confidence with STEM coursework and that it continued to impact progress in their major.

Students also have filled a variety of roles within the network and were able to detail responsibilities for each role and organize those roles in a hierarchical manner. For instance, participating in campus clubs; participating in summer immersion experiences as interns; serving as research scholars; serving in a campus club leadership role; and serving as a director. Asked to make suggestions, students recommended more outreach at both the high school and college levels to make other students aware of network opportunities.

Overall, data showed that First2 Network students persisted in their STEM programs at higher rates than both their first-generation and non-first-generation peers at WVU. The persistence rate for First2 Network first-time freshmen who consented to tracking was 71%, and the rate for sophomores and higher classes was 72%. Both rates are above corresponding rates for first-generation and non-first-generation students at WVU between 2005 and 2018. However, Pell grant-eligible STEM students' 55% rate on STEM readiness was below the 70% rate for non-Pell

students. Pell-eligible STEM students also had a lower persistence rate than non-Pell students (77% versus 85%), and a lower graduation rate (18% versus 28%).

STEM persistence and graduation rates varied for each cohort of first-time First2 Network freshmen who had provided consent for tracking. For the fall 2021 cohort, 78% persisted to the second year of college; for the fall 2022 cohort, 71% continued for another year of study. Graduation rates were available for the fall 2019 and fall 2020 cohorts, who posted completion rates of 50% and 75%, respectively. Other students either switched to a non-STEM major, transferred to another institution, or dropped out of college.

2. Recommendations

Based on the findings in this report, the evaluation team offers these recommendations going forward:

Continue building on coaching and onboarding support for new institutional team members and student directors. The First2 Network onboarding process for members drew the lowest-rated marks in the Institutional Team Survey. In their comments, several respondents cited the need for improvement in student onboarding, with one suggesting a “strict, developed process” to bring students into the program. Enhanced communication processes also can contribute to improvement. In addition, network members cited the need for continued attention to the mentoring/coaching component, given challenges in scheduling and carrying out PDSAs.

Offer continued support on building data infrastructure so institutional teams can accurately and securely track progress both with students and members. The network in Year 5 developed an implementation process on key PDSA strategies with the help of a full-time data liaison supported by a mentor. This effort promoted coordinated efforts across members within the same institutions and should serve as a model for other data collaboration work going forward. Some students remarked that documents sometimes had contradictory instructions, and building consistency in data and communication may help address these comments.

Continue clarifying the plans for transitioning into a nonprofit entity and build buy-in on that new infrastructure moving forward. This work is essential for sustainability of the First2 Network, and transition efforts need to include extensive buy-in from institutional teams, including students. Examining best practices in the network to date also can help ensure that the new entity integrates effective policies and approaches from the beginning.

Devote time and resources to amplifying student needs and voices for the future of First2 and research opportunities. Students reported more involvement with PDSA activities compared with earlier years, and most believed the student voice in the network was sufficient. However, some students continued to offer suggestions to reduce confusion at various junctures in the program, and leaders must continue to examine these suggestions to strengthen the student voice.

Continue to focus on celebrating the changes and resources secured to better support and engage institutional team members and help them coordinate what they do on their campuses. The transition to institutional teams has been generally smooth, with gains cited by both faculty and students. Network leaders should continue to support this transition and document effective practices and strategies to help other institutions in the future.

II. Introduction

First funded in 2016, the First2 Network is a West Virginia alliance seeking to improve the early persistence of rural, first-generation science, technology, engineering, and mathematics (STEM) students in their programs of study. The First2 Network was established as a means by which to address a troubling problem identified by research, namely that attrition from STEM majors is most likely to occur during students’ first 2 years of college.ⁱ Research also suggested that first-generation students—whose parents did not attend college—majoring in STEM disciplines face considerable obstacles to their college success.ⁱⁱ Accurate estimates of how many West Virginia students could be characterized as first generation are difficult to obtain. However, given that fully 70% of adults in the state do not have a postsecondary degree, many West Virginia STEM students matriculating to college are likely to be the first in their families to attend.

ICF serves as the external evaluator for the First2 Network. The evaluation employs a longitudinal, multimethod design to understand the project from various stakeholder perspectives and via an array of data collection and analysis techniques.

This report summarizes evaluation findings from the project’s fifth year, with data collected from October 2022 through July 2023.

1. Overview of the First2 Network

The First2 Network is supported by a 5-year National Science Foundation (NSF) grant from the program called Inclusion across the Nation of Communities of Learners of Underrepresented Discoverers in Engineering and Science (INCLUDES). The INCLUDES program supports projects that improve access to STEM education and career pathways, particularly for groups that are underrepresented in STEM. The network was one of the first 37 such projects, which were 2-year design and development launch pilots to develop prototypes for new models that broaden STEM participation.

In 2018, following completion of the 2-year design and development launch pilot, the First2 Network was awarded one of five grants to expand pilot projects into alliances. Alliances are collective impact projects, bringing together programs, people, organizations, technologies, and institutions to achieve results at scale, providing new research and leveraging NSF’s broadening participation investments. In its role as an INCLUDES-funded alliance, First2 Network facilitates collaboration

among university STEM faculty, rural first-generation STEM undergraduates, National Laboratories STEM professionals, state department of education staff, informal STEM educators, and industry representatives, among others, to study and address the problem of undergraduate attrition in STEM majors that occurs during the first 2 years of college.

To achieve its aim, and in addition to pursuing a collective impact approach, the First2 Network employs improvement science tools and processes, such as developing driver diagrams to

First2 Network Lead Organizations

The following organizations were awarded NSF INCLUDES collaborative grants to broaden the participation of underrepresented groups in STEM by improving persistence rates among rural, first-generation college students in STEM programs of study:

- Green Bank Observatory
- Fairmont State University
- West Virginia University
- High Rocks Educational Corporation
- West Virginia Higher Education Policy Commission

conceptualize how to address dimensions of the problem at hand, and Plan–Do–Study–Act (PDSA) cycles to test improvements.

Another hallmark of the First2 Network is its adherence to the principle that students—those with the lived experience of barriers to STEM persistence—should inform the search for ways to improve STEM persistence. Given this commitment, network students serve in network leadership roles (as Steering Committee members, institutional team members, campus club leaders, mentors, directors, and co-chairs), participate as full peers in PDSA working groups, and conduct outreach to STEM-interested students at their former high schools and to state legislators. In addition, students have opportunities to participate in authentic STEM research experiences for the purposes of building students’ STEM knowledge and skill and enabling students to experience the practice of STEM.

Based in West Virginia, this project reflects increasing state needs for STEM workers and increasing concern that the often rural and first-generation college students in the state may struggle to complete their programs of study. Key First2 Network activities include:

- Facilitating institutional teams¹ to iterate and study improvements to practices and programs using improvement science processes and tools (current topics include summer immersive STEM experiences, faculty–student engagement, and college transition, among others).
- Facilitating additional, sometimes ad hoc, teams or committees to address important emerging issues (such as the ongoing First2 Measurement Team).
- Integrating students into First2 Network leadership and facilitating a student leadership group in which students test improvement strategies.
- Conducting early STEM experiences for rural, first-generation STEM students via summer research internships while simultaneously subjecting such internships to PDSAs to continuously improve them.
- Operating a support network, including campus clubs, for students.
- Facilitating a STEM ambassadors program component to prepare students to return to their home communities to engage younger students’ interest in STEM and to harness teachers’ and school board members’ support for STEM education, and to engage with legislators and other state education leaders about the network’s vision and efforts.

To implement these activities in the context of collective impact, the First2 Network provides several leadership and management structures listed here.

- Leadership Team: This team consists of principal investigators and representatives from the five lead institutions—Green Bank Observatory, Fairmont State University, West Virginia University, High Rocks Educational Corporation, and the West Virginia Higher Education Policy Commission (HEPC) Division of Science and Research (DSR)—as well as key subcontractors, such as SRI International.
- Steering Committee: This committee includes Leadership Team members, institutional team representatives, and students in First2 Network leadership roles.

¹ Institutional teams were operationalized this year as First2 moved away from the working groups.

- **Backbone Organization (and its mentor):** To pursue ambitious goals across the cross-sector networks characteristic of collective impact projects, backbone organizations provide centralized coordination and support of day-to-day operations and implementation of collaborative work. In general, backbone organizations are responsible for (1) guiding vision and strategy, (2) supporting aligned activities, (3) establishing shared measurement practices, (4) building public will to solve a difficult problem, (5) advancing policy to remedy the problem in question, and (6) mobilizing funding. HEPC DSR serves as the First2 Network backbone organization. Because HEPC DSR has not previously undertaken such a role, however, SRI International is subcontracted to Fairmont State University to provide capacity-building and mentorship support to HEPC DSR.

III. Findings

This section summarizes analyses of data collected during Year 5 of the First2 Network. Data sources include the Steering Committee Survey, the Institutional Team Survey, the conference feedback form, and student focus groups.

1. First2 Network Context

1.1 Socioeconomic, Political, and Historical Context

The only state falling entirely within the federally designated Appalachian region, West Virginia is among the poorest states in the region based on U.S. Census Bureau data on poverty and median income.ⁱⁱⁱ Eighteen (or 33%) of the state's 55 counties are considered *distressed*, with high unemployment, low per-capita income, and high poverty rates; 12 (22%) are *at risk* of economic distress; and 24 (44%) are *transitioning* between strong and weak economies. Only one county ranks between the best 10–25% of the nation's counties and is considered *competitive*, or with a high likelihood to compete in the national economy.^{iv} Average per-capita income in 2021 was \$28,761,^v below the national average of \$37,638,^{vi} with 16.8% of the state population falling below the federal poverty line.^{vii} A quarter of the state's children under age 18 live in poverty and 16% of households are food insecure.^{viii} At the same time, while 88% of West Virginia residents 25 years of age and older are high school graduates,^{ix} in 2021, only 22% had a bachelor's degree and 69% lacked a postsecondary credential.^x In school year 2019–20, slightly more than half (51%) of public school students qualified for free/reduced-priced school meals.^{xi} While a variety of issues contribute to the state's social and economic woes, many can generally be characterized as resulting from a "resource curse." Appalachia's "resource curse" means the region is rich in natural resources but its people are, ironically, poorer on average than those in less resource-rich areas.^{xii} Factors contributing to this circumstance include industry manipulation of state policy and legislation to protect the interests of natural resource extraction (e.g., coal, timber), economic instability arising from cycles of economic boom and bust, low tax bases stemming from deals that limit corporate taxes, and the export of profits to the often out-of-state owners of industry.^{xiii}

The state is racially/ethnically homogenous compared to other states. With a 93% White population,^{xiv} only 4% of the population is Black, and 2% is Hispanic. In addition, the overall population in the state has decreased by 3% from 2010 to 2020. Of its 252,720 K–12 public school students,^{xv} 89% are White, 4% Black, and 2% Hispanic; 1% are English language learners (ELLs); and 22% are students with disabilities. More than half (51%) of the state population live in rural areas^{xvi} and 21% of rural school-aged children live in poverty.^{xvii} Overall, half (50%) of the state's schools are located in rural communities.

1.2 Education Context

State trends in K–12 and postsecondary education provide a mixed picture of student achievement. Based on the West Virginia General Summative Assessment, reading, math, and science performance increased slightly among students in 2022–23 compared with the previous year. Forty-four percent of students showed proficiency in reading, while the rates for math and science were lower at 35% and 29%, respectively.^{xviii} Despite small increases during the past 2 years, the rates are below the 2018–19 levels prior to the coronavirus disease 2019

(COVID-19) pandemic. For Grade 4, 46% of students were proficient in math and 44% attained proficiency in reading. In Grade 8, 43% reached proficiency in reading while 28% and 27% achieved that same level in math and science, respectively. For Grade 11 students, half (50%) were proficient in reading, yet only 28% were proficient in science and 21% proficient in math.

West Virginia National Assessment of Educational Progress results show moderate declines from 2019 to 2022, with COVID-19–related learning loss among the likely factors. The share of students at or above proficiency in Grade 4 math declined from 30% to 23%, while reading proficiency decreased from 30% to 22%. For Grade 8, math proficiency dropped from 24% to 15%, while reading fell from 25% to 22%. In both reading and math, a large gap between West Virginia’s performance and that of the nation overall has remained relatively stable over time.^{xix}

The state shows some growth in its efforts to ensure college and career readiness, however. For example, it offers multiple ways for students to earn postsecondary credit and public postsecondary institutions are required to accept credits.^{xx} From 2009 to 2020, the number of students taking Advanced Placement tests increased 26% and a higher percentage of tests had scores of 3 (out of 5) or higher. Graduation rates for 4-year high school students have improved over time (87% in 2014–15 to 91% in 2021–22), while the rate of White and African American 4-year high school students graduating on time increased (90% and 86% respectively, in 2017–18, and 92% and 87%, respectively, in 2021–22).^{xxi} The average ACT score of 2022 West Virginia high school graduates was 20.5 (out of 36), similar to scores in prior years.^{xxii}

The 2019 high school dropout rate for West Virginia was slightly above the national average (5.7% for West Virginia and 5.5% for the U.S.),^{xxiii} and college-going rates in 2017, 2018, and 2019 remained relatively unchanged (52%, 51%, and 52%, respectively) but decreased slightly in 2020 and 2021, when the rate stood at 49%.^{xxiv}

West Virginia’s postsecondary students are served by 12 public 4-year institutions,^{xxv} nine public community and technical colleges,^{xxvi} and eight independent 4-year colleges.^{xxvii} In the 16-state Southern Regional Education Board (SREB) region, West Virginia is in last place among SREB states in overall first-year persistence with a rate of 75% for 2018.^{xxviii}

However, action taken by the governor and state legislature in 2023 is expected to produce a substantial increase in high school students taking dual enrollment courses for college credit. Under House Bill 2005, the state will cover the cost of dual enrollment courses tied to some of the state’s most in-demand careers. While the former system mainly served students who expected to go to college, the new 4-year pilot program is targeting students with specific workforce interests who may not have thought about college. Community and technical colleges and 4-year institutions will offer courses in certain designated career pathways, including health care, information technology, advanced manufacturing, construction, engineering, education, agriculture, and other programs that meet a workforce need as determined by the West Virginia Department of Commerce.^{xxix}

1.3 STEM Education Context

West Virginia high school students indicate higher levels of interest in STEM than students nationally, according to a 2019 report by ACT—60% versus 43%.^{xxx} However, only 35% of test takers achieved the Mathematics Benchmark and only 41% the Science Benchmark. Even more concerning, just 14% achieved the STEM Benchmark (a derived score combining mathematics and science scores and correlated with success in STEM courses commonly taken by STEM students).

Policymakers, education leaders, and advocates have sought to improve STEM education across the state in various ways. The West Virginia Department of Education has implemented a comprehensive statewide approach to improving science, technology, engineering, arts, and math (STEAM) education, and advocacy organizations such as WV Forward, the Education Alliance, and the West Virginia Public Education Collaborative have undertaken initiatives to promote STEM. In addition, young people have access to various STEM enrichment opportunities, including STEM summer camps at state institutions of higher education, the governor’s STEM Institute, and programs sponsored by the National Aeronautics and Space Administration (NASA) and Green Bank Observatory.

West Virginia is designated as eligible for the Established Program to Stimulate Competitive Research (EPSCoR)—that is, the state is one in which the NSF has determined the need for special investment because it has received less than or equal to 0.75% of NSF research funding. EPSCoR eligibility is one indicator of limited STEM capacity, a circumstance that EPSCoR funding seeks to ameliorate.

Several additional efforts are underway to improve STEM education. The Education Alliance, an education nonprofit, supports STEM Works,^{xxxix} a collaboration with industry and business partners to enhance student STEM skills and STEM career readiness. A partnership between the West Virginia University (WVU) Center for Excellence in STEM Education and the West Virginia Department of Education established in 2018 has provided professional development and other supports for computer science instruction in the state’s schools. As a result, by 2021, 76% of West Virginia’s public high schools offered at least one computer science course, up from 46% in 2018–19.^{xxxix} The NSF awarded a grant to a founding member of the First2 Network to operate the Mountaineer Mathematics Master Teachers program, a network of math teachers collaborating to engage in continuous improvement of math teaching and learning.^{xxxix}

Nationally, despite the rapid growth of enrollment in STEM disciplines in recent years, the number of students graduating with a STEM degree has remained relatively stagnant due to diminishing student retention rates. While these results indicate the success of elementary and secondary education in cultivating interest in STEM fields, more work is needed to understand retention rates at the postsecondary level. Improving STEM retention nationally and in West Virginia is crucial to ensure a stable STEM pipeline and guarantee underrepresented young people’s fair access to STEM educational opportunities.

2. First2 Network Structures and Activities

2.1 Participants

As of August 2023, the First2 Network included 1,002 members (see Table 1), an increase of 595% from 144 in Year 1 and a 15% increase from the 866 members reported in August 2022. One third of members are students (30% undergraduate, 2% K–12, and 1% graduate), approximately a fifth (19%) are university or college faculty or staff, and 4% are K–12 faculty or staff. The organization type with which approximately a third (36%) of First2 Network members are affiliated is unknown.

Table 1. First2 Network Member Institutional Roles

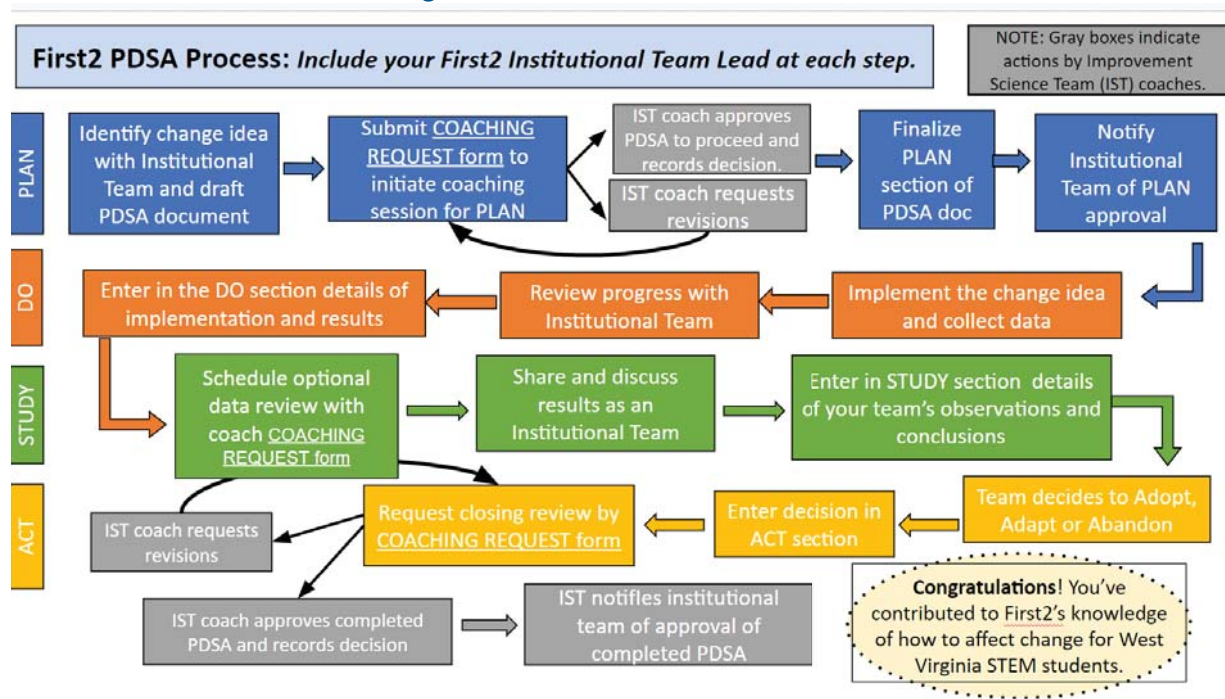
Role	N	Percent
Unknown	360	36%
Undergraduate Student	300	30%
University or College Faculty or Staff	194	19%
K–12 Faculty or Staff	43	4%
Nonprofit	23	2%
Private Industry	22	2%
K–12 Student	16	2%
National Laboratory	16	2%
State Government or State Education Agency	16	2%
Graduate Student	8	1%
Foundation	4	Less than 1%
Total	1,002	100%

2.2 Improvement Science Activities

In 2023, the backbone organization began quality assurance efforts on all PDSA work conducted on behalf of the network and, as a result, set a foundation for more clarity on shared measures, metrics, and goals that can support data sharing across the network. This provided support for transitioning from working group–led improvement science activity to institutional team–led activity where members align their institutional change ideas with First2 Network’s grant aims using PDSA cycles to investigate whether new or modified practices improve the outcomes in question. For example, PDSAs with campus clubs connect with the primary First2 Network driver—STEM students are meaningfully connected with faculty, staff, and peers in ways that promote belonging (fit), wellness, resilience, and financial stability. A few other topics aside from campus clubs included SciTech Social, College Readiness Ambassadors, Mentor Training, and Embedded Student Reporting in Prep.

Year 5 First2 Network activities continued with institutional team–led improvement science activities through an implementation process focused on key PDSA strategies (see Figure 1), developed in collaboration with a full–time data liaison who is also supported by the backbone and backbone mentor. This new system focused on coordinated efforts across members within the same institutions. As stated in their written guidelines, “Institutional teams should have a discussion on the change idea they want to pursue and what resources are available to complete this idea.” Additionally, coach support is available to foster a collaborative institutional team–generated idea that improves and standardizes PDSA metrics and, ultimately, aligns with the First2 driver diagram to affect student–level change.

Figure 1. PDSA Submission Process



Document Review

Analysis of First2 Network documents, including institutional team quarterly reports, meeting agendas, and session notes indicated that institutional teams, Steering Committee members, and affinity groups continued to garner support and resources to improve the quality and scalability of the network. These are key indicators of understanding systems pathways. Specifically, in this evaluation report and in the case of First2, this involves understanding increased pathways through capacity and connections.

2.2.1 Increased Pathway Capacity

Year 5 backbone efforts provided First2 with capacity support around integrating a more sustainable infrastructure to reach the network's overall aims. To start, First2 leadership operationalized the institutional teams—cross-departmental teams within an institution sharing the aim to improve First2 student success, test change ideas, scale good ideas, and share learning—to use a common reporting template and undergo a review for shared metrics when implementing improvement science ideas. Some of that support translated to development of shared measures being pursued: persistent college enrollment rate, course grades, course completion rate, probationary status rate, change in perceived sense of belonging, change in perceived self-efficacy, and change in perceived grit. A review team and coaches continue to document the inclusion of these common PDSA outcome metrics in both PDSA templates and Institutional Review Board (IRB) applications.

While this creates a systemic way for both the research and evaluation teams to use shared metrics in their data collection efforts across institutions, this posed several institutional challenges. To address these concerns at the institutional level, First2 implemented an IRB Tracker that centralizes key information per campus (PDSA leaders, institutional team leaders, IRB contacts) and that tracks progress on IRB applications and Collaborative Institutional

Training Initiative (CITI) certificates for local PDSA analysts per campus, which in future years will work to support their ongoing data-sharing infrastructure.

In addition, First2 implemented a coaching strategy to expand capacity for PDSA implementation ideas. Specifically, as the backbone reported, it uses “a “train the trainer” approach toward capacity building, where SRI’s researcher has “coached a team of improvement science coaches and organized shadowing sessions to build their capacity.” These coaching supports include templates and procedures for human subjects review to support PDSA data collection and analysis.

- IRB cross-institutional applications completed/approved: 2 (First2 Backbone Cross-institutional Aggregate Analysis through Fairmont State University (FSU), Green Bank Observatory (GBO)/High Rocks Educational Corporation (High Rocks) through WVU)
- IRB campus-level applications completed/approved: 5 campuses – Blue Ridge Community and Technical College (Blue Ridge), FSU, Marshall University (Marshall), Glenville State College (Glenville), and University of Charleston (UC)
- IRB PDSA-level applications completed/approved (WVU/West Virginia University Institute of Technology [WVU Tech]): 2
- IRB PDSA-level applications submitted/pending (WVU/WVU Tech): 1 embedded students, WVU campus clubs, WVU faculty and student engagement activities
- CITI certificates completed for all campus-level and entity-level PDSA analysts with IRB research determination: FSU, UC, WVU Tech, High Rocks, HEPC, Glenville, Blue Ridge

Working groups have also been replaced with affinity groups, topical groups made up of individuals from across First2 campuses, which connect to study the results of similar tests of change conducted at the institutions. Some of those affinity group efforts have been championed through Steering Committee members and institutional team leads. A few examples of this work include Math Team, campus club leads, STEM faculty-student engagement, and Immersion Team.

Related to students, the leadership development within First2 continues to thrive to prepare student leaders to engage in institutional change work and support peer-mentoring skill development. A few examples include the bridge program for rising freshman, mentor training with subsequent supporting documents, paid positions, and professional development events.

In addition to data sharing, institutional teams identified a need for more institutional buy-in from their administrators. While there is some evidence of efforts to involve key faculty directly and indirectly, as described in one institutional team report, there is still some progress to be made:

- *The institutional team is trying to recruit at least one involved faculty member from each department to try to increase awareness of what the group is doing throughout STEM. In the past, departments with faculty members involved in the process were much more heavily represented in the student organization.*

As one member noted during a meeting, “High-level administrative commitment and buy-in [is] missing at many campuses.” Specifically, institutional teams that manage to succeed at garnering support do so through long-standing champions and not by mobilizing local efforts within or across campuses. A “community organizing approach [is] needed on the campuses,” one member shared.

2.2.2 Increased Pathway Connections

First2 Network members rely on their connections between and across institutions in West Virginia to continue building the work of the network and improve overall quality for members. To do this, the network coordinator oversaw an Industry Advisory Board (IAB) to facilitate co-creation of clearer pathways from STEM education to STEM careers, among other responsibilities.

In Year 5, the IAB continues to develop next steps regarding the implementation of the “Sophomore Experience.” Additionally, one of the co-chairs of the IAB has obtained approval to host First2 students on their site this September for a tour and learning experience. Events will include interaction with STEM graduates who fill a variety of roles within a large chemical manufacturing company, insight into career paths for various STEM degrees, and a tour of a manufacturing facility in West Virginia.

Presentations and publications also reflect the network’s efforts to maintain and expand connections. For example, in July, Program Coordinator Jade Irving presented at the 2023 Student Success Summit. The title of the presentation was *Rethinking Career Services and How it Contributes to the Workforce*. This presentation focused on the importance of attracting first-generation students to offices of career services early in their college-going experience and engaging them throughout their college career. Emphasis was placed on the work that the First2 Network has been doing, particularly around connecting industry workers to students.

Institutional teams and partners from participating institutions of higher education presented change ideas during the May 2023 First2 Network Spring Conference held at the Stonewall Resort; breakout sessions on various subjects followed these sessions. The in-person conference included approximately 75 attendees. First2 Network Conference sessions focused on research, evaluation and measurement, development of PDSA cycles by institutional teams, sustainability, awareness of privilege, and industry partner perspectives on STEM education. Additional conferences attended by members included:

- *Dismantling Barriers to STEM: Innovative & Culturally Responsive Program Models for Student Preparedness & Success* was presented at IFORE Sigma Xi Conference in October 2022
- Marshall institutional team members submitted a proposal, titled *An Overview of The First2 Network in West Virginia*, to the American Studies Association's Conference held in Montreal, Canada
- West Virginia Science Teachers Association Annual Conference, October 28–30, 2023
- West Virginia Science and Technology Conference, July 19–20, 2023
- West Virginia Council of Teachers of Mathematics Annual Conference, March 17–18, 2023

In addition to formal meetings and presentations, partnerships are a core component of the network’s pathway connections and afford a way to create collective action and impact. As such, the network continued to focus on this aspect. Members of the First2 Network connected with partners around shared goals and information to support the network’s aims and efforts at a range of institutional and statewide events including the following:

- A large group of students and three faculty members from First2 attended the Discover Engineering Day at the Clay Center on February 18, 2023. The goal of this event was to encourage STEM interest among younger children (open to the public).
- After an admissions event, members of the institutional team met and discussed summer programs with local high school teachers and counselors. The team is working to set up outreach visits to engage local students and increase interest in STEM programs.
- Network members worked with the campus-based TRIO Program to feature First2 student research at First Generation Week.
- Network members connected and shared resources with WVU's existing Center for Learning, Advising, and Student Success.
- WVU recently joined the nationwide First Scholars Network, an initiative of Student Affairs Administrators in Higher Education who seek to enhance the academic and social experiences of first-generation students, which shows WVU's commitment to supporting its first-generation students.

Campus club meetings hosted across each network partner institution continue to be held at least twice during the fall and again in spring months. At certain institutions, in an effort to ensure successful collaboration across the institutions, campus club and institutional team meetings are held concurrently. "Club members led an initiative to staff a First2 vendor booth at the West Virginia Science Teachers Association conference Oct. 27–29," according to one institutional team report.

There was limited access to First2-sponsored summer immersion experiences in Year 5, with several institutions opting to focus on course-long or school year-long efforts rather than bridge programs. There was, however, one exception—an immersion site at FSU from July 10–23, 2023, hosted seven summer interns and was led by four undergraduate summer mentors and three faculty research mentors. Institutional team members met with the interns during a first-day orientation/introduction session, and the institutional team was proud to note that all seven interns continued involvement with First2 as scholars this fall.

The network's dissemination practices through research publications continued to evolve in Year 5. In fact, First2 members submitted several articles for publication. Examples of those accepted for publication include the following:

- Wheatley, C., Darrah, M., & Stewart, J. (2023). *Growth of West Virginia STEM education network to encourage student persistence*. 2023 Annual Meeting of the American Education Research Association, Division J, Postsecondary Education, Practices and Processes for Undergraduate Student Success, Chicago, Illinois, United States. https://convention2.allacademic.com/one/aera/aera23/index.php?cmd=Online+Program+View+Paper&selected_paper_id=2013648&PHPSESSID=dkbd9k7obpia3bds815ecmuq7q
- Darrah, M., Ogden, L., & Leppma, M. (2023). *Role of grit and other factors in mitigating math anxiety in college math students* [Conference proceeding] Annual Conference of Psychology of Math Education (PMENA 2023), October 1–4, Reno, Nevada, United States.
- Nemeth, M., Wheatley, C., & Stewart, J. (2023). Comparing introductory undergraduate physics learning and behavior before and after the COVID-19 pandemic. *Physical Review Physics Education Research*. (Accepted).

2.3 Steering Committee Survey

The evaluation team administered a comprehensive Steering Committee Survey in March 2019, March 2020, June 2020, April 2021, March 2022, and February 2023. The February 2023 survey was revised to align with the network's focus on institutional teams in Year 5, whereas in Years 1–4 the network focused on working groups. Therefore, some survey items are not comparable across years.

The Year 5 version of the survey asked members to rate the status of the Steering Committee through 10 statements about Steering Committee progress and 14 items about their involvement as Steering Committee members as well as two open-ended items to solicit feedback about the 24 items and/or their ratings.

A total of 10 Steering Committee members completed the online survey in February 2023. Of those respondents, 60% joined the Steering Committee more than a year ago, 30% joined within the last 6 months, and 10% joined between 6 months and a year ago.

2.3.1 Steering Committee Progress

Table 2 presents mean ratings regarding the Steering Committee's progress overall for survey items common across Years 1–5 (2019–23), items new in Year 5 (2023), items common across Years 1–4 (2019–22), and items common across Years 2–3 (2020–21). In the February 2023 mean column for the survey items that were common across Years 1–5, **green** text indicates an increase in average ratings of progress since March 2022, **red** text indicates a decrease, and **black** indicates no change.

Table 2. Mean Ratings for Steering Committee Progress Items from the Steering Committee Survey

	March 2019			March 2020			April 2021			March 2022			February 2023		
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
Items Common Across Years 1–5 (2019–23)															
The right people serve on the Steering Committee.	11	3.37	0.65	13	3.31	0.48	10	3.50	0.53	10	3.70	0.48	10	3.50	.53
The Steering Committee meets sufficiently regularly.	11	3.91	0.30	13	3.77	0.44	10	4.00	0.00	10	3.90	0.32	10	3.90	.32
The Steering Committee provides oversight and governance of the First2 Network.	11	2.73	0.65	13	3.46	0.78	10	3.50	0.53	10	3.10	0.57	10	3.50	.53
The Steering Committee has agreed upon a decisionmaking process.	11	2.91	0.70	13	3.38	0.87	10	3.70	0.48	10	3.20	0.79	10	3.40	.70
Steering Committee members trust each other.	11	3.27	0.65	13	3.46	0.66	10	3.70	0.48	10	3.30	0.68	9	3.67	.50
Communication within the Steering Committee is constructive.	11	2.91	0.70	12	3.42	0.67	10	3.60	0.52	10	3.20	0.79	10	3.70	.48
Steering Committee communications are timely.	11	3.09	0.83	13	3.23	0.60	10	3.50	0.53	10	3.10	0.74	10	3.40	.52
Steering Committee members have a clear understanding of the network's next steps.	11	2.64	0.51	13	2.77	0.60	10	3.30	0.67	10	2.90	0.32	10	3.10	.57
Items New in Year 5 (2023)															
The Steering Committee maintains a clear vision for the First2 Network.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.60	.70
Meetings are structured to ensure that Steering Committee business is completed.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.50	.71
Item Common Across Years 1–4 (2019–22)															
The Steering Committee has developed a clear vision for the First2 Network.	11	2.82	0.42	12	3.17	0.58	10	3.50	0.53	10	3.00	0.00	N/A	N/A	N/A
Item Common Across Years 2–3 (2020–21)															
The Steering Committee is successfully adapting programmatic efforts to meet COVID-19 challenges.	N/A	N/A	N/A	N/A	N/A	N/A	10	3.70	0.48	10	3.30	0.68	N/A	N/A	N/A

Items common across Years 1–5. Respondents reported more increases than decreases since 2022 for items that were common across Years 1–5 (2019–23) (six items increased, one decreased, and one remained the same).

Responses for these items were quite positive, with the mean score for five items at or above 3.50 on a 4–point scale (1 = *Not started*, 2 = *Beginning/Early stage*, 3 = *Making progress*, 4 = *Fully achieved*). The highest-rated item at 3.90 was that the Steering Committee meets sufficiently regularly; the lowest-rated item at 3.10 was that Steering Committee members have a clear understanding of the network’s next steps. Respondents reported a decrease for only one item: *The right people serve on the Steering Committee* decreased from a mean rating of 3.70 (standard deviation [SD] .48) to 3.50 (SD .53). There were no statistically significant differences for any of these items from last year to this year.

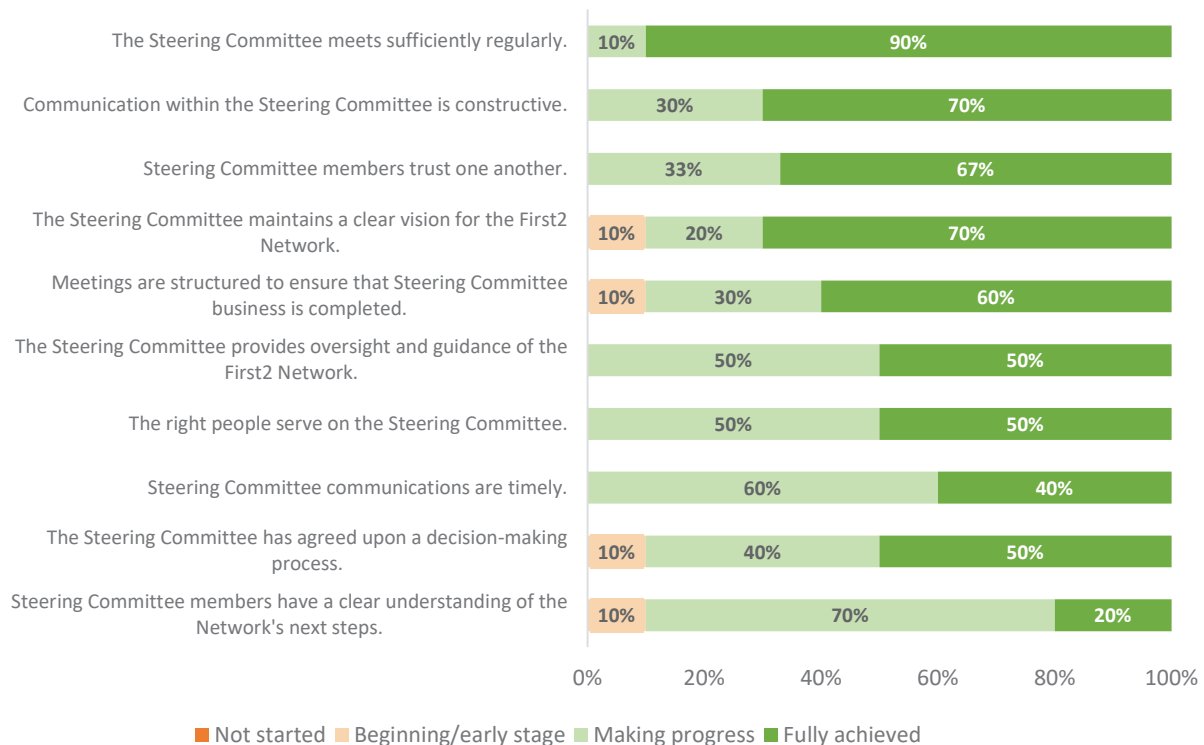
I have enjoyed seeing the work done by this group of individuals. They have a good sense of purpose, and they are committed to the success of the project.

– Steering Committee Member

Items new for Year 5. This section of the survey also included two new items for Year 5: *The Steering Committee maintains a clear vision for the First2 Network* and *Meetings are structured to ensure that Steering Committee business is completed*. Responses for these items were also positive with mean ratings of 3.50 (SD .71) and 3.60 (SD .70), respectively.

Figure 2 presents Year 5 (2023) item response percentages.

Figure 2. Item Response Percentages for Steering Committee Progress Items from the Steering Committee Survey



When asked to share any comments about their ratings for these 10 items, three individuals responded. Their verbatim comments follow.

- *Steering Committee functioning seems overly complicated at times. There are structural barriers to participation and many asks from the Steering Committee and First2 of its members.*
- *I have enjoyed seeing the work done by this group of individuals. They have a good sense of purpose, and they are committed to the success of the project.*
- *As it is true for any business, there are challenges to running a network like First2 and I feel the Steering Committee tries the best possible to move the network forward. Thanks to all who [are involved] and participate.*

2.3.2 Steering Committee Roles

Respondents were also asked to rate 14 items² about their involvement as a Steering Committee member. Table 3 presents mean ratings for survey items common across Years 1–5, items new in Year 5, items common across Years 1–4, and items common across Years 2–3. In the February 2023 mean column for the survey items that were common across Years 1–5, **green** text indicates an increase in average ratings of progress since March 2022, **red** text indicates a decrease, and **black** indicates no change.

Items common across Years 1–5. Mean ratings for four items concerning Steering Committee members’ roles were higher in February 2023 than in March 2022 and were lower for four items. The higher rated items focused on understanding responsibilities and making decisions about the direction of the network, the processes the network uses, and how to onboard new network members. Items with lower means focused on keeping network members accountable, determining how to track network progress, onboarding new members, and championing the network. The highest rated item at 3.63 was *I understand the responsibilities associated with my Steering Committee membership*; the lowest at 2.75 was *I help the Steering Committee determine how to track the network’s progress*. There were no statistically significant differences for any of these items from last year to this year.

Items new for Year 5. Survey Section 2 also included five new items that asked respondents about their roles on institutional teams and one new item that asked whether respondents consider involvement on the Steering Committee to be a worthwhile investment of their time. Responses to the items asking about institutional teams were positive, with all but one item having means above 3.00. The highest-rated item, with a mean score of 4.00 (SD .00), was *I lead an institutional team*. The lowest-rated item, with a mean score of 2.88 (SD .64), was *I help the First2 Network determine how to coordinate the new knowledge that institutional teams generate*. Steering Committee members responded positively (mean score 3.50, SD .76) to the item that asked about committee membership being a worthwhile investment.

² This set of items included an N/A option in case respondents did not think a particular item was relevant for their involvement.

Table 3. Mean Ratings for Steering Committee Role Items from the Steering Committee Survey

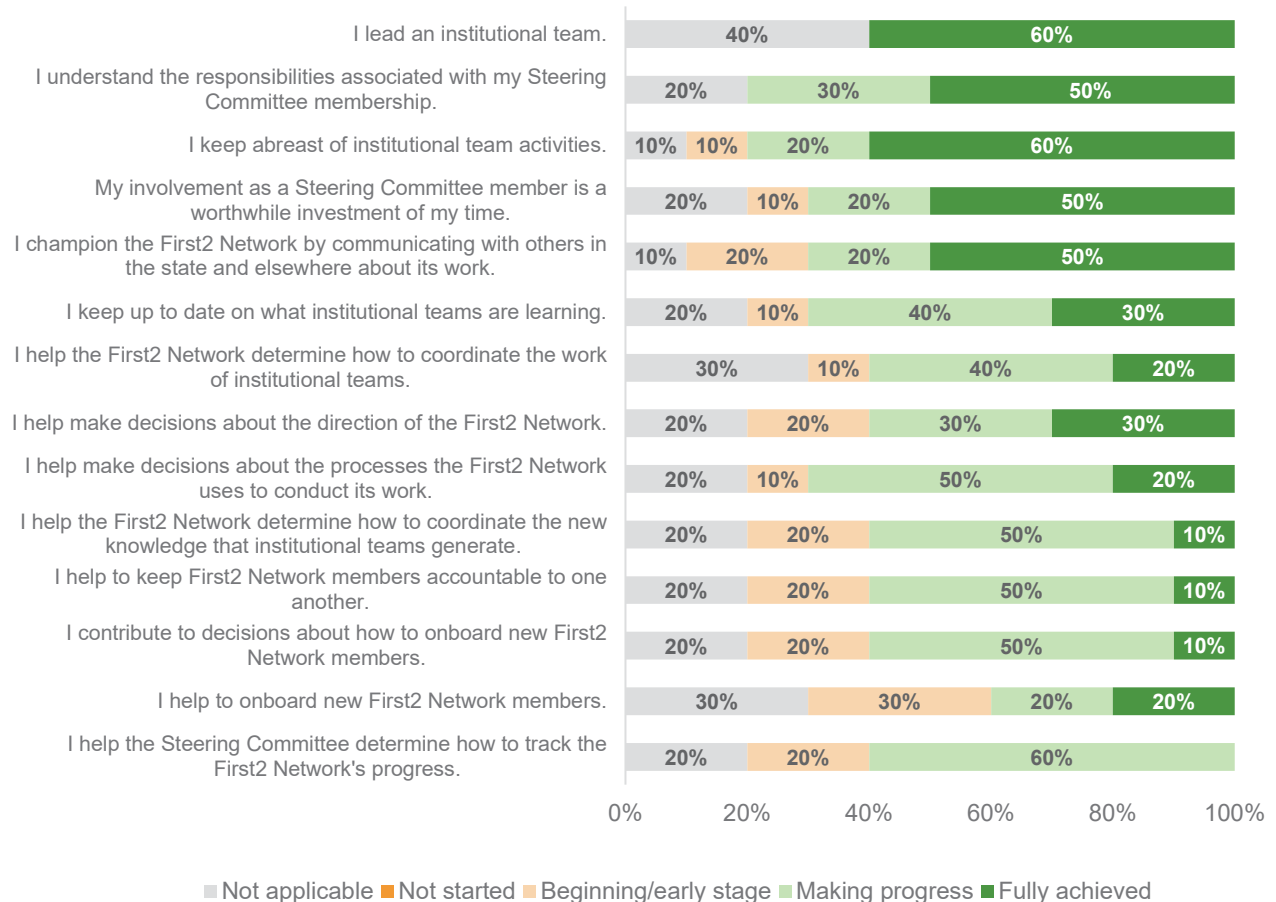
<i>In my role as a Steering Committee member ...</i>	March 2019			March 2020			April 2021			March 2022			February 2023			
	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	
Items Common Across Years 1–5 (2019–23)																
I understand the responsibilities associated with my Steering Committee membership.	11	3.00	0.45	13	3.38	0.65	10	3.70	0.48	9	3.56	.73	8	3.63	.52	
I help make decisions about the direction of the network.	11	3.09	0.70	13	3.54	0.52	8	3.50	0.53	9	3.00	.00	8	3.13	.84	
I help make decisions about the processes the network uses to conduct its work.	11	3.09	0.70	13	3.31	0.63	9	3.33	0.71	9	2.89	.93	8	3.13	.64	
I help to keep network members accountable to one another.	11	2.91	0.54	12	3.00	0.60	10	3.00	0.67	9	2.89	.60	8	2.88	.64	
I help the Steering Committee determine how to track the network’s progress.	11	2.73	0.65	13	2.85	0.69	10	3.20	0.79	9	3.00	.00	8	2.75	.46	
I contribute to decisions about how to onboard new First2 Network members.	11	2.64	0.92	13	3.00	0.58	9	3.33	0.71	7	2.86	.69	8	2.88	.64	
I help to onboard new First2 Network members.	11	2.64	1.03	12	3.17	0.58	9	3.33	0.87	8	2.88	.84	7	2.86	.90	
I champion the First2 Network by communicating with others in the state and elsewhere about its work.	11	3.36	0.51	13	3.85	0.38	10	3.60	0.70	9	3.67	.50	9	3.33	.87	
Items New in Year 5 (2023)																
I lead an institutional team.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	4.00	.00
I keep abreast of institutional team activities.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.56	.73
I keep up to date on what institutional teams are learning.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.25	.71

Evaluation of the First2 Network: Year 5

	March 2019			March 2020			April 2021			March 2022			February 2023		
<i>In my role as a Steering Committee member ...</i>	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD
I help the First2 Network determine how to coordinate the work of institutional teams.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.14	.69
I help the First2 Network determine how to coordinate the new knowledge that institutional teams generate.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	2.88	.64
My involvement as a Steering Committee member is a worthwhile investment of my time.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	10	3.50	.76
Items Common Across Years 1–4 (2019–22)															
I lead a working group.	11	3.36	1.36	9	3.78	0.44	6	3.80	0.41	4	4.00	.00	N/A	N/A	N/A
I keep abreast of working group activities.	11	2.82	0.60	13	3.92	0.28	10	3.40	0.70	10	3.60	.70	N/A	N/A	N/A
I keep up to date on what working groups are learning.	11	2.73	0.47	13	3.23	0.44	10	3.10	0.74	10	3.10	.57	N/A	N/A	N/A
I help the network determine how to coordinate the work of Improvement Teams.	11	2.18	0.87	11	2.82	0.60	9	3.22	0.97	9	3.22	.67	N/A	N/A	N/A
I help the network determine how to coordinate the new knowledge that working groups generate.	11	2.27	0.91	13	3.00	0.58	9	3.00	1.00	10	2.80	.42	N/A	N/A	N/A
Item Common Across Years 2–3 (2019–22)															
I help to support First2 Network programming adjustments to address COVID-19 challenges.	N/A	N/A	N/A	N/A	N/A	N/A	10	3.50	0.71	8	3.38	.52	N/A	N/A	N/A

Figure 3 presents item response percentages. Note that between 10% and 40% of respondents rated items as N/A, indicating they did not perceive those items as relevant to their involvement as a Steering Committee member. This may indicate a need to further clarify Steering Committee roles and responsibilities.

Figure 3. Item Response Percentages for Steering Committee Role Items from the Steering Committee Survey



2.3.3 Steering Committee Survey Summary

Respondents rated six of eight items about the Steering Committee’s progress higher in 2023 than they had in 2022, although there were no statistically significant differences from last year. Only one item decreased from last year, from 3.70 to 3.50—that the right people serve on the Steering Committee.

Respondents rated four of eight items about the Steering Committee roles higher in 2023 than in 2022, and again there were no statistically significant differences. Three of the four items related to members’ decisionmaking responsibilities. The item with the greatest increase was that members help make decisions about the processes the network uses to conduct its work (from 2.89 to 3.13). While mean scores for four items decreased from last year, two of these items decreased just slightly: that members help keep network members accountable to one

another and that members help to onboard new members. Two items exhibited a greater decrease—that members help determine how to track the network’s progress (from 3.00 to 2.75) and that members champion the network by communicating with others in the state and elsewhere about its work (from 3.67 to 3.33).

2.4 Steering Committee Group Interview

In June 2023, the evaluation team conducted a 30-minute virtual group interview during the monthly Steering Committee meeting with all members who were present for that meeting. Major topics included evolution of the Steering Committee over the year, facilitating and challenging factors, suggestions for improvement, most important accomplishments achieved, and achievement of goals. Responses are organized by these categories.

2.4.1 Steering Committee Evolution

One interviewee noted how the scaffolding of student leadership was really becoming evident, as demonstrated most recently at the May 2023 First2 Network conference. Students who joined the network several years ago as beginners have now taken on leadership roles within the network. This individual said, “That feels really solid and strong to me.”

Student co-chairs are participating more fully now in the Steering Committee meetings, at least during the school year. Participants noted that during summer months, student involvement in such meetings decreased. One interviewee provided an example of how important it was to have student involvement in the Steering Committee, as evidenced during the June meeting: “Having [student’s name] here, just pointing out a problem with the application link, has been transformative. It is so powerful.” One other participant’s comments focused on how participation in the Steering Committee was broader and more dispersed, instead of comprising mostly First2 key staff: “We’re getting more people from institutions.”

2.4.2 Facilitating and Challenging Factors

Facilitators. When asked what was working well in the Steering Committee, one interviewee focused on the shift to institutional teams, and how having two individuals share the role of institutional liaison at one particular institution has “been really helpful” so that the workload can be divvied up and one person can take point as/when needed. Further, having the institutional team in place fosters members being able to support one another, and that “flows into the Steering Committee and everything else we’re doing as well.”

Other members acknowledged having more knowledge about “what’s going on at other universities and other institutions across the state” now that the Steering Committee is composed of staff across all the institutional teams in addition to First2 key staff. Another commented how previously the working group members didn’t feel a part of the Steering Committee since not all institutions had representation on that committee, adding “This has been nice to have a higher-level picture of what’s going on that we can communicate amongst our institutional team.”

There were always representatives [on the Steering Committee], but it seems like the representation is more regular and informed and contributing. Maybe that’s a result of the longevity of the grant or how far we are in. I know I am so much more vested in it now than I was in the beginning. I have so much more to say and contribute. That’s the evolution personally that I have seen having been on the Steering Committee for both iterations of the working groups versus the institutional teams.

– Steering Committee Member

Yet another participant suggested the monthly meetings have been more regular but less frequent. In previous years, meetings were held more often and became “overwhelming.”

Challenges. In terms of challenges, one participant noted how First2 communications have been an ongoing issue in the past and that with the shift to institutional team membership there was a “subtle” effect on the Steering Committee this year, resulting in improved communications—“There’s an immediate pipeline and I think things get resolved fairly quickly.”

Another participant noted one potential drawback from fewer Steering Committee meetings is that members may not have as much “real-time” information, resulting for this member in a lack of awareness of how the May conference had been “reorganized dramatically.” A suggestion was offered to send an email message in the future, to alert members of such changes.

Another challenge encountered by Steering Committee members is the difficulty in finding common times when all Steering Committee members can participate in monthly meetings. However, having multiple institutional team members from each institution serve on the Steering Committee has mitigated this challenge, making it more likely that each institution is represented at each meeting.

2.4.3 Suggestions for Improvement

Suggestions included revisiting the schedule for the monthly Steering Committee members to ensure meetings are held at optimal times when the greatest majority of members are available. As noted above, another suggestion was to send messages about key First2 operations, such as the conference reorganization.

2.4.4 Most Important Accomplishments

Several interviewees identified what they viewed as the most important accomplishments of the Steering Committee over the past year. One noted the May 2023 conference, stating “that one was more impactful to me than all the rest of them.” And then added, “Spending that time with the team in a dedicated time, a dedicated space, learning and working, and even the students being there [fully engaged].” Another concurred, noting it was “really great” but also suggested adding time for institutional teams to meet at the end of future conferences so team members can process new learnings together and discuss any next steps.

Another participant noted that because so many new faculty members had joined their institutional team, having people attend the Steering Committee meetings “was a good chance to get to ask questions and make sure that we’re on the right track.”

I just thought that it [May 2023 First2 Network conference] went so well and the planners did a great job. I think it was the right amount of networking and teamwork and presentations. . . . All the questions I had; the presentations addressed those. – Steering Committee Member

We can’t just go to somebody who’s been doing this for a few years on our campus. It has to be somebody who’s been doing this for a few years in the network. So, being able to interact with people on the Steering Committee was really beneficial. – Steering Committee Member

Another accomplishment noted was the networking opportunities provided through participation in the Steering Committee. One individual commented, "I have thoroughly enjoyed meeting and working with folks from other campuses these past few years, because that rarely ever happened. I might have a brief association ... once in a great while ... but this is regular interfacing." And such interactions led to sharing about programs and services that could be replicated or modified for use at other campuses.

So that it itself has been so valuable to me, in seeing what they're doing, and the innovations that they try, and the struggles that they're making. And just working with folks from other campuses instead of being in this little isolated shell or bubble . . . this is a sustained interaction, which I totally appreciate.. – Steering Committee Member

2.4.5 Backbone Mentor Support

One interviewee commented that mentor backbone support from SRI "has tapered off greatly" and that SRI support is now focused on the Improvement Science Team to help institutional teams with the PDSA cycles being carried out at each institution. However, another interviewee reflected that in some ways, SRI may be "hampering what we do," noting "the PDSA work has been made so much harder than it was sold to us at the beginning." When asked to provide more context, the individual noted the current process is more time-consuming, with too many requirements. Another member agreed with this perception but hypothesized that perhaps the PDSA expectations in the beginning weren't as high, and that now expectations have been raised as the grant has evolved and matured. One other interviewee noted that perhaps condensing the PDSA templates would be beneficial.

I think there's plenty of [PDSA] resources out there. In particular, the coaching staff knows what they're doing, and they're able to point us in the right direction. And most of the times, when we go to our coaching meetings, we're not having to make major, crazy changes. . . . So, I think for the most part, the help that the First2 Network is already supplying through the mandatory coaching sessions has been enough to meet our needs. – Steering Committee Member

When asked how the HEPC DSR had become more integrated into the network as it carried out its backbone responsibilities, one individual reflected that, prior to HEPC's involvement as the network backbone, knowledge of HEPC was very limited: "It was this thing in Charleston, they published *The Neuron*, and that's pretty much all I knew about them." Now, it's clearer the value-add that HEPC can provide to higher education institutions in the state by creating and fostering deeper connections with those institutions.

I think HEPC serving as the backbone for this has helped . . . small 4-year comprehensive colleges really become more familiar with the work of HEPC. So I think it's been good for us, because they help us organize and they're a good go-to place, and I've become more familiar with EPSCoR grants and things that they have. So they've helped First2, but I think that they've also helped familiarize us with the work of HEPC. So it's less of this entity far-removed from us down at the state [capitol]. – Steering Committee Member

2.4.6 Achievement of Goals

When asked if the network was accomplishing its stated goals through the work of the Steering Committee, one interviewee recommended that the network strengthen its association with the West Virginia Academy of Science, noting that having First2 institutional teams present at the West Virginia Academy Science would be a “natural way of sharing information about First2” as well as “a natural way to prolong the life of First2 with an organization that’s already in place.”

2.4.7 Steering Committee Group Interview Summary

In sum, participants noted that the shift to Steering Committee membership across all institutional teams has fostered a greater understanding of what is happening across the state yet noted this also led to more of a challenge in finding times when all members can participate in the monthly meetings. Important accomplishments included the May 2023 conference, which provided networking and teamwork opportunities, and the ongoing networking opportunities made possible through Steering Committee membership.

2.5 Institutional Team Survey

A new data collection activity was introduced in Year 5 to gather feedback from members of the First2 Network institutional teams. This online survey replaces the former Working Group Self-Assessment survey and included new items about their perceptions of the First2 Network and their institutional teams as well as the PDSA items from the Working Group Self-Assessment.

This survey was launched in February 2023 to members of institutional teams at seven First2 institutions of higher education: Blue Ridge, FSU, Glenville, Marshall, UC, WVU, and WVU Tech. Results are summarized below.

A total of 47 completed surveys were obtained in February 2023; all respondents confirmed they were members of a First2 Network institutional team. Respondents were from the following sites:

- | | | |
|--|-----|--------|
| • Fairmont State University | 38% | (n=18) |
| • West Virginia University Institute of Technology | 28% | (n=13) |
| • West Virginia University | 21% | (n=10) |
| • Marshall University | 9% | (n=4) |
| • Blue Ridge Community and Technical College | 2% | (n=1) |
| • Glenville State University | 2% | (n=1) |
| • University of Charleston | 0% | (n=0) |

Nearly half (43%) were students, 38% were faculty members, 13% were administrators, and 6% defined their role as “other”; descriptions of “other” included lab mentor and career counselor.

2.5.1 Perceptions of the First2 Network

Respondents were asked to rate five items about their perceptions of the First2 Network. Responses for these items were fairly positive, with mean scores for two items at or above 4.00 on a 5-point scale (1 = *Insufficient* to 5 = *Fully Sufficient*). The highest-rated item at 4.11 was for the *First2 Network progress in supporting network students*; the lowest-rated item at 3.46 was

for the *First2 Network onboarding process for network members*. Table 4 presents frequencies (item response option percentages) and descriptive statistics (mean and standard deviation).

Table 4. Descriptive Statistics and Response Option Percentages for First2 Network Items from the Institutional Team Survey

Items	Descriptive Statistics			Response Option Percentages*				
	n	Mean	SD	Insufficient (1)	(2)	(3)	(4)	Fully Sufficient (5)
Support provided by the First2 Network to your institutional team	47	3.83	0.94	2%	6%	21%	47%	23%
First2 Network process for communicating with your institutional team	46	4.00	0.99	2%	4%	22%	35%	37%
First2 Network onboarding process for network members	46	3.46	1.15	6%	13%	28%	33%	20%
First2 Network progress in supporting network students	45	4.11	0.83	2%	0%	16%	49%	33%
First2 Network progress in meeting network goals	45	3.89	0.80	2%	0%	24%	53%	20%

*Percentages may not total 100 due to rounding.

Respondents were given an opportunity to share comments about their ratings for these five items. Twelve individuals provided feedback: six described areas in need of improvement, three provided both positive and negative feedback, and three noted either they or their site were new to the network. Comments are provided below.

Need improvement:

- *Scheduling could be communicated more [openly] to students.*
- *Sometimes we're not told about scholars until the absolute last minute.*
- *I understand why we have moved away from statewide teams but the institutional team seems like a waste of time. There is a large disconnect between faculty/student and what the network wants. There is no communication, no clear objectives, everything is constantly changing, and students do not understand why we have an institutional team when they rarely do anything but tell them what to do and put more work on the students . . .*
- *Student onboarding and offers need to be improved. There should be a formal offer email that comes from First2 once the student has been selected by the institution. Yes, the institutional team selects the students and can inform the student that they have been selected, but First2/[High Rocks] holds the purse strings for the student funding and should send a formal offer letter that includes the stipulations so that students know what they are agreeing to. Yes, it is written on the website when they apply but it needs to be repeated and reiterated several times as we have found in other programming.*

- *As a recent recruit to First2, it is often hard to figure out what [an] institutional team should be doing at any time. The PDSA approval process is hard to understand. It also feels like having reports due quarterly is too fast, especially when we have a large chunk of time off between semesters.*
- *It has been, across the board, an issue for most students and staff/leadership to find a time to meet. Most meetings are not at student-friendly times because they need to be within the working hours of leadership and I have found this to be a huge barrier. I think that the onboarding process for new students needs to be better and there needs to be better communication and a strict, developed process to onboard students. We had an instance where a student fell through the cracks and we did not know that they were a part of the network so they did not get contacted with resources about the First2 Network. Due to this, they lost their funding for 1 month.*

Positive and negative feedback:

- *I do think efforts for better communication between First2 Network members have improved. However, I think sometimes there could be clearer instructions given with important documents, including surveys such as this one, as to who should complete the survey.*
- *The onboarding process is generally good, but a lot of students fall through the cracks.*
- *I think that our students receive an adequate amount of financial support and onboarding support through student directors, co-chairs, and [named advisor], however, adding new faculty to our institutional team is difficult because the network is quite complicated and takes a lot of time with little support/benefits from the network.*

New to the network:

- *I do not have sufficient experience with the last 3 above.*
- *As we are not yet officially an institutional team, we do not yet have network students.*
- *I'm new to this organization, so I'm still learning about everything. So far, everyone has been helpful and full of information. I'm excited to see the many great opportunities for students.*

2.5.2 Perceptions of their Institutional Team

Respondents were then asked to rate six items about their perceptions of their institutional team. Responses for these items were similar, with mean scores for two items above 4.00 on a 5-point scale (1 = *Insufficient* to 5 = *Fully Sufficient*). The highest-rated item at 4.16 was for *Progress in supporting students at the institution*; the lowest-rated item at 3.60 was for the *Institutional team onboarding process*. Table 5 presents frequencies (item response option percentages) and descriptive statistics (mean and standard deviation).

Table 5. Descriptive Statistics and Response Option Percentages for Institutional Team Items from the Institutional Team Survey

Items	Descriptive Statistics			Response Option Percentages*				
	n	Mean	SD	Insufficient (1)	(2)	(3)	(4)	Fully Sufficient (5)
Institutional team process for sharing information with the First2 Network	47	4.04	0.91	2%	2%	19%	43%	34%
Your institutional team onboarding process	47	3.60	1.25	9%	11%	21%	32%	28%
Progress in supporting students at your institution	45	4.16	0.90	2%	2%	13%	42%	40%
Progress in meeting your institutional team goals	46	3.96	0.94	2%	7%	13%	50%	28%
Extent to which your institutional team is working together collaboratively	46	3.96	1.03	4%	2%	22%	37%	35%
Extent to which your institutional team is connected to the First2 Network	46	3.96	0.92	2%	2%	24%	41%	30%

*Percentages may not total 100 due to rounding.

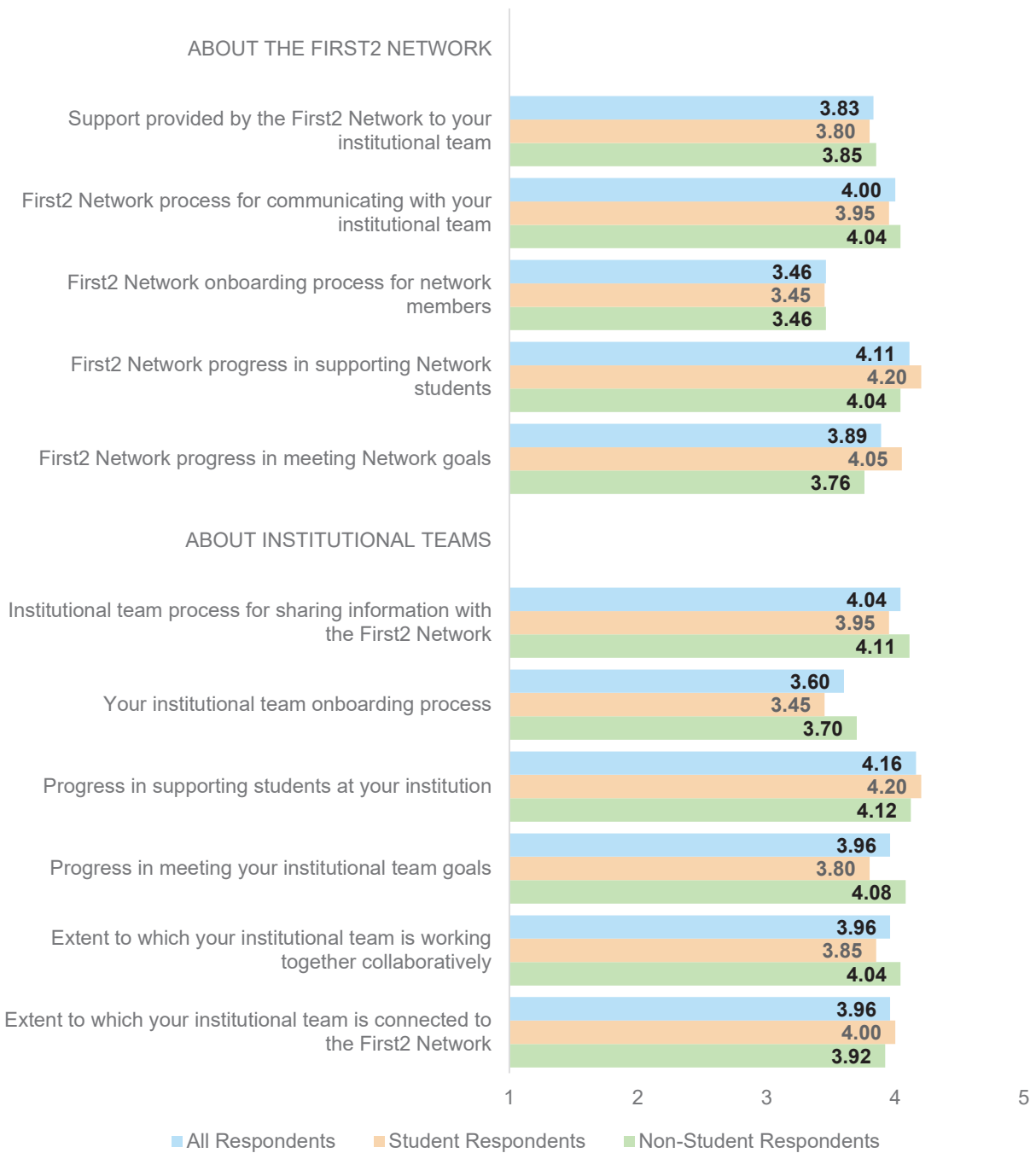
Respondents were given an opportunity to share comments about their ratings for these six items. Eight individuals provided feedback; verbatim comments are provided below.

- *Always room for improvement on above but system is working OK it seems.*
- *Faculty are over-committed and the current financial environment (budget issues, hiring freezes, faculty retirements, scarcity, fewer students, less state appropriations) are contributing to faculty/staff being exhausted, overworked, and underappreciated. Add to that the fact that First2 has funding to support students but minimal funding to support faculty/staff who are critical to First2 functioning and the functioning of institutional teams, it is surprising so many people are still involved. This is not just a problem with First2 but really a larger problem with NSF and its funding model of providing support for participants but minimal support for the people who administer the programs. It often leads to student participants getting paid (stipend, lodging, travel) much better than the people who run NSF programs.*
- *N/A*
- *I believe that our team could improve on communication and goals. Yet, we are in the midst of a transition between faculty leadership at the [Marshall University] Club. We are also recuperating since [named faculty member] left for retirement. I believe we will naturally improve as we go further into our journey.*
- *The connection between the network and the team is good, but engagement tends to be rather low.*

- *A lot of the members of the [WVU Tech] institutional team are newer, but I feel like they are making great strides in the process of connecting with the network and utilizing the resources.*
- *Our team works really well together, however, there is a lot of confusion and miscommunication between Marshall and our requirements as an institution, especially for PDSAs.*
- *Our institutional team seems to constantly forget to inform us about new scholars, or do it at the last minute. This has led to a scholar not receiving funding because they were not onboarded properly with the institutional team leaders (faculty). They're also not very responsive, and don't give direct answers to questions that need urgent responses. Only 1–2 of the many members at our institution respond to emails; it seems like everyone likes to leave it up to the chairs to give answers.*

Figure 4 presents a visual depiction of the mean scores for each of the five items about the First2 Network and the six items about the institutional teams. And, given students made up such a large proportion of respondents, average scores by student respondents versus non-student respondents are also depicted. More variation occurred between students and non-student respondents in the items focused on the institutional teams. Students' ratings for four of these six items were lower, indicating less sufficiency, especially for the *Institutional team's onboarding process* and *Progress in meeting institutional team goals*.

Figure 4. Mean Scores for First2 Network and Institutional Team Items from the Institutional Team Survey



2.5.3 Institutional Team PDSAs

Respondents were next asked to list all the PDSAs currently underway at their institution and those completed within the past 6 months, what additional support or resources are needed to complete any PDSAs currently underway, and which PDSA had been their favorite. Table 6 presents a summary by site. (Blue Ridge is excluded since its one respondent did not provide comments for these four items).³

Table 6. PDSA Information by Site from the Institutional Team Survey

PDSAs Currently Underway	Additional Support or Resources Needed for Current PDSAs	PDSAs Completed Within Past 6 Months	Favorite PDSA
Glenville State University (n=1)			
Math Anxiety PDSA	The Math Anxiety PDSA is delayed due to Institutional Review Board (IRB) approval.		
Marshall University (n=3)			
Pipetting exercise	Lab supplies	Pipetting exercise	Analysis of student samples feedback loop
Dimensional analysis	IRB process information	Dimensional analysis	
First2 student sample analysis		First2 student sample analysis networking dinner	Networking dinner
Networking dinner			
Campus club		Fall campus club	Team dinner
COVID catch-up		COVID catch-up	
Summer immersion		Summer immersion	
High school ambassador		High school ambassador	
Institutional team dinner			
Student goals			
Fairmont State University (n=6)			
Science fair	Student participation	SciTech Social	Sci Tech Social
Falcon Fresh Start			Falcon Fresh Start
Summer immersion	Time and willingness from people involved		Campus clubs
Campus club			
College readiness ambassadors			
Student ambassadors club	Time for team to get together to study them		
Math help			
STEM get-to-know-you picnic			
Hometown talks			

³ It appears that asking all institutional team members to list the PDSAs currently underway or completed within the past 6 months may be overly burdensome, and perhaps in the future these questions should be asked only of the institutional team lead at each site.

PDSAs Currently Underway	Additional Support or Resources Needed for Current PDSAs	PDSAs Completed Within Past 6 Months	Favorite PDSA
West Virginia University Institute of Technology (n=9)			
Study habits	Financial support	Bingo night	Bingo
Campus club		Study habits	Time management
Bingo night	Chem tutor needs	Student resources	Prioritization
Online tutoring	coaching	Time management	Study habits
Summer camp		Hometown ambassadors	
Hometown ambassadors		Student/faculty engagement	
Escape room		Prioritization	
Student/faculty engagement			
Chem tutor			
West Virginia University (n=9)			
How-to videos	Help encouraging members to participate in PDSAs that need Network participation	Summer immersion	Summer immersion
Discord communication			Mentor training
Dinner with the deans at West Virginia University			Biweekly listserv email
Discussion post for equitable STEM course experience	Continued mentoring by the improvement science team		Book club
Mentor training			
Campus club			
Biweekly listserv email			
Book club			
Embedded students in prep chemistry			
Creation of public service videos			
Student club			
Opportunities email list			

Finally, respondents were then asked to rate 17 items about their perceptions of their institutional team for each of the PDSA cycles (five items for Plan; and four each for Do, Study, and Act). Responses for these items were mostly positive, with mean scores for 13 items above 4.00 on a 5-point scale (1 = *A weakness* to 5 = *A strength*); respondents could also select an *I Don't Know* option if they were unsure about a particular item. The highest-rated item at 4.38 was that the *Institutional team uses PDSA cycles to spur improvement in testable iterations* (Plan); the lowest-rated item at 3.77 was that the *Institutional team conducts research to clarify and further specify problems of practice prior to identifying and assessing strategies for addressing those problems* (Plan). Table 7 presents frequencies (item response option percentages) and descriptive statistics (mean and standard deviation); percentages for *I Don't Know* responses are depicted in red.

Table 7. Descriptive Statistics and Response Option Percentages for PDSA Items by Site from the Institutional Team Survey

Items	Descriptive Statistics			Response Option Percentages*					
	n	Mean	SD	A weakness (1)	More a weakness than a strength (2)	Neither a weakness nor a strength (3)	More a strength than a weakness (4)	A strength (5)	I Don't Know†
Plan	34	4.04	0.82						
The institutional team agrees to focus upon a shared aim.	37	4.09	0.91	3%	0%	16%	38%	32%	11%
The institutional team conducts research to clarify and further specify problems of practice prior to identifying and assessing strategies for addressing those problems.	36	3.77	1.17	6%	3%	25%	22%	28%	17%
The institutional team refers to the First2 Network driver diagram to help identify problems of practice to address.	36	4.07	1.08	3%	6%	11%	28%	36%	17%
The institutional team uses PDSA cycles to spur improvement in testable iterations.	36	4.38	0.94	3%	0%	11%	22%	53%	11%
The institutional team makes decisions about PDSA measurement that balance rigor and feasibility.	36	3.84	1.04	3%	3%	28%	25%	28%	14%
Do	33	4.04	1.00						
The institutional team uses PDSA forms to record expected outcomes of each improvement strategy implemented.	36	4.13	0.97	3%	0%	17%	28%	36%	17%
The institutional team establishes processes for collecting, organizing, analyzing, and synthesizing data during PDSA cycles.	36	4.09	1.13	3%	6%	19%	17%	47%	8%
The institutional team helps staff at our institution to implement improvement strategies for addressing problems of practice.	36	4.13	1.09	3%	3%	19%	17%	44%	14%
The institutional team consistently collects data on a short list of indicators to measure results from the improvement strategies implemented at our institution.	36	3.78	1.26	3%	17%	14%	19%	36%	11%

Items	Descriptive Statistics			Response Option Percentages*					
	n	Mean	SD	A weakness (1)	More a weakness than a strength (2)	Neither a weakness nor a strength (3)	More a strength than a weakness (4)	A strength (5)	I Don't Know†
Study	31	4.11	0.95						
The institutional team analyzes data collected about improvement strategies and compares them to projections developed in the Plan step.	36	4.07	1.03	3%	0%	22%	19%	36%	19%
The institutional team members ask questions of those affected by the work about what the data mean.	36	4.04	1.04	3%	0%	22%	19%	33%	22%
The institutional team considers the extent to which the analyzed data do or do not represent progress toward the overall aim.	36	4.16	1.00	3%	0%	19%	22%	42%	14%
The institutional team shares findings in ways that take account of the needs of our institution, the network, and its members.	36	4.04	1.11	3%	3%	19%	17%	36%	22%
Act	31	4.08	0.98						
The institutional team determines whether the improvement strategy being tested should be adopted, adapted and re-tested, or abandoned.	35	4.10	1.08	3%	3%	20%	20%	43%	11%
The institutional team decides what should be adjusted and studied next, if the improvement strategy needs to be adjusted.	35	4.13	1.02	3%	3%	14%	29%	40%	11%
The institutional team decides whether the improvement should be tested in new contexts and/or at larger scales, if the improvement strategy is successful.	35	4.14	1.04	3%	0%	20%	17%	40%	20%
The institutional team iteratively tests what related processes or supports are needed to ensure that effective improvement strategies produce improvements reliably.	35	3.89	1.13	3%	6%	20%	20%	31%	20%

*Percentages may not total 100 due to rounding. †Excluded from mean and standard deviation calculations.

Figure 5 provides a visual depiction of the mean subscale scores for PDSA cycles. And, given students made up such a large proportion of respondents, average scores by student respondents versus non-student respondents are also depicted. Students’ ratings were considerably higher for each of the four PDSA cycle subscales.

Figure 5. Mean Scores for PDSA Subscales from the Institutional Team Survey

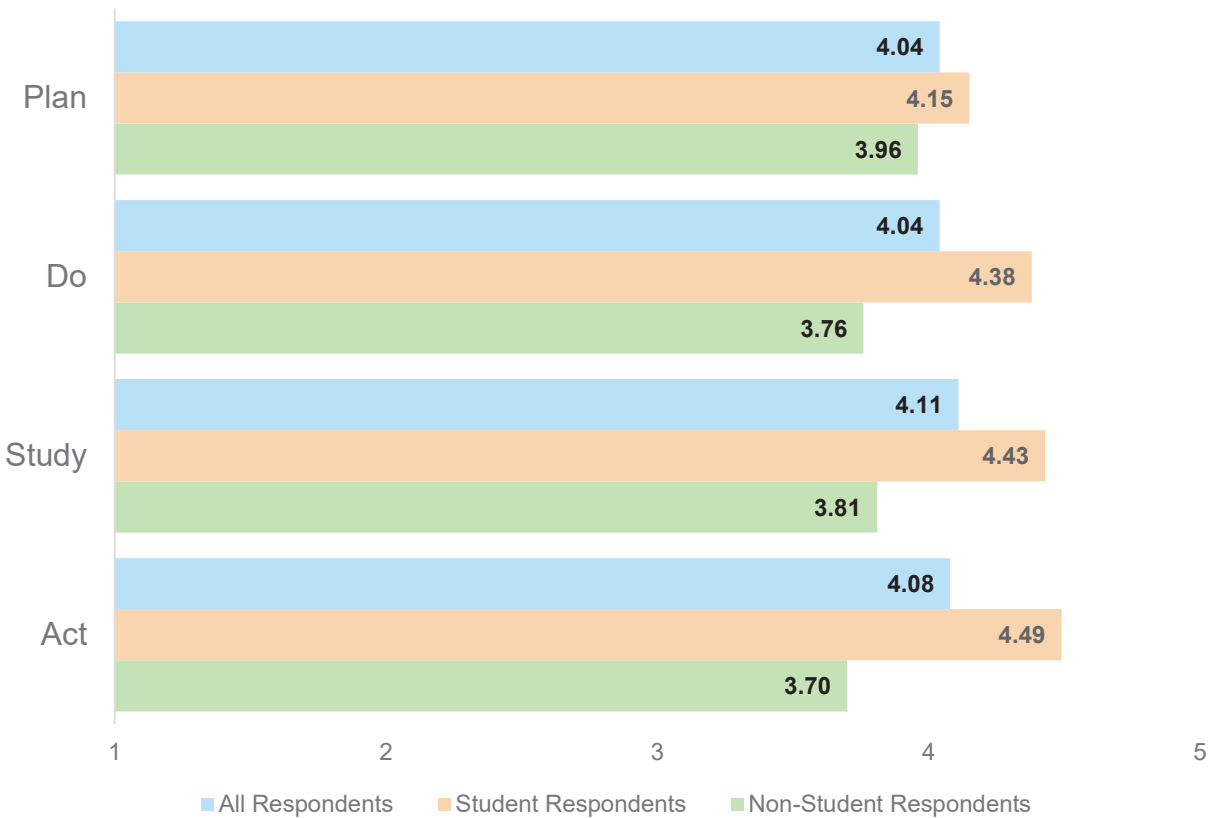
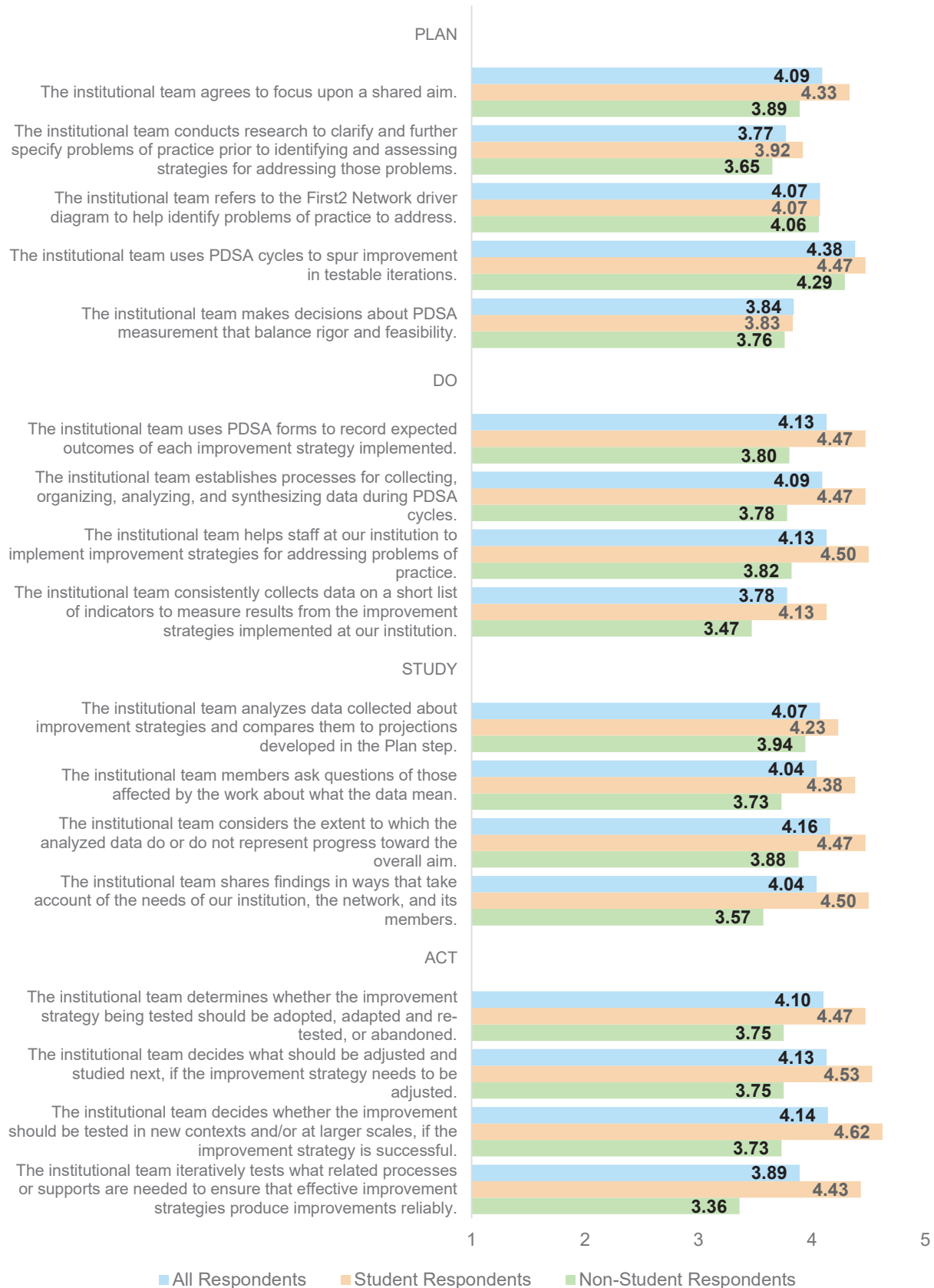


Figure 6 provides a visual depiction of the mean scores for each of the PDSA items. And, given students made up such a large proportion of respondents, average scores by student respondents versus non-student respondents are also depicted. Students’ ratings were higher for every one of the 17 items.

Respondents were given an opportunity to share comments about their ratings for these 17 items. Four individuals provided feedback; verbatim comments are provided below.

- *We do many of these things in one way or another during our summer lab experiences but it would not be accurate to say the “institutional team” does these things—it is more just folks in the lab giving feedback.*
- *I put “I don’t know” for many of these questions because I have only been part of the institutional team for this year, and I don’t know what process we will use to make changes to PDSAs for the next cycle.*
- *We do not work on PDSAs together collaboratively, so cannot comment on any of these.*
- *N/A*

Figure 6. Mean Scores for PDSA Items from the Institutional Team Survey

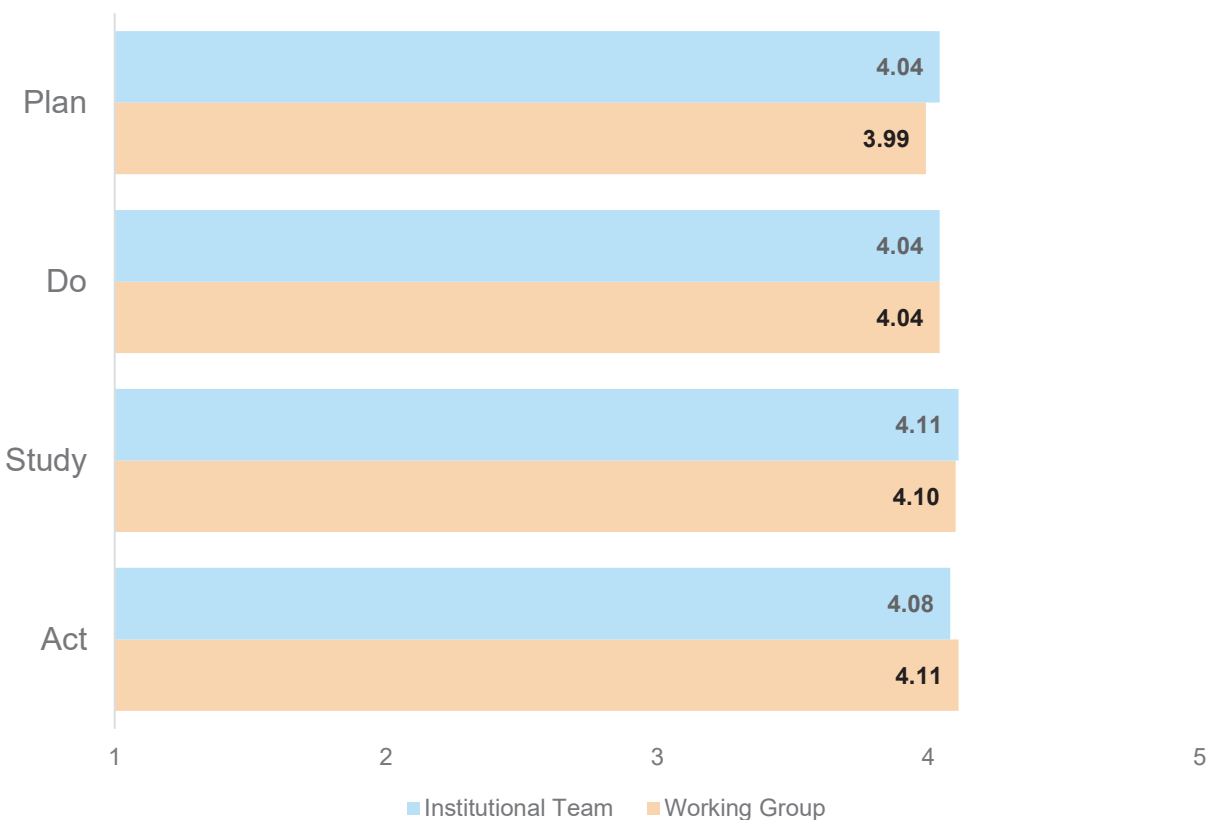


2.5.4 Institutional Team PDSA Scores Compared to Working Group Self-Assessment PDSA Scores

Although not directly comparable, since the composition differs between former working group members and current institutional team members at the seven participating higher education institutions, results were quite similar for the last working group self-assessment scores (from November 2021 administration) and the institutional team scores (from February 2023).

As shown in Figure 7, the institutional team Plan score was slightly higher at 4.04, compared to 3.99. The Do scores were identical at 4.04, and the Study scores were nearly identical at 4.11 (institutional team) and 4.10 (working group). The Act scores were very similar, with 4.08 (institutional team) and 4.11 (working group).

Figure 7. Mean Scores for PDSA Subscales from the Institutional Team Survey and the Working Group Self-Assessment Survey



2.5.5 Institutional Team Survey Summary

In sum, respondents had positive perceptions about the First2 Network, especially for its progress in supporting network students. They had similar perceptions about their institutional teams, again especially for progress in supporting students. Their perceptions about PDSAs showed little variation among the Plan (mean of 4.04), Do (mean of 4.04), Study (mean of 4.11), and Act (mean of 4.08), indicating all four cycles were viewed on average as more of a strength than a weakness. Further, in comparison to the last set of working group self-assessment PDSA scores, the institutional team PDSA scores were very similar, showing little variation over time and between these different compositions of network members.

2.6 Institutional Team Group Interviews

In June 2023, the evaluation team conducted six 1-hour virtual group interviews (one per site for Blue Ridge, FSU, Glenville, UC, WVU, and WVU Tech); Marshall University (MU) declined to participate in an interview. A total of 25 institutional team members participated; individual institutional team participation included: Blue Ridge = 4; FSU = 5; Glenville = 4, UC = 3, WVU = 5, and WVU Tech = 4.

Major topics included evolution of the institutional team over the year, institutional team purpose and roles, facilitating and challenging factors affecting PDSAs, key outcomes, systems-level changes at the institutional level and across the network, student focus and engagement, institutional team collaboration, suggestions for improvement, and most beneficial support from the First2 Network and additional support needed. Responses are organized by these categories.

2.6.1 Institutional Team Evolution

All six sites identified a number of ways in which their institutional teams had evolved over the past year. For one site, the past year was a start-up exercise with putting plans in place for the coming fall semester; for others, the past year saw both transitions in team membership as well as team growth as teams worked to build stronger, more visible connections within their respective sites; for example, adding team members from across content areas as well as career or student support services.

Common themes noted by most teams were gaining a deeper understanding of how the different parts of the institutional team fit together and could work together, and how institutional team members were also participating in First2 activities such as Steering Committee or Improvement Science Team meetings and/or attending conferences. One site mentioned holding meetings more frequently on a regular basis, another mentioned holding institutional team meetings during student club meetings twice a semester to ensure student involvement, and one site acknowledged the “phenomenal” support that the First2 Network provided as their staffing transitions took place on their institutional team.

2.6.2 Institutional Team Purpose and Roles

When asked to articulate the purpose of the institutional teams, sites offered similar interpretations about working within each site to support first-generation students and help them be more successful. And working within those sites seemed to make the work more directly aligned to their respective responsibilities and more directly focused on their respective student populations. Whether support was focused on content area, research opportunities, breaking down barriers, building connections between students and faculty, or even persistence in general, participants

The institutional team is taking what the network discovered over the previous 4 years and instead of looking outward, we're now taking best practices and moving inward and taking what successful PDSAs were developed and implemented and initiated and . . . the work that the working groups did, and focusing on our own institution instead of just trying to do it networkwide. For me, it's a very tangible process now, it's very concrete. I know before I was kind of floating out there in a working group and I was trying to figure out how to fit in, but now clearly I have a context and this all makes sense to me. And I can focus my attention on our population, which aligns better with my job and makes sense to make time for it. It's now more of a priority for me.

– Institutional Team Member

across sites were united in their understanding of the purpose of the institutional teams, and recognized the value of building those strong connections within their respective institutions.

Additional insights related to the institutional team purpose focused on the value of the First2 Network—one individual commented that receiving the subaward enabled participating faculty to get small stipends, which helped encourage faculty involvement. Others reflected on how the network gave them an opportunity to stay connected to other institutions, see what is happening at other campuses and what challenges they are facing, and how they are addressing those challenges.

When asked about their specific roles within their institutional teams, participants offered a variety of comments. Some were broad statements, such as to “understand how the PDSA works and how we can implement PDSAs with our students and our staff so that we can track some form of measurement and progress.” Others were more specifically focused on a specific role on the team, such as the institutional liaison, Steering Committee representative, the IRB liaison, and so on. Still others saw their role as connectors or bridges with industry, with students, and with student support services. As one participant suggested, “Basically there were specific positions that we need to designate someone to . . . so instead of having one person doing half of the work, . . . we have designated roles for almost everyone.”

2.6.3 Facilitating and Challenging Factors Affecting PDSAs

Facilitators. The most common facilitating factor across sites seemed to be the support provided by the First2 Network, including coaching, accessing PDSA examples carried out by others, funding, access to individuals with First2 experience who can provide support, and being involved in various First2 groups such as the Improvement Science Team. One individual reflected, “I think they did a phenomenal job with the resources they provided.” A member from the same site noted, “I just used the math PDSA that was already created, so it was really easy to implement.”

I think the templates are pretty nice. I mean, they don't always have all the information you need, but they are a good starting point for someone like me who, I mean, I didn't even know what a PDSA was a year ago. It is helpful to see some examples and especially the templates that are for campus club that everyone's doing, and they're iterating those, so they're getting better every year, I think. And those are helpful starting points. – Institutional Team Member

One individual noted having some of their members also serve as representatives to the Improvement Science Team: “We’re trying to work it from both ends so that we have people understand as the rules and processes are evolving, how to apply them in the PDSAs.” Another concurred, adding, “I think being on the inside has helped us know right away what to do before we get started.”

Challenges. Several sites were more forthcoming in their discussion of PDSA challenges but all six sites identified specific issues with which they were struggling. The most common cross-cutting barrier included the PDSA process itself, which was viewed as being overwhelming and overly prescriptive. Interviewees noted that some faculty and

Just the whole process right now, I think, with trying to get different things approved through the Improvement Science Team, and the coaching that's supposed to be involved. ... And the whole process has really just been kind of confusing where we are just going in circles, and I think it's prevented certain projects from moving forward. – Institutional Team Member

students struggled to understand the purpose of or process for carrying out PDSAs. Further, participants perceived a shift had occurred in the PDSA requirements, and that what was earlier touted as not being a very hard process was now being held to a different standard and, as one participant said, “It’s not an easy process, there is a learning curve.” A sampling of illustrative quotes follow.

- *There is a frustration level where you think you're doing it right and then you get coached and you're like, "Oh, I'm not doing this right." You've got to rethink it, redo it, or whatever. It's a learning process and you can't look at it like "I'm just going to get this done quickly."*
- *I think there hasn't always been a clear communication of why we do this formal PDSA process that seems complicated instead of just doing an event or a thing that to us seems obvious that it would probably help people. And so, especially when we're trying to engage students in the PDSA process, they don't really understand why and it just feels like something they have to check off. And I even saw that some of the other faculty felt that way a little bit, I think, of "Why do I have to jump through all these hoops?" They feel more like hoops without the understanding of why we're doing them, why it's important—without an understanding of what improvement science really is.*
- *I'll say that it's the chicken and the egg, right? If we do low-quality PDSAs, we don't get data that tells us anything. And that's sort of what we did for several years. We don't really have a value added. It was easy, but it didn't really add much value. Now we made it really hard, . . . and hopefully we're going to start getting value, but because the IRBs were so delayed, and that was another barrier for me, we need to show people . . . "What did we learn? Why is this a valuable process? Why was it good that we did campus clubs the same way across the network? And what can we do as a comparison now?" I think if those stories were on the website, it becomes a lot easier to buy into.*
- *The main barrier for me with PDSAs was actually understanding the PDSAs itself. . . . We understood that PDSAs would be something, and it turned out being something totally different. And so I think the main barrier was information. We received different information from different people from within the First2 Network. We were doing PDSAs in one way, and it seemed like it wasn't the way that it should be done.*
- *The way the network has been talking about PDSAs has changed dramatically over the last 5 years. They were supposed to be easy, simple, quick things that you did, you implemented, and then you kind of reported out on what you did, and then you either did it again or not. They are so strict and rigorous now about what they want you to do.*
- *So the PDSAs are supposed to be easy, quick. And they've turned into this really rigorous monotonous process such that you have to have coaching for everything you do. For instance, I have two PDSAs that are done. I've written them up, I've written everything up on them, and now I'm told that I have to have exit coaching. Come on, why do I need exit coaching?*
- *Yeah, the warning that I gave early on was that if you continue down this route with all these requirements, this will not be sustainable in the long run. You can do it while people are getting paid a little bit of a stipend or something like that. But if you continue to do these requirements and . . . instead of using a carrot, using a stick on these kind of things, it's not going to be sustainable. So to me, the carrot that I was trying to promote was "If you get involved with this PDSA with a larger group, you will be able to publish*

your research with this larger group” and things like that, to use some kind of a carrot other than money for sustainability. But it hasn't happened. And I think that as soon as the funding is gone this whole thing is going to collapse because of the overhead and the requirements, because there's not going to be anybody paid to do it, [so] nobody's going to do it.

- *We all have to go through this coaching thing so they would explain the PDSAs, and then we design the PDSAs accordingly. And it seems like they keep asking us again and again for more coachings. We already planned, it's all in the [Google Drive]. And we keep adding things as we complete the PDSA. But all this meet again, meet again, and honestly, sometimes I'm afraid in the next meeting, everything is going to change again and I will have to go back and rewrite everything. Because it seems like if you have a meeting with a different person, the concept changes and then you have to go back and kind of do it again.*
- *But the problem too is you're talking to people who have lots of research experience. You're talking to people who have led dissertations with grad students and who have plenty of publications of their own. And then you're trying to tell them how to do a simple cycle of research. This is not needed. And early on, I said these people are researchers. They should be teaching the class of how to do research; not being told how they should do research.*

A related challenge is trying to navigate the First2 website to find resources for carrying out PDSA efforts. One individual noted that finding relevant resources on the website was like “trying to pull a needle out of a haystack” and another commented that while the website contained a “lot” of information about PDSAs and improvement science, “it’s not always very succinct or easy to find.” Others seemed unaware that any such resources existed. For example, one individual noted a hurdle was in finding training for specific roles (such as institutional liaison or club advisor) and so resorted to asking questions of First2 staff. This individual learned there was going to be a training but was unable to participate and said, “It would be nice if that was something that already existed in some kind of document that I could just read.”

Another issue was the mentoring/coaching component, with difficulties noted in getting time scheduled with a mentor, knowing who a mentor was for a particular site, and being required to participate in multiple coaching sessions for a single PDSA. Several sites also identified the IRB process for carrying out PDSAs and sharing data was problematic, both in terms of figuring out and completing that process as well as in receiving IRB approvals.

Finally, a few individuals identified a challenge related to the required use of common metrics across PDSAs when some outcomes may not be as relevant depending on PDSA topics, such as grades (which are problematic as well with IRB approvals and Family Educational Rights and Privacy Act regulations) or survey items related to self-efficacy or belonging.

2.6.4 Key Outcomes

Across sites, three main types of outcomes emerged as common themes, the first being how the institutional teams are strengthening the connections within campuses and making the First2 work more relevant or aligned with individual responsibilities. A sample of illustrative quotes follow.

[The institutional team] has formalized interactions that we didn't have before. And that's made a whole bunch of things possible. Just realizing that's a person with the same goals as you, they have some tools that they're using that you didn't know about. And so you can use those tools. Just that networking among campus professionals has been a really cool . . . outcome of institutional teams. – Institutional Team Member

- *I think that more people on our campus are better connected to the network through the institutional team than they were when we used to have working groups.*
- *I think it brought the work home. And so now I think we have more people that get it, whereas before it was just like, oh, you're part of this thing and I know you're working on this thing, but now everybody's working on this thing because they're working on it here.*
- *The best way you're going to get them to act on it is if it appears to be relevant. And so I see more people actively engaging now than I saw before because of that inward kind of [focus on institutional teams].*
- *We've got more buy-in now, I think, from more people.*
- *I think it's a tremendous success to have wonderful faculty willing and interested to work on this to replace our other faculty. That's been a major transition for us, and success.*
- *Getting connected with the right offices on campus . . . that's important for this team, having the right people at the table.*

Another theme focused on the results from various PDSA studies, some positive and some leading to more iterating. Further, one individual pointed out various products that also resulted from PDSA studies, such as presentations, publications, and student projects (such as research studies, dissertations, and so forth). A few illustrative quotes follow.

- *We have good resources, we think. We don't have a clear understanding of why students aren't up-taking them, and we want to solve that with our students this year.*
- *I think most of our PDSAs that we've been working on have been related to student engagement, and through engagement, hopefully retention. So . . . trying to break down barriers between students and faculty members has been one of our main objectives, which again, it helps having a lot of faculty and a lot of students involved so that they're interacting and they're working together in different ways. So I think that's the one that comes immediately to mind as a major outcome.*

Finally, interviewees from one site focused on having more interaction among faculty and students, more opportunities for students to focus on and be more involved with STEM, more student awareness of student support services, and being “more aware, conscious, and thinking in terms of first-generation students”—things they will encounter and how to remove obstacles.

And one individual at another site noted that the First2 student club was named Organization of the Year at that campus, which was “a major accomplishment.”

2.6.5 Systems–Level Changes

Systems–level change at institutions. When asked to identify any systems–level changes that had been observed or that sites were striving to reach, perceptions differed by sites. One site focused primarily on growing their PDSA efforts and better integrating STEM components. One individual commented, “I think that’d be really cool because there’s just so much that overlaps in there.” Another individual concurred, adding, “I think we definitely will. I think there’s just a pathway to it . . . we’re trying to find our path, our way, our place . . . so it’s a process.”

At another site, one individual noted the desire to more effectively “incentivize faculty as part of their general faculty development to participate in this because clearly the institution is interested in recruitment and student success. . . . I think that would be a systems change I’d love to see.” Another interviewee reflected that they’ve made “some leeway” with helping faculty see more of the value in career services through involvement on the institutional team “and [they are] really utilizing us . . . we’re slowly getting there.” One other individual concurred, adding that career services staff have been attending First2 IAB meetings “and that direct industry careers connection, I think, is a weak spot in the whole higher ed system that it feels like there’s a potential to really make some impact on.”

Several sites focused on what they hope to achieve through their respective PDSAs, which focused on topics such as the student club, faculty/student engagement, math skills, math anxiety, retention rates, student mentoring, and student engagement. An individual at another site reflected that having a campus liaison as part of the institutional team will provide a “point of contact” that structurally will work better than “having a variety of individuals reaching out to a number of others across campus.” Finally, one site also recognized that the institutional team structure itself pointed toward systems–level change; illustrative quotes follow.

- *I do think having those key people, people associated with undergraduate research programs, associated with the First Gen . . . effort, that's what First2 is trying to promote. So that's system change, in my opinion, those people.*
- *If First2 is thinking about sustainability, it needs to be that way. . . . It's sustainable because we are already here and we will continue doing this stuff as we do.*

Systems–level change across the

First2 Network. There was general consensus across sites that their individual institutional team efforts could collectively lead to systems–level changes across the First2 Network. A sampling of illustrative quotes follow.

Good things are happening across the state, different schools are doing different things. System level changes are not easy . . . so far everyone is feeling that there is a positive change.
– Institutional Team Member

- *There's certainly opportunities for institutions to work together on joint PDSAs . . . so that level I see it as being possible.*
- *And that direct industry careers connection, I think, is a weak spot in the whole higher ed system that it feels like there's a potential to really make some impact on.*

- *Certainly the cross-fertilization is huge. We found out about [one site's] COVID catch-up thing, and that's what was the impetus for [our effort]. Just because it failed, it doesn't feel like a failure because we know that there's got to be something there of getting students to connect to the academic resources at the right time in the right way.*
- *Obviously that is a benefit for people to talk and share that information and try to come up with some ideas for solving some of these problems. Bringing these entities together across the state is obviously really important. And that's what First2 has done for us.*
- *Yes, I'd say yes. And this was very clear to me during the conference because we could present what we were doing here, and we would network with other institutions and maybe help them or implement things that they were implementing. . . . I do believe that having these moments, it might be once a year where all institutional teams can come together and tell everyone what they're working on, and then we can implement something that we are not doing here. We can help other institutions.*
- *At the conference, then we had those breakout sessions, and then from that, I think we have started an affinity group around a topic. So I think that while we went from working groups that were forced to institutional teams, now we're going to real working groups that are affinity groups that are coming up naturally—grassroots affinity groups. So I think that that's the transition I think is healthy. And I think the conference has to be—we have to continue the conference for that to be facilitated.*
- *We're all at [one site] but how often do we actually get to see each other and work with each other? And by making it an institutional team, and you can focus on that because what we can do or we need to focus on is very different from . . . other institutions. And so by bringing it to our local team, but then you can go and you hear things and you learn things from other institutions of what they're doing. . . . And so even though it may not work exactly the same, learning that's an idea that we could take and we could run with it with our own twist. And I think when you . . . have the time to focus on your institutional group of the people who can make that change together, and we see what's happening, I think that really helps.*
- *I think if we come up with things that work well, then we can help them work well at other schools as well. . . . I'm actually involved in a group that's looking at math anxiety, which started out as a PDSA at a couple of schools, not ours. But now I'm going to be involved in trying to bring this study to our campus, and hopefully help our students. So I think across the network, just being able to share good ideas, and make it so that other people can try the same things and hopefully get the good ideas to work for them as well.*

However, several individuals also recognized that with the institutional team structure, there may be less cross-institution interaction, which could limit such change:

- *I'm going to say, compared to the old system, we're hindered a little bit now because we don't have a lot of cross-institution interaction the way we did before. So that really only happens at the conference and then maybe during each of us in a meeting here or there. So yeah, something like that, being more intentional with getting groups of people from different institutions together in a room chatting about the big ideas would probably help facilitate that.*
- *We used to be in a working group, . . . there were different schools talking about different subjects because we took from there the math pairs, so that was really an instrumental starting point for us when I sat in one of those meetings. So I do miss that*

as well because hearing what others are doing, giving you ideas for what you could do and then hearing your ideas. So that was a good thing. How to get it started again—there may be some others who are just as interested, maybe outreach, not sure.

Finally, one individual cautioned that a lack of funding support, with current First2 funding ending soon, was a cause for concern yet expressed hope for the sustainability of the statewide efforts:

- *We are running out of funding for First2 network, so this is a concern. So then, in that case, if we really run out of funding, I have nothing to support the networks. And I think that will come down to the institutions to find a way to sustain it and move it forward internally. Again, very similar things happening as well in the campuses, not only First2 Network—there are many, many other things very similar to First2 Network. I think when we get a chance to maybe sit down and maybe talk with the different groups doing similar things, and then eventually merge the work into a single portfolio, so that would be very appealing for the institution leaders that you like to maybe fund it. . . . Again, we need to be a little bit innovative to see how things would be sustained. . . . We have to just try it, and learn about it, and sustain it. I mean, we better sustain. In the institutional level, again, if everyone can sustain, it'll be a global statewide change. That's why we call it as a network. So hopefully, we will find a way to keep it running. So I'm optimistic on that. Hopefully, we'll be able to identify some other avenues.*

2.6.6 Student Focus and Engagement

Student focus. Institutional teams were asked how they kept a conscious focus on students at the center of their work. There was a general consensus across sites that all their efforts were focused on students. A sampling of illustrative quotes follow.

- *I think it comes pretty easy, it's always the focal point . . . "What can we do to give students a chance for us to promote that sense of belonging?" So we're always trying to think of whether it be an event, something to do with STEM, or just an event in general. But we're always thinking about what from that can be a takeaway for the student in terms of us promoting the sense of belonging, the student being able to recognize faculty and support services at the college so they can get what they need to stay and to be successful. So I don't think that's a hard task.*
- *I think we get more participation earlier than we do later towards graduation and in the end of the semester. But anytime we have the immersive planning, we invited students and they would come and go. Earlier, we had students participate, later we did not. And that is a mindset shift for me because it was always faculty, faculty, faculty, wait, what, include a student in that? We're planning about students, but that is definitely a shift for me in terms of participating in First2 and First2 is totally responsible for that. It was like, "Oh, yeah, we should invite a student." Now it's, "Yes, you must invite a student." That is definitely progress there.*
- *I will be honest with you and say that as a small institution, students are typically the focus of everything that we do. And I know that sounds really cliché, but we actually call ourselves, whether it's internally or externally, a teaching institution, so the focus is on the students.*
- *Our focus is the students, not anything else.*

- *Everything we do, we focus on students. And that's now the new administrative focus is, "If it's not something that's going to support students, we're not going to do it."*
- *I think, at least from my perspective on the PDSAs, all the ones I've been involved with were actually student driven.*

However, several sites noted that for various reasons, they did not yet have student involvement on the institutional team. Those reasons included missed deadlines for submitting student names, transition among students due to graduation or exiting First2, competing priorities for students, and waiting for student directors to be identified.

Student engagement. Institutional team members across sites shared a variety of ways in which students were engaged with their teams. Specifically mentioned were having First2 mentors, directors, and students participate in team meetings; having students and faculty collaboratively present at conferences; having institutional team meetings held periodically during student club meetings; having students actively involved in PDSAs; having students contribute to applications for grant funding; having institutional team faculty members attend student events; and holding institutional team meetings at times when students can participate. An individual at one site expressed their site's misunderstanding that the team was restricted to faculty members, and they have "made a conscious effort to invite more students" to their meetings. Across sites, there was a continuum of no student involvement to sporadic student involvement to continual student engagement.

2.6.7 Institutional Team Collaboration

When asked to describe their team's level of collaboration or interaction among members, there seemed to be general recognition across sites that there was an organic fluidity inherent in the team structure, with more participation at certain timepoints, i.e., that engagement waxed and waned depending on schedules, priorities, and First2 activities. Illustrative quotes follow.

- *I think we come together when we need to for certain projects that we're working on, certainly. So at some points we have more interaction than at other points where things are a little bit quieter.*
- *I think that as the semester wore on, we saw fewer and fewer at our institutional team meetings as everybody got really busy. But as the need arose for a particular thing that we were doing, that group would show up for that. . . . There was a need, and they were there, and then a few of them might have disappeared, but then the next time they were needed, they were there. Our team is a little fluid.*
- *I think that's something we need to work on a little bit more [not having a few individuals doing most of the work] and making sure that everyone is involved in most aspects, so at least they understand what's going on. And then provide the help and support where they feel that their strengths are, their skillset really falls. I think it needs to be much a team effort.*
- *I think just being able to see what other people are doing, and talk as a group, will be enough to chart a course.*
- *I think we just need to meet as a group a little bit more often so that we're all staying aware of what's going on, and picking what we want to dedicate resources to.*
- *And a lot of the times it's just shooting out a round of emails just to get updates from different members, try and get an idea of how much they've been doing. So we chat a*

lot more through email than we do full meetings. But again, I think having more regular meetings that are in person, or in Zoom, where you're seeing each other, will give us a better chance to point in the same direction.

- *I think that [dissemination of results as a group, faculty plus students] would definitely enhance the level of collaboration.*

2.6.8 Suggestions for Improvement

When asked what ideas they had for enhancing the work of their institutional teams, one site focused on becoming more familiar with PDSAs and “finding that rhythm.” This site also discussed the possibility of modifying First2 subawards to semester-based funding instead of year-based, to better accommodate student transitions and turnover at their site.

Another site anticipates getting student input in the fall in order to “figure out a very clear path and what we need to do to accomplish our goals.” An individual at another site suggested “I would like to see the students invite us to more events, because we’re not going to go to the student events unless they invite us because I also want the students to have their own space and we have told them that.”

Finally, one other site focused on several avenues of exploration for their team involvement, including community outreach opportunities, science fairs, afterschool programs, service work, and student clubs. In addition, one individual suggested efforts to help students better connect to the spirit of the campus: “What are some of the traditions that we can create that is another way to connect them and make them feel a part? Because if they feel good about being where they are and that experience from the outside of the classroom, then it transfers inside the classroom. And all these other experiences and things that we’re putting together, it makes them more invested.”

Civic engagement, community outreach is a wonderful opportunity to get students—it kind of breaks down the barrier between faculty and students. And when faculty and students can come together and work for a common cause, it helps them to engage with faculty and it is not intimidating, it's not intrusive, but yet to see that we're serving together, and a lot of things can happen out of that. Faculty are getting to know students more organically, more naturally, and then students feel more confident when they're working on it with faculty. And it also helps those students that are a little bit more introverted to begin to engage and meet other students and peers and build relationships. And I think that's so important when you talk about that community feel, because . . . sometimes students can feel a little on the outside . . . particularly if you're first generation. . . . And so I think that helps to break down some of the barriers and some of the things that we come from different backgrounds, different experiences. Being first gen, we have some commonalities, but we also have some things that are different. And so I think it helps them to become more connected, just with other students in general, and it helps them in that growth process and that developmental process that they go through.

– Institutional Team Member

2.6.9 First2 Network Support

Most beneficial support. Members across institutional teams identified numerous examples of the most beneficial support provided to them by the First2 Network. The most commonly mentioned support was the collaborative nature of the network. Illustrative quotes follow.

- *The whole collaborative nature of the First2 Network and how supportive people are, if you have a question or whatever, is what I've really appreciated.*
- *[The networking] really has been the most beneficial thing to me too. Just getting to know and work with so many other people throughout the whole state has really been something I've enjoyed and learned a lot from.*
- *I think meeting all these people from throughout the whole state is really cool. There's a lot of networking that is involved and I think it's good for students to meet students at other institutions as well. The networking is probably . . . the biggest thing I've appreciated.*

Other common supports included the human resource capital (knowledge and support), mentoring, financial support, the conferences, the resources available on the website, and the backbone support. A sampling of illustrative quotes follow.

- *Probably the people that have already been in our shoes and are further along than what we are, that we're not reinventing the wheel by any means for what we're trying to get accomplished on our campus. So there's definitely people as resources.*
- *We had a meeting in the spring sometime to talk about the proposal for the grant for the next year and how we needed to frame that and what needed to happen. That meeting was extremely helpful for me to understand the process and what [site staff] had gone through previously. And so just having those touchpoint meetings I think are really important, so that was helpful. And then just to reassure—we could reach out if we had any questions, any concerns, that they were here to help us as they really consider us almost a new group at this point.*
- *And I think clear expectations help me a lot. Okay, this is the ask. We need to do this by this date. This is the thing we need to do. This is how we're going to know if we did it right, this is what we'll get as a result of it. Those things, it just makes it way easier to administer something like this.*
- *I think the mentoring is definitely critical, and financial, obviously. So of those two, can't go wrong with those, just like ice cream.*
- *It definitely has mattered [financial support]. Paying people for the extra work that they do to make something happen has definitely been It makes me less anxious about asking people to do things.*
- *Especially getting to know them at conferences, I see them as earnest people, honest brokers, looking to do the right thing; makes it a lot easier to work with.*
- *The conference is so important for . . . us to interact. And I hope the network can keep at least the conferences as an opportunity for us to meet with other institutions, other students, other faculty from other institutions.*

Just being able to communicate with other institutions like my last PDSA that I did, I haven't completed it yet, but . . . I got all of my materials from [another site]. They were very kind and generous to share every material that they had, every resource that they had so that we could try to implement it here. And so that's definitely something that is very beneficial. Just having those individuals that you can talk to that have already done this, they know what issues they had. They can give a lot of tips and tricks, so very supportive. – Institutional Team Member

- *I've found the conferences very helpful. Making those connections with others, hearing what other people are doing, generating ideas, that's been excellent support.*

Additional support needed. When asked what additional support was needed from the First2 Network, the most frequently-mentioned topic was for a reorganization of the network website.⁴ Illustrative quotes follow.

- *Make stuff on the website easier to find. Categorized and cataloged better, just so we don't have to reach out and ask questions. And honestly, we don't know whether it's us or whether everyone else is the same way.*
- *The greatest weakness, because sometimes find[ing] that information on the website can be a nightmare. And so organization of the website—I've complained about [that] several times.*
- *I know First2 has been using the Google Drive quite a bit, but I think we all admit that finding things in that Google Drive, if you don't have the direct link to it, is [difficult]. I have tried, because I'll lose the direct link [to a particular resource]. It's like, "Oh, well, I've had that document before. I should be able to get back to it." And an hour later, I'm emailing Jade going, "Jade, can you just send me the link because I can't find it to save my life."*
- *Unfortunately, again, it's a big network that has a bunch of things in it. And as it grows, and we're not using that anymore . . . [material remains posted]. It kind of, it needs some TLC. Someone who's willing to go through and organize or sort into ways that are more easily digestible.*
- *And then everything was in these Google Drives that you're trying to sort through and find and read through. And that was a little hard to [navigate], you weren't familiar with how things were named, or how . . . to work your way through that.*

Other suggested supports included additional resources (documents and/or recordings) for orientation and onboarding, and one individual reported having to convert Microsoft documents to Google documents in order to share on the network drive. Finally, several interviewees at one site perceived there were too many requirements for both faculty and students. Those comments follow.

I realize that students are busy and being asked to do a lot and we are as well. And think about that with the things that are coming down the pike, knowing that this is just an add-on to everything else that we do. And if you want to keep something sustainable, especially after a grant [ends], it needs to be that it is not a huge time suck on your job and that it's not pulling you from other things, it's just an enhancement.

– Institutional Team Member

- *Fewer reports. Fewer structures, fewer requirements. And I'm also worried about the requirements that they put on the students. I feel like sometimes the students are getting overwhelmed by all of the requirements that First2 is putting on them. . . . So I think I'm a little worried about all the pressure the network is putting on the students. And I do know that there are students who aren't involved in First2 because there's too many requirements and too many strictures, too many hoops to jump [through] for the network.*

⁴ Participants across sites identified issues with both the network website and the network Google Drive, and at times seemed to use these terms interchangeably.

- *I had students dropping out of the network just because of the requirements. They were like, "No, I cannot handle all the requirements." Because they already have the requirements of the research, which is connected to the program, and this should be all they need to do. But they have to do all these extra things [so] that they say, "No, I can't continue doing this extra, extra." So I think the network needs to rethink the requirements for students. They are too overwhelmed. Freshman year is already an overwhelming time in their lives. If you keep adding things for them, they just give up. They feel like it's too much. . . . I'm not saying remove [all] requirements, they need to have some requirements. But if the scholar program is tied to another program at each institution, let the institution deal with the requirements. So I had the requirements for my students in [another] program. If they did my requirements, they would be meeting the First2 requirements because I selected them.*

2.6.10 Institutional Team Group Interview Summary

In sum, participants across institutional teams were gaining understanding of how institutional teams function, both within teams and across the First2 Network. The cross-cutting goal of supporting first-generation students was clear across sites, all sites reported a conscious focus on students, and team members found working within their respective sites aligned their efforts more directly to their respective responsibilities and their respective student populations. The most common facilitating factor across sites was the support provided by the First2 Network, and the most common challenges were the PDSA process and navigating the network website. Key outcomes across sites included strengthening connections within campuses and PDSA results. Systems-level change perceptions differed across sites, but there was general consensus that individual institutional team efforts could collectively lead to systems-level changes across the First2 Network. Participants found the collaborative nature of the First2 Network as its most beneficial support and suggested a reorganization of the network website was needed as additional support.

2.7 Conference Feedback Forms

Participant feedback is secured following each First2 Network conference via an online survey. During Year 5, First2 hosted a virtual fall conference October 21–22, 2022: Changing the System through Improvement Science and Industry Collaboration. The network also hosted an in-person spring conference May 11–13, 2023: Improvement Science, Mentoring, Industry Connections, which was held at Stonewall Resort in West Virginia.

2.7.1 October 2022 Results

A total of 42 respondents completed the online survey. Twenty-nine percent of the respondents were new to the First2 Network, 27% were members of an institutional team within the First2 Network, 24% were network members but not involved in an institutional team, 17% served in a leadership position within First2, and 2% were aware of the First2 Network but not involved. More than three-fourths of respondents were students (78%), followed by educators (12%), industry/nonprofit/government/other (7%), and staff/administrator (2%).

Respondents were asked to describe how they were involved with an institutional team. The wording of this question, or at least its open-ended nature, may have caused confusion among respondents. More than a fourth (28%) indicated they were a scholar, 16% did not respond, 14% indicated they were a student director, 12% indicated they were not involved, and 5% indicated

they were researchers. An additional 28% responded by providing some other type of role description; a few examples include faculty liaison, campus club vice president or liaison, Improvement Science Team member, or IAB member.

Respondents were asked to indicate all the virtual sessions they attended. Results are shown below in Table 8, indicating high participation rates across most sessions.

Participants were asked to rate three items about the First2 Network. Responses for these items were very positive, with mean scores ranging from 4.00 to 4.32 on a 5-point scale of *Strongly Disagree* (1) to *Strongly Agree* (5): *I am committed to doing the work associated with the First2 Network* (4.34), *I am enthusiastic about participating in the First2 Network* (4.24), and *I understand what my role is in the First2 Network* (4.10).

Respondents were also asked to rate 12 items about the virtual conference. Ten of these items had mean scores at or above 4.20. The highest-rated item was that the *Conference provided sufficient time for participants to share observations/ask questions* (4.51) and the lowest-rated item was that *Sufficient time was provided for general networking with other First2 Network members* (3.88).

Table 8. Participation Rates for October 22 Conference

Day	Session	Participation Rate
Friday, October 21	Purpose Setting	56%
	STUDY: Immersive Experiences	61%
	ACT: Immersive Experiences	63%
	Breakout Rooms by Institutional Teams	71%
	Report Outs from Institutional Teams	85%
	Spotlight on Change Ideas from Network Members by Campus	81%
	Wrap Up, Next Steps, and Closing	83%
	Q&A About Sustaining the First2 Network in Year 6 and Beyond	59%
Saturday, October 22	Welcome, Introductions of Industry Members, Intro to IAB	81%
	Fairmont's Industry-Informed Project	73%
	Q&A, Open Discussion	78%
	Let's Hear from Our Industry Partners	78%
	Breakout Rooms with Industry	56%
	Next Steps and Closing	56%

See Figures 8 and 9 for more detail. The first figure shows the item response percentages (organized as on the feedback form) and the second figure shows the item mean scores (organized by mean value). The three network items are depicted with green bars on the second figure to differentiate them from the conference items.

Figure 8. Item Response Percentages for October 2022 Conference

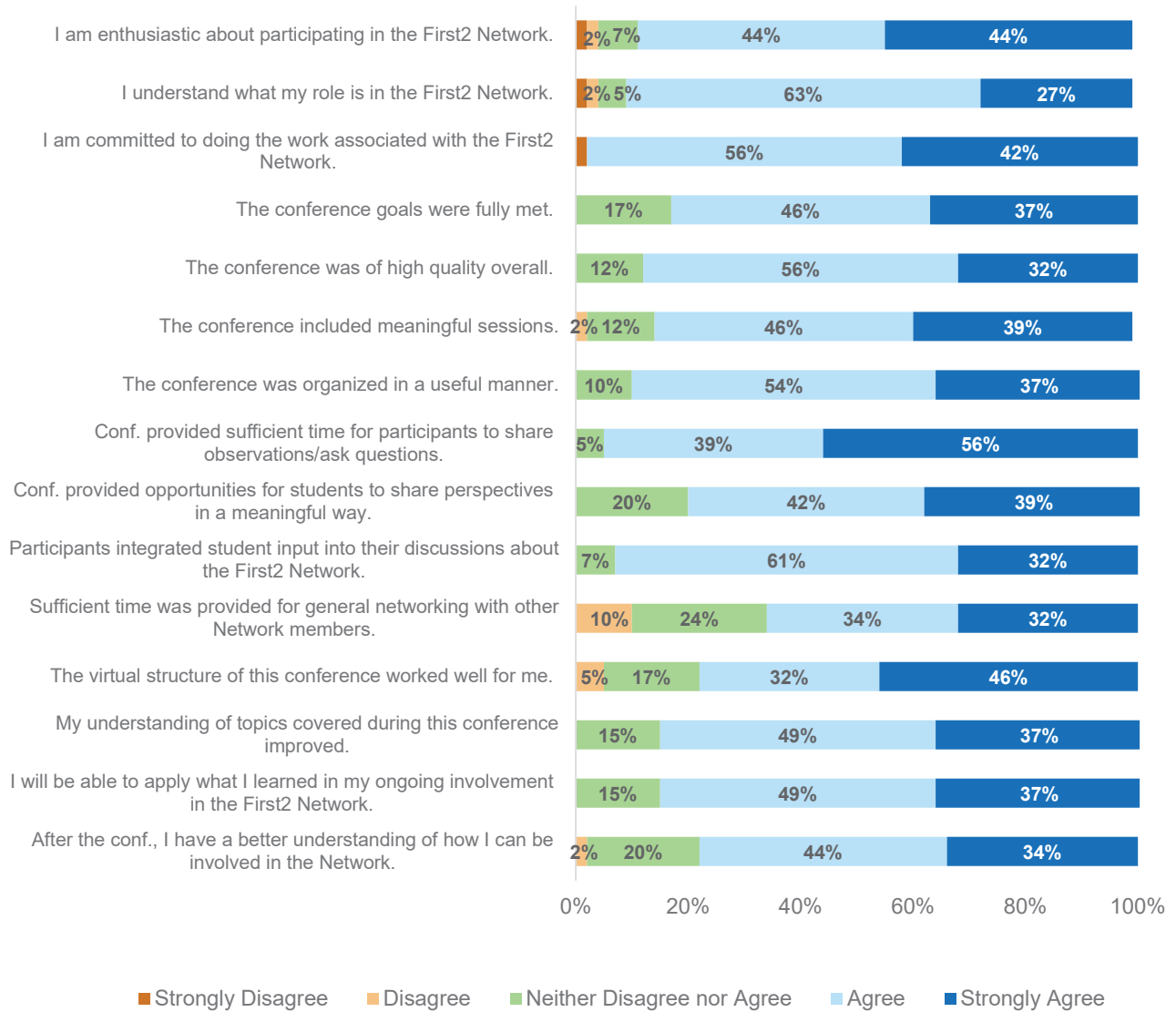
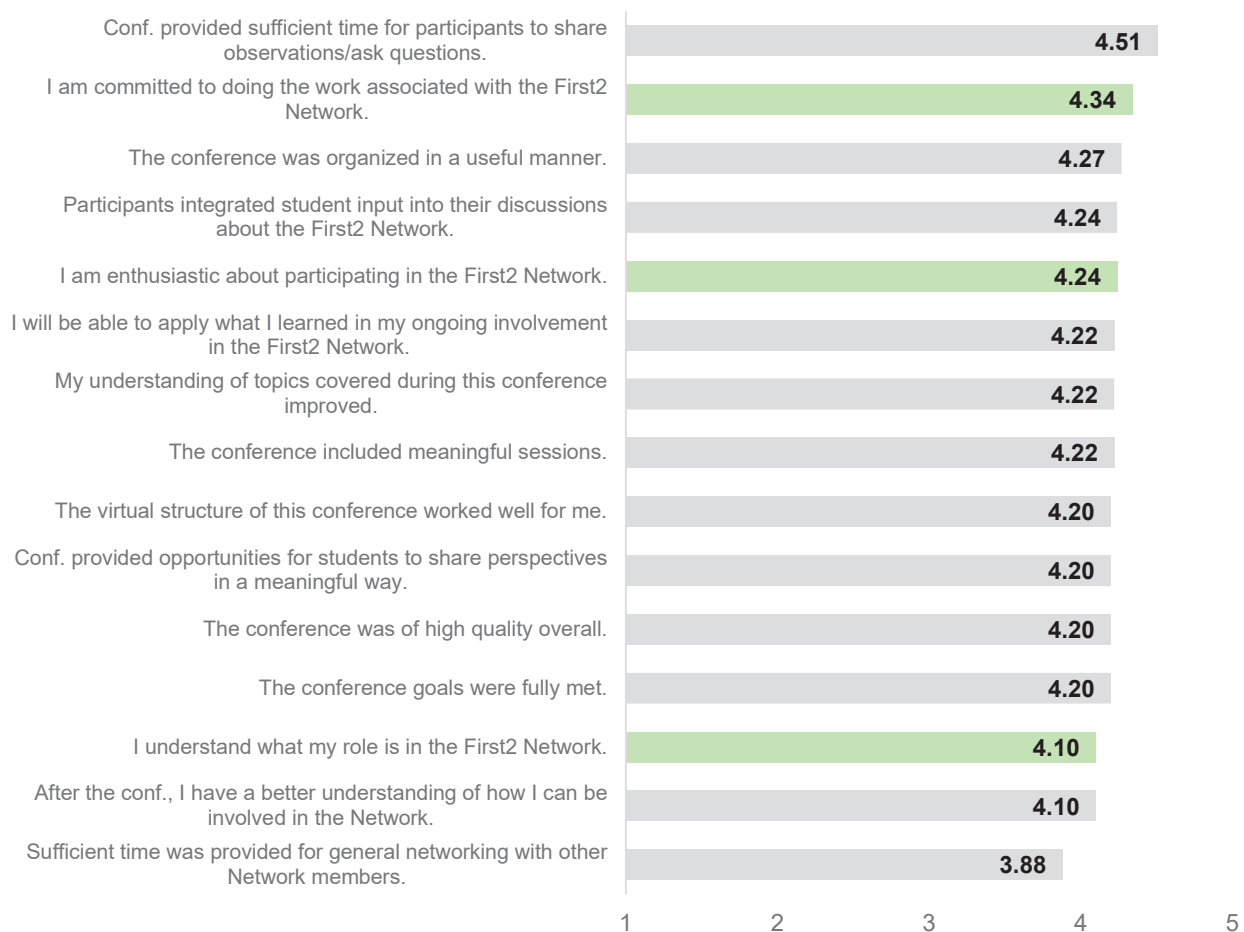


Figure 9. Item Mean Scores for October 2022 Conference



In the final section of the feedback form, respondents were asked to provide comments for five open-ended prompts. When asked to identify the high point of the conference, 33 individuals responded, with industry sessions being the most commonly identified high point (55%). Other themes focused on the First2 Network (12%), PDSAs (9%), and student voice (6%), with 18% miscellaneous. A few illustrative industry theme quotes follow.

- *I liked getting to talk with the industry partners the best, because we were able to ask questions about what STEM industry people really do.*
- *I loved listening to the industry professionals share their experience and journey to where they currently are. During our breakout rooms, I learned about details such as interview process, healthcare coverage, etc., that many industry professionals shy away from in a discussion.*
- *The high point for me was the breakout room session/Q&A with industry leaders. Getting to speak one-on-one with them was a fantastic networking opportunity and definitely expanded my horizons.*
- *Building connections with people who are experts in their field.*

- *The breakout rooms with industry were really, really helpful for students. The speakers gave great advice.*

When asked to identify what did not work as well, 32 individuals responded. Sixteen percent indicated that everything had worked well. The most common themes were (1) timing issues about the Friday/Saturday schedule (34%) and (2) timing issues about the pacing of the conference (25%); an additional 25% of the comments were unique in nature. A few illustrative quotes about each of the timing issues follow.

- *The times on Friday were kind of difficult for some students to attend since a lot of us have classes in the afternoon.*
- *The Saturday date conflicted with a required undergraduate recruitment event at my institution.*
- *Some of the breakout rooms lasted a really long time, and our institutional team kind of ran out of things to talk about.*
- *It was a little tough to just have two 10 [minute] breaks.*

When asked what additional information was needed related to their work within the First2 Network, 25 individuals responded, with 60% noting no additional information was needed; the remaining comments were unique in nature. Similarly, 26 individuals provided responses when asked what support was needed from the network for them to become more involved; 62% noted no additional support was needed or they were unsure, and several of the remaining comments focused on better communication about what First2 is and when events are happening.

The final prompt provided respondents an opportunity to make any other comments about the conference. Twenty-two individuals responded, with 36% indicating they had no other comments and 50% providing a positive comment; an additional 14% of comments were unique in nature. A few illustrative quotes follow.

- *It was great—everyone was very enthusiastic and cordial.*
- *It was very helpful for understanding the overall goals of the network.*
- *This was my favorite virtual conference I've been to. It was very informative and helpful.*

2.7.2 May 2023 Results

A total of 63 respondents completed the online survey but 10 surveys were excluded since no items were rated. Results are summarized below based on the 53 remaining cases. Nearly half of the respondents (47%) were members of an institutional team within the First2 Network, 25% were network members but not involved in an institutional team, 23% served on the First2 Network steering committee, 17% were new to the First2 Network, and 4% were aware of the First2 Network but not involved (note that respondents could select more than one response, so the total is more than 100%). For those respondents who were members of an institutional team, they were asked to provide their role on that team. Most common roles included student directors, scholars, liaisons, co-chairs, and team members. Nearly half (42%) of the respondents were educators, followed by students (32%), staff/administrators (11%), nonprofit/government/other (11%), and industry reps or industry partners (4%).

Respondents were asked to indicate all the sessions they attended. Results are shown below in Table 9, indicating high participation rates across sessions.

Table 9. Participation Rates for May 2023 Conference

Day	Session	Participation Rate
Thursday, May 11	Welcome all Participants!	76%
	Improvement Science Storytelling Workshop	77%
	Storytelling by Institutions	83%
	Networking Break and Poster Session	87%
	Takeaways from Institutional Poster Session	81%
	Steering Committee Meeting	64%
	Dinner and Reception	85%
Friday, May 12	Decisions to Study and Persist in STEM	93%
	Breakout Session: Belonging – Campus Clubs	43%
	Breakout Session: Academics – Math Anxiety, Math Preparation	43%
	Breakout Session: Immersion – Summer Immersion, Internships, Bridge Programs	40%
	Breakout Session: Belonging – Faculty/Student/Staff Communication, Social Interactions	38%
	Breakout Session: Academics – College Success Habits, Metacognition	42%
	Breakout Session: Leadership – Student Leadership Training, Mentor Training	40%
	Full Group Huddle (Debrief)	91%
	First2 Student Panel	89%
	Breakout Session: Centering Student Leadership in Institutional Teams	42%
	Breakout Session: Careful Conversations: Inclusive Communication in the 21 st Century	28%
	Breakout Session: Roundtable: Active Learning in STEM	36%
	Breakout Session: First2 Campus Clubs	47%
	Breakout Session: A Day in the Life of a College Student	34%
Breakout Session: WV Jobs Network and Students	34%	
Saturday, May 13	How a Patchwork of Data Can Tell the First2 Network Story	81%
	The Industry Advisory Board Presents: Sophomore Experience	72%
	Industry Exhibit/Networking	70%
	Industry Panel	70%
	Closing	70%
	“Bonus” Sustainability Roundtable	38%

Participants were asked to rate six items about the First2 Network. Responses for four of those items were very positive, with mean scores above 4.00 on a 5-point scale of *Strongly Disagree* (1) to *Strongly Agree* (5): They are enthusiastic about participating in the First2 Network (4.51), they are committed to doing the work associated with the First2 Network (4.49), they are committed to contributing to institutional team efforts as a part of the First2 Network (4.41), and they understand their role in the First2 Network (4.15). The remaining two items had slightly lower mean scores: They are confident the transition to institutional teams was a positive change for the First2 Network (3.58), and the network's shift to institutional teams has been helpful (3.48).

Respondents were also asked to rate 13 items about the conference. Twelve of these items had mean scores above 4.00. The highest-rated items were that the in-person structure of the conference worked well (4.56) and that the conference provided opportunities for students to share their perspectives in a meaningful way (4.55). The lowest-rated item was that they had a better understanding of the role of institutional teams in the First2 Network (3.69).

Figures 10 and 11 provide more detail. Figure 10 shows the item response percentages (organized as on the feedback form) and Figure 11 shows the item mean scores (organized by mean value). The six network items are depicted with green bars in the second figure to differentiate them from the conference items.

In the final section of the feedback form, respondents were asked to provide comments for five-open-ended prompts. When asked to identify the high point of the conference, 40 individuals responded, with the most common themes including the networking/interaction, the student sessions, and the keynote sessions. A few illustrative quotes include:

- *I really enjoyed the networking portion of the conference, and the space to provide and receive feedback to other faculty members.*
- *I loved getting the chance to meet people in the network and learn from everyone. The sessions were all well prepared and excellent.*
- *I liked hearing from students, both in the student panel and in smaller breakout sessions.*
- *For me, it was interacting with the students and hearing their positive feedback.*
- *I liked the presentations about the data on day 2 and 3. It really helped me put all of our work in perspective.*
- *Presentations from the evaluation team showing the data collected and analyzed. It makes us see that the network moved in the right direction.*

Figure 10. Item Response Percentages for May 2023 Conference

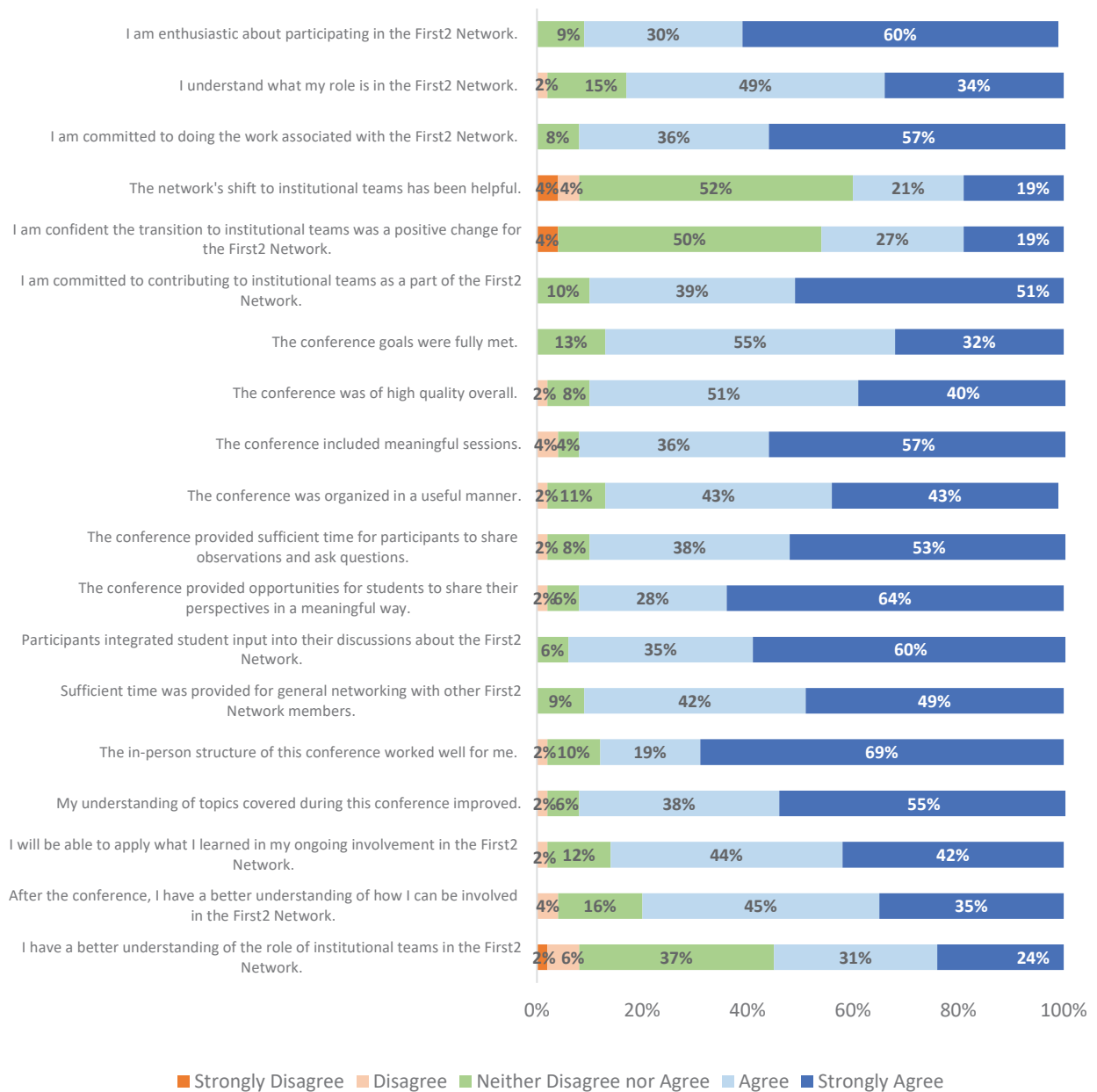


Figure 11. Item Mean Scores for May 2023 Conference



When asked to identify what did not work as well, 35 individuals responded. The most common themes were timing issues, organization/clarity about the agenda or specific sessions, and overall positive comments. A few illustrative quotes follow.

- *Some of the sessions were too long. It would have been nice to have shorter sessions instead of 1-hour sessions.*
- *More time devoted to the breakout sessions as some that I wanted to attend were at the same time as others I wanted to attend.*
- *The storytelling training was too fast and ineffective. An overview of PDSA cycles would have helped newbies.*
- *The purpose of some of the sessions was a bit blurred. For example, during the second session on “campus clubs,” the main discussion was about other PDSAs, not the campus club particularly. I also think that starting the first day sitting by institutional teams encouraged segregation between different schools.*

- *I thought this was an excellent convening, maybe the best one.*
- *I thought this conference worked very well, the amount of data shared and the PDSA work of the institutional teams helped me see the breadth of work being done and showed the value of sharing the data with everyone in one setting.*

When asked what additional information was needed related to their work within the First2 Network, 30 individuals responded, with the most common theme noting no additional information was needed; the remaining comments were unique in nature. Similarly, 30 individuals provided responses when asked what support was needed from the network for them to become more involved, with the most common themes noting no additional support was needed and better organization of the website and Google Drive; the remaining comments were unique in nature.

The final prompt provided respondents an opportunity to make any other comments about the conference. Twenty-three individuals responded, with most providing a positive comment. A few illustrative quotes include:

- *This conference allowed us all to share many great ideas about how to improve the organization and how to better help students persist in STEM.*
- *Really good to see so much content/value added by the institutional teams!*
- *These conferences are essential to keep people connected.*
- *I've attended three in-person conferences and I think this one might have been the one I enjoyed and learned the most from. I appreciated the focus on sharing the data First2 has collected and each of the sessions I attended were very good. Thank you to all of those involved in getting the conference together and for the continued work each of you do.*

2.7.3 Conference Feedback Forms Summary

In sum, participants provided positive feedback about two events, with most of the rated items higher than 4.00 on a 5-point scale. For the May conference, the lowest-rated items focused on the shift to institutional teams (3.48–3.69). For the October conference, the lowest-rated item was that sufficient time was provided for general networking with other First2 Network members (3.88); this item increased to a 4.40 rating at the May conference.

3. Systems Targeted by the First2 Network

3.1 Network Value Survey

The Network Value Survey, administered annually in June, asks members to use a 4-point scale to rate the value of aspects of the network across 23 items divided into five value lifecycles: (1) immediate value, (2) potential value, (3) applied value, (4) realized value, and (5) impact value. This survey is based on research suggesting that what people value about the networks in which they are engaged evolves in a roughly developmental manner.^{xxxiv}

Figure 12. Network Value Lifecycles



According to this research, Figure 12 depicts how networks generate five progressive levels of value to their members over time, each of which is aligned with the five survey sections:

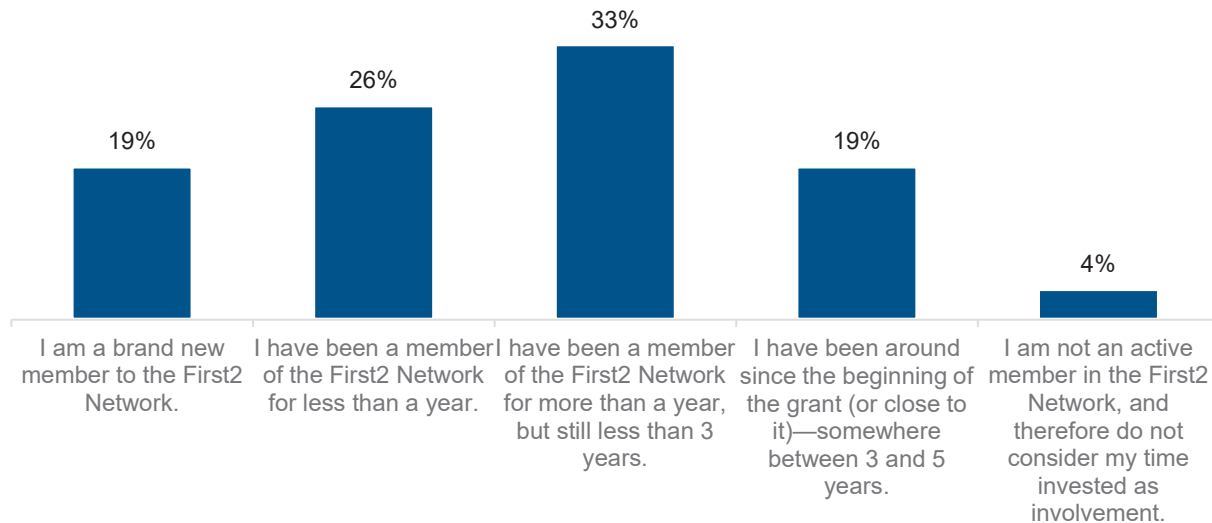
1. **Network and Community Building (Immediate value/activity):** Activities and interactions (e.g., network events, new relationships)
2. **Gaining New Knowledge (Potential value/output):** Knowledge capital (e.g., acquisition of information and skills that can be applied later)
3. **Applied Learning and Practices (Applied value/application):** Changes in practice (e.g., employment of new knowledge and skills)
4. **Performance Improvement (Realized value/outcome):** Performance improvement (e.g., achievement of network goals, such as improved STEM program persistence rates in this case)
5. **Influence and Redefining Success (Reframing value/impact):** Redefining success (e.g., development of new, more ambitious network goals)

The first set of five items on the Network Value Survey assesses the extent to which members value the networking and community-building generated by network participation (activity). The next four items ask respondents to rate the extent to which they value gaining new knowledge from network participation (output). The next set of five items asks members to rate the value of opportunities for applied learning and practice that the network offers (application), whereas the next four items ask members to rate the value of possibilities for performance improvement generated through network participation (outcome). The final five items invite members to rate the extent to which they value the network for its contribution to their ability to refocus and redefine success (impact). In addition, open-ended questions ask members to share examples of how the value acquired through network participation manifested in their own work.

The evaluation team examined the extent to which members' value beliefs about the network change over time. A total of 32 respondents completed the survey in Year 5 compared to 58 respondents in Year 4, 46 respondents in Year 3, 49 in Year 2, and 39 in Year 1. Survey respondents indicated their level of agreement to 23 statements related to their experience with First2 membership. The items used a 4-point scale: 1 = *Strongly Disagree*, 2 = *Disagree*, 3 = *Agree*, and 4 = *Strongly Agree*. Results for all analysis reported in this section are based on those who responded to the item. All effect sizes are small unless otherwise noted.

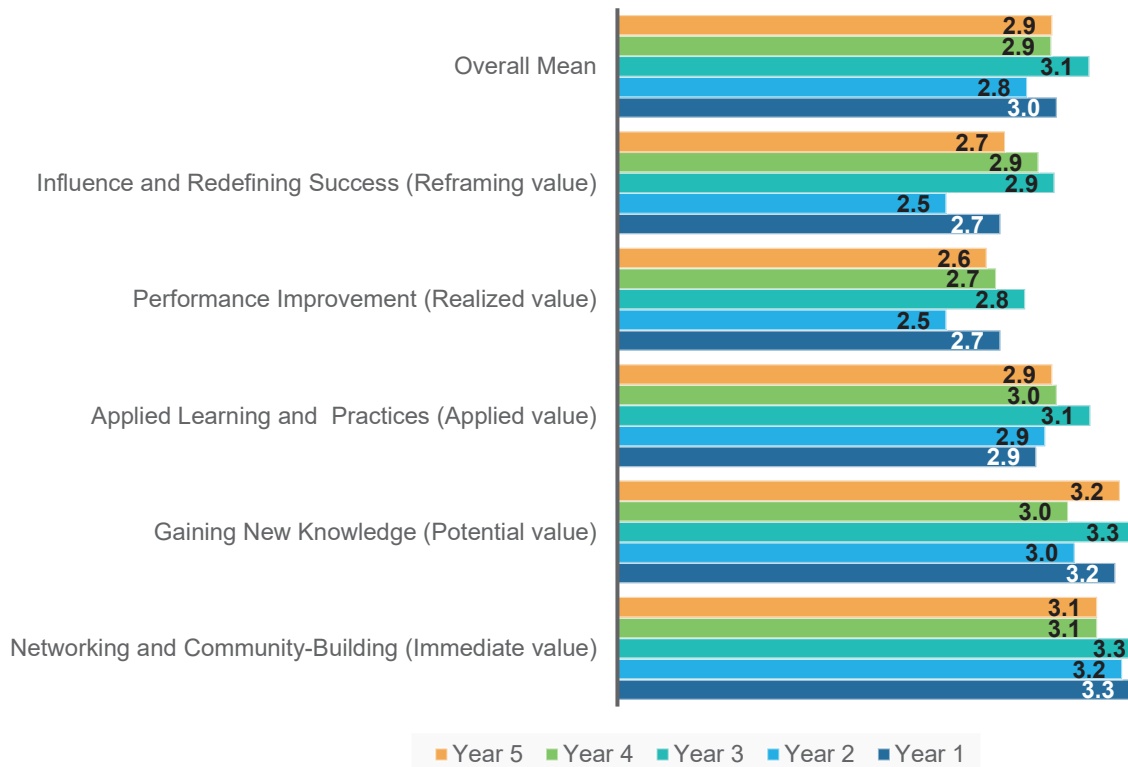
Surveys also included questions prompting respondents to report on annual member status. Of the 27 respondents to this question in Year 5, almost half were student members (44% of 27). Nearly half of the respondents (45%) indicated they were either brand new to First2 (19%) or had been a member for less than a year (26%). Most respondents reported they have been a member for at least a year but less than 3 years (33%). Approximately one-fifth of the member respondents indicated they have been active since the beginning of the grant. See Figure 13 for details. Most respondents were from the faculty and student engagement working group (25%), followed by the student leadership working group (20%). Only 4% of the respondents reported no active membership in the network.

Figure 13. Years of Active Membership in First2



Lifecycle mean responses ranged from 2.6 to 3.2 in Year 5, and the highest mean and greatest growth in mean rating in Year 5 compared to Year 4 was in potential value as in Gaining New Knowledge (difference=+.26). Year 5 members also found high value in the initial activity phase when members focus on immediate value, Networking and Building Community—that is, the creation of new relationships and shared network experiences found early in the network’s lifecycle. This item had the same mean rating as in Year 4 (mean=3.1). In Year 5, network members also reported value in applied value manifested as Applied Learning and Practices (mean=2.9). The lowest mean rating in Year 5, consistent with the prior years of the grant cycle, was in realized value reflected as Performance Improvement (mean=2.6). Mean ratings for reframing value as in Influence and Redefining Success was the only lifecycle phase to show a decrease over the past year (Difference=-0.8). Figure 14 provides an overview of these ratings by year.

Figure 14. Overall Mean Scores by Lifecycle and Year



Overall mean scores from Years 1–5 are presented in Table 10 below, as well as mean scores for items associated within each lifecycle. Members reported the greatest agreement with three statements: *Gained insight about a person or group I can turn to for information or support* (3.39), *Acquired a new skill or new knowledge* (3.25) and *Gained access to professional relationships that change my perspective or understanding* (3.21). There were some gains from Year 4 to Year 5 ratings, with the largest gain in overall mean rating associated with the Gaining New Knowledge, which indicates that members continue to gain insight and access to relevant information and people, with mean component improvement ratings of between .14 and .34 respectively.

The highest-rated item at 3.38 was that members gained insight about a person or group they can turn to for information or support. The lowest-rated item—*Observed practice/policy improvements at my organization resulting from network work*—was within the lowest-rated lifecycle, Performance Improvement (realized value/ outcome), and was the lowest-rated across all cycles (2.50), and across all 5 years. An additional item—*Observed data indicating that my organization’s performance improved*—showed an increase (+.19), which may indicate some members are seeing the evidence of improvement in their own organization or through achievement of network goals, such as improved STEM program persistence rates.

While Year 4 to Year 5 ratings show some declines ranging from -.01 to -.35, only three items may be concerning: (1) *Participated in network activities that were meaningful* (-.33), (2) *Contributed to a new framework or system for achieving network aims as a result of new understandings* (-.34), and (3) *Engaged previously uninvolved stakeholders in network efforts* (-.22). These declines may reflect the transitional changes of the network structure from working group to institutional teams.

Table 10. Network Value Survey Item and Subscale Mean Scores

Cycle	Response Option	Year 1	Year 2	Year 3	Year 4	Year 5	Difference Yr 5–Yr 4
		(n=42)	(n=49)	(n=46)	(n=58)	(n=29)	
Networking and Community Building (Activity)	Participated in network activities that were meaningful	3.31	3.21	3.39	3.33	3.00	-0.33
	Made connections with colleagues around shared goals	3.38	3.38	3.41	3.24	3.38	+0.14
	Gained access to professional relationships that change my perspective or understanding	3.29	3.10	3.33	2.98	3.21	+0.23
	Engaged regularly with the network*	3.14	3.26	3.09	3.09	2.96	-0.13
	Interacted with students as contributing members of the network	N/A	3.26	3.41	3.03	3.07	+0.04
	Activity Mean	3.28	3.24	3.33	3.13	3.12	-0.01
		(n=37)	(n=48)	(n=46)	(n=58)	(n=28)	
Gaining New Knowledge (Output)	Saw opportunities for learning that I did not see before	3.33	3.02	3.38	3.02	3.18	+0.16
	Gained access to new tools, information, or processes I would not otherwise have access to	3.18	2.98	3.22	2.97	3.11	+0.14
	Gained insight about a person or group I can turn to for information or support	3.28	3.17	3.41	3.09	3.39	+0.30
	Acquired a new skill or new knowledge	3.05	2.94	3.20	2.91	3.25	+0.34
	Output Mean	3.21	3.03	3.30	3.00	3.23	+0.23
		(n=39)	(n=48)	(n=46)	(n=58)	(n=31)	
Applied Learning and Practices (Application)	Applied skills or practices learned through the network to accomplish a goal or connect to student groups	2.92	2.83	3.05	2.93	3.16	+0.23
	Used knowledge or skills obtained through the	N/A	3.10	3.33	3.02		+0.02

Cycle	Response Option	Year 1	Year 2	Year 3	Year 4	Year 5	Difference Yr 5–Yr 4
Performance Improvement (Outcome)	network to contribute to understanding of problems or issues					3.04	
	Made changes in my organization based on network work	2.64	2.63	2.89	2.76	2.64	-0.12
	Used a document produced or made accessible by the network	2.95	3.00	3.14	2.98	2.88	-0.10
	Leveraged a network connection to accomplish a task	2.92	2.92	3.11	3.07	2.92	-0.07
	Application Mean	2.86	2.90	3.10	2.95	2.93	+0.02
		(n=37)	(n=49)	(n=46)	(n=58)	(n=28)	
	Observed practice/policy improvements at my organization resulting from network work	2.54	2.48	2.70	2.64	2.50	-0.14
	Encountered evidence that the network has advanced its reputation	3.03	2.67	3.18	2.82	2.70	-0.12
	Observed evidence of improvement in the key student outcomes we are pursuing	2.76	2.54	2.82	2.75	2.79	+0.04
	Observed data indicating that my organization’s performance improved	2.46	2.17	2.52	2.48	2.58	+0.10
	Outcome Mean	2.70	2.46	2.81	2.67	2.64	-0.03
		(n=36)	(n=49)	(n=46)	(n=57)	(n=27)	
Influence and Redefining Success	Engaged previously uninvolved stakeholders in network efforts	2.94	2.70	2.83	2.79	2.57	-0.22
	Contributed to a new framework or system for achieving network aims as a result of new understandings	2.89	2.79	2.80	2.93	2.59	-0.34
	Used what I learned from network work to develop a new strategic direction at my institution	2.50	2.46	2.66	2.70	2.52	-0.18

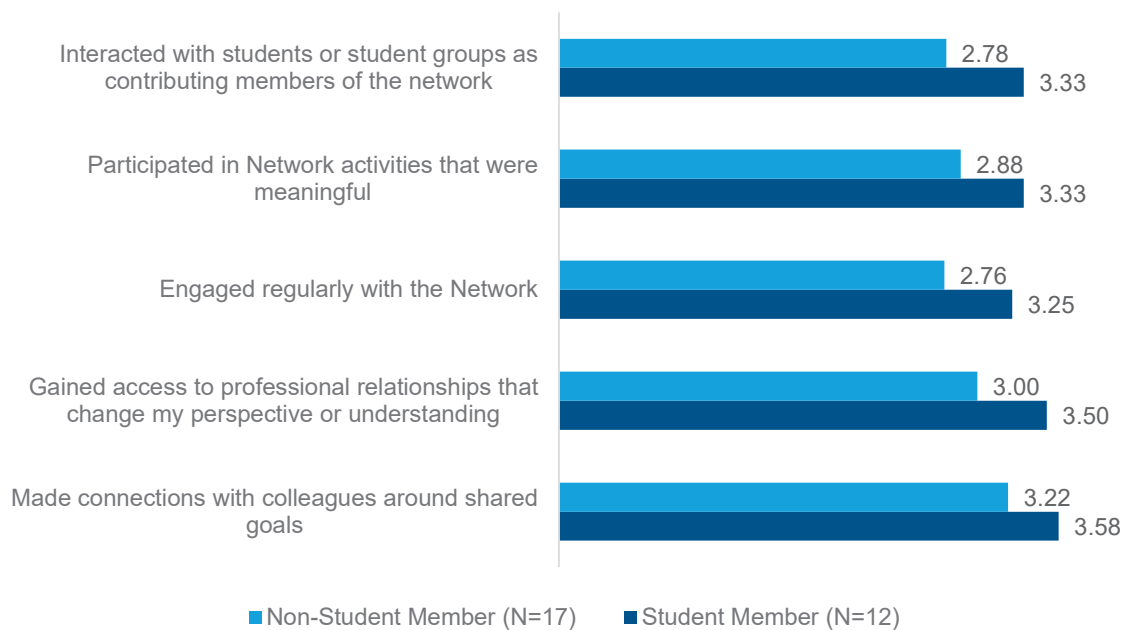
Cycle	Response Option	Year 1	Year 2	Year 3	Year 4	Year 5	Difference Yr 5–Yr 4
	Reflected anew on what it takes to achieve success	3.19	3.02	3.33	2.95	2.96	+0.01
	Demonstrated an understanding of the complexity of elements important to rural students’ pursuit of STEM careers	N/A	3.00	3.12	3.11	2.92	-0.19
	Impact Mean	2.88	2.79	2.95	2.89	2.72	-0.17

N/A: Members were asked three additional survey items this year; as a result, no data for these items are available from Year 1. Appendix B contains a reproduction of the Network Value Survey.

3.1.1 Immediate Value: Networking and Community-Building (Activity)

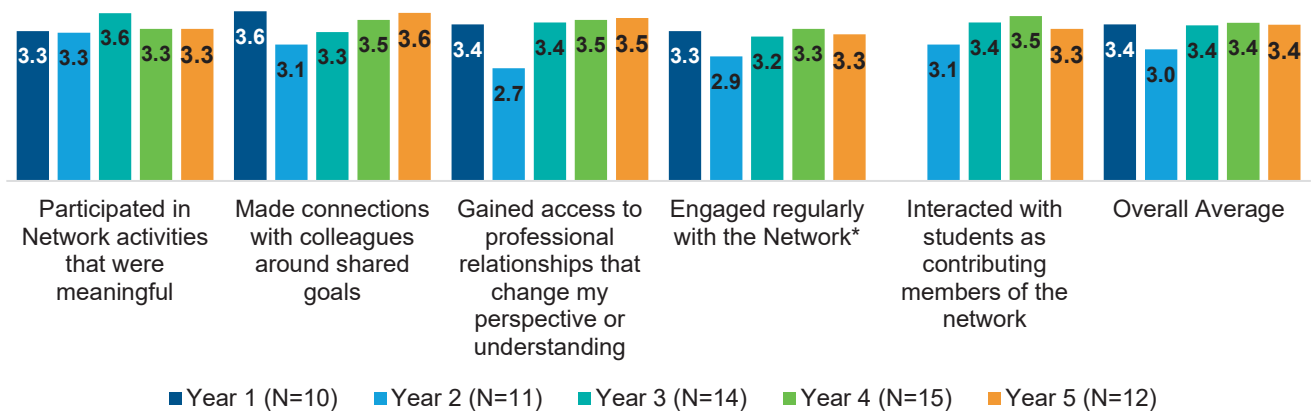
Among the respondents on the 4-point agreement response scale, student members had the most agreement with all items. Specifically, more than 90% of students agreed or strongly agreed that they found value from networking and community building. Specifically, all respondents agreed they *Made connections with colleagues around shared goals* (mean=3.58) and *Interacted with students or student groups as contributing members of the network* (mean=3.33). While non-student members had less agreement across all items, student and non-student member respondents believed in the value of the network to help them *Gain access to professional relationships that change their perspective or understanding* (mean=3.00 and mean=3.50 respectively).

Figure 15: Immediate Value – Year 5 Agreement Percentages by Student versus Non-Student Status



As shown in Figure 16, student respondents showed a similar overall agreement rating from Year 3 to Year 5. Across the previous year, student members reported the greatest gains in immediate value from *Made connections with colleagues around shared goals* (difference=+0.10 points). Despite this transitional year from working groups to institutional teams, First2 student leadership efforts support student participation within and across institutions, as discussed in the Social Network Analysis Section 4.1. Even the lowest mean rating—indicating that the item was not as highly rated as the previous year—*Interacted with students as contributing members of the network* (difference=-0.20) reflects a strong agreement level.

Figure 16: Immediate Value – Mean Ratings for Student Members by Year



The survey subsection included an open-ended item asking respondents to describe a meaningful activity or connection they experienced (e.g., a conversation, a working session, a project) through the network. All 16 respondents to the open-ended item believed they had participated in activities or events and accessed resources and opportunities that supported a common goal of student success amongst first-generation students. Several members commented on the importance of the First2 conference as the core mechanism for making connections. “Attending the spring conference in person provided an excellent opportunity to connect with industry partners and institutional team members from around the state,” one noted. A student commented about the importance of professional mentorship and support, saying, “I found the session after the presentation of our projects very helpful, as the feedback from professionals in their respective fields gave me valuable insight on how to better present scientific findings in the future.” Other respondents indicated the importance of both institutional team meetings and PDSA working group meetings. One student shared, “The working sessions that my co-leader and I had to prepare for our club group [were] meaningful and impactful. The opportunities to meet with the mentors had a great deal of impact.” Non-members also reported the importance of connecting with students and hearing their perspectives. “I attended a student meeting and they talked about their experiences with STEM, activities that semester so far, their future goals, and their challenges. It was great to be a part of it because the students were not only vested, but making their opinions known,” one shared.

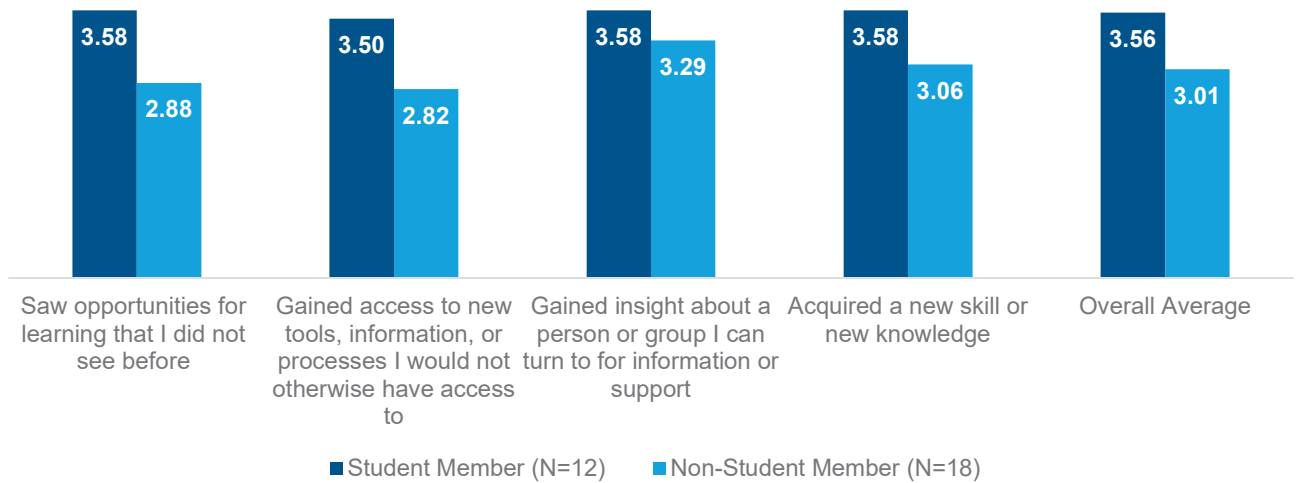
3.1.2 Potential Value: Gaining New Knowledge (Output)

Using the 4-point response scale, respondents most agreed that they found value from gaining new knowledge as a participant in the First2 Network community. However, the mean average for all members decreased from the previous year by 0.23 points (mean=3.23). On average,

there was some variation in the potential value of the network by member type. Figure 17 shows students valued the new knowledge acquired via network participation more highly than other members (mean=3.56 and mean=3.06).

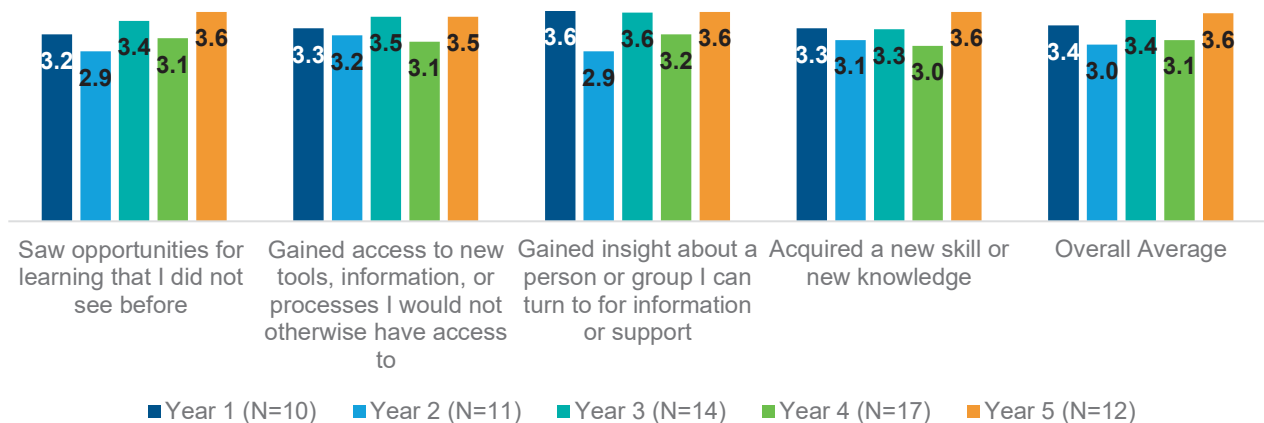
Regarding individual subscale items (Figure 17), all members were most likely to agree with the statement *Gained insight about a person or group I can turn to for information or support* (mean=3.58 and mean=3.29). Students also strongly agreed on the potential value of their experience in the network, while other members had less agreement across all items, as evidenced by mean ratings. Non-student member respondents were least likely to agree that they had *Gained access to new tools, information, or processes I would not otherwise have access to*.

Figure 17: Potential Value – Year 4 Mean Ratings by Member Type



Among student respondents, overall mean ratings increased by approximately 0.5 points from Year 4 (mean=3.1) to Year 5 (mean=3.6), as shown in Figure 18. Students responding to indicators about potential value reported high levels of agreement, even greater than the Year 4 levels. Specifically, subscale items showed large gains from Year 4 to Year 5. The highest gains reported are from the item *Acquired a new skill or new knowledge* (difference=0.6).

Figure 18: Potential Value – Student Member Mean Ratings by Year



When asked to describe ways the network has supported them to gain new knowledge and how they thought it might be useful, many student members elaborated on their work within their peer and local community.

- *The First2 mentor camps encouraged me to reach out to other STEM camps and become more active in my local region for helping schools become aware of resources in college and First2.*
- *The ability to connect with other first-generation students has been helpful to me, a first-generation student as well, because their insight and perspectives have helped me to remain optimistic about college. Because of their counseling and guidance, I feel that I am more likely to persist in STEM.*

Several other members shared how they value specific resources shared to advance the First2 Network aims. One member shared how “PDSA templates and sample PDSAs that were constructed to fit the Driver Diagrams” served as useful tools.

Other respondents expressed an appreciation for knowledge that advances their confidence to advocate for the student and the network to provide opportunities, specifically amongst first-generation populations. “I learned how to contact my representatives, how to do PDSAs, and connect with staff,” one said.

3.1.3 Applied Value: Applied Learning and Practices (Application)

Overall, members agreed with applied value—as in the application of learning and practices afforded them by the network (mean=2.93); even more so, students had a higher overall agreement in applied value than non-student members (mean=3.0 and mean=2.8) on the 4-point agreement scale. Figure 19 details the individual items and their mean ratings by student member type. Non-student members had higher ratings compared to student members for two of the five items, including *Used a document produced or made accessible by the network* and *Leveraged a network connection to accomplish a task*. This variance may be attributable to the steady active participation of non-student members utilizing templates, partners, and articles more often than student groups.

The highest-rated item for student members was *Applied skills or practices learned through the network to accomplish a goal or connect to student groups* with a mean rating of 3.6 followed by *Used knowledge or skills obtained through the network to contribute to understanding of problems or issues* with a mean rating of 3.3.

Figure 19: Applied Value –Year 5 Mean Ratings by Member Type

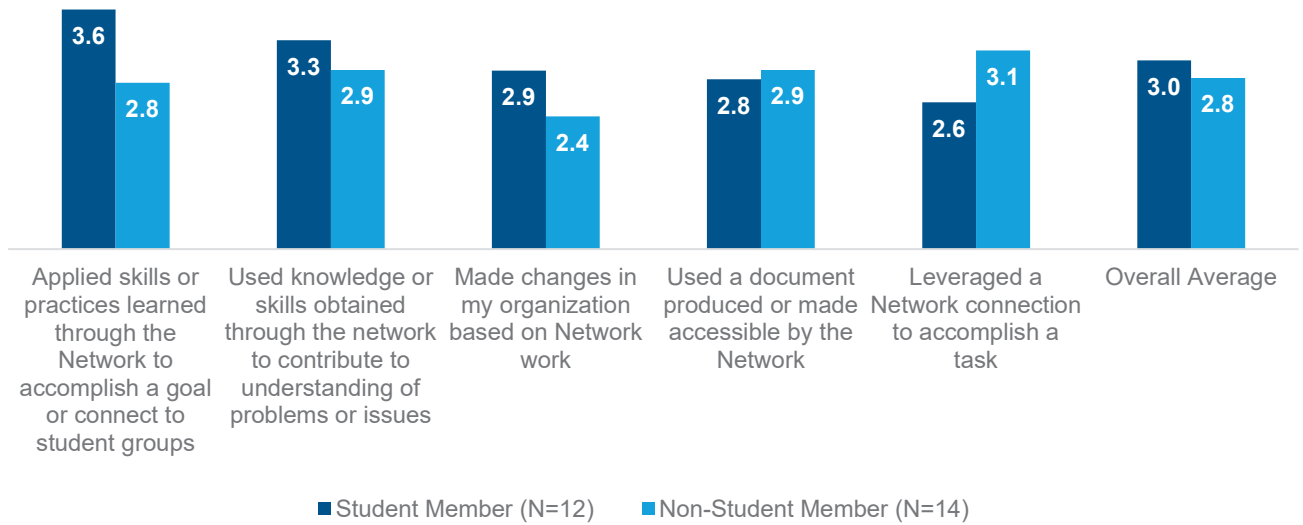
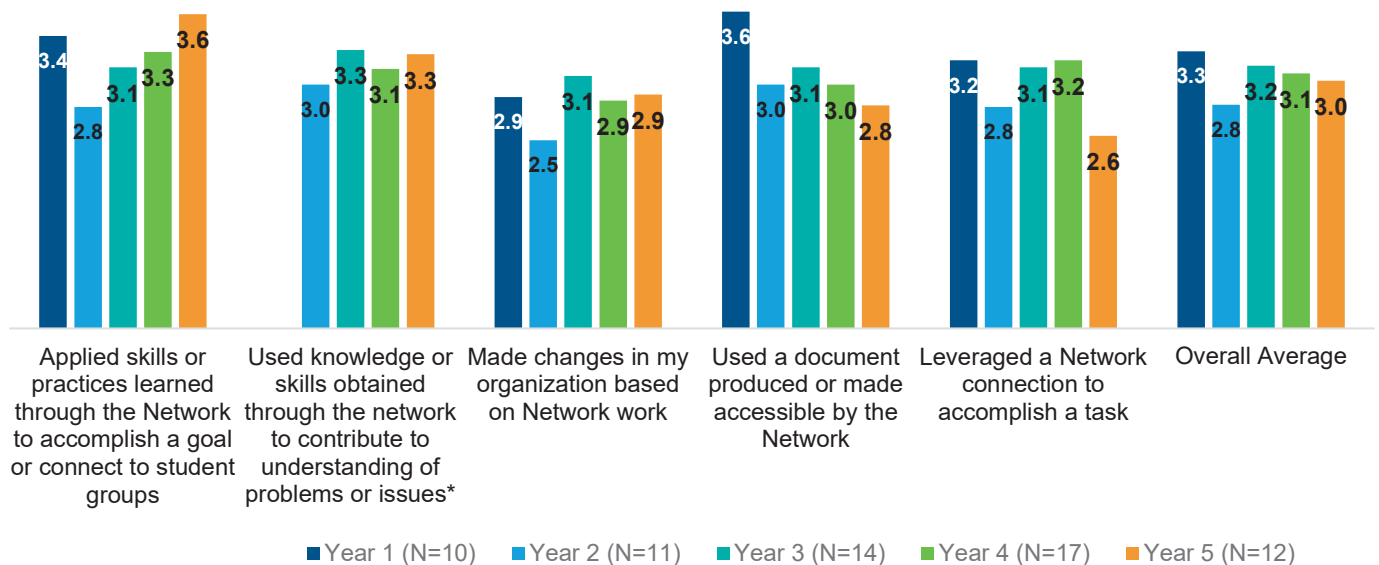


Figure 20 shows student respondents felt consistently strong about the value of the application of tools and resources from the network to their lives, specifically in two of the five items. Student respondents’ mean ratings increased in two categories: *Applied skills or practices learned through the network to accomplish a goal or connect to student groups* and *Used knowledge or skills obtained through the network to contribute to understanding of problems or issues* from Year 4 to Year 5 (0.3 and 0.2, respectively). Students in Year 5 were least likely to agree they *Leveraged a network connection to accomplish a task*. Given the transition to institutional teams, this may be attributable to a misunderstanding that the connection had to happen outside of their First2 Student network at their institution. “I didn’t have much involvement in these two areas, as I did not have the time,” one student explained.

Figure 20: Applied Value – Student Member Mean Ratings by Year



Of the 11 provided comments when asked an open-ended question about how they applied something they learned through the network to their practice and what it enables that might not have happened otherwise, one student commented, “Through my participation in the First2 program, I learned how to work collaboratively with my peers to get feedback on my individual project.” Another individual shared that they had really interacted with students, noting learning more about “other programs at the school needing outside assistance that allowed more connections and a part-time job.”

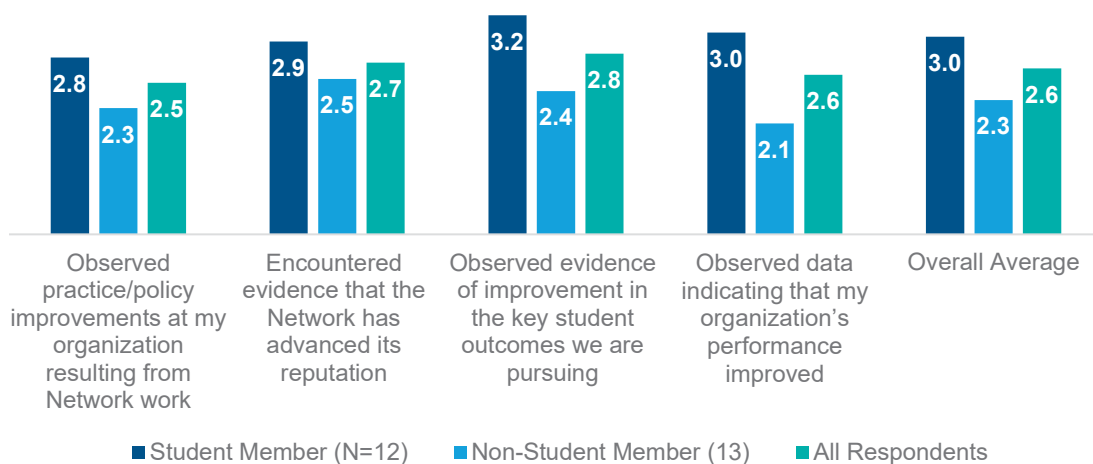
Others discussed how their involvement in the network encouraged them to incorporate student voices. “I have started to think and plan differently about how I talk to and communicate with first-gen students and students as a whole,” one noted. One person shared how “work of the network is becoming more focused.”

3.1.4 Realized Value: Performance Improvement (Outcome)

Student and non-student members rated the value of performance improvement quite differently. Figure 21 shows students rated these areas of observation much higher than non-student members, as this group ranked 0.7 points higher than other members (mean=3.0 compared to mean=2.3).

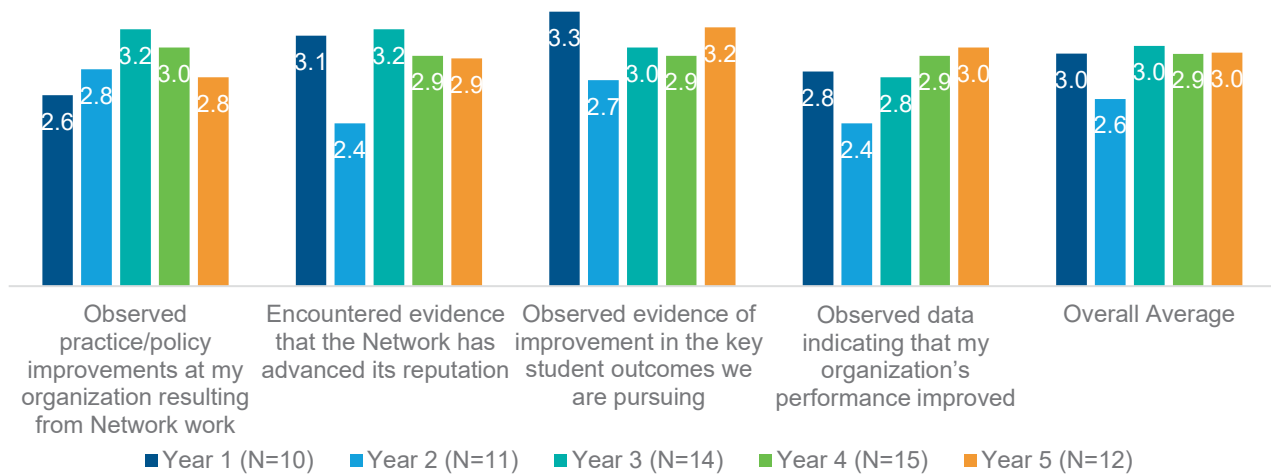
For non-student members, mean ratings fell below 2.5 for all but one item, *Encountered evidence that the network has advanced its reputation*, indicating that while there were some faculty and community members who strongly disagreed with the statement, several also agreed (See Figure 21). The highest rated item for student members concerned how they *Observed evidence of improvement in the key student outcomes the network is pursuing*, with mean ratings of 3.2 (combined ratings of *Agree* and *Strongly Agree*). Most student members (9 of 12 respondents) reported that they see the value of the network through observed data, indicating that their organization’s performance has improved, as compared to only 3 out of 13 non-student members. See Figure 21 for more detail.

Figure 21: Realized Value – Year 5 Mean Ratings by Member Type



Student respondents felt consistently stronger about the effects of the network’s performance improvement aspects on their lives. Overall student mean ratings increased by 0.1 point from Year 4 to Year 5 (Figure 22). Mean ratings decreased only for one item, *Observed practice/policy improvements at my organization resulting from network*. Students reported stronger levels of agreement related to their direct involvement in First2, specifically on the highest-rated mean item in Year 5, *Encountered evidence that the network has advanced its reputation* (2.9).

Figure 22: Realized Value – Student Member Mean Ratings by Year



When asked to expand upon how participation in the network affected their success (personally, professionally, or organizationally) some respondents shared struggles while others talked about successes. Specifically, one respondent expressed positive sentiments to support on-campus institutional teams, saying, “I like applying now to my own campus, which makes a better sell for time I donate.”

Respondents expressed increased access to campus events, status, and support amongst their peer colleagues. As one faculty member noted, “Participation with First2 allowed me to access professional and educational channels within the network itself, to further my efforts in my other scientific and professional endeavors. My participation has also allowed employers and internship recruiters to acknowledge my experience in research.” In terms of student value, respondents were again in Year 5 appreciative and reported network benefits of connection with faculty, staff, and employers. “I have become more comfortable with the staff in my college community, which has encouraged me to ask for help or reach out for opportunities,” one said.

A few shared how participation supported their future career goals by enhancing their research opportunities. “The funding has helped me do research that will help professionally in the future,” one respondent shared. Another reported gratitude for financial support saying, “Without the support from the network, both emotionally and financially, I would not be able to effectively pursue my college degree.”

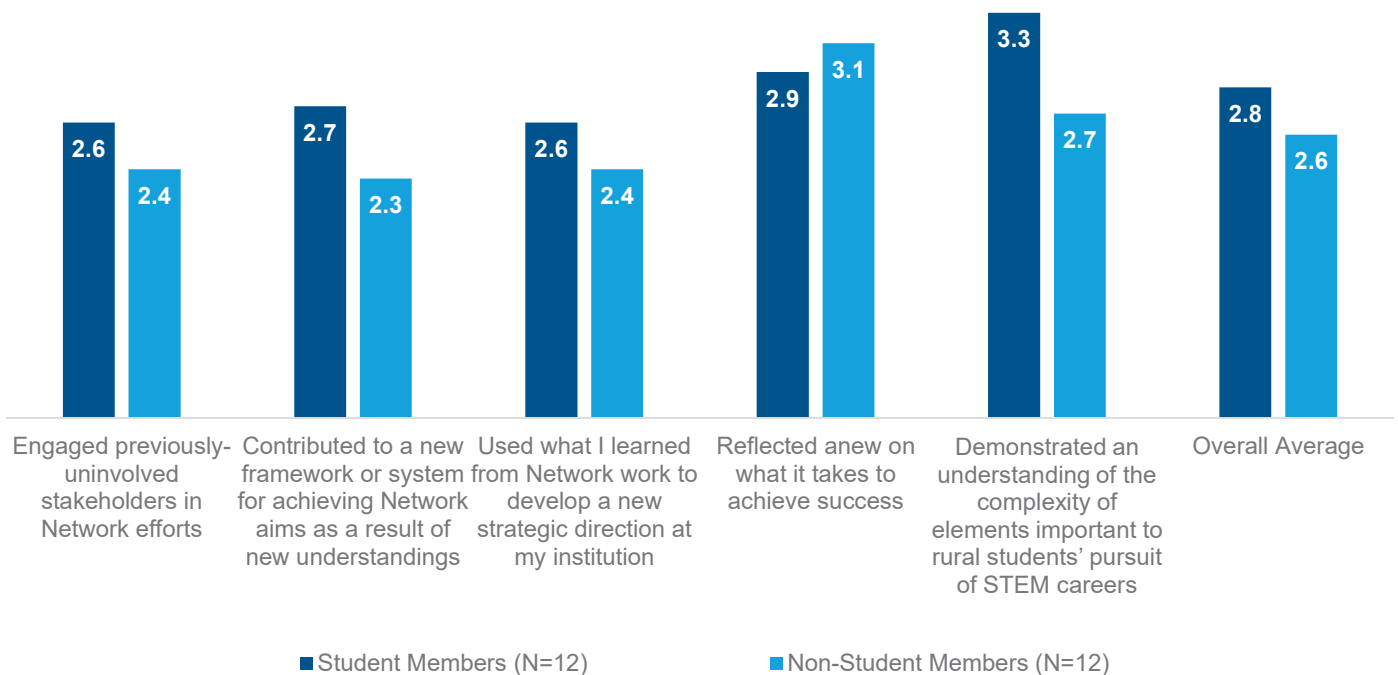
Overall, the sentiments shared by many respondents indicated positive transitions to campus-based teams through gains in connections made because of their network participation. One

respondent noted, “Participating in the network helps me to promote our program, which benefits first-gen and underrepresented students.”

3.1.5 Reframing Value: Influence and Redefining Success (Impact)

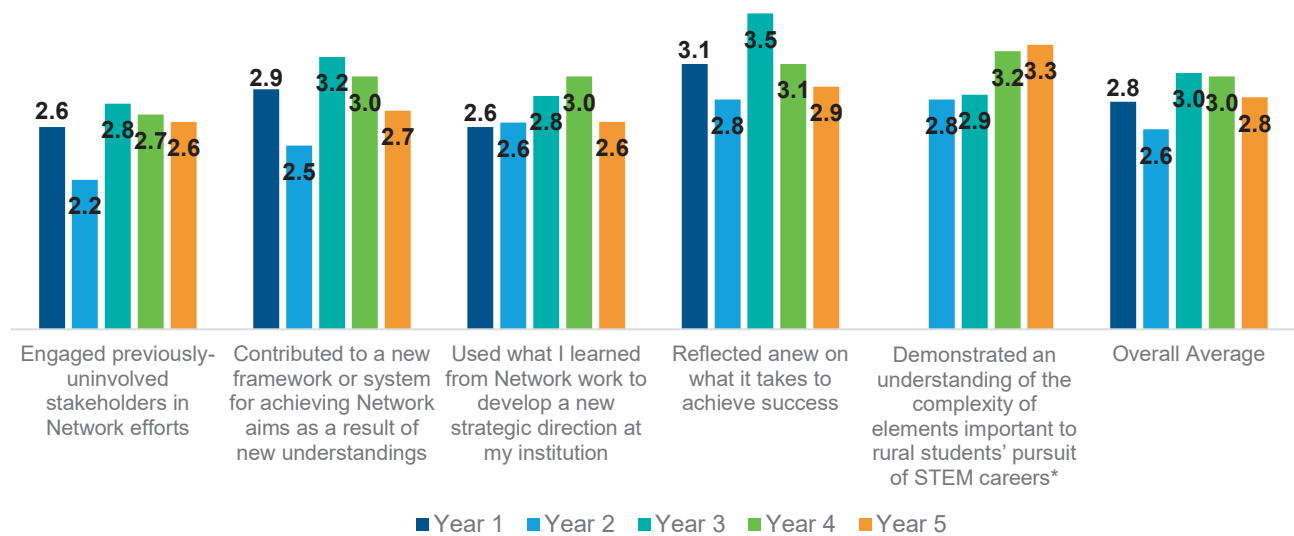
Student members rated the reframing value component higher than non-student members, meaning most students agreed about the influence of redefining success brought on by their participation as First2 Network members (2.8 compared to 2.6). With all but one item, student members had higher ratings; most non-student members agreed that as part of the First2 impact, they *Reflected anew on what it takes to achieve success* (see Figure 23). The least highly rated item for student members was *Used what I learned from network work to develop a new strategic direction at my institution* (2.6). Student members were most likely to agree with the item *Demonstrated an understanding of complexity of elements important to rural students’ pursuit of STEM careers* (3.3).

Figure 23: Reframing Value – Year 5 Mean Ratings by Member Type



Overall, student member ratings were similar in Year 5 to Year 4. Year 5 students valued the impact First2 Network is having on their personal and professional lives and on campus. The highest-rated item, *Demonstrated an understanding of the complexity of elements important to rural students’ pursuit of STEM careers*, with a mean rating of 3.3 was followed by *Reflected anew on what it takes to achieve success* (2.9). One item showed a pattern of annual increase from Year 1 to Year 5: *Demonstrated an understanding of the complexity of elements important to rural students’ pursuit of STEM careers* (3.3). The lowest-rated items at 2.6 were *Engaged previously-uninvolved stakeholders in network efforts* and *Used what I learned from network work to develop a new strategic direction at my institution*. See Figure 24.

Figure 24: Reframing Value – Student Member Mean Ratings by Year



Seven respondents commented on the open-ended question regarding any changes in their perspective, direction, strategy, or understanding of what success is as a result of First2 collaborative efforts. Most respondents commented there was no change in their beliefs about success, but a few shared reflections about understanding what it takes to achieve success as a network.

- *I have learned that failure is OK, as long as it is followed by useful action.*
- *I remember someone at the conference, I believe Ashley, said something about knowing that First2 has been a success when it's not needed anymore, and I feel like that changed my perspective on success for certain things.*

Another member expressed the challenges related to creating foundational strength on campuses, and shared how there was misunderstanding around the requirements for effective improvement science. “The working groups failed to provide sufficient structure for conducting research into supportive practices across the network,” one respondent shared. The respondent described how the transition to institutional teams is challenging given that higher education organizations have existing structures that limit collaboration across and between campuses. This respondent also noted that “campuses achieving a team approach across multiple First2 activities led by multiple investigators tend to be those with a pre-existing research culture (e.g., WVU) or those with a strong champion (e.g., FSU).”

3.1.6 Network Value Survey Summary

Overall, average ratings of all five components on the Network Value Survey increased from Year 4 to Year 5 for student members, but gains were less realized for non-student members as documented through item-level participant ratings. Students agreed with benefits across each value lifecycle, showing appreciation for the connections, colleagues, and collaborative network provided them through the work in the network. These students cited high levels of involvement in First2, including internships and leadership in First2 Network activities. Additionally, members expressed an increased understanding of student needs and voices, specifically students from rural, first-generation backgrounds. One member shared, “Difficulties with this transition include a lack of succession plans for new First2 faculty or staff champions, a lack of institutional

incentives for junior faculty to participate in this work, and a lack of research infrastructure in teaching institutions (e.g., ready-made connections with institutional research offices, access to secure survey tools, standard IRB procedures, etc.)” Other comments provided examples of how leadership valued the establishment or greater focus on shared metrics, templates, and coaching support for each campus but even so, there still exists the lack of campus IRB infrastructure.

4. Impact of the First2 Network

4.1 Social Network Analysis

Social network analysis (SNA) permits the analysis of network size and the number and strength of connections among network members. Eighty-three network members completed the annual social network survey in December 2022 (compared to 65 in 2021, 44 in 2020, 32 in 2019, and 25 in 2018) based on their network activity over the past year. The composition of network members' organizations is provided below in Table 11.

Table 11. SNA Survey Respondent Organizational Affiliation

	Organization Name	Number of Respondents	Percent of Respondents
Lead First2 Network Organizations	West Virginia University	31	37%
	Fairmont State University	14	17%
	Green Bank Observatory	1	1%
	Higher Education Policy Commission	1	1%
	High Rocks Educational Corporation	1	1%
Other Organizations	Marshall University	9	11%
	WVU Institute of Technology	8	10%
	University of Charleston	5	6%
	Glenville State University	3	4%
	Blue Ridge Community & Technical College	2	2%
	Davis & Elkins College	2	2%
	West Virginia State University	2	2%
	MATRIC	1	1%
	SRI	1	1%
	West Virginia Department of Education	1	1%
	West Virginia Wesleyan College	1	1%
Total		83	100%

Note. Percentages may not equal 100% due to rounding.

Of the 83 respondents, 64% were female, 46% had completed some college (and 29% had achieved a doctoral degree), and 57% were between 18 and 24 years of age (followed by 17% between 55 and 64). About a fourth (28%) were at their organization 6 months or less; another 23% had served at their organization for 3–5 years and 22% for 1–2 years. In addition, more than half (57%) were undergraduate students and 22% were faculty members/lecturers/teachers.

4.1.1 Member Engagement

Respondents identified up to 10 members of the First2 Network with whom they communicated on issues relevant to their tasks in the network. For each individual identified, respondents assigned a code describing the level of engagement with each individual (1 for *less strong relationships* up to 5 for *strong collaborative ties*). The five levels^{xxxv} include:

1. **Networking:** Aware of organization, loosely defined roles, little communication, independent decisionmaking

2. **Cooperation:** Shared information, formal communication, somewhat defined roles, independent decisionmaking
3. **Coordination:** Shared information frequently, defined roles, some shared decisionmaking
4. **Coalition:** Frequent communication, shared resources, shared decisionmaking
5. **Collaboration:** Frequent communication, shared resources, mutual trust, coordination on most or all decisionmaking

The number of individuals identified, along with the average collaborative scores, are shown in Table 12 and Figure 25. All 83 respondents identified at least one individual with whom they collaborated. Four respondents collaborated with 10 individuals; all other respondents collaborated with between two and nine individuals.

Table 12. Network Members Identified as Collaborators in the First2 Network

Individuals Identified	Number Identified	Average Collaboration Score
1 member	83	3.72, Coalition
2 members	53	3.91, Coalition
3 members	37	3.95, Coalition
4 members	20	3.85, Coalition
5 members	15	3.60, Coalition
6 members	12	3.67, Coalition
7 members	9	3.67, Coalition
8 members	7	3.29, Coordination
9 members	6	4.00, Coalition
10 members	4	4.25, Coalition
Overall score		3.80, Coalition

Figure 25. Levels of Collaboration by Individuals Identified



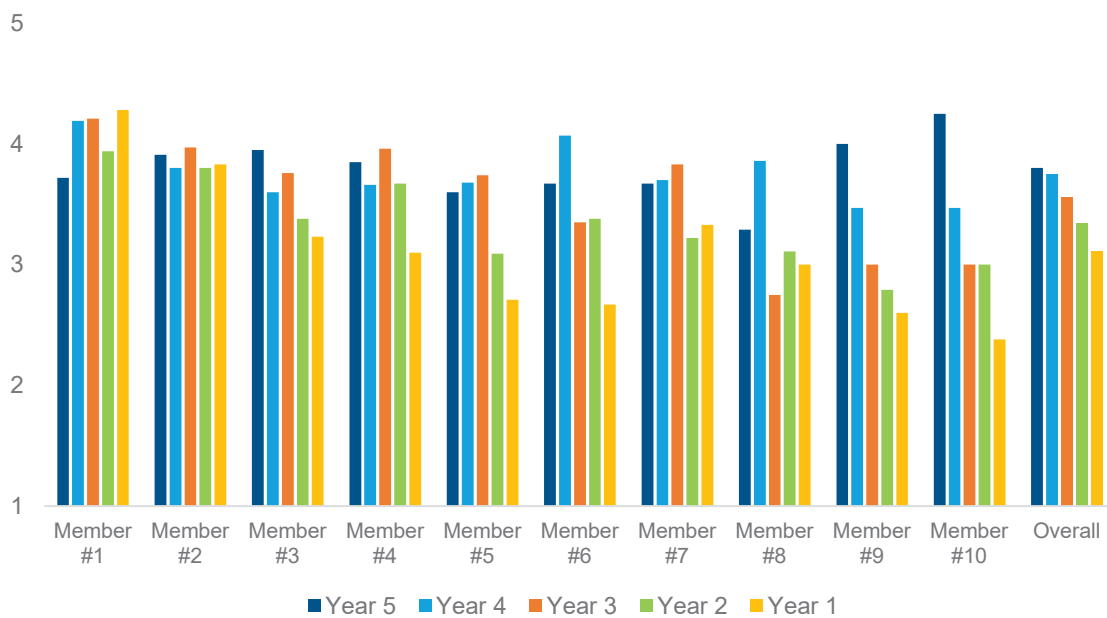
Although in previous years, the collaboration score was higher for the first individual identified by the network respondents, this year's results differ. The highest collaboration score at 4.25 is

for the tenth person identified, with four individuals providing ratings, followed by 4.00 for the ninth person identified, with six individuals providing ratings. Further, there is ongoing fluctuation of the value of the ratings that do not follow previous years' generally decreasing values after the first person identified.

The overall score is 3.80, which falls closest to the coalition level. This year's results indicate a slightly higher level of engagement, moving from the overall score of 3.75 for Year 4, 3.56 for Year 3, 3.34 for Year 2, and 3.11 for Year 1, most of which were closer to the coordination level. And, while the number of respondents identifying multiple members decreased from last year, the strength of those relationships fluctuated for each level, with half increasing this year (2, 3, 4, 9, and 10 members) and half decreasing this year (1, 5, 6, 7, and 8 members).

Figure 26 depicts the overall strengthening of the engagements from Year 1 to Year 5, in general, for the members identified as collaborators.

Figure 26. Levels of Collaboration by Individuals Identified by Year

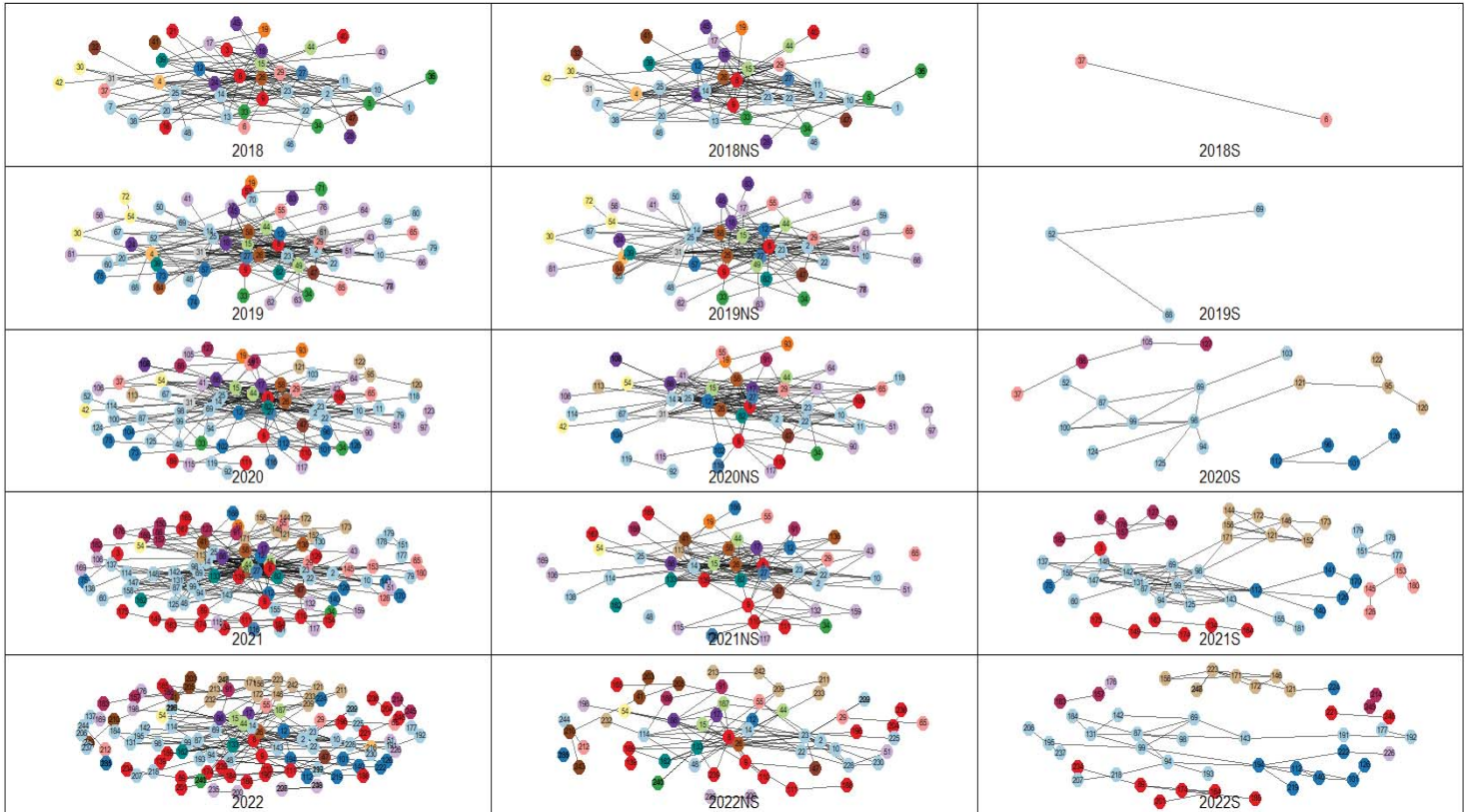


4.1.2 Connections by Year

Based on the 83 respondents, the graphs shown in Figure 27 depict the connections among those individuals identified as collaborators within the network for Year 5 (2022), as well as for the previous 4 years—for all respondents, for all respondents except students, and for only student respondents. Each circle (or node) depicts an individual and the lines (edges) represent the connections between network members. The organizations of individuals most frequently identified are denoted with different colors.

These five yearly graphs show the growth of the network over time, illustrating not only an increase in identified collaborators, but also in the number of connections these collaborators have. Across all 5 years, those individuals most central are from FSU, MU, and WVU. The number of nodes (individuals) increased annually from Year 1 to Year 5 (from 48 in Year 1 to 122 in Year 5), as did the number of edges (connections) (from 146 in Year 1 to 304 in Year 4), but then the edges decreased in Year 5 to 211.

Figure 27. SNA Map of Connections to the First2 Network by Year



Organizations	
■	WVU
■	Marshall University
■	Fairmont State University
■	WVU Institute of Technology
■	Other

Key	
Year	= All respondents
YearNS	= All respondents except students
YearS	= Only student respondents

4.1.1 SNA Summary

In sum, the trend across years continues in general as the First2 Network has become more collaborative this year with an increase in the number of unique network members identified and a slightly higher level of collaborative engagement among members overall.

4.2 Intern Survey

For a variety of institution-specific decisions, only one First2 Network institution planned a summer immersion research experience—Blue Ridge Community and Technical College. However, given low student commitment, Blue Ridge did not hold the summer immersive program. FSU did hold a 3-day bridge program August 15–18, 2023. It is anticipated that FSU will administer a modified version of the pre/post Intern Survey during this bridge program, but results will not be available in time for inclusion in this report.

The evaluation team will be carrying out a follow-up survey in fall 2023 for students who participated as interns during any of the summer immersion research programs held during one of the four previous summers (2019–22) and who completed the Intern Survey during their immersion experience. This activity will investigate whether students' perceptions changed related to STEM efficacy, identity, career, and plans; sense of school belonging; personal skills; and knowledge of, attitudes about, and skills to conduct research. Results from this follow-up survey will be included in the final evaluation report.

4.3 Student Focus Groups

During March 21–27, 2023, the evaluation team conducted 10 virtual group or individual interview sessions with college students who had either participated in one of the nine summer 2022 research internships or who were involved in some other capacity with the First2 Network (i.e., campus clubs, student leadership, scholars, mentors, and so forth). A total of 24 students participated in these feedback opportunities.

4.3.1 One-Word Descriptions and Demographics

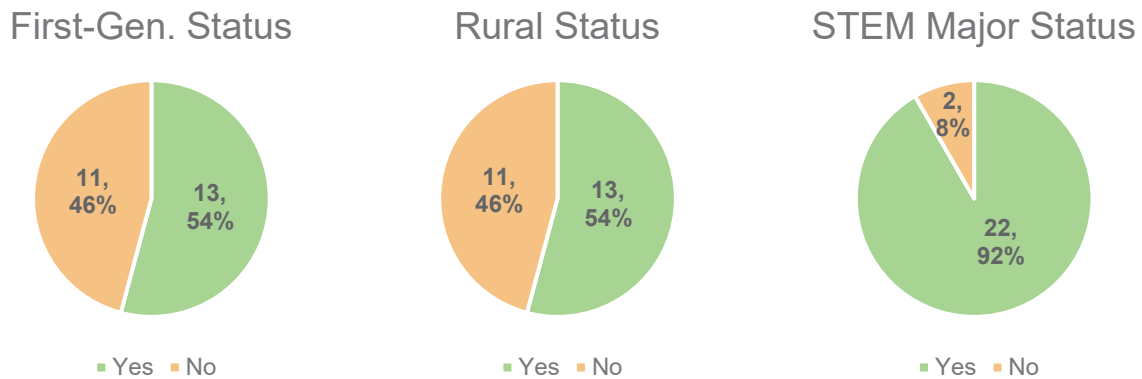
As an icebreaker activity, students were asked to provide a one-word description of their First2 Network experience. Figure 28 depicts their responses, with *Opportunity* being noted most frequently (three times) and five other positive words being mentioned twice each; only one negative descriptor was mentioned once (*Overwhelming*).

Figure 28. One-Word Description of First2 Network Experience



Students were also asked three descriptive questions to identify whether they were first-generation college-goers, whether they came from a rural background, and whether they had a STEM major. As shown in Figure 29, 92% had a STEM major, and more than half (54%) were from rural areas and/or were first-generation college-goers.

Figure 29. Summary of Respondent Demographics



The remaining questions were organized into four categories—students’ early experience with the First2 Network, their overall involvement in the First2 Network, their experiences during the summer research internships (for those who participated), and a wrap up—followed by an overall summary. Responses are organized by question within these categories.

4.3.2 Early Experience with the First2 Network

How did you learn about the First2 Network? The most common way of learning about the First2 Network was through email messaging from high school staff, college professors, friends, and/or First2 staff. Other methods included conversations with instructors, friends, or First2 staff; internet searches; and a Research Apprenticeship Program presentation.

What was the main reason you wanted to become a member of the network? The most frequently mentioned reasons for becoming involved with the First2 Network were the opportunity to get involved in research early in their college experience and the financial incentive. Other common reasons were to get a feel for college/campus life, to meet students and faculty, and because of their interest in STEM. A few respondents noted how it fit in with their desire to help others with their college transitions. A few illustrative quotes are provided below.

Well, I found out just because I was looking up things to do over the summer and I was trying to see, "Okay, well I'm going to go to college. I might as well figure out something that I can do with my time." Well, I was looking up research opportunities in particular and there aren't a lot of them open to incoming freshmen. Normally, they're for people who are already in undergrad. And so I'm like, "Okay, is there any opportunity that is going to get me specifically into doing research now?" And so First2 was able to provide that.

– Student Member

- *For me, the pay and then the opportunity to do research enticed me to join.*
- *First was the money, but also, it was 2 weeks at my campus . . . so I wanted to get a feel for what the campus life was like.*

- *The opportunity to do research was very enticing because I really had no idea where to start.*
- *I thought that it could help me find people in my major and build connections with other STEM majors.*
- *I like the connection with like-minded students from West Virginia and rural areas.*
- *My reasoning [is] that it had something to do with STEM. Since I was majoring in that, that was my really main decision.*

What suggestions do you have for sharing this network opportunity with other students?

There was a consensus among many participants that more awareness of and outreach by the First2 Network was needed at the high school level. Students suggested in-person visits by not only student hometown ambassadors, but also directors and faculty members involved with First2. And, that such visits should target all four grade levels of high school students as well as guidance counselors, advisors, and teachers. Several illustrative quotes follow.

But I think that just getting more high schoolers into it and making it known. . . . I'm in the eastern panhandle, so it's like the annex of the state in some ways. But I don't know how promoted it is out there in the public school systems because I never heard anything about it. And I was lucky that my mom and I did find it.

– Student Member

- *I think a really good way would be going into schools—and not only First2 scholars, but also directors and faculty members of First2—going into schools and not only focusing on seniors, but focusing on juniors, sophomores, freshmen, and getting them ready to be a senior and think about it more.*
- *I think that probably working directly with counties to get that awareness out. I know that as students we do the ambassador presentation, but I don't feel like those are really impactful. Because 99% of the time, we aren't able to speak to a senior class because those seniors are busy with their exams. Or they're busy with whatever they're trying to do, or they're not interested in what we have to say.*
- *I definitely think that guidance counselors and going to high schools, I know the hometown ambassadors, but it's hard to reach such a big population when you only can go to one classroom. So if guidance counselors can be that liaison and really show their senior students this opportunity, I think that would be more helpful because that's where I got most of my opportunities given to me, was through my guidance counselor.*

Participants also suggested that more outreach was needed at the college level, especially for current freshmen, to make the opportunity more visible and well known within the universities. A few illustrative quotes follow.

- *I'm not sure what [all] the colleges are doing, but we've been doing pretty well this year with marketing to high schoolers, but I think we also need to make the opportunity more well known within the college.*
- *So I'm sitting there and I was like, I'd never even heard of the program before I got here. There's nothing really I've seen—like I wish there was a way to better reach the freshmen in general at the college level because sometimes if you don't specifically go to their high school or something and give a presentation, those people slip through the cracks.*

Two students suggested a need for better clarity around recruitment. For example, one explained that the requirement for a hometown ambassador visit to a student's previous high

school had at first seemed to imply this student was not eligible to apply, given his/her previous high school was out of state. Once assured the visit could be to any high school, this student then applied and was accepted in the network. Another noted the misconception that first-generation status was a requirement made some potential applicants refrain from applying.

4.3.3 Overall Experience with the First2 Network

What role do students play in the First2 Network?

Participants noted a variety of roles that students fill in the network and were able to detail responsibilities for each role and organize those roles in a somewhat hierarchical manner. For instance, participating in campus clubs; participating in summer immersion experiences as interns; serving as research scholars (Tier 1 requiring 50 hours of research and Tier 2 requiring 100 hours of research); serving in a campus club leadership role (president, vice president, secretary, and treasurer); serving as a mentor for a summer immersion; serving as a director (requiring 150 hours of service); and serving as one of the four First2 co-chairs.

I really enjoyed being a mentor. I liked helping out with the research projects and showing the students all around the campus and helping set things up for them and helping to make sure that they have an enjoyable experience. I also found it really beneficial to interact with a couple of slightly older student leaders that were also mentors at the time and learn from them how they've been involved, and I was able to develop some leadership skills by both interacting with the younger students and the slightly older students.

– Student Member

Participants indicated that scholars may not have as much interaction with the actual network, but more so involvement through the campus clubs. Directors and co-chairs have more involvement with the First2 Network through additional meetings, facilitation of student meetings, and facilitation of campus clubs, and are more commonly involved with campus institutional teams (although for at least one university, all First2 students are part of that institutional team). One student noted that in addition to the extra meetings and facilitation, co-chairs also help with checking First2 students' timesheets "to make sure that they filled them out correctly" and to ensure that students are meeting their required hours. A few students noted that in addition to their research responsibilities, scholars also had a commitment to serve as a hometown ambassador.

Campus club meetings range from monthly to weekly across campuses, and most involve both social and academic activities. Participants described book studies, study hours, homework sessions, and well-being checks, in addition to a host of social activities such as escape rooms, pumpkin painting, cookouts, card playing, team-building exercises, faculty/student dinners, and group hikes. In describing one institution's campus club activities, a student said, "We did a Valentine's themed [team-building exercise] where we wrote love letters to ourselves to check in [on] our semester progress, and what we would love to do in the future, and what we love about ourselves and stuff like that."

Several students explicitly noted the First2 Network's focus on leadership opportunities for students, as well as how student-centric the network is, especially given the responsibilities carried out by directors and co-chairs. Further, several students described their own growth in the network as they started as interns or scholars and progressed to mentors, directors, and even co-chairs.

In First2, a lot of the campus clubs are based on leadership. I'm in one of those leadership positions, and First2 seems like they put a lot of resources towards promoting that objective of leadership, even on a small scale.

– Student Member

Several illustrative quotes follow that are representative of the breadth and depth of student roles within the network.

- *I served as a mentor for this past summer. I thought that was super fun. It was fun to lead all the students and make their activities and interact with them, help them find their way around campus because now I'm like, "It's just campus. It's my home away from home." To them, it's a complete different world. That was fun.*
- *So I started as a scholar. And then I bumped up to a director, and then I bumped up as a co-chair. So I kind of worked my way up through leadership roles in the network.*
- *We have the high school ambassadorships. I've really enjoyed doing that with a friend of mine. We've gone to a couple of high schools in the area. We've done more than just the requirement just because we enjoy that so much.*
- *The [Your Time to Thrive] book club has been really great. Those are the meetings that I do enjoy. And honestly, the ones that I go to more often than the study sessions, because there is a lot more room for members to talk amongst one another and there's pointed discussion and it's . . . sort of a self-help book that we've been working through. . . . Everything's very much geared towards the college students' struggle and trying to take pieces of sort of like everyday life and how to organize those. How do we prioritize things that are important? How do we make sure we're getting enough sleep? What about nutrition? And so those meetings have been a lot more helpful.*
- *I've really appreciated the student directors at my campus. They seem to really be going the extra mile for us, which I really appreciate. . . . They're reaching out one-on-one, which I really appreciate, and I had an issue where I can't attend the club meetings this semester because it conflicts with my work schedule. So they're willing to meet one-on-one outside of the club meetings. So I still meet the requirements and everything.*
- *I've been starting to go to a lot of conferences this semester. So I represent First2 when I do my posters. I have the logo on there and I talk with people if they're interested about my funding sources, that sort of thing. So I guess I'm not really, or technically, any leader in any formal capacity, but I do rep First2 wherever I go.*

Describe your involvement in helping the network identify and test strategies for better serving rural, first-generation students. There was a range of First2 student involvement in the PDSA activities across institutions. Participants most commonly noted the PDSA requirement associated with the

hometown ambassador activity. Direct involvement in these PDSAs varied, ranging from minimal involvement, focusing only on the Do phase, up to being responsible for collecting data and maintaining the PDSA record in the repository.

I think it's a new thing this year that we have to do a PDSA cycle for our hometown ambassador visits. . . . But I'm definitely involved in that, and that's the first time I've actually seen the template and filled it in, but also, we started at our institutional team meetings since we had combined them with some of our club meetings. We've been doing the Study and Act portions of the PDSAs that some of our faculty members have done and some of our student directors have done. We've been looking at the data, analyzing it, and figuring out our next steps for that too. That's been a new thing for us, and I think it works really well. It gives us a chance to see what kind of an impact we're making and then also give some student feedback into what we think could better it next time.

– Student Member

Several students stated they have been involved in multiple PDSAs. Several examples were described, including

students' study habits, hometown ambassadors, campus clubs, networking dinners, book clubs, mental health resources, and a STEM starter pack. Illustrative quotes follow.

- *This year I'm working on a book club to see if it increases the attendance in clubs and things like that. So I've been pretty involved in multiple PDSAs and sort of familiar with the process. So at the beginning, when I was a scholar, I pretty much just played a role in the Do process, and someone else filled out the Plan and the Study and the Act parts for me just because I was less familiar and didn't really understand what it was. And then as a director, I sort of learned more about it and I did the whole process by myself and got to type it all up and do everything. So sort of done a little bit of everything, but it takes a while to learn how it all works because it is a little bit confusing. And as an outsider to PDSA, you're like, "What is that?"*
- *We did two different PDSA cycles. It was the campus club one, which I think is required for every campus, and then the networking dinner. We found that students were intimidated or scared of professors, deans, assistant deans, so we hosted a networking dinner, which was a casual dinner. Everybody was in jeans and nothing formal, and we had it at a nearby restaurant over here. We facilitated conversation and fun activities like a little bingo for everyone to participate in, and afterwards, we did a survey and found that everyone was more comfortable now to approach these professors or deans or advisors, which was really helpful.*
- *[Doing a book study PDSA] is about putting micro habits into your daily routine so that you can develop habits. . . . We're basically just trying to see if people try the things that the book says, do they feel like it helps them? . . . It's like a group PDSA in that multiple directors are all working on it. . . . Basically, what we're doing is we go and . . . have a presentation reviewing the chapters that we were supposed to read and do a group discussion . . . about it. At the end of the meeting, we have everyone take a survey to talk about what they thought about the chapter, things that they want to try to implement into their daily routine, how that's going for them, stuff like that. At the end, we're going to use those surveys to complete the PDSA sometime before finals.*
- *Hometown ambassador this year has been focused on PDSAs of us breaking down more and more of what kind of input we're doing for hometown ambassadors. And so I've been involved on that front because that's my own presentation. Yeah, I've been involved in the backend part of it, collecting data, analyzing the data, seeing what I could get out of it, reporting, formatting those results in a way that the First2 Network can use them . . . just formatting the data in a way that makes it more digestible, I think.*
- *For my personal PDSA, I'm working on a discourse to help communication within the club and see if the notifications that I'm providing [are] helping the students complete their scholarship requirements in an effective way, and also help them attend more meetings and get an understanding of what it is to be part of the First2 Network.*

There also seemed to be a range of involvement of First2 students with the institutional teams. Some participants reported that only directors and co-chairs were directly involved with the institutional team at their campus, while others noted that all First2 students were involved at least minimally with their institutional teams. One director described multiple areas in which directors were involved with their institutional team: network budgeting (for the campus club, internships, leaders); campus club planning; networking across the campus; and completing PDSAs. According to participants, one campus is organized so that "the institutional team and all of the campus club and scholars and directors have an overlap. Because we basically merged

the [monthly] meeting so that everyone can participate, whether it's students helping me in the institutional team or the institutional team helping students."

How much of a voice do you have in the network? Students in general? Responses were mixed as to the degree of voice students had in the First2 Network. Some students had mostly positive perceptions about student voice in the network, i.e., several noted that First2 routinely employed surveys to gather student feedback, and that the network was student-driven. Illustrative quotes follow.

Surveys are a very important part of the First2 Network. They're done with mostly everything that we've done, and with the all-student meetings, I know that in the student director meetings, that we'll spend time to look at that survey information.

– Student Member

- *After our all-students meetings, we get to do a survey and you can put your input in, what you want to change, what you want to see from your campus club students or directors, what you want to see in the next all-students meeting, and so that's when your feedback will be read by the student directors during our meeting and we make changes based on those comments. . . . So I think there is an opportunity for students to speak up to make changes within the network if they would like to.*
- *For the overall student network, it's still very student-driven. Every meeting we have, they're giving us surveys, asking "What do you want to see at these meetings? What do you want to do with the network?" We're just always asked our opinions and [for] any suggestions that we would have going forward.*
- *I would say in general, there's more of a bureaucracy to get through. You have to go through the steps and the motions, but it's definitely something that can be done if it's something we really are passionate about and want to change.*
- *I think that I actually do have a pretty good voice in terms of the concerns that I could show or my ideas. . . . Leadership . . . has just been, they're very easily reachable. . . . And so I feel like personally I am able to influence change in the network. I think there's a good balance of it now. The student directors are a good liaison for the general student population because they're the ones that are in the closest contact with the leadership necessarily. They go to weekly meetings with them, and they're usually the people that students will report to if they have some kind of issue. . . . I think that they've actually taken a lot of our constructive criticism into account and made a lot of changes.*
- *I feel it's very student-voice oriented. It's not just all the higher-up leadership making decisions for us and there's nothing we can do about it because that's how they want to run. . . . They really value student input and how [students] feel about their organization.*
- *I think that I have a pretty good way to produce my voice in the First2 Network because I'm a co-chair, so I constantly have to talk to [named advisor] and voice opinions on what is happening. And I've also been dealing with some student issues, so I'm helping those students understand what's going on and help them figure out the things that they need and help them voice their concerns.*

Other students had mixed perceptions about the level of voice students have in the network, recognizing areas where student voices are minimized, but also describing efforts undertaken to promote student voice. Several students provided examples where student feedback led to adjustments to the number of required meetings and conferences and how the hometown ambassador training was provided. A few illustrative quotes follow.

I think that our voice and our involvement has increased significantly over the last year. I know last year we did not feel as though we had very much of a voice, but we kind of spoke up and got together, and then there was some changes that were made. So I feel like we do have a pretty big role in developing things within the network and changing things.

– Student Member

- *I know last year, students voiced some concerns about some of the requirements and a resolution was able to be resolved. For example, I think one of them was changing from a full conference attendance to just 50% of the conferences as a requirement. So I think it shows that if students do have a concern that . . . the First2 Network is responsive to student feedback.*
- *Last year, there was a lot more requirements than there are this year. . . . They had to attend, I think, six or seven club meetings, they had to do all-student meetings. We have to do a conference and journals and things like that. . . . I know we decreased the amount of club meetings and decreased the amount of journals, and there [were] a few other changes that I can't remember.*
- *I think the students definitely have a big voice in the network. Just last year, we had a couple of changes that happened that were specifically because students spoke up. Students are also able to advocate if they are not liking a certain policy. . . . And then as a director as well, especially in terms of voice, you're able to communicate some of those concerns as well that you may be having on your campus with students, or concerns students have with the network, or even about STEM in general.*
- *I think it's pretty good. The directors get a lot of say. We have a more direct connection with [named advisor] and people who run things, really, which is nice. I remember as a scholar, I felt like if I said something, it didn't really matter. . . . There are a lot of scholars compared to directors, so I understand that it's a bit easier to listen to a smaller group. But at the same time, it's gotten better, definitely, even for scholars, I'd say, compared to where it was last year. But it's still not quite perfect.*
- *I felt like, comparatively, this year the network has been a lot more open about their plans and a lot more willing to take our concerns into consideration. An example would be that, at least in the previous year, the meeting for hometown ambassador was an 8-hour day on Zoom, just entirely all at once was 8 hours. And admittedly, there was a lot of good information, but it was just very difficult for students who'd been doing virtual learning for the last year and a half and then having to sit through an 8-hour day on their Thanksgiving break. . . . When we voiced those concerns, the network actually made a drastic change. They cut that meeting down to an hour and a half, and they said, "Here is a form that you can fill out if you have any questions. You can always reach out to the student directors or to [First2 leaders]." . . . And so it helped a lot for the people who already knew how to do hometown ambassador, that this could just be a faster meeting, that they got all the information that they needed to . . . but the freshmen or the people who are new to it still had the support that they needed.*

Several students had less-positive perceptions about the amount of student voice in the network. A few illustrative quotes follow.

- *I know there's a lot of communication issues, but it also feels just like if the student can't figure out something by themselves without any guidance, then they can't figure it out at all. Because a lot of times you're told to find an alternate if you can't do something, but you don't know what could be accepted as an alternate and so it gets really complicated.*
- *I think at the campus club level we tend to have a good bit of voice, but in the context of the all-student meetings or the conferences, it felt a lot less. This is a secondhand story from my partner, but she was at the fall conference that was on Zoom and she said that she asked a question and someone sort of knocked her down and was mad that she even asked the question. It was during a segment where they were talking more about the data, and the audience was definitely—it felt like it was aimed toward people higher up in the organization—but students were still required to attend. So she thought that she could ask a question and then she felt sort of shut down.*
- *A lot of times it feels like not a big [voice]. . . . I've just never felt like there's a good place or a good point for me to voice any concerns or like, even during the all-students meeting, whenever [advisor] [asks for] any questions, I'm not going to be the one person to pop up and be like, "Hi" Or even within [our] First2 chapter, there's not really a good way to give feedback directly for the First2 program. I know that if we have any concerns, we can always go to one of the officers and they can direct them to the people who are higher up in the First2 Network, which has happened a couple times. So there's been some sort of indirect—"If I tell you, you'll tell them, and then they'll tell the rest above." But it doesn't seem like there's a direct route for me to just be like, "Hey, this would be neat if . . ." and at that point you're kind of like, "Well, is it worth it?"*
- *But I think genuinely the students that don't have people like that [helping them navigate the network] are struggling, especially because when it comes to requirements, especially for the conference, we were told . . . that graduation was kept in mind in terms of the May conference. And so it was still done on the weekend of graduation, which is keeping a lot of our seniors who need their requirements to be done, and they're unable to do it because of that. And when we try to reach out and say that there is a problem with it, it tends to just be pushed off until the last minute, or it tends to just be left, or they'll tell us we have to figure it out ourselves. I think it's other issues as well, but especially with conferences, because last semester the online conference was during student hours, so a lot of students were unable to attend that [one] and it makes people have to go to the in-person one in May. And then if students . . . are graduating, they can't go because of the graduation.*

I do feel like there could be an increase in student voice just because the leadership times that they meet are not at student-friendly times. So for example, if you want your voice to be heard, you need to go to the backbone meetings. But the backbone meetings are on Tuesday at 3 p.m. or something like that . . . when most students have classes. And so student voice can't really be shown or heard because they're at class and they can't attend those meetings. – Student Member

How, if at all, has your involvement in the network helped you persist with your STEM studies? Several major themes emerged, with the first focused on the benefit of building a stronger network of connections among faculty and students. Another theme that students identified focused on the research opportunities that the network provided. Several illustrative quotes for each theme follow.

I had another scholarship opportunity and that professor is the one that also did First2. So that . . . connection with a faculty member has helped me drastically. He was my Computer Science I . . . professor, and so we had that relationship already and that was so helpful. I've now gotten to meet other faculty members . . . and doing research projects with them. . . . I learned something or was doing research on something that I am currently learning in class right now so I already had a head start on it. And then again, making friends on campus as well. The campus club I think is a great opportunity, some of my best friends I've made through that campus club. So I think it's an overall great experience for building a network, increasing student belongingness, increasing retention in STEM, and giving people the opportunity to learn more in their field.

– Student Member

- *It's definitely [given] me a community . . . of other students who are in very similar situations, and I think that helps my mindset.*
- *I think, especially the summer program, especially because the four or five people that I had in the group that I was mentoring, I still keep up with. So it's good for creating those close contacts. . . . So I think in terms of getting people comfortable with what they're doing in terms of being a STEM major in that first couple months aspect of being in college and settling, I think the summer programs [are] really, really influential.*
- *My intern experience in 2021 was really fun. It got me into research and also two of my best friends were my mentors . . . and so I met them through that internship and then they became my best friends after. And so having that experience really helped introduce me to a lot of people that have been a really good support system for me.*
- *I feel like I've gotten really more connected to staff and all of that slowly through First2. My internship here, the mentor that was doing it, I'm going to have him next semester in a small physics class. So I was talking to my advisor yesterday and he's like, "This guy's awesome. He's a great teacher." And I was like, "Oh, I already know him."*
- *The First2 Network encouraged me to get involved into research, and then also, I viewed a lot of the older First2 students as mentors when I was first getting involved in the network and an underclassman, and they would just give advice about scheduling classes, how to do well in certain classes . . . and I found that really helpful.*
- *I know for me personally, the research that I had done over the summer, I continued throughout the semester and I actually presented at undergraduate research day at the [state] capitol. I would not have been able to do that without the First2 Network.*

Participants also noted the financial benefits of network participation. A few illustrative quotes follow.

- *I think that the amount of involvement that I've put into First2 has actually helped me because I figured out exactly what I wanted to do. So I've actually been able to pursue things like research. I've been able to do mentorships during the summer. And now I'm doing a teaching position during the summer for Upward Bound. So I think the amount of work that I put into First2 in terms of leadership roles has allowed me to figure out that I like being in a position where I can voice my opinions and also help people voice theirs. I think that it's definitely helped me in terms of what I want to do after I graduate.*

- *Financially it has helped me a ton. And so I always sort of wonder if I didn't have that extra income and I had to work more hours at my job, would I have been as successful as a student?*
- *I think the network has definitely given me a lot of benefits to be able to thrive in my STEM major. And just to say, for one, the stipend that they give us to do research a month is really helpful because I know a lot of us would have to get part-time jobs to be able to pay the bills, but having the stipend means that we can do research and move forward in our careers because having research experience is really important.*
- *Obviously, the stipend is really good motivation to just go and put myself out there and get in hours that I need because we're getting rewarded to do stuff that's only going to benefit us in the long run.*

And, finally, several students reflected on how their network involvement had impacted their decisions about a STEM major. A few illustrative quotes follow.

- *For me, I was considering changing my major before I had the opportunity to do research, but when I started that and also getting to meet people—that was one of the major, major benefits—was having a strong network of peers with similar situations and similar interests as I am, and just having that support for my friends and having the opportunity to do research made me convinced like, “Okay, biology is for me.”*
- *I'd say my involvement as an intern before my freshman year ended up influencing me to change my major to something I ultimately found a lot more enjoyable. . . . I discovered that I really loved physics and there was a whole computer science element to it, so I decided to do physics and computer science, and without the First2 Network, I would've never done that, and then I've also found that I've been able to develop a lot of leadership skills and just get a lot more involved and a lot more confident with myself through all of my activities in the First2 Network, and that has helped me tremendously.*

4.3.4 Summer Research Internship Experience

To what extent did the research internship meet your expectations? Not all of the students who engaged in these group interview sessions had actually participated in one of the First2 Network summer research internships; therefore, this set of results is based on a subset of respondents.

For those students who participated in one of the summer 2022 research internships (or, in a few cases, an earlier internship), most noted it did meet their expectations. A sampling of illustrative quotes follows.

I personally think it over-exceeded my expectations. I definitely did not think I was going to do the in-depth research that we did and get that hands-on time with the professors that I would be taking classes with throughout the semesters.
 – Student Member

- *For me, I'd say it far exceeded my expectations. It ended up being far more enjoyable than I ever thought it would be and I loved it. For me, it helped me find the major I wanted to go into. It helped connect me with research experiences here. It's helped me find this network, which has helped me develop leadership skills, and I made several friends during the internship . . . and I'm still in contact with them so that was really helpful.*
- *I will say leading up to the camp or the research experience, it was a little bit unorganized, . . . but the actual research immersion experience itself was really good . . . and it met my expectations.*

- *For expectations, I don't know if I necessarily had any besides just getting to know the faculty more . . . that was a big thing that drew me in, but . . . I made friends that I still have to this day from that, and then I also learned a great deal about things that I was going to do in the next semester with computer science.*
- *Going into my internship, I thought it was going to be more of a shadowing experience and I wouldn't get hands-on experience, but I got to work with the machines and the materials in the lab and that was super cool. So it exceeded my expectations, and I tried to carry that experience for when I was a mentor to other interns.*
- *I would say that it exceeded my expectations—not quite as much as in the research because the faculty coordinator emailed us, very clearly laid out what we would be doing—but what really surprised me was the amount of support we got from the network while we were doing it and how much they taught us about university life and prepared us and helped us contact professors to ask if we could do research in their lab.*
- *It was really nice for them to tell us about college life. I expected it to be more formal than it was, but they were really welcoming, and nice and very friendly. The research wasn't as in-depth as I thought it would be for the topic that I chose, but it was still good.*
- *Honestly, I think I had lower expectations for it just because I had no idea what to expect. I'd never done anything like that before. So we were doing obviously everything we need to during the day, and then it was just we had so much time on the weekends and after that to just hang out and be college students [which] was really awesome. And I feel like I learned a lot more than I thought I would.*

A few students noted the research aspect exceeded their expectations, but that other aspects of the internship were less satisfactory, such as logistics; illustrative quotes follow.

- *The research was everything and more than what I thought it would be. . . . I learned a lot about the research process, especially with physics. . . . And the logistics, I thought we'd be eating in a dining hall. We stayed in nice dorms, but we had to Grubhub all of our food and stuff. And I think there was something with how they gave us the funding for the food that was . . . we had to use a certain method of payment. So that was unexpected. And then it felt a bit chaotic in terms of the schedule. . . . And then there were a lot of activities planned—they did make some of them optional, which was nice.*
- *The research [was] as expected or better than expected. I was a little disappointed about how much time we had in the lab. I personally could have been in the lab much longer and been perfectly happy. I feel like a lot of the issues that we had also came down to poor pre-planning or just issues with distributing funding. Because we had some social events, but you didn't have really a choice to opt out of them because you're required to be in pairs. And if only one person wanted to opt out, then you had issues. . . . But overall, I mean, I enjoyed what I was there to do, which was the research. I do know that there were some things that definitely shouldn't have been required. . . . But overall, it's good.*

One student who had participated in one of the 2022 internships had a less positive perception of the internship experience, noting, "It was kind of what I expected. I expected to spend a lot of time in the lab. But what I didn't expect was how I kind of felt like I was in middle school again, because you can't have your car, you can't leave campus, you're confined to your dorm.

Basically, you wake up, you eat the same meals every day. . . . The lab part was helpful, but I felt like I had lost a lot of freedom—I didn't like that."

What provided the most value to your college experience? Students responding to this prompt focused primarily on three themes: the lab/research experience, the networking, and getting familiar with the campus. A few illustrative quotes follow.

For me, I don't know, I was definitely—before college—very, very anxious about just navigating the campus. And then after staying at [campus] for 2 weeks, I knew my way around. I was oriented and I knew where all the classrooms were that I was going to have to go to that semester. And it definitely helped so much coming here. — Student Member

- *I would say instructions and general lab techniques, like learning how to micropipette and things like that and having the support and the kickstart to ask a professor to do research in their lab. And the person I requested to meet that summer; I'm still doing research with today.*
- *I really got experience in the lab for the first time with the instruments that we used. Our first lab and actual class, I was going around and setting up the microscopes because I had already done it.*
- *I wouldn't have done RAP [Research Apprenticeship Program] I don't think if I hadn't done the summer immersion program.*
- *During mine, I actually got to spend time with two upper-class forensics majors and they actually showed me around the forensics lab and where everything is . . . so it made it really easy for me whenever I had actual classes in the lab and I knew where everything was. I knew what not to touch, what to touch, and it really helped a lot.*
- *I would say the connections with the other students that were there because I made friends and I'm still friends with them now and I see them almost on a daily basis. Also, just feeling more comfortable here on campus.*
- *Probably meeting professors. Because throughout the week, they reached out to some of the STEM professors . . . so they'd come talk to us one-on-one at different times. And so I actually got to meet my biology professor I had last semester, a month or two before the semester started. I was like, "I have you this coming semester for Bio 120" and she was like, "Really? I can't wait to have you." [I made] connections and it relieved anxiety.*
- *A big thing for me was that we knew where everything was in this campus. We got our parking passes already taken care of, so there was a lot of benefits that way; I was very prepared for my classes once they started.*

How, if at all, did participating in the research internship affect your decision to declare or not declare a STEM major? Perceptions seemed fairly even among respondents about the research internship having an affect or not on their decision to declare a STEM major. About half reflected that the internship did impact their decision. A few illustrative quotes follow.

Doing the research last summer definitely let me know which direction I wanted to go within my major. — Student Member

- *It definitely gave me reassurance that I was going to be doing something that I loved to do and that it was going to work out.*

- *Yeah, so I was going in for physics and I did the physics internship, and it definitely helped me stay on that path because my first decision for physics was to go into astronomy, but then that internship wasn't really astronomy related. We did light, so it was particle physics. So I got to see a whole other side of physics. . . . Now I'm in a position where I don't really want to do astronomy anymore, I want to stay with physics.*
- *I felt like I kind of had an upper hand on all my peers because I was actively in the lab. I was working in a research lab as a first semester freshman, and nobody else had even thought that far. And I feel like it helped in my classes too, because I knew random stuff just from the lab. Because a lot of your first semester is like learning how to use equipment and stuff, and I already had that experience.*

The remaining students reported less of an impact on their decisions related to a STEM major. Illustrative quotes follow.

- *I don't think it made much of an impact on my decision for my major.*
- *I feel like it didn't really impact what I wanted to do with my major because I've always wanted to be a forensics major and I knew that even coming into college.*
- *I was going into the same major before I came into the internship.*
- *I'm a forensic science major, and, specifically, I focus on forensic anthropology. And this internship happened to be forensic anthropology. It was a continuation of previous research that I had done. So I think if it was my only research experience, it would've confirmed that this is what I want to do. But since I already knew that it was just a fun experience to get more time in the lab.*

And, finally, one student reflected on a recent decision to switch to a nursing major next semester: "I started working in a lab last semester and it made me realize that maybe that's not the scene for me. It has nothing to do with First2 at all. I just think that it did provide plenty of insight as to what I would be doing if I stick with it, specifically in a research way. . . . I think First2 is great. . . . [and] it's been helpful in realizing that maybe that's not for me."

How, if at all, did participating in the research internship influence your confidence in your ability to do STEM coursework?

Most students who responded to this prompt perceived that the internship experience had positively influenced their confidence in their ability to do STEM coursework. A few illustrative quotes follow.

For me, I'd say the biggest struggle in coursework is the load of it, but it definitely helped me see how much persistence it takes in terms of that. Our experiment wasn't just step by step, this is what we're doing and it's going to work for sure. It was like, "This is how it should happen. I have no idea how you guys want to set it up. It's all on you." So there was days where we made no progress because it was just trial and error. I think that really helped me see how hard it was going to be, but also at the end of the day, we did it.

– Student Member

- *Just knowing it was my first time in a lab and that I'd done all this research because we'd actually done posters during ours and we presented it to the president and a couple other faculty members and it just gave me confidence that I could do this and be good at it as well.*
- *It definitely increased my confidence for lab-related courses and for . . . doing research within my lab.*
- *I would say it made a little boost on hands-on work that I was like, "Okay, I think I can do this because I've done something similar and I've gotten through it."*

- *We got a couple of calc lessons from the professor we were working with because we had to do calculations for the measurements we were taking. So I got to get a little preview into what multivariable calculus is like; it was interesting getting a taste of that.*

How, if at all, did participating in the research internship influence your sense of yourself as a future scientist or mathematician?

Most students provided feedback for this prompt, and nearly all of them perceived the research internship had positively influenced their sense of themselves as a future scientist or mathematician.

Illustrative quotes follow.

I would definitely say that I started thinking of myself as a scientist when I started First2 and basically just developing what I wanted to do for [a] career. – Student Member

- *For me, I knew I would want to do something in biology. I wasn't completely sure, but I definitely grew a love for soil biology afterwards and I just knew that's what I wanted to do.*
- *It definitely helped me figure out the different steps that I needed to take to achieve my goal academically.*
- *It really helped me figure out what I wanted to narrow down my forensics studies too, and I know in my research, I [did] 3D-digitized skeletal human remains and it helped me realize that I want to work in osteology. It made me feel like I going to be able to work in osteology after I graduate.*
- *It was like more of just, "I do want to do this." I can see myself doing this because I was enjoying it.*
- *Just in general, getting all that lab experience makes you feel more like you're prepared to actually do something in the field or in general in science.*

One student, who had participated in an earlier internship prior to 2022, reflected, "It didn't necessarily help me realize anything, it just gave me a little head start in my major, which was beneficial."

How, if at all, did participating in the research internship continue to influence your progress through your STEM major?

Nearly all the students responding to this prompt perceived that the First2 Network had positively influenced their progress through their STEM majors. A few illustrative quotes follow.

For me, I think without the internship, it would've been very likely that I would've changed my major possibly to something not STEM-related. Definitely, the internship, it would be very unlikely for me to be in research now without it. – Student Member

- *I feel like it definitely has continued for me because . . . it has given me confidence that I am a scientist and that I can do it, and also, I always go back to the relationship I have with my professors. I think that was one of the main accomplishments out of the internship and I've had more opportunities to do research because of that, even with different professors, because they know that I can do the research.*
- *I know it's influenced me along the way. Even though it was during the summer and it's now spring, I still go back and think about what I did during the internship and how I can apply that to my research [now] and think about all the good things that I did in the summer research that can go with my current research . . . like, "How did I keep my science journal?" I should keep it like that and just be more organized by going back and thinking about the summer internship.*

- *Again, I think it just made me more comfortable with having no college experience. It made me realize that it's not crazy and super intimidating to approach professors.*
- *It was getting exposure to [different sub-fields] and discovering I enjoyed it. It's also helped me, I think I want to continue doing research for the rest of my undergraduate years and probably after I would like to go to grad school, which I wasn't considering.*

One student said, "If I was less already preset on my path . . . it would've definitely confirmed that I wanted to do this and gotten me into research. But since I was already very interested in research and this specific research, it was just extra."

What changes should be made to improve future research internships?

Several students provided suggestions for improving future research internships, and most of those focused on the research aspect, especially adding research projects for other STEM fields. A few illustrative quotes follow.

I guess the only improvement is just getting more varied projects. I know there's quite a few people who were excited to be there, excited to do research, but there wasn't something that was quite their field. So getting more professors, more experts in, or having students design their own research project might be interesting.

– Student Member

- *I think that there should be more different experiment opportunities because I know for the group that was here during summer, there were three forensics majors, one education major, and I think two biology majors, and a mechanical engineering major. And the mechanical engineering major and the education major, they didn't really have an experiment to do that was a part of their major and I feel like if we had something for them, that would've been really beneficial to them.*
- *I didn't experience this, but like I said, we had a computer science major with us and they didn't really start doing research till halfway through the program, so he was stuck with us out in the forest kicking up rocks and collecting samples. I know he did not enjoy that, so for his sake, maybe some more variety as far as that.*
- *They need to make sure it's focused on research in its entirety. I think that's what draws a lot of people into it. Because I didn't know about professional development stuff requirements. And we had to do a lot of different tours. I'd rather either take a break and do more research or [do] something that's related to that.*

A few other students had suggestions focused on logistical issues. Illustrative quotes follow.

- *I think the only struggle that we had over the summer was the food because we were . . . Grubhubbing dinner every night, and then that's super expensive because you have to pay for them to get here. So we definitely ran out of money pretty quickly.*
- *it was a weird time period. It was during the end of the summer, but there was a full week break between the end of the internship and the beginning of classes where you weren't allowed to stay on campus. And so, at least for me, I'm from Michigan, so I'm a 7-hour drive. So . . . I had to . . . pay extra out of pocket to rent a room for a week. So maybe making sure that it actually makes sense with when classes are starting—either give them more time in between or less time, just make it more convenient.*
- *Future internships, I would probably say give weekends off, honestly. Because I think that it was demanding being here for 2 weeks. You get no time. You get leisure time at 8 at night, and at that point you're tired. And you can't leave campus. You're in your dorm. I would definitely say put some breaks in there because it was a lot.*

4.3.5 Wrap Up

How can the First2 Network provide you with better support as you continue in your STEM program? Several themes emerged from students' suggestions for better support from the network. One broad theme focused on better clarifying First2 responsibilities and requirements for students as well as improving the quality and amount of communication between First2 students and leadership. Several illustrative quotes follow.

I think just providing, when you join or when you're planning on applying, a very basic list of, this is what's happening, this is when you have to do it by, this is required or optional. Especially for those who are applying for directors' positions or higher-up positions because I feel like that communication is just not there.

– Student Member

- *I feel like a lot of things get lost in translation when communicating through six different people. It gets communicated from the higher ups to [advisor] and then to the student chairs and all that, and then to the scholars. And I feel like sometimes things get . . . it's unclear sometimes what needs to be done. I know with the student ambassador stuff, there's been a lot of confusion with what we have to do exactly for that. Clearer communication I think in general.*
- *I know when I first joined and I first got access to the Google Drive with all the information and stuff that some of the documents have contradictory instructions. It was confusing to find the things at times until I figured out which folders have what. And then I would read through some documents and it'd say different things about different requirements. I have a pretty good understanding of some of them now, but it was very confusing at first and then you just have to ask somebody else.*
- *I think for the network as a whole, I feel like there needs to be more communication between main leadership and those on campus. . . . I really feel like we've kind of been really disconnected from the students, and we're not really sure how to get people to come. Most of the time it feels like we kind of have to strong arm them into coming, or offer something for them to come to a club meeting. And so it's been kind of really difficult on some of the officers and the directors.*
- *I feel like there's sometimes a bit of a disconnect with the average First2 scholar, and then also the administration. Again, going back to that example with the fall conference, sometimes it feels like scholars are in the room to listen and not be heard. Be seen and not heard. That's what it feels like sometimes, especially being somewhat of a newer scholar.*

Another theme was to provide more flexibility related to First2 requirements for students, both in terms of activity types and the number of hours required. A few illustrative quotes follow.

- *I'm not sure how quite attainable this would be, but maybe more flexibility with the hours. If you do somewhere in between 50 and 100 hours, you get paid for those hours instead of having to do exactly 100 or exactly 50 since we don't get paid overages or anything like that. Having that wiggle room would be better and let some of the students do more meaningful research with their time instead of rushing to fill a certain quota.*
- *I think especially because this is my senior year, I think a lot of the requirements like in terms of hours, I'm good with some of the specific requirements, trying to fit those in with my schedule. I'm like, "When do I even have time to sleep?" And I'm like trying to juggle everything. And some of the bigger requirements, like hometown ambassador, I still have not completed that and I still don't know where that's going to fit in.*

- *I think that dropping the requirements for students would be a major thing, because I think as first-generation college students, you always have so much on your plate and it feels more like a job rather than a support network. And so if they drop the requirements and just were able to make an incentive for students to come do these things that will help them, I think that's better than making it a requirement because then it feels like a job.*

A third theme was that they were satisfied with the types and amount of support being provided by the First2 Network for students. A few illustrative quotes follow.

- *I think just having the mentors there is a huge benefit for me because if it's something just as simple as scheduling classes or having someone to ask, "Oh, I have this assignment. Do you remember anything about it?" Just any form of help that you can get from someone who's been in your shoes before, I think that's one of the things that would be most impactful for me, is just having someone there to turn to with your questions and there to support you, encourage you.*
- *I think that there's already a lot of support as is. I think that upcoming freshmen have plenty of outlets to turn to.*
- *Overall, I struggle to find any hefty critique with that [support].*

There were a number of idiosyncratic suggestions offered by students. This included suggestions such as improving First2 opportunities and resources, better integrating First2 support with other college support systems, improving the summer immersion experiences, having industry representatives talk with small groups of interested students instead of in full-group sessions of all students, and increasing the opportunities for interaction with First2 students across campuses.

What is one thing that the First2 Network is doing especially well for students? Participants identified several things they perceived that First2 was doing especially well for students. The most common focused on helping build relationships with other students and faculty. A few others included funding to support work in their STEM majors,

I guess, building just community between students as Appalachians and rural, first-generation students and minority students and things like that, just motivating them to pursue STEM and do research, I think they do pretty well for the most part. Also I would say just overall funding students is a great way to motivate them to stay in STEM, to stay in research. – Student Member

opportunities to conduct research, and increased communication and interaction between First2 students and leadership. Several illustrative quotes follow.

- *Just the funding, being able to be funded to do things inside of your major rather than having to go work an external job somewhere else is just insanely—I can't think of another word to say—but insanely beneficial, I've found, in my years here.*
- *Definitely would've barely known my professors if I hadn't had done First2. Also, from a communication and sharing of opportunities within the network [perspective], because I found out about a lot of things that I had no idea existed, such as REU [Research Experience Undergraduates].*
- *I would say providing leadership roles for students because there's many different avenues such as the director position, co-chair position, the fact that you can run for an office or position on campus. So there's varying levels of leadership that you can do.*

- *I really, really enjoy the industry partnerships that First2 does, and . . . appreciate them having industry experts at the conferences [and] at our all-students meetings.*
- *We have a lot of support from peers, but also, you get a better relationship with your professors. That has definitely been something that I've enjoyed because if I have a problem with classwork . . . I can be like, "Hey, do you mind to help me with this?" I think because of that relationship that we do have, they're more prone to help and be there.*
- *I think that something that you're doing exceptionally well is the communication between directors and some of the main leadership. Because we are able to share what's going on at our campuses every week, because we have directors' meetings . . . so we're able to reach out and ask questions anytime we want to.*
- *I think just creating that sense of community, especially between colleges across the state. That's one thing that I enjoy about the all-students meeting is that I'm not just meeting with people from my college, but I'm meeting with people who are in similar circumstances across the entire state and getting to talk with them and learn more about them and maybe make another friend from a whole other college that I still talk to now through the program. And I think just creating that network of students at a statewide basis has been really well done.*
- *I hesitate to say money, but that is a big part of it and it is nice. But also, in that exact same hand is the research experience. Before I really got into First2, I didn't even know you could get into research as an undergrad. I certainly didn't know how to go about it or how to get paid with it. The network pretty quickly put me in touch with people who had those resources, and I was in a lab within the first month of my freshman year. Already, through that and through things like the conference that they have in the summer, you get a lot of valuable connections in the field that you want to go into. That's hard to do with my major, so I think it's been really valuable. I think definitely networking. . . . Even if it's not putting you in touch with people in your career that you want to go into, it's putting you in touch with other students who may have had similar experiences and can give you advice. That's really good, especially for freshmen who are first generation and don't have family that can give them that same advice.*

Any final comments to make anonymously via a survey link? None of the interview participants provided any feedback through the optional survey link shared at the end of each session.

4.3.6 Student Focus Group Summary

In sum, respondents most often joined the First2 Network for the immersive experience that involved them in research and for the financial compensation. They suggested more outreach at both the high school and college levels to make other students aware of First2 opportunities.

Participants were able to clearly identify the various roles that students could hold within the First2 Network, and they noted the network's focus on leadership opportunities for students as well as the student-centric nature of the network. In terms of student voice, perceptions were mixed about the degree of voice that students had in the network. Some felt student voice was sufficient, others recognized areas where students had brought about changes to network requirements, and still others identified areas where improvements might still be needed.

Compared to earlier years, First2 students seem to have more experience this year with PDSA activities. Most had been involved at least minimally with PDSAs related to campus clubs or hometown ambassadors. Further, some students reported direct involvement with their campus institutional team (especially directors and co-chairs), while others noted minimal involvement.

Students identified several ways in which their involvement in the First2 Network has helped them persist with their STEM studies, including building a strong network of connections among faculty and students, providing research opportunities and financial benefits, and how their network involvement had impacted their decision about a STEM major.

Regarding the 2022 summer research immersive internships, most respondents reported their expectations had been met or exceeded, especially related to the research activities. They found most valuable the research experience, the networking, and becoming familiar with the campus. About half perceived the internship had affected their decisions related to a STEM major but others reported less of an impact. Most perceived the internship had positively influenced their confidence in their ability to do STEM coursework and their sense of themselves as a future scientist or mathematician, and that their internship experience continued to influence their progress through their STEM majors. Suggestions for improving future internships focused primarily on including research projects for additional STEM fields.

4.4 Student Outcomes

4.4.1 First2 Network Student Persistence Rates

During the First2 Network's fourth year, network leadership members conceptualized and established a data-sharing system whereby students participating in some aspect of network activity provided informed consent for the network to use their Social Security numbers to obtain verified HEPC data about STEM persistence. HEPC set up a secure site through which network leaders uploaded Social Security numbers and agreed to merge those identifiers with their state data set to compile individual-level persistence results. HEPC then aggregated STEM persistence information into a summary report that was shared with the evaluation team for this year's annual evaluation report.

The overall STEM fall-to-fall persistence rate among First2 Network, first-time freshmen who provided consent for tracking is 71% (35 of 49 students) from fall 2018, 2019, 2020, and 2021 cohorts (fall-to-fall persistence information for the fall 2022 cohort is not yet available). The overall STEM fall-to-fall persistence rate among First2 Network sophomores and higher who consented to tracking for those four cohorts plus the fall 2022 cohort is very similar, at 72% (65 of 90 students).

STEM persistence and graduation rates varied for each cohort of first-time First2 Network freshmen who had provided consent for tracking. As shown in Table 13, by spring of 2023, persistence rates ranged from 0% for the fall 2018 cohort⁵ to 78% for the fall 2021 cohort. By the end of spring 2023, graduation rates ranged from 50% for the fall 2018 to 75% for the fall 2019 cohort. The remaining percentages of these students either switched to a non-STEM major, transferred to another institution, or dropped out of college.

STEM persistence and graduation rates also varied for each cohort of First2 Network sophomores and higher who consented to tracking. As shown in Table 14, by spring 2023, persistence rates ranged from 0% for the fall 2018 and 2019 cohorts to 88% for the fall 2022 cohort. By the end of spring 2023, graduation rates ranged from 100% for the fall 2018 cohort to 28% for the fall 2022 cohort. The remaining percentages of these students either switched to a non-STEM major, transferred to another institution, or dropped out of college.

⁵ The small number of students providing consent means that this estimate cannot reliably describe the experience of other fall 2018 cohort students in the First2 Network.

Table 13. STEM Persistence and Graduation Rates by Cohort for First2 Network Freshmen with Tracking Consent

Cohort	Persistence Rate (as of Spring 2023)	Graduation Rate (at End of Spring 2023)
Fall 2018 Cohort of First-Time Freshmen	0% (0 of 2)	50% (1 of 2)
Fall 2019 Cohort of First-Time Freshmen	75% (9 of 12)	75% (9 of 12)
Fall 2020 Cohort of First-Time Freshmen	67% (8 of 12)	N/A
Fall 2021 Cohort of First-Time Freshmen	78% (18 of 23)	N/A
Fall 2022 Cohort of First-Time Freshmen	71% (17 of 24)	N/A

Table 14. STEM Persistence and Graduation Rates by Cohort for First2 Network Sophomores and Higher with Tracking Consent

Cohort	Persistence Rate (as of Spring 2023)	Graduation Rate (at End of Spring 2023)
Fall 2018 Cohort of Sophomores or Higher	0% (0 of 3)	100% (3 of 3)
Fall 2019 Cohort of Sophomores or Higher	0% (0 of 5)	80% (4 of 5)
Fall 2020 Cohort of Sophomores or Higher	54% (7 of 13)	92% (12 of 13)
Fall 2021 Cohort of Sophomores or Higher	77% (20 of 26)	42% (11 of 26)
Fall 2022 Cohort of Sophomores or Higher	88% (38 of 43)	28% (12 of 43)

4.4.2 West Virginia University Student Persistence Rates

WVU, one of the First2 Network's primary institutions, has been tracking student persistence in STEM majors by analyzing whether students involved in the network directly or indirectly (through participation in a network PDSA) remained in a STEM major over time. Investigation of this data set reveals that of the 423 students with a STEM major who either participated in First2 or in a network PDSA, 47% remained enrolled in a STEM major (which is higher than the current WVU STEM persistence rate of 27%). Of the remaining 53% who left STEM, 25% switched to a non-STEM degree, 4% switched to a health-related major, 3% switched to a STEM-adjacent major, and 21% dropped out of college.

WVU also has a data system in place that enables users to track STEM student persistence by first-generation status and by rural status. Results are shown below for WVU, with the expectation that similar data from other public higher education institutions in West Virginia will become available in future years, as institutions are starting to explore putting such systems in place at their respective sites.

Table 15 presents the number of first-generation and non-first-generation WVU STEM students, along with the average 1-year experience persistence rates for each group. Figure 30 provides these rates in a visual format, showing a clear pattern of first-generation STEM students having lower persistence rates than their non-first-generation counterparts since 2005, other than a single year's anomaly in 2014. Further, the gap between the two groups seems to have widened for cohorts since 2016, with 2018 showing the largest difference of 17 percentage points.

Table 15. 1-Year Persistence Rates for WVU STEM Students by First-Generation Status

Year	First-Generation		Non-First-Generation	
	Number of Students	1-Year Persistence Rate	Number of Students	1-Year Persistence Rate
2005	387	55%	1,567	61%
2006	357	57%	1,642	61%
2007	401	59%	1,590	61%
2008	457	54%	1,994	63%
2009	445	59%	1,638	62%
2010	513	53%	1,829	61%
2011	443	60%	1,932	62%
2012	362	58%	2,259	61%
2013	156	58%	2,177	62%
2014	509	64%	1,832	62%
2015	530	62%	2,217	64%
2016	685	56%	2,059	63%
2017	614	55%	1,866	63%
2018	453	49%	1,663	66%

Figure 30. 1-Year Persistence Rates (Percentages) for WVU STEM Students by First-Generation Status

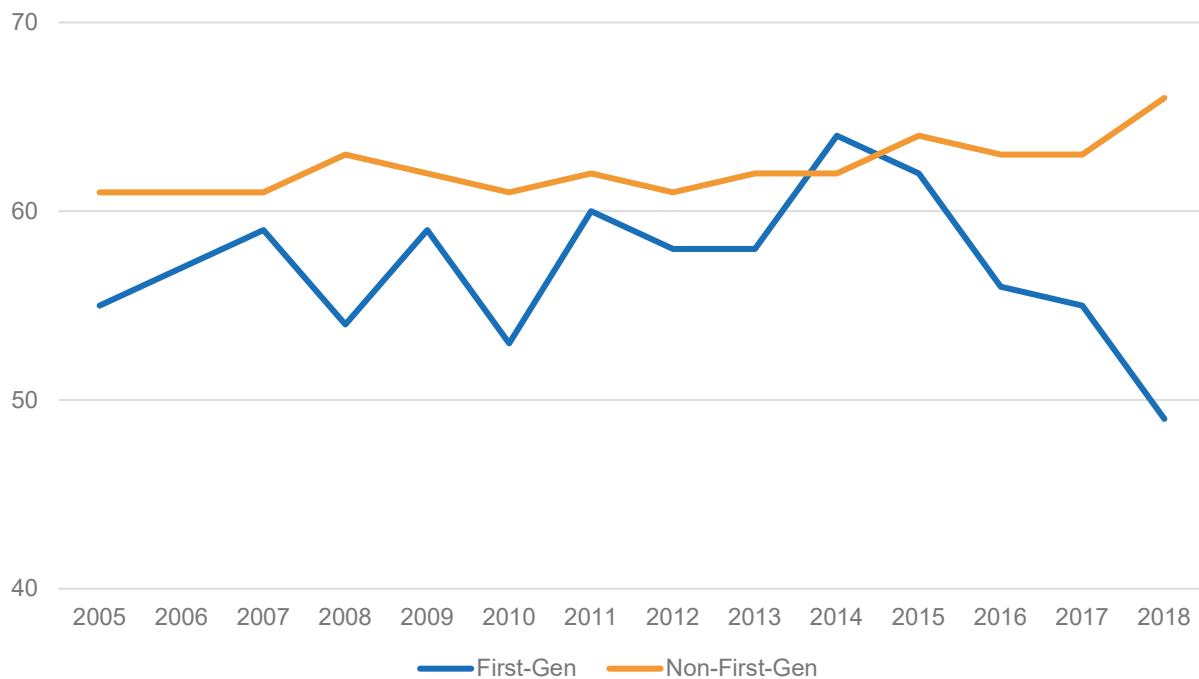
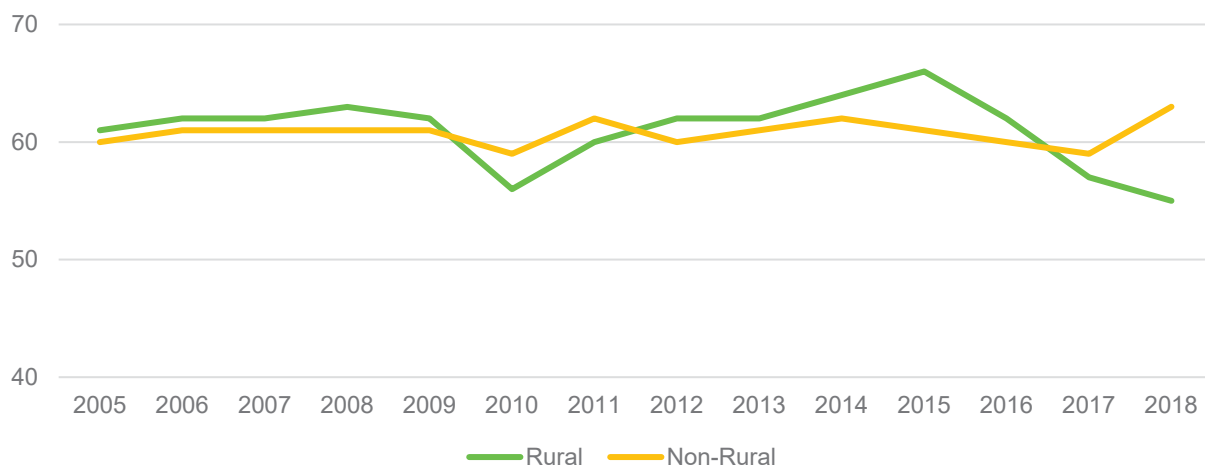


Table 16 presents the number of rural and non-rural WVU STEM students, along with the average 1-year persistence rates for each group. Figure 31 provides these rates in a visual format, showing a less clear-cut pattern of rural and non-rural student persistence rates. Overall, rural cohorts show slightly higher persistence rates for most years but three cohorts (2010, 2011, 2017) show slightly lower persistence rates for rural STEM students and the 2018 cohort depicts the largest gap between rural and non-rural students, a difference of eight percentage points favoring non-rural students.

Table 16. 1-Year Persistence Rates for WVU STEM Students by Rural Status

Year	Rural		Non-Rural	
	Number of Students	1-Year Persistence Rate	Number of Students	1-Year Persistence Rate
2005	182	61%	1,635	60%
2006	201	62%	1,686	61%
2007	186	62%	1,680	61%
2008	208	63%	2,023	61%
2009	185	62%	1,714	61%
2010	226	56%	1,840	59%
2011	182	60%	2,122	62%
2012	187	62%	2,091	60%
2013	182	62%	1,958	61%
2014	159	64%	2,009	62%
2015	189	66%	2,225	61%
2016	177	62%	2,241	60%
2017	159	57%	2,031	59%
2018	175	55%	1,768	63%

Figure 31. 1-Year Persistence Rates (Percentages) for WVU STEM Students by Rural Status



4.4.3 Statewide STEM Readiness, Persistence, and Completion Rates

One metric the First2 Network tracks is the percentage of STEM students across West Virginia persisting in their programs of study, regardless of their participation in network activities. Because the network also seeks to influence the readiness for STEM students for college and STEM program completion, this report also includes STEM readiness and STEM completion rates.

These state-level data are provided by HEPC DSR and disaggregated by variables of interest to the First2 Network for which data are available. Data are organized by College Readiness (STEM readiness rate), STEM Persistence (retention rate), and STEM Completion (graduation rate). Appendix C provides more complete details by College Readiness (Tables 1a–1f for readiness for 2016–21 freshmen), College Participation (Table 2 for fall-to-fall and fall-to-3rd fall retention rates for 2016–21 freshmen), and College Persistence (Table 3 for graduation rates for 2012–17 freshmen).

These data provide point-in-time information as part of the examination of trends throughout the First2 Network. In general, several consistent trends are apparent in these data:

- Pell recipients have significantly lower rates of readiness, persistence, and completion than their non-Pell counterparts.
- STEM students have consistently higher readiness and persistence rates than non-STEM students, but most often have lower completion rates.
- In general, results by rurality indicate slightly lower readiness, persistence, and completion rates for rural youth as compared to non-rural youth.

To highlight areas of interest within readiness, persistence, and completion, Figures 32–37 are presented on the next several pages. Note that all of these depictions focus on students based on whether they were a STEM major or a non-STEM major during their first year.

For College Readiness (Figures 32–33), Figure 32 shows that STEM students have higher rates of STEM readiness than non-STEM students, regardless of rurality, for all six freshmen cohorts. Rural STEM and non-rural STEM scores increased from the 2016 cohort to 2017, then show a generally decreasing pattern through the 2021 cohort. The non-STEM groups (rural and non-rural) both show an increase in STEM readiness rates for each successive cohort from 2016 to 2018, then rates drop or stay the same for the 2019 cohort (rural and non-rural, respectively), before both decrease for the 2020 and 2021 cohorts. The largest change is the 17-percentage point increase from 2016 to 2017 for non-rural STEM youth.

Figure 32. STEM Readiness Rate (Percentage) by Freshmen Cohorts: Rurality by Major

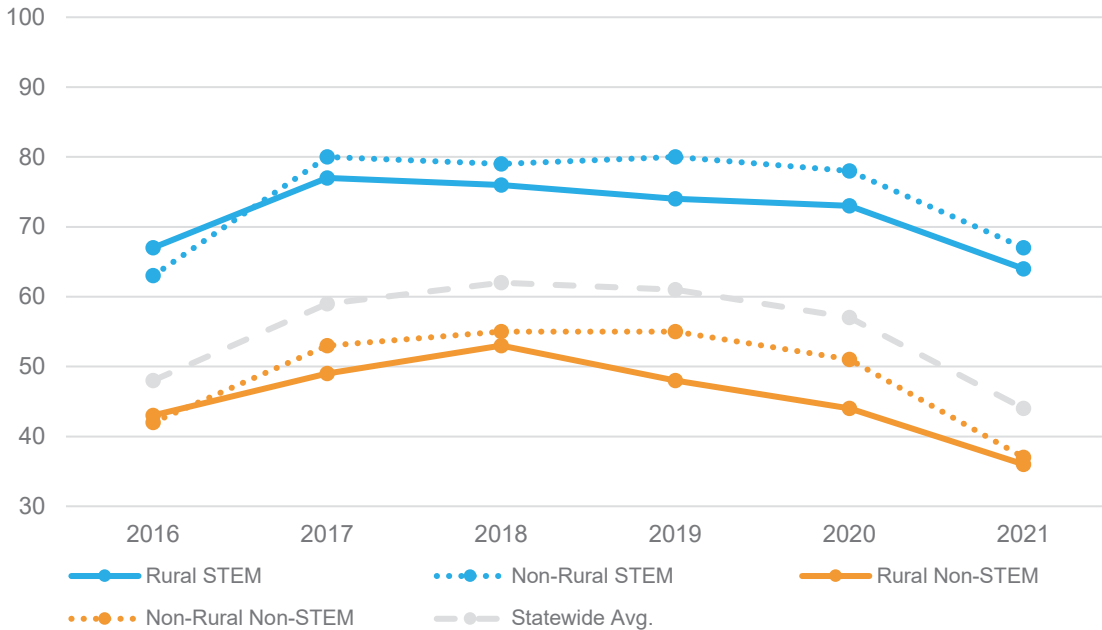
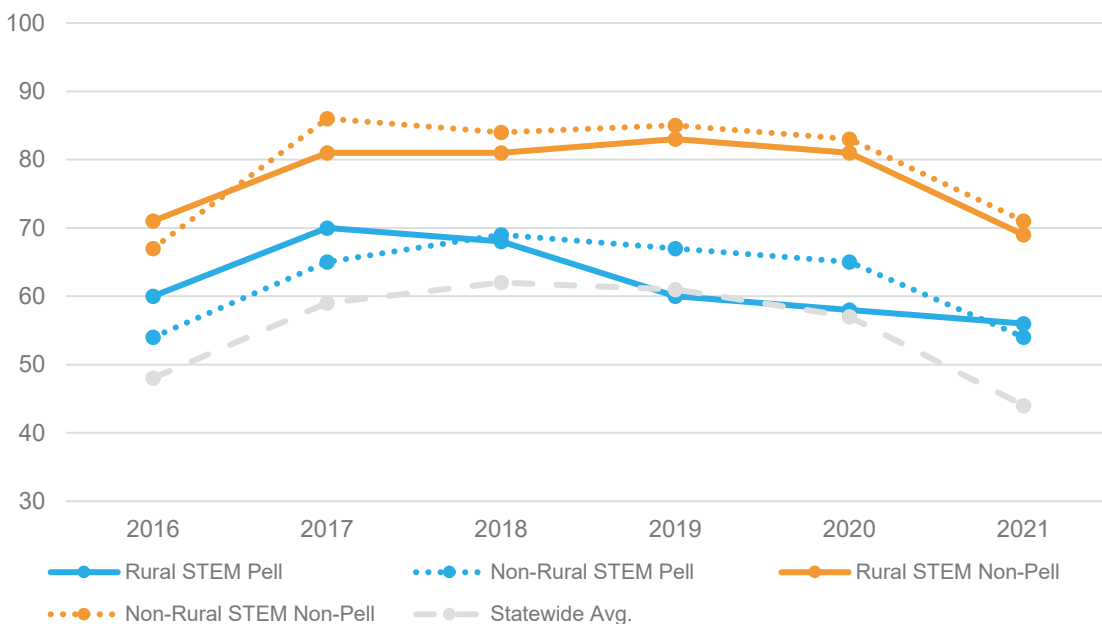


Figure 33 shows that for STEM students, Pell recipients have lower STEM readiness rates than their non-Pell counterparts, regardless of rurality, for all six cohorts. All four groups show varying patterns of increases, decreases, or nonchanging rates across the six cohorts, but all four groups show a decline for the 2020 and 2021 cohorts. The largest change is the 19-percentage point increase from 2016 to 2017 for non-rural STEM non-Pell youth.

Figure 33. STEM Readiness Rate (Percentage) by Freshmen Cohorts: Rurality by STEM Major by Pell



For College Persistence (Figures 34–35), Figure 34 shows that STEM students have slightly higher retention rates than non-STEM students, regardless of rurality, for all six cohorts. All four groups show a decrease in retention rates from the 2016 to 2017 cohorts, then increases from 2017 to 2018 and 2018 to 2019, before reflecting decreases from 2019 to 2020. From 2020 to 2021, the retention rates increased for rural STEM students, decreased for non-rural STEM students and non-rural non-STEM students, and remained the same for rural non-STEM students.

Figure 34. Fall-to-Fall Retention Rate (Percentage) by Freshmen Cohorts: Rurality by Major

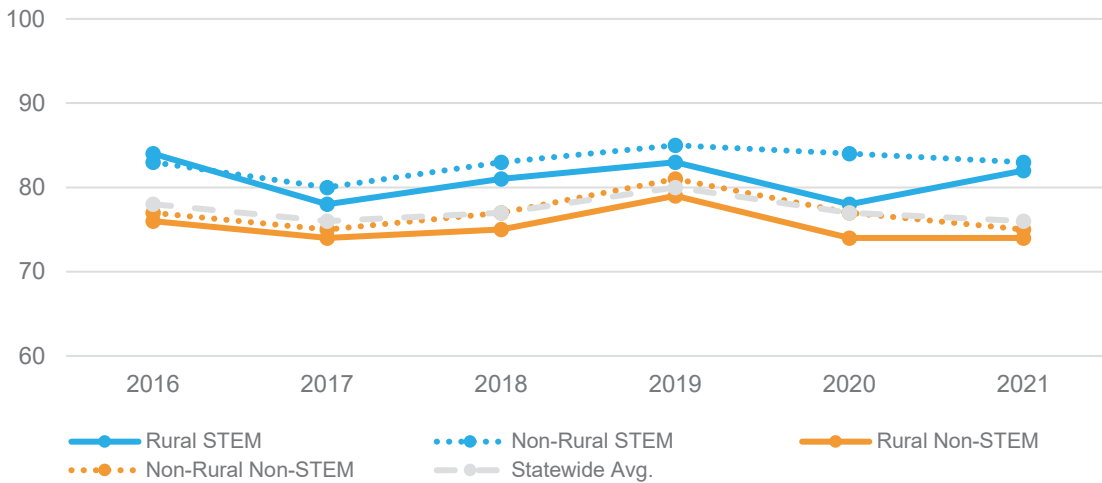
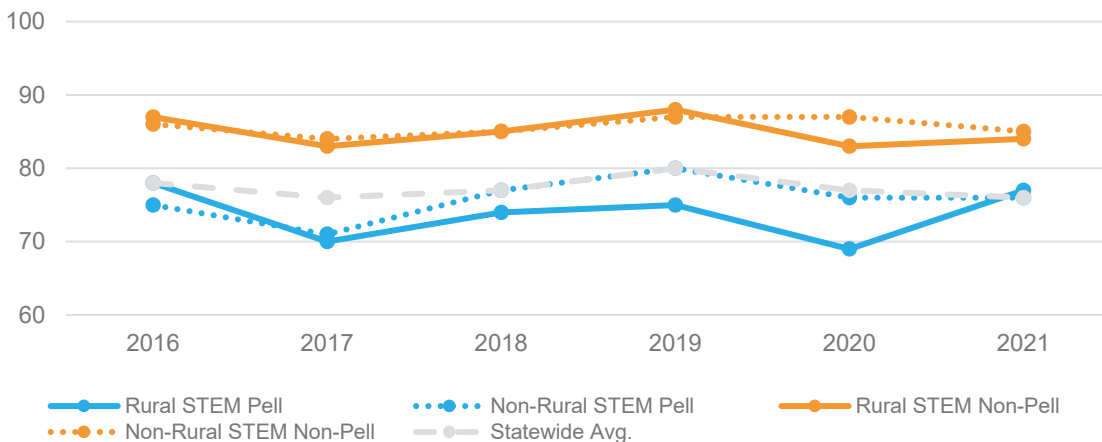


Figure 35 shows that for STEM students, Pell students have lower retention rates than their non-Pell counterparts, regardless of rurality, for all six cohorts. All four groups show a decrease in retention rates from the 2016 to 2017 cohorts, then increases from 2017 to 2018 and 2018 to 2019, before showing a decline for the 2020 cohort (except for the non-Rural STEM non-Pell group, which remained the same). From 2020 to 2021, the retention rates increased for two groups (rural STEM Pell and rural STEM non-Pell), decreased for one group (non-rural STEM non-Pell), and stayed the same for one group (non-rural STEM Pell).

Figure 35. Fall-to-Fall Retention Rate (Percentage) by Freshmen Cohorts: Rurality by STEM Major by Pell



For College Completion (Figures 36–37), Figure 36 shows that STEM students have lower graduation rates than non-STEM students, regardless of rurality, for five of the six cohorts (2013–17); the 2012 freshmen cohort had slightly higher graduation rates for STEM youth compared to non-STEM. All four groups show varying patterns of increases, decreases, or nonchanging rates across the six freshmen cohorts.

Figure 36. 4-Year Graduation Rate (Percentage) by Freshmen Cohorts: Rurality by Major

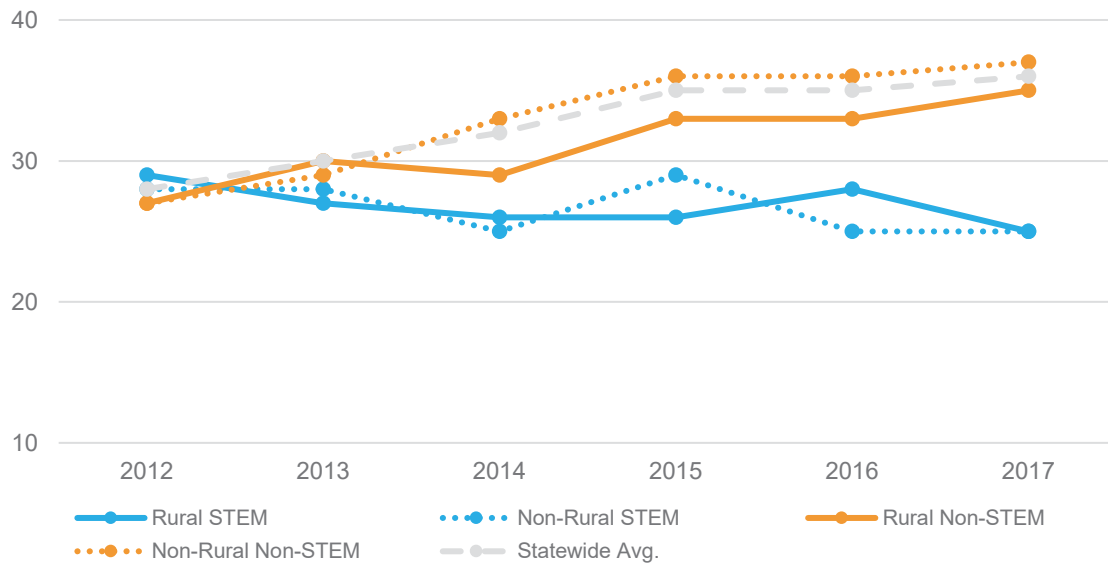
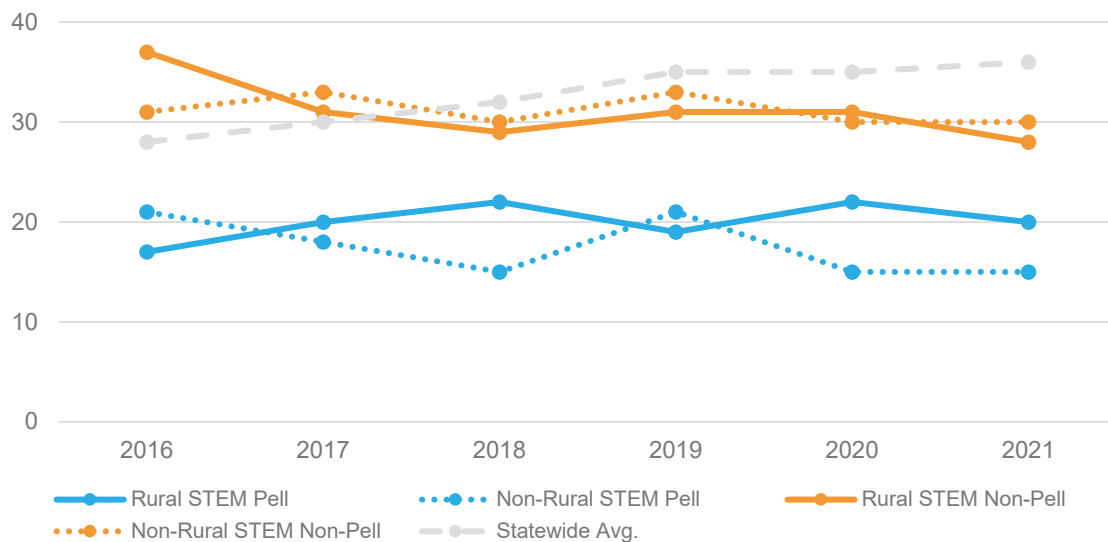


Figure 37 shows that for STEM students, Pell recipients have lower graduation rates than their non-Pell counterparts, regardless of rurality, for all six freshmen cohorts. All four groups show a variety of increases, decreases, or nonchanging rates across the six freshmen cohorts.

Figure 37. 4-Year Graduation Rate (Percentage) by Freshmen Cohorts: Rurality by STEM Major by Pell



4.4.4 Student Outcomes Summary

The overall STEM persistence rate among First2 Network first-time freshmen who provided consent for tracking is 71% (35 of 49 students). The overall STEM persistence rate among First2 Network sophomores and higher who consented to tracking is 72% (65 of 90 students).

WVU data permit analyses of STEM persistence among first-generation students more broadly. At WVU, 1-year persistence rates are lower for first-generation students compared to non-first-generation students for the 2005–2018 cohorts, with 2018 showing the largest difference. On the other hand, the 1-year persistence rates show little difference between rural and non-rural WVU STEM students for those same cohorts, with 2018 showing the largest difference. Among all WVU students who participated in the First2 Network in any manner, the STEM persistence rate was 47%, which is higher than the current WVU STEM persistence rate of 27%.

Analyses of all West Virginia students enrolled in public institutions indicate that Pell-eligible and rural youth had lower rates of STEM readiness, persistence, and completion than their non-Pell-eligible and non-rural counterparts. STEM students had higher STEM readiness and persistence rates than non-STEM students, but lower completion rates.

IV. Conclusions and Recommendations

1. Conclusions

1.1 First2 Network Structures and Processes

While the number of interns declined, student membership increased from Year 4 to Year 5 by almost 10% (279 to 300). Most First2 students continued their leadership and participation efforts within the network, primarily through campus clubs. Network strategies that continue to sustain student leadership and overall membership include hosting three network events, promoting social media (website, newsletter, X [formerly known as Twitter]), and presenting at six local or state conferences. The First2 Network made substantial progress in tightening its focus on improvement science through institutional teams and affinity groups. Quality review and enhanced coaching support provided by the staff played an integral role in strengthening PDSA change ideas and ensuring they were aligned to drivers. In addition, efforts for obtaining and reporting shared metrics continued in Year 5 through establishing institutional-level IRBs to secure systems for surveying and tracking First2 students' persistence experiences. Sustainability and scale-up efforts focused on building the capacity of institutional team leaders and standardizing onboarding for members.

Steering Committee survey feedback showed most items increased from Year 4, with most items falling in the range of *Making Progress* to *Fully Achieved*. In general, Steering Committee progress items received higher ratings than those pertaining to members' involvement in the Steering Committee.

Feedback from Steering Committee members who participated in the group interview revealed that having members from each institutional team serve on the Steering Committee has helped foster a greater understanding of what is happening across the state. Further, having broader Steering Committee membership from across the state has also helped foster networking opportunities amongst staff at different institutions.

Institutional Team Survey feedback revealed members' positive perceptions about the First2 Network and the progress made by the respective institutional teams, especially in the area of supporting students. Their perceptions about PDSAs showed little variation among the Plan, Do, Study, and Act cycles, viewing all as more of a strength than a weakness. Further, there was little variation in PDSA scores from institutional team members as compared to working group members from the November 2021 Working Group Self-Assessment survey results.

Feedback from institutional team members who participated in the site-specific interviews revealed that members were gaining understanding of how their teams function—both within their respective team and across the First2 Network. In general, participants found that working within their respective institutions resulted in more alignment to their individual responsibilities and a greater connection to their respective student populations. Two challenges were common across institutions—navigating the First2 Network website and responsibilities related to carrying out and documenting PDSA efforts. However, these results are based only on four or five team members per site and so may not be representative of each institutional team (and one institution did not participate in this activity).

The First2 Network hosted two conferences in Year 5, a virtual fall conference and an in-person spring conference. Participant feedback was positive for both conferences, with average ratings

ranging from around 3.5 to 4.5 on a 5–point agreement scale. Across conferences, the networking, industry panels, and keynote sessions were noted as high points; scheduling/pacing issues were most frequently identified as areas in need of improvement.

1.2 Systems Targeted by the First2 Network

The First2 student respondents of the Network Value Survey reported strong perceptions of the systems level impacts related to their network membership. While student members reported increased gains across all value lifecycles and subsequent areas including the networking and community–building, followed by gaining new knowledge and applying learning and practices, there was strong increases in using what was learned from network work to develop a new strategic direction at their institution. Even though Year 5 reflected the lowest number of respondents to the Network Value Survey, all five subscale scores showed slight increases for student members from Year 4. For example, members held stronger agreement that they *Observed data indicating that my organization’s performance improved*, reflecting that some members are seeing the evidence of improvement such as in improved STEM program persistence rates. As First2 Network continues to solidify their collaborative efforts, student members stay consistently engaged and value their participation as evidenced by progressing from the value of networking itself to valuing the ways network involvement enables institutional change.

Backbone activities focused primarily on developing improvement science practices to support institutional team capacity and sustainability. This work also provided support for institutional teams to complete PDSAs and submit to IRBs for use of shared data. There was agreement among members that the network communications and conferences continue to provide opportunities for ongoing connections and partnerships.

Year 5 participants found that working within their respective institutions resulted in more alignment to their individual responsibilities and a greater connection to their respective student populations, while affinity group efforts provided members cross–institutional efforts. However, challenges of distribution of labor still exist. Each campus must develop their capacity internally, “even if there is no current expertise in an area on a campus” as one member noted. Year 5 also addressed member challenges related to carrying out and documenting PDSA efforts, highlighting an increased effort of standardized processes and documentation. Staff continue to work toward creation of a sustainable leadership plan, with one the challenges being getting a large number of new faculty members trained in new roles with each team.

For example, at WVU Tech, members tried to recruit at least one involved faculty member from each department to try to increase awareness of what the group is doing throughout STEM. Efforts underway at WVU Tech and the other institutions are now supported through additional funding provided by a recent award to First2 to support institutional teams.

1.3 Impact of the First2 Network

Year 5 First2 Network included a 15% increase from the 866 members reported in August 2022. SNA survey data also reveals that the trend across years continues in general as the First2 Network has become more collaborative over Year 5, with an increase in the number of unique network members identified and a slightly higher level of collaborative engagement among members overall.

Focus groups revealed that students most often joined the First2 Network for the research opportunities and the financial compensation. Participants noted the network's focus on leadership opportunities for students as well as the student-centric nature of the network. While participants' perceptions about the degree of voice that students had in the network varied, in general it was perceived as being sufficient, and several examples were shared of how changes had been incorporated based on student input. Further, students reported more involvement with PDSA activities as compared to earlier years.

Most interview participants who had participated in a summer 2022 research internship reported their expectations had been met or exceeded and said that the research and network were most valuable to them. Most perceived the internship had positively influenced their confidence in their ability to do STEM coursework and that it continued to influence their progress in their STEM major.

The overall STEM persistence rate among First2 Network first-time freshmen who provided consent for tracking is 71% (35 of 49 students). The overall STEM persistence rate among First2 Network sophomores and higher who consented to tracking is 72% (65 of 90 students). The clearest comparison may be with WVU data on the STEM persistence of first-generation students between 2005 and 2018, with rates ranging from 49% to 64% (in contrast to the rates among non-first-generation students, which varied between 61% and 66%). Thus—although data are limited due to the small number of consenting students—estimates suggest that First2 Network students persist in their STEM majors at higher rates than both their first-generation and non-first-generation peers at WVU.

As in prior years, statewide analyses in which Pell-eligibility is employed as a proxy for first-generation status indicate that Pell-eligible STEM students had lower STEM readiness scores and lower STEM persistence and graduation rates than non-Pell-eligible students. Further, rural students in general earned lower STEM readiness scores and had lower persistence and graduation rates than their non-rural counterparts.

2. Recommendations

As the First2 Network begins its sixth year and progresses toward sustainability, network leaders and members may want to consider the following recommendations.

Continue building on coaching and onboarding support for new institutional team members and/or directors. The First2 Network onboarding process for members drew the lowest-rated marks in the Institutional Team Survey. In their comments, several respondents cited the need for improvement in student onboarding, with one suggesting a “strict, developed process” to bring students into the program. Enhanced communication processes also can contribute to improvement. In addition, network members cited the need for continued attention to the mentoring/coaching component, given challenges in scheduling and carrying out PDSAs.

Offer continued support on building data infrastructure so institutional teams can accurately and securely track progress both with students and members. The network in Year 5 developed an implementation process on key PDSA strategies with the help of a full-time data liaison supported by a mentor. This effort promoted coordinated efforts across members within the same institutions and should serve as a model for other data collaboration work going forward. Some students remarked that documents sometimes had contradictory instructions, and building consistency in data and communication may help address these comments.

Continue clarifying the plans for transitioning into a nonprofit entity and build buy-in on that new infrastructure moving forward. This work is essential for sustainability of the First2 Network, and transition efforts need to include extensive buy-in from institutional teams, including students. Examining best practices in the network to date also can help ensure that the new entity integrates effective policies and approaches from the beginning.

Devote time and resources to amplifying student needs and voices for the future of First2 and research opportunities. Students reported more involvement with PDSA activities compared with earlier years, and most believed the student voice in the network was sufficient. However, some students continued to offer suggestions to reduce confusion at various junctures in the program, and leaders must continue to examine these suggestions to strengthen the student voice.

Continue to focus on celebrating the changes and resources secured to better support and engage institutional team members and help them coordinate what they do on their campuses. The transition to institutional teams has been generally smooth, with gains cited by both faculty and students. Network leaders should continue to support this transition and document effective practices and strategies to help other institutions in the future.

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