Stevens Initiative

2024 Survey of the Virtual Exchange Field Report

Findings from a survey of virtual exchange programs connecting young people in different countries from fall 2022 through summer 2023

ACKNOWLEDGEMENTS

ABOUT THE STEVENS INITIATIVE AND THE ASPEN INSTITUTE

The Stevens Initiative is an international leader in virtual exchange, which brings young people from diverse places together to collaborate and connect through everyday technology. Created in 2015 as a lasting tribute to Ambassador J. Christopher Stevens, the Initiative invests in virtual exchange programs; shares research, resources, and promising practices to improve impact; and advocates for broader adoption. Learn more: https://www.stevensinitiative.org/

The Aspen Institute is a global nonprofit organization whose purpose is to ignite human potential to build understanding and create new possibilities for a better world. Founded in 1949, the Institute drives change through dialogue, leadership, and action to help solve society's greatest challenges. It is headquartered in Washington, DC and has a campus in Aspen, Colorado, as well as an international network of partners. For more information, visit https://www.aspeninstitute.org/

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Introduction

The field of virtual exchange has undergone tremendous shifts since 2018. Exchange programs leveraging technology have grown, yet this expansion has been complex and non-linear, largely due to the pandemic. As the only comprehensive data collection effort in the field to date, the Stevens Initiative's Survey of the Virtual Exchange Field Report plays a critical role in understanding virtual exchange through research and evidence. Building upon the first survey that was launched in 2020, the *2024 Survey of the Virtual Exchange Field Report* offers a systematic and evidence-based view of virtual exchange around the world, especially during a time of immense global shifts.

Virtual exchange is not easily defined as the nature of such activities varies across different countries and stakeholders. There are common best practices and frameworks in the Stevens Initiative's *Virtual Exchange Typology* and accompanying glossary that set a framework for some key elements of any virtual exchange. These include the intentionality of virtual exchange and its focus on collaboration and reciprocity of knowledge and learning. The typology and accompanying glossary are important efforts toward developing shared understanding and definitions among virtual exchange practitioners—including what types of exchanges exist, how they are created, and what is required for implementation—and enabling further development of the field. The survey includes only those programs that meet the criteria identified in the typology.

> **What is virtual exchange?**
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> Virtual exchange uses **technology** to connect people for education and exchange. Virtual exchange programs typically serve **young people**. Many virtual exchange programs are international, connecting participants in different countries to help them gain **global competencies**, among other knowledge, skills, and abilities. Many practitioners believe that **facilitation** by prepared, responsible adults — often but not always educators — is an important component of successful virtual exchange.
>
> *The Stevens Initiative*

2023 Approach to Surveying the Field

Based on a survey of 232 virtual exchange providers, the current report covers virtual exchange programs that were implemented globally from September 2022 through August 2023. A key addition to the 2023 survey is a set of questions that explore how virtual exchange providers can leverage data to inform their practices and their advocacy efforts. The online survey was distributed through the Stevens Initiative's contact list of virtual exchange providers and grantees; through virtual exchange networks such as COIL Connect, Brazilian Virtual Exchange (BRaVE), Red Latinoamericana COIL, UNICollaboration, SUNY COIL, and the Asia Pacific Virtual Exchange Association (APVEA); and through other organizations, member associations, and institutions. The process was also guided by a global advisory group of virtual exchange experts who reviewed the survey and supported its dissemination in their world regions.

Highlights

- **Virtual exchange programs bounce back to the levels seen in 2021:** The 2023 survey reflects a similar level of participation seen in 2021. This increase over the past year can likely be attributed to an increase in virtual exchange provision, as well as the survey's broader reach.
- **Virtual exchange providers surveyed in previous years report an increase in the number of virtual exchange programs and participants:** An analysis of a subset of 56 providers who responded to the survey both in 2023 and 2021 shows a positive change: the number of virtual exchange programs and participants grew by 39% and 23%, respectively, for this group.
- **Half of all virtual exchange providers are outside the U.S.:** The survey reveals that 50% of all virtual exchange providers were based outside the U.S., marking a significant shift from 35% in 2022. Virtual exchange programs in the U.S. tend to be overrepresented in information and reporting available on virtual exchange, and these findings support an important goal of capturing global data on virtual exchange.
- **The higher education sector continues to be prominent in virtual exchange:** For the fourth consecutive year, the higher education sector had the highest level of representation in the survey, with the largest group of providers of virtual exchange programs and with postsecondary students being the largest participant group.
- **Providers leverage data to advocate for the importance of virtual exchange:** Virtual exchange providers use data in varying ways to advocate for the importance of virtual exchange: 34.5% have used survey data to better understand their virtual exchange programs relative to other programs and a quarter have used it to demonstrate the need for such programs with key decision makers. Providers report that they also use a range of arguments to make the case for virtual exchange, and the most compelling argument is that such programs increase access to global learning for a larger number and wider range of participants.
- **Virtual exchange is poised for growth, but funding remains a barrier:** While over 80% of respondents are optimistic that they will either sustain or grow their current level of virtual exchange programming, over half the respondents indicated that funding remains a significant barrier to implementing and expanding such programs. Additionally, among the small number of providers who are active in the virtual exchange space but were unable to offer any programs this past year, lack of funding was cited as the main reason.
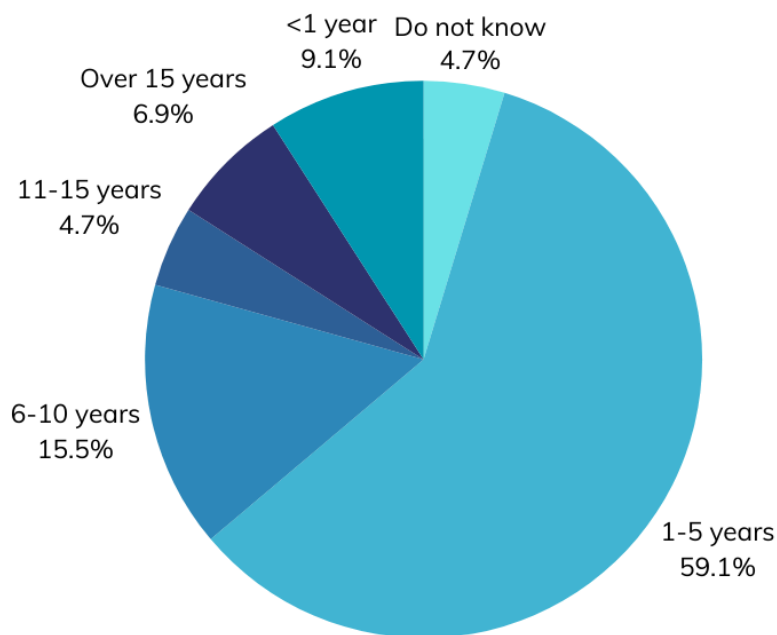
Key Findings

Who Participates in Virtual Exchange Programs?

The survey asked virtual exchange providers whether they offer virtual exchange programs and/or training. For the purposes of the survey, the Stevens Initiative defines a virtual exchange provider as an organization, informal organization, network, and/or primary, secondary, or higher education institution that implements virtual exchange programming[1].

Of the 232 institutions and organizations around the world that responded to the survey, most were higher education institutions (HEIs) (73%), followed by non-governmental organizations (NGOs) that function in more than one country (10%). Similar to the past iterations of the survey, HEIs continue to be represented at a higher rate than any other institution type. Most respondents (59%) have been offering virtual exchange programs and/or training for five or fewer years. This suggests that the field is still nascent and has the potential to grow substantially.

YEARS OF EXPERIENCE WITH VIRTUAL EXCHANGE

- <1 year 9.1%
- Do not know 4.7%
- Over 15 years 6.9%
- 11-15 years 4.7%
- 6-10 years 15.5%
- 1-5 years 59.1%

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[1] https://www.stevensinitiative.org/frequently-asked-questions-survey-of-the-virtual-exchange-field/

Programs and Participants

Of the 232 responding organizations and institutions, 205 providers reported offering virtual exchange programs/training in 2022-2023. Among this subset of 205 providers, 80.5% were able to provide specific details about their programs/training and reported offering 3,635 programs that served a total of 155,064 participants.[2] The Stevens Initiative defines a facilitator as a person who plays a present and active role in enabling constructive engagement among virtual exchange participants. Facilitators are sometimes, but not necessarily, educators.
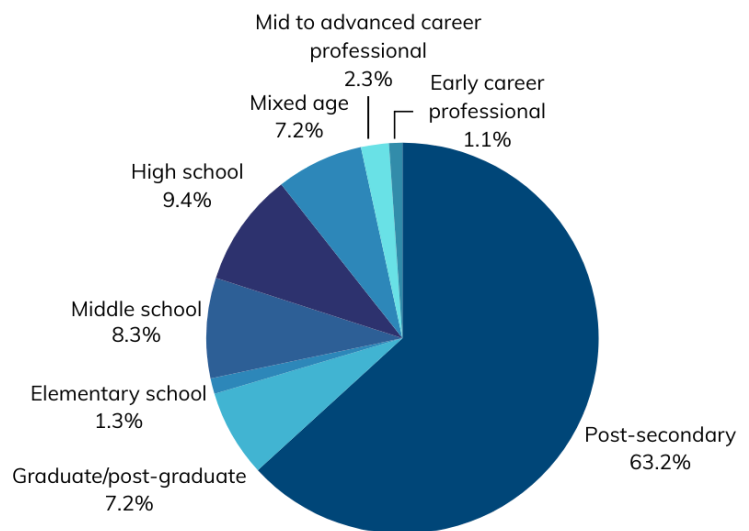
The 2023 survey captured more responses and data on providers and participants than the 2022 survey, which included data for 147 providers who reported offering 2,565 programs that served 120,714 participants. As discussed in prior reports, the number of providers, programs, and participants responding to the survey has fluctuated over the past three years. The change in field size according to survey data may be due, in part, to which organizations have responded from year to year. Barriers that affect institutions' ability to offer virtual exchange are discussed later in the report.

Total respondents, programs, and participants in 2023

205 Respondents reported offering virtual exchange in 2022-2023
165 Respondents provided programmatic data
3,635 Virtual exchange programs reported
155,064 Participants in virtual exchange programs

In 2023, most programs (70%) served a college-aged or higher education population, primarily at the undergraduate level; 19% served a school-aged K-12 population, ranging from elementary to high school; and 3% reached participants who were either early career or advanced career professionals.

EDUCATION LEVEL OF VIRTUAL EXCHANGE PARTICIPANTS

- Mid to advanced career professional 2.3%
- Early career professional 1.1%
- Mixed age 7.2%
- High school 9.4%
- Middle school 8.3%
- Elementary school 1.3%
- Graduate/post-graduate 7.2%
- Post-secondary 63.2%

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[2] The number of programs and respondents might vary in the analysis as not all providers were able to provide detailed data for all survey questions.
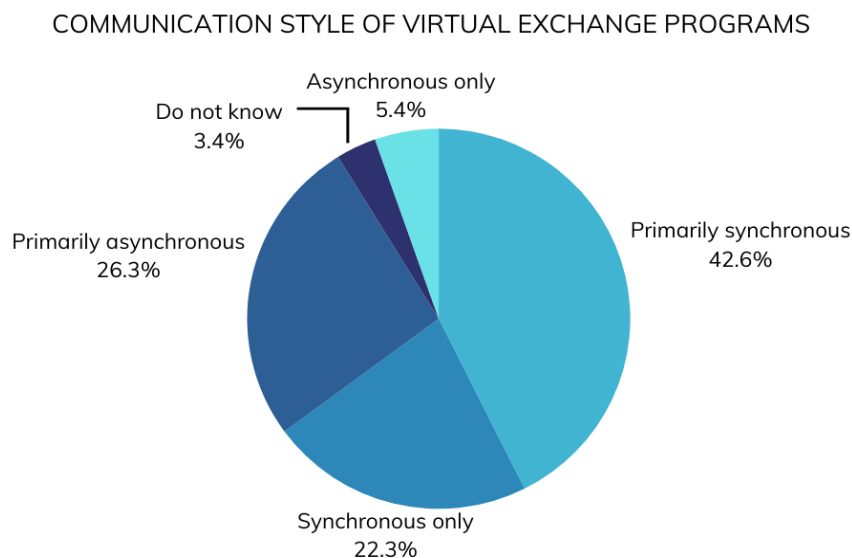
What Does Virtual Exchange Look Like?

The How of Virtual Exchange

Each year, institutions and organizations are asked to report on the types of virtual exchange programs they implement. Similar to past years, the most common type of program is a Collaborative Online International Learning (COIL) course (43%), which is developed by pairs or small groups of educators working together to design a virtual exchange that connects two or more higher education courses in different places. The second most frequent type of program (20%) reported is an open enrollment virtual exchange program where there is no single site, location, or classroom that hosts participants in person, such as the AFS Intercultural's Global You Adventurer program. The third most common type (13%) is a single virtual exchange program run similarly across several sites, locations, or classrooms, such as the PATHWAYS Institute for Negotiation Education's Game Changers program.

Respondents were also asked about how many of their programs include specific virtual exchange activities, defined by the Stevens Initiative as a holistic or collective description of the activities and learning cycle undertaken by participants throughout the virtual exchange program. The most common activity type is **paired courses** that include a final project or capstone (36% of virtual exchange programs), followed by **videoconference dialogue**, sometimes with an associated project component (24%), and **collaborative project-based learning** (18%), among others.

When implementing virtual exchange programs and training, institutions and organizations utilize a variety of communication methods to engage their participants. More than 65% of programs embed a blend of **asynchronous** (in which participants share information and engage at different times) and **synchronous** (in which the engagement is in real time). As reported in previous years, the most common type of engagement (43%) combines synchronous exchange with some asynchronous activities.

COMMUNICATION STYLE OF VIRTUAL EXCHANGE PROGRAMS

Asynchronous only
5.4%

Do not know
3.4%

Primarily asynchronous
26.3%

Primarily synchronous
42.6%

Synchronous only
22.3%

In 2021, the survey began capturing data on **languages** used in virtual exchange programs. This year, 64% of programs were offered in English only, compared to 77% in 2022. Respondents also reported that their programs were offered in English and another language (22%), as well as only in a language other than English (13%). Other than English, the most common languages reported were Spanish, French, Portuguese, Arabic, Japanese, and Mandarin Chinese. As noted in past reports, the predominance of English may reflect the language's systematic use to make communication possible between groups of people who do not share a native language or dialect. This could also be attributed to the longstanding role of the U.S. in virtual exchange, and the fact that the survey has been conducted in English only.

LANGUAGE USED FOR VIRTUAL EXCHANGE PROGRAMS
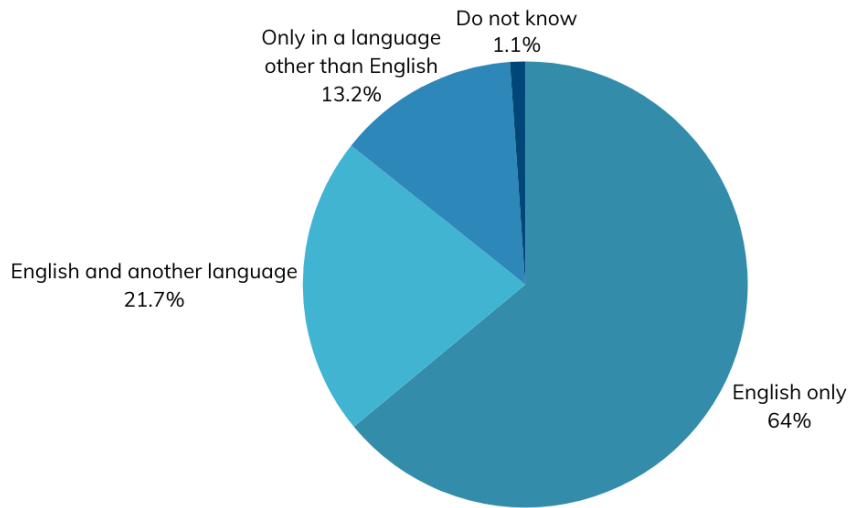
DURATION OF VIRTUAL EXCHANGE PROGRAMS
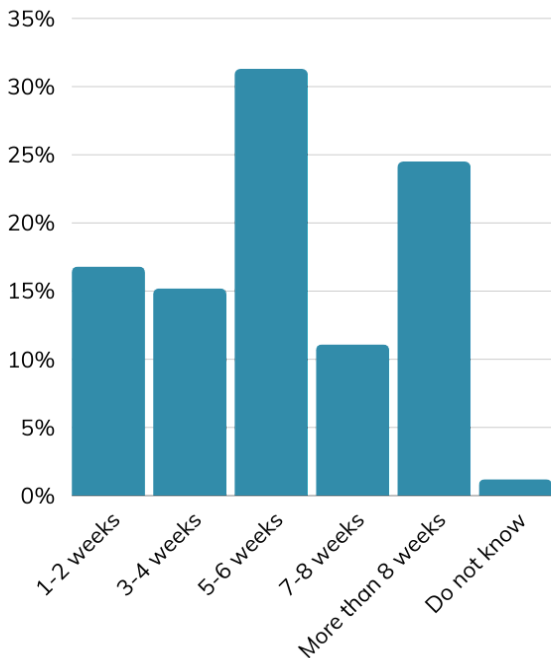
Since 2022, the survey has also gathered data on **time spent** on virtual exchange to better understand the **intensity and duration** of these programs. Respondents were asked to identify the average number of hours that both participants and facilitators spend per week on virtual exchange programming. On average, participants reported spending 3.3 hours per week on their programs, compared to 4.7 hours per week reported in 2022. Facilitators reported spending an average of 5.0 hours per week on their programs, similar to the 5.5 hours reported in 2022. The most frequently reported duration of programs was five to six weeks (31%), which remains consistent with previous survey responses. About a quarter of programs are longer than eight weeks (24.5%), followed by programs that were just one to two weeks in duration (17%).

The Role of Training

As the field grows, institutions and organizations implementing virtual exchange also play a key role in providing **training** to other providers and individuals, including institutions, instructors, and staff. Similar to last year, the most frequent type of training reported (45%) was for designing a collaborative virtual exchange/COIL program. The second most frequent type of training was on the implementation of an organization's specific exchange program(s) (32%), followed by training for educators/facilitators on the implementation of a virtual exchange run by a single institution (24%). Other training activities included training of virtual exchange ambassadors (alumni of virtual exchange programming) and training for students embarking on virtual exchange programs. Almost a quarter of respondents indicated not offering virtual exchange training.

TRAINING IN VIRTUAL EXCHANGE

Types of Training	Responses*
Training for educators/facilitators on designing a collaborative virtual exchange/COIL	44.8%
Training for facilitators on the implementation of your organization's specific exchange program(s)	32.1%
Training for educators/facilitators on the implementation of a virtual exchange run by a single institution	23.6%
Virtual exchange training programs for a fee (i.e. individuals or organizations paying to attend your training programs)	10.9%
Other type of training (please specify)	9.1%
No virtual exchange training was provided by our organization	24.8%

Total exceeds 100% as respondents could select more than one option

TOP 10 CONTENT OR TOPIC AREAS OF VIRTUAL EXCHANGE PROGRAMS

Content or Topic Area	Responses*
Intercultural dialogue or peacebuilding	29.0%
Language learning	12.9%
Entrepreneurship or business	9.0%
Education	6.8%
Humanities	6.5%
Science, Technology, Engineering and Math (STEM)	6.2%
Art	5.0%
Global or international affairs	4.7%
Public or community health	3.5%
Civics or leadership	2.9%
Mix of the above primary learning content, topic, or subject areas	20.0%
Do not know	1.6%

*Total exceeds 100% as respondents could select more than one option

The Content and Substance of Virtual Exchange

Respondents were asked about ten **content or topic areas** covered by their virtual exchange programs. The top three content, topic, or subject areas were intercultural dialogue or peacebuilding (29%); language learning (13%); and entrepreneurship or business (9%). This year, language learning replaced Science, Technology, Engineering, and Mathematics (STEM) as the second most commonly reported content or topic area. About a fifth of the respondents indicated that their programs included a mix of various content, topic, or subject areas. Beyond the 10 key areas, respondents reported on other topics including the UN Sustainable Development Goals (SDGs), coding, media literacy, negotiation, tourism and hospitality, and environmental justice, among others.

Which Countries Participate in Virtual Exchange?

In 2022, 32% of providers were based outside the U.S., whereas in 2023, 50% of those who responded to the survey were outside the U.S. This shift is likely due to two reasons: (1) the survey effort is gaining momentum outside of the U.S. due to focused outreach and partnership efforts; and (2) virtual exchange activity is also expanding significantly in other world regions. Following the U.S., the second most predominant region for virtual exchange was Latin America (21%)—rather than the Middle East as in earlier years—followed by Europe (12%).

The 2023 survey also reflected responses from the following countries/territories that were not represented in the 2022 survey: Argentina, Australia, Bolivia, Burkina Faso, Chile, Cyprus, Ecuador, Egypt, El Salvador, Honduras, Hong Kong, Hungary, Germany, Ireland, Libya, Peru, Philippines, Poland, Singapore, Spain, and Yemen.

Respondents were asked about the **top countries or territories** where their virtual exchange program participants reside, as well as their numbers. As described in previous reports, many respondents continue to have challenges reporting on this level of data and were only able to offer the name of the country or territory but not the number of participants residing in those locations. The data available reveals that the top 10 countries in terms of number of programs serving participants in those countries are: United States (92), Mexico (48), Brazil (38), Colombia (36), Spain (27), United Kingdom (26), France (23), Japan (23), India (21), and Germany (20).

TOP 10 COUNTRIES OF VIRTUAL EXCHANGE PARTICIPANTS

Country	Number of programs represented
United States	92
Mexico	48
Brazil	38
Colombia	36
Spain	27
United Kingdom	26
France	23
Japan	23
India	21
Germany	20

Expanding Networks and Collaborations

Another lens through which to analyze the global dispersion of virtual exchange is through global and regional virtual exchange networks and consortia that play a pivotal role in supporting organizations/institutions interested in implementing virtual exchange programs and training. Many respondents indicated that they were part of one or more consortium, with the largest group (41%) reporting being associated with COIL Connect. The second largest group were institutions/organizations associated with the Stevens Initiative (24%), followed by the SUNY COIL Global Network (23%) in the U.S., UNICollaboration in Europe (12.5%), and Red Latinoamericana COIL in Latin America (11%). Other networks included BRaVE (Brazilian Virtual Exchange) in Brazil; Global Partners in Education, American Association of Colleges and Universities (AAC&U), and the Virtual Exchange Coalition in the U.S.; JPN-COIL Association in Japan; and the Consortium of Virtual Exchange.

While originating in specific regions, many of these networks also have members in other world regions, countries, or territories. Virtual exchange networks can also differ in their purpose and structure. For example, those who reported an affiliation with the Stevens Initiative might be part of the Initiative's wider network or could be grantees or sub-grantees that receive financial support for their virtual exchange programs or research.

Implementing Virtual Exchange: Barriers and Challenges

The overarching **challenge** reported by almost half of all providers was the availability (or lack thereof) of funding to offer virtual exchange. Related to the issue of resources is the persisting digital divide or lack of technology access (14%); infrastructure issues such as the lack of electricity (10%); and staffing shortages (3%). Almost 15% of respondents also reported that policy shifts and other national-level drivers that favored a return to physical or in-person mobility posed a key challenge. Other barriers include a lack of buy-in from key participants and stakeholders, and the lingering impact of COVID-19.

BARRIERS TO VIRTUAL EXCHANGE

Barrier	Responses*
Availability of funding to offer virtual exchange	48.2%
Policy shifts and national-level drivers that favor physical mobility	14.9%
A digital divide or lack of technology access	13.7%
Infrastructure issues such as lack of electricity	9.5%
Lack of "buy-in" from key decision makers, students, and potential facilitators	7.7%
Post-COVID factors (i.e., burnout, enrollment, school distruptions, etc.)	3.0%
Staffing shortages to implement virtual exchange	3.0%
Other	17.3%
None of the above	21.4%

*Total exceeds 100% as respondents could select more than one option

Growth in Virtual Exchange Over Time

Using the 2021 survey as a baseline, a subset of 56 virtual exchange providers—most of whom were HEIs, nonprofits, or NGOs that operate in multiple countries—responded to both the 2021 and 2023 surveys.

- Between 2021 and 2023, the total number of virtual exchange programs implemented by this subset of 56 providers increased by 39%, from 1,220 to 1,696 programs. During this same time, the number of participants in these programs increased by 23%, from 78,450 to 96,766.
- Most of the growth noted above was among nonprofits and NGOs in one country, whose programs and participants increased by 336% and 218%, respectively. Nonprofits and NGOs that operate in multiple countries also saw a large growth in programs (137%) and a moderate growth in participants (11%).

While the findings above offer a window into change and growth among virtual exchange programs, they should be interpreted with caution as they are likely affected by some of the broader limitations of the survey, as well as the ongoing challenges that virtual exchange programs face in reporting granular data. Further, the composition of the overall pool of respondents to the survey has shifted each year.

Making the Case for Virtual Exchange: Data and Advocacy

While virtual exchange practitioners recognize the transformative power that such programming has on participants and facilitators, it has not always been easy to convince others of the enduring value of virtual exchange. An important addition to the survey this year was to better understand how virtual exchange providers advocate for the importance of such programs on their campuses, within their organizations, and with other key stakeholders. We asked respondents to share whether and how they use data from the Survey of the Virtual Exchange Field Report to inform practice and advocacy, and what sorts of arguments and proposals they have used to make the case for the value of virtual exchange, especially given that this type of exchange can often suffer from a bias of being "second best" to more traditional mobility and exchange. This section not only presents key findings on these topics but does so to inform the practice of virtual exchange in various settings.

- **Three ways to use data to advocate for and support virtual exchange:** Although we asked specifically about leveraging data from the Survey of the Virtual Exchange Field Report, we believe that the following strategies apply to all forms of data that virtual exchange providers have at their disposal. Data can help:
    1. Providers develop a better understanding of their own virtual exchange program(s) relative to other virtual exchanges (34.5% of respondents).
    2. Demonstrate the need for such programs to key decision makers (25%).
    3. Measure the progress and outcomes of virtual exchange programs (20%).

- **Five ways to make the case for the value of virtual exchange:** Our survey respondents indicate that there are a range of proof points that can make the case for the importance of virtual exchange. The top five arguments that seem to be most effective and convincing include the following. Virtual exchange:
    1. Increases access to global learning for a larger number and wider range of participants (noted by 84% of respondents).
    2. Has positive academic, social, and cultural outcomes for participants (81.5%).
    3. Helps build and reinvigorate partnerships (55%).
    4. Enables language learning (45%).
    5. Is a critical complement to physical exchange and mobility (45%).

Additional arguments to demonstrate the importance of virtual exchange include that virtual exchange is sustainable; there are beneficial outcomes for faculty/facilitators to pursue other international opportunities; and virtual exchange has positive impacts on recruitment, retention, and engagement with class activities and with student employability, which in turn has a potential positive impact on developing future-ready work skills.

Lessons Learned

As with each iteration of the survey, the 2024 Survey of the Virtual Exchange Field Report reveals the complex and evolving nature of the field of virtual exchange around the world. When the first survey was launched in 2020, it was an opportunity both to enumerate virtual exchange activity globally and to surface the inherent challenges of, and learnings from, gathering and reporting data on virtual exchange programs. This section highlights key lessons and takeaways for the field, while also addressing the constraints of the current survey.

- **Defining virtual exchange:** The survey reveals that despite a detailed typology developed by the Stevens Initiative, virtual exchange programs and initiatives around the world are defined and understood differently. For example, those who implement COIL programs at their institutions may find the terminology used within the survey difficult. While the survey attempted to compensate for this by encouraging COIL respondents to treat each unique COIL "course" at their institution as a virtual exchange program, this still presented challenges as most institutions implementing COIL tend to view all of their exchanges as a single program. A second challenge is that the Stevens Initiative's typology might reflect a U.S.-centric approach to virtual exchange, while other world regions might understand the notion of a "program," "training," and/or "participant vs. facilitator" differently. The survey effort continues to evolve each year to capture different types of virtual exchange to inform the field, yet gaps remain.
- **Data collection and reporting:** Institutions and organizations continue to face challenges with reporting granular data regarding their virtual exchange programs. Specific areas in which providers continue to struggle to provide data include: specific types of programs and their associated activities; the communication style/approach for programs; the primary learning

content, topic, or subject areas covered; and the location of their participants. In the case of COIL exchanges, this is because much of this detail is left to the partnered instructors and is not always managed by those who facilitate these programs. This is both a strength and a weakness of these programs and in many cases also reflects the lack of deep institutionalization of these efforts. The Initiative continues to advocate for improving the quality and reliability of virtual exchange data globally, which is a main focus of the survey effort. As such, it is essential for institutions and organizations to respond to the survey each year.

- **Areas for future focus:** Gaps remain in our understanding of virtual exchange and, as such, we identify the following areas as ones that would benefit from further exploration:
  - Measuring the quality of virtual exchange, including how programs themselves infuse quality assurance into the delivery of virtual exchange.
  - Developing a deeper understanding of the dynamic role of virtual exchange facilitators and educators.
  - Disentangling the distinct nature of virtual exchange programs vs. trainings that are provided to implement virtual exchange programs. For example, training itself can be for a range of purposes, including course design; coordinator/facilitator training; leadership training; conflict resolution; and intercultural competence, among others.
  - The need to build the capacity of organizations to gather and report data on virtual programs, as well as assess their outcomes and impact.

Looking Ahead

A key question that arose in last year's survey and report was whether virtual exchange would continue to grow. This year's survey reveals an increase in virtual exchange, both in the overall number of programs and participants as well as the subset of organizations who responded in both 2021 and 2023. We attribute this to a stabilizing of the overall global ecosystem of exchanges and mobility, but also to a concerted outreach and dissemination effort by the Stevens Initiative, partner organizations and associations around the world, the advisory group, and the research team to encourage virtual exchange providers to respond to the survey.

When asked about plans for the future, a majority of respondents are optimistic about their virtual exchange programs: 51% indicated that they expect their programming to grow, and 35% indicated that they intend to sustain their current level of programming. While this year's survey indicates growth and change in the field, there are two key challenges that remain: the lack of resources available to launch and sustain virtual exchanges and the ongoing need to advocate effectively for the value of virtual exchange programs. These findings suggest that virtual exchange is on an upward trajectory yet remains a complex field that requires the sustained and nuanced exploration made possible through the Stevens Initiative's annual Survey of the Virtual Exchange Field.

Appendix A: Methodology

The fourth survey of virtual exchange programs was implemented by the Stevens Initiative between July 2023 and September 2023 and conducted in partnership with Rajika Bhandari Advisors. The online survey captured virtual exchange programs globally that were implemented from September 2022 through August 2023. The survey effort was also guided by a global advisory group of virtual exchange experts.

Survey administration: To ensure consistency across reports, survey questions from three prior surveys were used, with additional questions incorporated as relevant. The survey was pilot tested with a small group of respondents from last year's survey before being widely disseminated. To ensure the widest reach possible, the survey was distributed through the Stevens Initiative's network of more than 10,000 individuals and organizations, shared globally through large virtual exchange networks such as COIL Connect, Brazilian Virtual Exchange (BRaVE), Red Latinoamericana COIL, UNICollaboration, SUNY COIL, and the Asia Pacific Virtual Exchange Association (APVEA), and disseminated to organizations and institutions in a wide range of countries. A total of 232 virtual exchange providers responded to the survey, with 205 reporting virtual exchange programs that occurred in 2022-2023. Among the subset of 205, 80.5% (165) were able to provide detailed data about their programs.

Data management and analysis: Survey data was cleaned, validated, and analyzed following standard protocols and best practices. Extensive follow up was conducted with respondents to clarify responses and complete missing information. Due to significant global variations in how virtual exchange is defined and captured through program data, validating responses required an intensive and iterative process.