



National Federation of the Blind

National Center for Blind Youth in Science

Accountability Evaluation

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Prepared by:

Joe E. Heimlich, Ph.D.
Mary Ann Wojton, Ph.D.

Prepared for:

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Executive Summary

As part of a grant from the National Science Foundation, the National Federation of the Blind (NFB) developed, implemented, and evaluated the National Center for Blind Youth in Science (NCBYS), a three-year full-scale development project to increase informal learning opportunities for blind youth in STEM. Through this grant, the NCBYS intended to extend opportunities for informal science learning for the direct benefit of blind students through the three overarching goals:

1. Contribute to the knowledgebase of effective practices regarding STEM education for the blind.
2. Educate families, blind youth, future educators, and museum personnel about the techniques and tools used to effectively engage blind youth in informal and formal STEM settings.
3. Strengthen resources for engagement of blind youth in STEM education.

The National Center for Blind Youth in Science conducted six distinct programs. The NFB STEM2U regional programs included programs for blind youth, their parents/caregivers, blind teen mentors (apprentices), and museum educators. There was a separate program for blind teens, entitled the Engineering Quotient (NFB EQ) programs. Additionally, there was a teacher professional development program that occurred in conjunction with two of the NFB STEM2U regional programs and one of the NFB EQ programs.

The Lifelong Learning Group (part of COSI) was retained as an outside evaluator and conducted the formative evaluation throughout the program. This report focuses on the accountability evaluation of this project.

Findings

Overall, participants were satisfied with the program. Youth liked the STEM activities, museum visit, and the meals. Parents/caregivers and teachers believe the staff went above and beyond to accommodate their needs.

Youth valued their program for providing opportunities to be independent and be with peers. They developed their blindness skills (especially cane skills), science process skills, and team building skills. Youth believed these skills would help them both in and out of school. Parents/caregivers believe the youth program helped their child develop science skills and the skills necessary to be successful in society. Youth intend to use the team building and science process skills they learned in their workshop in their science classes. They also believe that the life and blindness skills they learned/reviewed during the workshop would be useful throughout life.

Parents/caregivers and teachers valued the opportunity their respective programs provided for networking with others in similar situations. Additionally, parents learned to connect with the National Federation of the Blind, their child's rights, and how to advocate for their child within the school system.

Teachers expanded their abilities to use accessible lab equipment and hands-on STEM lessons with their students. Teachers intend to connect with the NFB network for additional professional development and expand their use of accessible lab equipment and hands-on STEM activities with their students.

Museum staff valued their training for increasing their awareness to the issues faced by blind visitors. Museum staff value all visitors and this training provided them additional skills to assist blind visitors. During the training, museum staff increased their skills to effectively describe science content and assist blind visitors throughout the museum. Museum staff feel more confident in helping blind visitors and intend to add additional braille signage and new programs which are not as reliant on visual cues.

Conclusions

Regarding the specific goals of the project, the accountability evaluation asks the questions, to what degree did the project meet each of its goals?

1. Did the project contribute to the knowledgebase of effective practices regarding STEM education for the blind?

To some degree. Through this project, there are several legacy outcomes. The reports of the program efforts singly are available on informal.science.org. An article entitled, *Accommodating Blind Learners Helps All Learners*, by the authors of this evaluation and Natalie Shaheen, NCBYS Program Director, was published in the *Journal of Museum Education* (March 2016). This article shares the lessons learned by the authors that highlight effective practices to enhance museum learning for blind visitors and how by using these methods, museum educators can create stronger education programs for everyone. At the time this report was being prepared, an additional article, focused on adapting classroom science lessons for the blind, was nearing completion for submission to the National Science Teachers Association journal *Science and Children*.

2. Did the project educate families, blind youth, future educators, and museum personnel about the techniques and tools used to effectively engage blind youth in informal and formal STEM settings?

Yes. Parents and youth valued the youth program because the children were able to learn science content and visit a science museum with other blind youth. Youth intend to use the team building and science process skills they learned in their workshop in their science classes.

Parents believe they learned alternative techniques their child could use to succeed in STEM learning and how to connect with the NFB. Parents who attended two NFB STEM2U programs, one in year one and a second in year two, noted the increased focus on STEM and appreciated learning of resources and tools that would support their child.

Apprentices successfully mentored blind youth engaged in STEM learning. Apprentices learned ways to monitor youth as they used accessible STEM equipment. Additionally, this experience supported apprentices in skill development that may support their general endeavors as blind people and their ability to take on a mentoring and leadership role with blind youth and STEM.

The museum staff training increased staffs' comfort and confidence level with blind visitors and their ability to determine and properly offer assistance to a blind visitor. Staff credit the workshop

with a personal awareness of the importance of descriptive language, the development of tactile maps for the museum, and stronger relationships with existing groups that serve the blind. The museums have also all undertaken important efforts to make their facilities or programs more inclusive for the blind. The host museums are all, in their own ways and timelines, changing in ways that make them more accessible to and welcoming of the local blind communities which is an important legacy element of this project.

The NFB EQ program appears to have met its goal of nurturing teens' interest in STEM and encouraging them to consider STEM careers by providing a robust STEM program with activities that teens were successfully able to complete. Teens in this program were:

- Introduced and gained experience working with adaptive STEM tools such as the talking tape measure, clicking rulers, and talking salinity meters
- Introduced and gained experience with drawing tools to increase teen's drawing skills
- Provided opportunities to develop creative thinking and problem solving skills
- Given the opportunity to work with others to complete a task

Additionally, raised-line technical drawing increased teen's spatial understanding of science and math concepts, including scale drawings and isometric shapes. Technical drawings also appear to increase teen's understanding of the importance of drawing as an engineering tool.

3. Did the project strengthen *STEM teaching* resources for engagement of blind youth in STEM education?

To a great degree. Teacher participants were able to learn about tools for adapting science, develop support networks, and participate in hands-on STEM activities they can replicate with their students. This has led to an increased confidence in teachers for facilitating STEM-activities for their students. The teachers were also able to experience a variety of tools and exposed to other adaptive approaches that they could share with colleagues.

To support teachers, the NFB created and maintains a website, <http://www.blindscience.org/nfb-eq-teacher-instructional-website>, to support teachers and parents with accessible STEM lessons, tools, and techniques. Lessons, with modifications to increase accessibility, are available for elementary, middle and high school teachers on a variety of topics, including alka seltzer rockets, earthquake resistant buildings, and the Enzyme Function of Liver Peroxidase (a.k.a, Catalase). To increase accessibility for all lessons, there is a list of tools (including pictures, purchasing, and use information) that can assist teachers in making STEM lessons accessible for the blind, including talking tape measures, tactile astronomy books, and molecular model kits. Finally, there are names and contact information for several blind individuals working in STEM. These individuals are willing to support teachers as they adapt science lessons for the blind.

The project supported the development of a raised-line technical drawing process which, in application, increased teen's spatial understanding of science and math concepts, including scale drawings and isometric shapes. Technical drawings also appear to increase teen's understanding of the importance of drawing as an engineering tool. These and other adaptive teaching resources used in the workshops, and tested by the youth and teachers, are part of the NFB's resources made available for educators and families.

Table of Contents

Executive Summary	ii
Findings.....	ii
Conclusions.....	iii
Tables	vii
Introduction.....	1
Methods	1
NFB STEM2U Regional Workshops.....	2
Teen (Apprentice) Program	2
Program	2
Methods	3
Findings.....	3
Youth Program.....	8
Program Description	8
Methods	8
Findings.....	9
Parent/Caregiver Program	11
Program Description	11
Methods	11
Findings from the Immediate Post-Measure.....	12
Findings from the Delayed Post-Measure.....	14
The Museum Educator Program	16
Program Description	16
Methods	16
Findings.....	16
Teacher Professional Development.....	21
Program Description	21
Methods	21
Findings.....	22
Other themes that emerged.....	26
Engineering Quotient Program.....	28
Program Description	28
Methods	29
Findings.....	29

Findings.....	Error! Bookmark not defined.
Conclusions and Recommendations.....	38
Appendix A.....	41

Tables

Table 1.	Evaluands and evaluation constructs	1
Table 2.	Apprentice’s ratings of self-determination.....	4
Table 3.	Apprentice’s ratings of blindness skills and characteristics.....	5
Table 4.	Apprentice’s ratings of leadership skills gained during the Academy	6
Table 5.	Apprentice’s ratings of skills necessary to work with youth	7
Table 6.	Parent’s ratings of program skill elements.....	10
Table 7.	Parent’s belief of what children found important.....	10
Table 8.	Parent’s mean rating of the importance of NFB STEM2U workshop elements.....	11
Table 9.	Parent’s rating of the importance of NFB STEM2U workshop elements	12
Table 10.	Parental learning in NFB STEM2U parent program.....	13
Table 11.	Delayed Impact on Youth’s Interest in and Knowledge of STEM	14
Table 12.	Delayed Impact on Youth’s Problem Solving and Team Work Skills.....	15
Table 13.	Delayed Impact on Youth’s Blindness and Social Skills.....	15
Table 14.	Delayed Impact on Parents’ Actions.....	16
Table 15.	Program impact on museum staff’s abilities.....	18
Table 16.	Museum Staff Satisfaction Ratings	20
Table 17.	PD program impact on teacher’s teaching methods.....	23
Table 18.	Comparison of program impact on teacher’s teaching methods.....	23
Table 19.	Overall program impact.....	24
Table 20.	Comparison of overall program impact.....	25
Table 21.	Teens interest towards STEM	32
Table 22.	Impact of the NFB workshop.....	34

Introduction

As part of a grant from the National Science Foundation, the National Federation of the Blind (NFB) developed, implemented, and evaluated the National Center for Blind Youth in Science (NCBYS), a three-year full-scale development project to increase informal learning opportunities for blind youth in STEM. Through this grant, the NCBYS intended to extend opportunities for informal science learning for the direct benefit of blind students through the three overarching goals:

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The National Center for Blind Youth in Science conducted six distinct programs. The NFB STEM2U regional programs included programs for blind youth, their parents/caregivers, blind teen mentors (apprentices), and museum educators. There was a separate program for blind teens, entitled the Engineering Quotient (NFB EQ) programs. Additionally, there was a teacher professional development program that occurred in conjunction with two of the NFB STEM2U regional programs and one of the NFB EQ programs.

The Lifelong Learning Group (part of COSI) was retained as an outside evaluator and conducted the formative evaluation throughout the program. This report focuses on the accountability evaluation of this project.

Methods

The six program components were all evaluated separately. In order to minimize the potential for evaluation/research fatigue across all components, the evaluation team initially worked closely with the researcher. To support the dissemination and publication of any stage of this work, a comprehensive IRB was obtained through the Museum of Science, Boston.

For each of the audiences, measures included process and outcome indicators, see Appendix A. Specific components varied with each evaluand, but the intention across the evaluation efforts was to answer the broader questions across the array of participants. Table 1 shows the primary intentions of evaluation measures across the various audiences.

Table 1. Evaluands and evaluation constructs

Evaluand	Satisfaction	Value	Intentions	Knowledge	Skills	Importance	Flow
3-6 graders	X	X	X	X	X	X	X
9-12 graders	X	X	X	X	X	X	X
Parents	X	X				X	X
Teachers	X	X	X		X	X	X
Science Center Staff	X	X	X		X	X	
Scientists, etc.	X	X	X			X	
Project team	X	X				X	X

Each of the variables was specific to the programmatic component and intended outcomes for the audience, but the goal was to look at the same variables from multiple perspectives.

The evaluation questions that guided the evaluation were directly tied to the goals of the project:

1. To what degree and in what ways did this project contribute to the knowledgebase of effective practices regarding STEM education for the blind.
2. How effective were each of the strategies in educating families, blind youth, future educators, and museum personnel about the techniques and tools used to effectively engage blind youth in informal and formal STEM settings?
3. To what degree did the project strengthen resources for engagement of blind youth in STEM education?

The first goal focused on the research conducted for the project, which is reported elsewhere. Related to the evaluation, observations made across program efforts were captured and reported in an article published in the peer-reviewed journal, *Museum Education*.

The second question was addressed by focusing the evaluation measures used formatively in Year one, to more clearly focus on accountability measures of outcomes. These changes were primarily measured on the youth, the teacher, the parent/caregiver, and the museum educator instruments.

The third goal was addressed through analysis across all programs to identify the materials and resources produced and/or refined for each of the programs and the perceived value of these resources by the program participants.

Data were analyzed collectively. During analysis, categories of participant responses about their knowledge were developed inductively through the coding process (i.e., they emerged from the data itself rather than being prescribed). Quantitative data were analyzed using the Statistical Package for the Social Sciences (SPSS); descriptive statistics were used to present overall patterns in the data.

NFB STEM2U Regional Workshops

Regional workshops included programs offered to teens (apprentices), youth, parents/caregivers (of the youth), and museum staff members. They were offered at six sites throughout the country. Project year one was a planning year. In project year two, the cities and the museums involved were the Port Discovery Children's Museum (Baltimore, MD), Museum of Science (Boston, MA), COSI (Columbus, OH). In project year three, programs were held at the Phoenix Science Center (Phoenix, AZ), Exploratorium (San Francisco, CA), and the Science Museum of Minnesota (St. Paul, MN).

Teen (Apprentice) Program

Program

The teen (apprentice) program began in September of each project year when the teens attended a Leadership Academy at the NFB headquarters in Baltimore. This weekend experience provided

opportunities for the apprentices to better understand the skills and characteristics of a successful blind person, leadership skills, and STEM activities. Additionally, apprentices met those with whom they would be working at their regional program. The Leadership Academy was followed by teleconferences to plan the regional STEM workshops. Finally, apprentices assisted NFB staff facilitate the youth program. Serving as role models, the apprentices worked with small groups of youth to develop blindness skills, and facilitate science activities during the NFB STEM2U workshops.

Methods

The evaluation design involved two approaches: observations throughout the first Leadership Academy (September 2014) and a web-based post-experience questionnaire administered via an e-mail invitation sent to apprentices immediately after they completed their NFB STEM2U regional program across programs.

Data were analyzed collectively. During analysis, categories of participant responses about their knowledge were developed inductively through the coding process (i.e., they emerged from the data itself rather than being prescribed). Observations were compared with the goals of the Academy. Quantitative data were analyzed using Excel and SPSS; descriptive statistics were used to present overall patterns in the data.

Findings

Participants

There were 57 apprentices, between the ages of 13 – 22 who attended one of the two Leadership Academies held at NFB headquarters in Baltimore. Via observation, it was noted apprentices were a diverse group of race and ethnic backgrounds from different states. Parental permission was obtained for 56 of 57 apprentices to participate in a web-based questionnaire after the post-regional STEM2U workshop, to determine how well the Apprentices felt prepared for their role with the youth with whom they would work with in the NFB STEM2U programs; 41 apprentices (73 % response rate) completed the post-regional program questionnaire.

Self-Determination

Teens trained during the Academy were independent, responsible young adults who were taking the appropriate steps to develop the necessary knowledge and skills to be a successful mentor, as evidenced by a summated mean score of 4.318 on a 5-point scale consisting of self-determination statements. (See Table 2). Data collected post-NFB STEM2U program indicate the apprentices felt the NFB provided a safe, caring, environment to learn and develop their skills, as evidenced by mean scores of 4.0 or greater on a 5-point scale. Apprentices appreciated they could voice their opinions and that their opinions mattered to NFB staff. As is typical with many teens, apprentices felt they could have done more to stretch themselves during the Leadership Academy, as evidenced by the lowest mean score (\bar{x} =3.564) for the statement “I felt I stretched myself”.

Table 2. Apprentice’s ratings of self-determination

	Mean	Std. Dev.
I felt I was able to determine the steps to be a successful apprentice	4.39	0.711
I felt I was able to voice my opinion	4.50	0.679
I felt I wasn't able to do anything right (Reverse Coded)	4.46	0.913
I felt I was competent.	4.08	1.075
I felt I was controlled and pressured to behave in certain ways (Reverse Coded)	4.00	1.198
I felt I was cared for	4.47	0.862
I felt I was distant from the other High School Students (Reverse Coded)	4.38	1.030
I felt I could be me	4.39	0.771
I felt I was smart and able to do most everything well	4.168	0.886
I felt I was responsible and dependable	4.31	0.731
I felt I demonstrated initiative and the ability to learn	4.33	0.662
I felt I was self-sufficient	4.39	0.747
I felt I learned from my instructors	4.38	0.807
I felt I stretched myself	3.56	1.188
I felt my opinion mattered	4.40	0.841

1(Strongly Disagree) to 5 (Strongly Agree)
 N varies between 38 - 41

Skills and Characteristics of a Blind Person

Apprentices felt they developed the characteristics of a successful blind person, as well as blindness skills such as cane travel and self-advocacy, throughout the NFB STEM2U experience. Additionally, apprentices indicated they learned the importance of giving back to the blind community and it is OK to be blind as evidenced by mean ratings of 4 point or higher on a 5-point scale (Table 3).

Apprentices were unlikely to develop blindness skills and coping skills to deal with public attitudes towards blindness, as evidenced by mean scores of 3.795 and 3.921 respectively. The majority of apprentices had developed blindness skills before attending this program, which may explain the low score for developing blindness skills. The low mean score for coping skills to deal with public attitudes towards blindness may be due to the limited access teens had with the public during the Academy and NFB STEM2U programs.

While teens traveled independently to NFB programs, during the program apprentices had little opportunity to interact with the public. During the program, interaction with the public appeared to be limited to dinner outings with their peers, and science museum visits where they were chaperoning the youth participants. The dinner outings during the academy and the NFB STEM2U programs were successful, however apprentices had limited access to the public during these experiences as they were with their peer group and chaperoned by leaders in the NFB. During their visit to the museum apprentices were typically focused on chaperoning the youth in their group, which limited their interaction with the public. With such limited interaction, it is understandable that apprentices were least likely to develop coping skills to deal with public attitudes towards blindness.

Table 3. Apprentice’s ratings of blindness skills and characteristics

	Mean	Stand. Dev.
I felt it was OK to be blind	4.90	0.307
I learned it is OK to be blind	4.51	0.731
I developed my blindness skills (braille, cane travel, self-advocacy)	3.80	1.128
I developed my coping skills to deal with public attitudes towards blindness	3.92	0.997
I developed skills to be successful in society	4.05	0.973
I learned the characteristics of a successful blind person	4.00	0.987

1(Strongly Disagree) to 5 (Strongly Agree)
 N varies between 37 - 41

The apprentices who completed the regional post-questionnaire appreciated the leadership/mentoring activities included in the Academy. During one Academy activity, the apprentices were asked to read and synthesize materials that focused on one of the five characteristics of a blind person.

1. It’s OK to be Blind
2. Coping with public attitudes
3. Blindness Skills
4. Give Back
5. Blending In

Some of the apprentices who responded to the web-based questionnaire (7 of 34 respondents) felt the most important aspect of the NFB STEM2U program was developing their own blindness skills or the youth’s blindness skills. One apprentice wrote, “The most important aspect for me was having the opportunity to teach the blind juniors that it is okay to be blind. They learned new techniques to help them do things independently.” Another shared, “The most important part for me was learning how to be a successful blind person through both my work with the juniors and the alternative techniques and skills that I learned from others.” Finally, one apprentice stated, “The most important aspect of the workshop for me was getting a chance to be independent and away from my family. The program gave me a great chance to practice independence skills through traveling, management of personal surroundings, and independence in making decisions and taking initiative.”

Defining Mentorship

Apprentices who responded to the web-based questionnaire (24 of 34 respondents) found mentoring the youth participants the most important aspect of the NFB STEM2U program. During the conversation with Mark Riccobono, apprentices identified several characteristics of a mentor, including:

- Content expert
- Role model
- Nurtures others to move forward
- Self-aware
- Good problem solver

- Open to new ideas
- Respects themselves and others
- Always learning

One apprentice shared that mentoring is a “mutually beneficial symbiotic relationship” where both the mentor and mentee benefit. Apprentices continued the mentorship work begun at the Academy throughout the year, working with NFB staff to develop and implement plans to successfully mentor youth during the regional NFB STEM2U programs.

After completing the regional STEM2U program, apprentices shared that the most important aspect of the workshop was “Interacting with the students and seeing the results of the program's impact.” One apprentice shared, “The most important aspect for me was having the opportunity to teach the blind juniors that it is okay to be blind. They learned new techniques to help them do things independently.”

Leadership Skills

In addition to blindness skills, apprentices also developed leadership skills during the Academy. Apprentices reported learning skills that they believe will help them in the future. They also advanced their understanding of the principles of leadership. Additionally, they developed their abilities to work with others on projects as evidenced by mean ratings of 4.275 or higher on a 5-point scale of leadership skills (Table 4).

Table 4. Apprentice’s ratings of leadership skills gained during the Academy

	Mean	Stand. Dev.
I learned new skills that will help me in the future	4.32	0.850
I advanced my understanding of the principles of leadership.	4.50	0.641
I developed my abilities to work effectively with others on team projects.	4.28	0.784
I set challenging but realistic goals	3.85	0.933

1(Strongly Disagree) to 5 (Strongly Agree)
N varies between 39 - 41

After completing their duties at a regional NFB STEM2U workshop, apprentices were asked about the importance of selected leadership skills, and to self-report their perceived skill level for a list of leadership skills. Apprentices believed the ability to work with others, take initiative, and problem-solve were essential skills needed to work with youth, as evidenced by extremely high ratings of 4.757 or higher on 5-point scale (SD=0.723 or lower), as illustrated in Table 5.

While apprentices believe these skills to be important, they self-reported their skill level lower than the importance rating, as noted by mean differences of .860 or greater. Analyzing the data with an independent samples t-test, statistically significant differences were found between the perceived importance and self-reported skill level for all but one skill, project documentation. Apprentices viewed project documentation neutrally, and believed their skill level was adequate. Those skills found with statistically significant differences at the .001 level, between importance and perceived skill level, include:

- Time management

- Ability to take initiative
- Problem Solving Skills
- Ability to work with others
- Attention to detail

It is also important to note that for none of the skills was self-report of skill equal to or exceeding importance. This could suggest that 1) the youth see the importance of all the skills and also the continual skill development required to master the skill, or 2) the youth do not have a sense of appropriate skill for a task in this context. We believe it is the former, but critical understanding of level of expertise to immediate task may be an important consideration for future leadership programs.

Table 5. Apprentice’s ratings of skills necessary to work with youth

	Perceived Importance Mean	Std. Dev.	Self-Report Skill Level Mean	Std. Dev.	Mean Difference
Attention to detail ***	4.50	0.830	3.81	0.928	0.69
Good problem solving skills ***	4.76	0.723	3.90	0.968	0.86
Imagination *	4.47	0.647	4.03	0.959	0.44
Ability to work alone without supervision *	4.32	0.784	4.00	1.086	0.32
Project documentation	3.38	1.234	3.16	1.285	0.22
Public speaking skills**	4.22	0.936	3.50	1.390	0.72
Ability to work with others***	4.87	0.522	3.85	1.051	1.02
Determination *	4.67	0.737	4.21	0.843	0.46
Time management ***	4.45	0.677	3.08	1.164	1.37
Ability to take initiative ***	4.74	0.503	3.76	1.261	0.96

N varies between 37 – 41, 5-point scale

***statistically significant at .001

**statistically significant at .01

*statistically significant at .05

Apprentice Impact on Blind Youth and STEM

Apprentices learned ways to monitor youth as they participated in STEM activities during the Leadership Academy. This was modeled by the NFB STEM2U Leadership Academy facilitators before apprentices took on the role during the regional workshop. Nonvisual skills apprentices learned to monitor the youth included:

- Facilitating hands-on experience with accessible STEM equipment
- Giving explicit directions, painting a picture (top right, top left, lower right, lower left) in order to orient children to what they need
- Modeling an activity for youth by asking the youth to put their hand on yours and feel what you are doing.
- Checking in with youth to determine levels of understanding, comfort
- Cleaning up as they completed a lesson to avoid confusion

- Using audio cues to keep track of youth (conversation, voice-check)

Although apprentices received adequate training during the Leadership Academy, almost 1/3 (10 of 34 respondents) of the apprentices who completed the post-experience questionnaire after the regional program felt they needed additional skills to support the youth. The skills needed focused on the social and emotional development of youth, including:

- “How to deal with kids who have not ever been away from their parents”
- “Ways to separate kids and manage their negative behaviors”
- Help with children who are “too reliant on others”

Apprentices (8 of 34) also wanted additional time to find their way around the museum before leading youth through the museum.

In addition to learning how to facilitate STEM activities, apprentices also spoke to the impact of the NFB STEM2U program, including the Leadership Academy and regional programs, on the youth and themselves. Several apprentices believed that “helping the juniors learn about science technology engineering and math” was the most important aspect of this program. Another wrote s/he felt the youth learned that “blind people can succeed in science careers.” Finally, one apprentice shared, “This is an amazing and fulfilling program that honestly probably changed my view on my career path.”

Youth Program

Program Description

The STEM2U youth program involved small groups of youth working with blind teen mentors (apprentices) to complete STEM-related activities both in a classroom setting and then in a hands-on science museum. STEM activities varied depending on the strengths of the museum partners and included adapted electricity and rat basketball shows, sound activities, cow eye dissection, and building with foam blocks. Youth were also given the opportunity to explore the partner museum with their teen mentors.

Methods

Data for this program evaluation were collected from the youth and their parents/caregivers. During the course of the regional programs, the evaluation team observed the programs in order to note the flow and intersections of the sessions and how different components serve the desired outcomes from a design perspective. During five of the six programs, evaluators did pulse interviews, asking participants questions in order to track connections to the program.

At the conclusion of the program, the younger participants were invited to respond to questions about the program using an oral questioning route. The adult participants were invited to respond to computer-based questionnaires tied to the at the final program meeting and via e-mail from the NFB staff.

Findings

Across sites, youth were satisfied with the program and enjoyed attending because it was a fun, educational experience where they had opportunities to do hands-on STEM activities. Additionally, they were able to interact with other blind children and to visit a science museum. The majority would do the program again and most would tell a friend they really liked the NFB STEM2U program. The youth shared they enjoyed several aspects of the program, including (depending on the site):

- Making the racer
- Engineering
- Working with the mentors
- Spending time at the museum
- Math
- Helping friends; talking to the other kids
- Being independent
- Going out to dinner with the other parents/students
- Learning

Students believed they improved their skills or content knowledge in science, technology, engineering, and life skills. Each site had somewhat different lists depending, in great part, on the type of programming offered at the science museum. Generally, some of the more consistent gain areas included:

- Independence
- STEM (i.e., solving engineering problems, science process skills)
- Teamwork
- Blindness skills, especially cane skills
- Self-efficacy
- Belonging

During the program, parents/caregivers were queried regarding their expectations for the program for their ward. Two dominant themes were consistent: science content and social skills with their peers. Following the program, parents/caregivers were asked to rate several elements of the NFB STEM2U program regarding their child's skill development; mean ratings for each element were above average on a 5-point scale. The summated means of the six regional programs also indicate that parents bring their children to these workshops to develop their science and social skills, in addition to the skills their child needs to be successful in society. As illustrated in Table 6, parents at all six programs indicated they were least concerned with the development of their child's blindness skills when compared to science, social and the skills necessary to be successful in society.

Table 6. Parent’s ratings of program skill elements

	MD	MA	OH	AZ	CA	MN	Summated Means
	N=11	N=14	N=12	N=11	N=11	N=12	
Blindness skills	3.91	3.64	3.75	4.09	3.45	3.92	3.79
Science skills	4.09	3.86	4.17	4.45	4.09	4.00	4.11
Social skills	4.00	4.21	3.83	4.45	4.00	4.25	4.12
Skills to be successful in society	4.20	4.07	4.00	4.27	3.91	3.92	4.06

1 (Not At All Important) to 5 (Extremely Important)

Parents/caregivers in all six programs believed their children found this as an opportunity to have fun with other blind children. Table 7 (below) includes mean scores for parent’s/caregiver’s beliefs of what their child felt were the most important elements of the program for the six programs, as well as the summated means from all programs.

Table 7. Parent’s belief of what children found important

	MD	MA	OH	AZ	CA	MN	Summated Means
	N=11	N=14	N=12	N=11	N=11	N=12	
Have fun	4.82	4.79	4.92	4.90	4.91	4.75	4.85
Spend time with other blind children	4.36	4.43	4.33	4.73	4.36	4.64	4.48
Learn science content	4.27	4.21	4.42	4.45	4.27	4.25	4.31
Spend time with teen apprentices	4.18	4.14	4.17	4.55	4.00	4.42	4.24
Visit a Science Museum	4.09	4	4.58	4.40	4.27	4.25	4.27
National Federation of the Blind Reputation	3.45	3.14	3.75	4.09	2.91	3.33	3.45

1 (Not At All Important) to 5 (Extremely Important)

Parents/caregivers who attended a regional workshop valued each of the elements that comprised the youth program of the NFB STEM2U workshop, as evidenced by mean ratings of 4.50 point or higher on a 5-point scale. Across sites, parents/caregivers valued the program for providing their child an opportunity to have fun, spend time with other blind youth, and learn science content. This is similar to parents who attended the previous regional workshops as illustrated by the summated means for all of the regional programs. Across the programs, parents’ wanted their children who attended the program to:

- Have fun
- Spend time with other blind children
- Learn science content
- Opportunities to interact with blind teen mentors.

Table 8 (below) details parents’ ratings of the importance of workshop elements.

The value of this program is illustrated by many of the parents'/caretaker comment. As one parent stated, "My child was nervous about her dissection unit in science class at school before STEM2U. At STEM2U she met a friend who had just dissected a sheep's eye and shared the experience with [the child]. One week later and as a direct result [the child] independently dissected a cow's eye with great interest and learning and confidence." Another noted "the program encouraged her child's independence; sharing her child was "immersed in a setting that was encouraging, supportive, safe, and fun." The program "challenged his comfort zone while allowing him to be well taken care of. . . the perfect balance."

Table 8. Parent's mean rating of the importance of NFB STEM2U workshop elements

	MD	MA	OH	AZ	CA	MN	Summated Means
	N=11	N=14	N=12	N=11	N=11	N=12	
Child learn science content	4.82	4.71	4.83	4.82	4.73	4.38	4.72
Child had fun	4.64	4.93	4.92	4.73	4.91	4.75	4.81
Child spent time with other blind children	4.64	4.93	4.67	5.00	4.82	4.83	4.82
Child develop independence	4.55	4.64	4.83	4.45	4.64	4.67	4.63
Child spent time with teen apprentices	4.55	4.50	4.50	4.55	4.55	4.58	4.54

1 (Not At All Important) to 5 (Extremely Important)

Parent/Caregiver Program

Program Description

The STEM2U parent/caregiver program involved parents interacting with NFB staff and volunteers in small and large group learning situations. This program evolved, from the first offering which focused primarily on the NFB sharing information with the parents/caregivers about the NFB and how parents could advocate for their child's rights in the school setting, little of which related to STEM; to programs that used a mix of presentation formats, honored parent knowledge, and focused on STEM.

Methods

Data for this program evaluation were collected from the parents/caregivers. During the regional programs, the evaluation team observed the programs to note the flow and intersections of the sessions and how different components serve the desired outcomes from a design perspective. During five of the six programs, evaluators did pulse interviews, asking participants questions in order to track connections to the program. At the conclusion of the program, the adult participants were invited to respond to computer-based questionnaires tied to the at the final program meeting and via e-mail from the NFB staff.

Findings from the Immediate Post-Measure

Overall, parents were satisfied with the NFB STEM2U program. Of the 96 parents or caregivers attending the program for parents/caregivers, seventy-one completed the web-based questionnaire for a 74.0% response rate. Post-program mean scores were determined for several program elements, including staff, schedule, and meals. These statements were typically rated a 4 or higher on a 5-point scale. In some of the sites, staff appeared to have performed above and beyond to expectations in accommodating parents, earning a perfect score of 5.

The satisfaction, however, did not necessarily originally match the expectations with the outcomes. In the early program on-site interviews, three program expectations emerged: 1) support/networking with other parents; 2) science and teaching using science resources designed for blind youth; and 3) parenting of blind youth resources. Many of the parents/caretakers entered with the desire to learn how to better work with their child around STEM, including lessons they could do at home with the child. During the first program, several parents noted the “bonding is good” while one person commented on very personal changes: “I’m finding I didn’t deal well with the grieving process [of my child’s loss of vision]” and “This is helping me be less over-protective.” While the first program produced several positive outcomes, parent expectations were not met. This issue was addressed in stages over the next few workshops until a consistent performance level was met.

For example, parents of the earlier programs were least satisfied with the program content, which might be due to entry expectations regarding topics to be covered. Three concerns were reflected: 1) a desire for more information about resources available; 2) more focus on adaptations for science; and 3) opportunities for parents to interact with the youth, cooperatively engaging in science. In the later sessions, these concerns were not raised or reduced in frequency. As one example, the opportunity to network with parents of blind youth increased from $\bar{x}=4.09$ to a $\bar{x}=4.83$ at the final session with mostly upward trending mean scores (See Table 9).

Table 9. Parent’s rating of the importance of NFB STEM2U workshop elements

	MD	MA	OH	AZ	CA	MN	Summated Means
	N=11	N=14	N=12	N=11	N=11	N=12	
National Federation of the Blind Reputation	4.45	4.50	4.67	4.73	4.55	4.42	4.55
Opportunity to network with parents of blind youth	4.09	4.57	4.67	4.73	4.36	4.83	4.45

1 (Not At All Important) to 5 (Extremely Important)

Parents were asked to rate their level of agreement with statements measuring what they learned on a scale of 1 (strongly disagree) to 5 (strongly agree). These mean ratings indicate that parents learned to connect with the NFB, alternative techniques to succeed in STEM learning, and their rights and the rights of the child in the school setting, as illustrated in Table 10. Overall, they were slightly less likely to learn about advocating if a child’s rights were violated. In both Columbus and San Francisco, rights and advocating were somewhat lower while in Baltimore, techniques to

success in STEM learning was lower. These findings reflect the on-site interviews in which parents noted the desire to receive/learn tools and resources to assist their child in learning STEM and to better parent blind youth.

Table 10. Parental learning in NFB STEM2U parent program

	MD	MA	OH	AZ	CA	MN	Summated Means
	N=11	N=14	N=12	N=11	N=11	N=12	
Connecting with the NFB network	4.64	4.21	4.08	4.64	4.18	4.42	4.36
Their rights and the rights of the child in the school setting	4.27	4.07	3.67	4.45	3.73	4.25	4.07
Advocating if child’s rights are violated	4.18	4	3.58	4.00	3.64	4.25	3.94
Alternative techniques to succeed in STEM learning	3.64	4.21	4.25	4.45	4.55	4.42	4.25

1 (Not At All Important) to 5 (Extremely Important)

Across sites, parents/caregivers valued the NFB STEM2U program for providing opportunities to network with parents of other blind children. When the parents/caregivers responded to an open-ended question to share what they valued most, half of the parents identified networking as being the most personally valuable element of the program which is reflected in the summated mean score. As one parent shared, what was valuable was “Getting to know other people who are in similar situations.”

In early workshops, there were some comments offered to the evaluators during the on-site interviews with the parents that they were learning and valued the program, but it was not as focused on the skills, ideas, and practice for helping their child to be independent. Further, the evaluators noted that the presentations were very heavy on the formal education system with little or no integration into the informal learning environment, such as how to use science centers, zoos, parks, museums, etc. with their child. Over time, the workshops were adjusted to better reflect parents’ expectations and the comments became much more specific such as “more about technology- what technology skills or experience do kids need to be competitive in the work place or at college,” and another parent suggested revising the closing ceremony to include “having the kids talk to the audience about what they experienced and learned.” A lot of the credit for the evolution of the parent program should go to NFB volunteers and staff. During the fifth parent program, one parent stated, “I think the parents could have spent more time with Pat, Dave and Natalie going over the practical techniques and materials to help adapt 'sighted' science instruction for blind children. What they provided was great but we would have been comfortable if that block had been longer.” This shift in comments supports the changes made in the programs to more fully address the needs of the parents and caregivers.

Findings from the Delayed Post-Measure

After the completion of all regional programs, parents were invited to complete a second evaluation to determine if the immediate outcomes of the NFB STEM2U regional program led to lasting impact; 22 of the 93 parents invited responded (24% response rate). Of the adults responding, 21 of the 22 considered themselves to be sighted. Two respondents had attended the Phoenix, AZ, three attended the Baltimore, MD, four attended each of the Boston, MA, Columbus, OH, and St. Paul, MN workshops, and six attended the San Francisco, CA program.

The parents who responded felt the NFB STEM2U program had a lasting effect on their child’s interest in STEM (\bar{x} =4.090), visiting science centers (\bar{x} = 4.36), and in their school STEM classes (\bar{x} =4.18) as illustrated in Table 11. One parent wrote, “In public school, there are virtually no opportunities to engage in hands-on science lessons. Right now, for example, my daughter is studying plate tectonics. Everything is so visual. She loves science, but can’t access it. Attending the event in Columbus, Ohio, was fantastic because she was a true participant and didn’t need to learn facts by rote. She’d love to attend more STEM2U events.” Another shared, “I believe this opportunity was a large stepping block. Unless we continue to expose our kids to programs and follow-up, we will not get the full benefit. In my case, having this to say ‘remember when’ gives us a huge advantage to continue to encourage him in this field.” One parent had a critical insight and made the case for sustained learning: “As for interest in STEM, the program is just too short to have a lasting impact. There were a couple days and then no follow-up. If there was a sustaining follow-up it could change that dynamic.”

Table 11. Delayed Impact on Youth’s Interest in and Knowledge of STEM

Statement	Mean	Std. Dev.
After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).	4.09	0.811
At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.	3.73	0.631
At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home	4.00	0.690
Participation in the NFB STEM2U program increased my child’s interest in his/her school STEM classes	4.18	0.588
Participation in the NFB STEM2U program increased my child’s awareness of STEM careers	3.73	0.703
Participation in the NFB STEM2U program increased my child’s interest in pursuing a STEM career	3.36	0.581
After attending the NFB STEM2U program, my child wanted to visit another Science Center	4.36	0.727

1(Strongly Disagree) to 5(Strongly Agree)
N =22

Parents also felt the program had an impact on 21st century skills. Parents/caregivers felt the youth improved their team work (\bar{x} =4.00) and problem solving (\bar{x} =3.96) skills. (See Table 12). A parent shared, “My child has learned how to persevere when doing complicated close-work tasks.”

Another wrote “[My daughter’s] problem solving skills and technology skills have improved greatly. She is able to work with others and talks frequently to a couple of girls she met at the STEM2U program.”

Table 12. Delayed Impact on Youth’s Problem Solving and Team Work Skills

Statement	Mean	Std. Dev.
Participation in the NFB STEM2U program helped my child better solve problems	3.96	0.653
Participation in the NFB STEM2U program increased my child’s ability to work with groups of children on specific tasks	4.00	0.873
Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task	3.73	0.883

1(Strongly Disagree) to 5(Strongly Agree)
N =22

Another goal of the program was building the blindness and social skills of the youth (Table 13). Parents noticed that after the program, their child was more independent (\bar{x} =4.00) and developed skills that would help them be successful in society (\bar{x} =4.23). A parent wrote, “My son’s biggest area of improvement from the Boston event was his mobility skills and comfort level in an unfamiliar place. He gained the self-confidence to know he can go anywhere!” Another wrote, “The strongest impact of the STEM program on my grandson were the hands-on opportunities to explore STEM topics and to work with other students with visual impairments.” Finally, a parent shared, “It was a good resource for parents, and a good way for my son to see what older kids are doing and their independence. “

Table 13. Delayed Impact on Youth’s Blindness and Social Skills

Statement	Mean	Std. Dev.
At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community	4.18	0.664
At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society	4.23	0.685
After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful	3.82	0.907
After attending the NFB STEM2U program, my child exhibited signs of increased independence	4.00	0.816
After attending the NFB STEM2U program, my child wanted to attend another NFB program.	4.73	0.456
My child has kept in contact with friends s/he made at the NFB STEM2U program.	2.96	1.253

1(Strongly Disagree) to 5(Strongly Agree)
N =22

Related to the influence on the parents/caretakers themselves, the program had the biggest impact on parent’s ability to advocate for their child’s rights in the school setting using knowledge they learned at the NFB STEM2 U Program (\bar{x} =4.14) (See Table 14). One parent commented, “The information given to us and discussions has made me a better advocate overall. I still have those

handouts and when I encounter difficulties, I have the tools. I am more likely to call the NFB to help me with an issue.” Other parents mentioned they appreciated learning the “techniques to make tactile materials.” One parent pointed out the challenges of trying to engage a group of children with different knowledge levels and abilities, writing “The real value for us was the peer exposure, which we deeply appreciated. The organization and attendees were tremendously welcoming and supportive. The content was unchallenging, but of secondary importance. I honestly felt the content was significantly below grade level for sighted peers and certainly below [my daughter’s] capacity.”

Table 14. Delayed Impact on Parents’ Actions

Statement	Mean	Std. Dev.
I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM	3.76	0.831
I have advocated for my child’s rights in the school setting using knowledge that I learned at the NFB STEM2U program	4.14	0.727
I have met with my child’s teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes	3.86	0.964
I have connected with the NFB Network to acquire information for myself and/or my child	3.67	1.065
I have kept in contact with other parents I met during the NFB STEM2U program	2.86	0.990

1(Strongly Disagree) to 5(Strongly Agree)
 N varies from 21 - 22

Overall, parents who responded to the delayed-post questionnaire valued the NFB STEM2U regional program for increasing their awareness of STEM options and their ability to advocate for accessible STEM tools, technology, and support for their child’s classroom science experience. They also valued being around other like-minded parents. For their child, they valued the hands-on STEM activities, the motivation to continue learning science, and the opportunity for their child to meet other “kids who are blind and see older kids who are blind being able to navigate around the city without their parents.” Finally, one parent shared her child had “more confidence in knowing anything is possible if he wants it enough.”

The Museum Educator Program

Methods

Data for this program evaluation were collected from the museum educators. At the conclusion of the program, the museum staff were invited to respond to computer-based questionnaires via e-mail from the NFB staff, typically shared by the museum coordinator. Additionally, four museum staff were interviewed to better understand the long-term impact of the training program.

Program Description

The STEM2U museum educator program involved museum staff interacting with NFB staff and volunteers. The workshop included examining each museum for inclusion opportunities, learning to use descriptive language, additional effective communication methods to encourage inclusivity, and how to adapt activities to make them more tactile and approachable for the visually impaired.

The goals of the training were to expose museum educators to tools, strategies, and activities for making their programs accessible to blind participants.

Findings

Participants

There were 136 museum staff trained at four of the six regional workshop sites (Boston, MA; Columbus, OH; Phoenix, AZ; and St. Paul, MN). Sign in sheets recording attendance were misplaced for the Baltimore, MD and San Frisco, CA, trainings by the researcher collecting the data, so the evaluators did not have the numbers available to them to include those numbers in the evaluation report. Four museum staff, one each from Port Discovery and the Exploratorium, and two from the Science Museum of Minnesota, were interviewed to better understand the long-term impact of the training.

Program Impact

The museum staff training program outcomes elicited slightly positive ratings from the staff (3.585 summated mean of all statements on a 5-point scale). The training increased staff's ability to properly offer assistance to a blind visitor (\bar{x} =3.98) and increased their confidence level in working with blind visitors (\bar{x} =3.83) as illustrated in Table 15. Museum staff felt the training had less of an impact on altering everyday museum program and exhibit experiences (\bar{x} =3.20), helping staff describe STEM content to all visitors (\bar{x} =3.25) and blind visitors (\bar{x} =3.49).

Table 15. Program impact on museum staff's abilities

	Mean	Std. Dev.	Range
Comfort level with blind visitors	3.65	0.770	2-5
Confidence level in working with blind visitors	3.83	0.803	2-5
Knowledge of accessibility and universal design and how it pertains to museums	3.61	0.737	2-5
Everyday museum program and exhibit experiences	3.20	0.715	2-5
Ability to describe STEM content to blind visitors	3.49	0.683	2-5
Ability to describe STEM content to all visitors	3.25	0.809	1-5
Ability to determine if assistance is needed by a blind visitor	3.68	0.907	1-5
Ability to properly offer assistance to a blind visitor	3.98	0.758	3-5
Summated Mean	3.59		

1 (No impact) to 5 (Completely Changed)
N ranges from 39-41

Specific aspects of the training museum staff felt were important include:

- “Thoughtful use of analogy within descriptive language (describing things in terms of familiar objects rather than geometric shapes is better)”
- Examples of adaptations from other museums
- Learning in our museum setting
- “The 10 tips at the end of the program”
- Learning how folks who are blind adapt, teaching tips

- “I didn’t realize how much tactile clues contributed, as audio seemed more obvious to me as a method of learning and perceiving things”

Prior to the program, the museums offered different supports to blind visitors, including:

- Braille signage, primarily wayfinding or in specific exhibit areas
- Tactile elements/exhibits throughout the museum
- Pre-arranged individual activities/tours
- Live presentations include tactile items from collections and models created by a 3d printer
- Descriptive language within live presentations
- Cameras, projectors, screens and good lighting in presentation spaces
- Differently-textured flooring that differentiates program space from exhibit space.
- Audio description in specific exhibit spaces
- Interactive aspects, which encourage teamwork, in specific exhibit areas

Additionally, the Science Museum of Minnesota supports blind visitors with “Museum Geographies”, narratives that provide an orientation to the museum’s spaces.

In addition to the museum’s current inclusion efforts, museum staff were also asked to share about how the workshop might change their work. The majority of staff were most likely to mention they would focus on descriptive language when they facilitate education programs in the future, “because this helps all guests participate in the activity.” An Exploratorium staff member shared, “The program gave me great practice in thinking about how I communicate and explain activities or exhibits. I couldn't rely on ambiguous language ("this" or "that") when explaining what was going on or what we were going to do.” COSI staff appreciated the practical advice, e.g., hand-over-hand guiding, and the opportunity to “ask the instructor personal questions about being blind.” A Port Discovery staff member shared, “I feel like I have inside knowledge on how blind people feel and what they experience. I understand I don't have all the answers but I feel more like a friend and less like a stranger. I'm sure that alone will help me interact with more sensitivity, warmth.”

After the training program, museum staff were considering resources or services to facilitate full participation by blind visitors, including:

- Wayfinding, including a first time visitor guide for all visitors (including blind visitors)
- Review of exhibit plans by blind advisors
- New ways to annotate museum exhibits electronically
- Braille and tactile props at demonstration spaces

- Braille signage
- Experimenting with QR codes to access exhibit labels for certain label-dependent exhibits
- Beacons that help individuals who are blind navigate the museum
- Planetarium programs with tactile elements/better audio descriptions
- Sonify data so that visitors who are blind can interpret graphs during their museum experience
- Re-usable raised-line notepads

Additionally, Baltimore Port Discovery museum staff believed the museum is considering new programs which are not as reliant on visual cues, and adding audio to exhibits. Many of the museums plan to continue to partner with the national and/or state NFB to bring STEM programs to blind youth and teachers of blind youth. One Exploratorium staff member stated, “Thanks to the STEM2U project, I have made solid contact with Lighthouse for the Blind in our city and have already visited their teen program once with hands-on activities. Their teen program will visit our museum in three weeks for a day of hands-on science, exploration of exhibits on the museum floor, and conversation with teens currently employed in our high school docent department.”

Exploratorium staff felt “every aspect of this project was wonderful.” One staff member shared, “From meeting the staff of the NFB, to planning and working with them over the past six months, to getting connected to our local Lighthouse organization, to eventually meeting and spending a day with the hilarious, intelligent, and thoroughly delightful children and teens who came to San Francisco to be part of this. The most important part of it all, however, has been how vocal my youth staff (all sighted) have been about the impact it has made on them and how jazzed they are about continuing to work with blind and visually-impaired children and teens.” Finally, one staff reminded, “Even small changes/modifications can have a big impact on accessibility. Start small, think big. As educators interacting with visitors we can make changes on the fly if we are aware of challenges.”

Overall, staff were satisfied with the program. Table 16 shows the clearly positive satisfaction rating with the tremendously high schedule satisfaction across sites.

Table 16. Museum Staff Satisfaction Ratings

	Mean	Std. Dev.
Staff	4.44	0.594
Program Schedule	4.78	0.423

1 (Very Unsatisfied) to 5 (Very Satisfied)
N ranges from 39-41

A potentially important measure of the value of the program was change within the institutions. One institution has had very little movement on addressing change within the institution; a second has been very slow to accomplish anything and the project manager notes “they have many meetings to figure things out and that slows them down.” This institution is focusing on adding accessible elements to their Theater of Electricity, as well as adapting some other experiences. A third museum, which had good interest and attitude but was slow to implement change, is now doing work that will be of great value to the local blind patrons, especially in their Planetarium and Life exhibition. This institution also built a good relationship with the (at the time) president of the state chapter of the NFB.

A fourth museum partner had a large team on the project, representing an array of expertise. This institution had an interesting shift in understanding. They had been working with one blind individual whose views on blindness were different than the NFB; this project led the museum to perceiving multiple perspectives about blindness and they now are connected to the state NFB and their local chapter of BLIND Inc., in addition to their original contact. Additionally, the NFB continues to work with this museum to refine the NFB STEM education programs.

The fifth partner museum has invited the NFB to join their exhibit advisory board as they re-imagine their museum to ensure accessibility. This institution has adopted ideas of more inclusive design for the blind into their overall work and has implemented Blind Square to help with nonvisual navigation. Finally, the sixth partner museum also has made good connections to the local blind community. The staff appears to be excited about their work and has created a braille/large print map of their facility.

These efforts indicate an important legacy element of this project. The host museums are all, in their own ways and timelines, changing in ways that make them more accessible to and welcoming of their local blind communities.

Teacher Professional Development

Program Description

The professional development program for teachers focused on alternative techniques teachers could use to help students succeed in STEM learning. There were two 2.5 day programs connected to the NFB STEM2U program and one 5-day program connected to the EQ program. Like the parent/caregiver program, the teacher program evolved. The original program was taught by NFB staff with little outside help, focusing on blindness skills and few STEM specific applications; the final program was co-facilitated by an NFB staff member and an informal science educator.

The final teacher professional development program focused on the process skills of science, which was different from the first two programs. Basic science content that is typically taught to several different grade levels (i.e., force and motion, chemistry) was paired with specific process skills that incorporated adaptive tools. For example, participants added bells to lightweight objects they created before sending them through a wind tube. The addition of the bells allowed blind participants to hear where the object was as it moved through the tube. While the activities were different, the workshop including several elements of the prior teacher workshops, including sharing a variety of accessible equipment that supports STEM learning, including talking measurement probes and tactile drawing tools. Teachers also had the opportunity to network and learn from each other.

Methods

The evaluation questions for this program varied slightly from the larger evaluation and included:

- What happens in the teacher professional development program for its audience?
- In what ways do the teachers see the program affecting their work?
- How does this experience affect the individual and their understanding of blind youth and STEM?

During the course of the PD program, the evaluation team observed the teachers in order to note the flow and intersections of the sessions and how different components serve the desired outcomes from a design perspective. Additionally, the evaluator conducted pulse interviews, asking the teachers questions in order to determine if participants were realizing the desired program outcomes. At the conclusion of each program, the teachers were invited to respond to a computer-based questionnaire tied to the program at the final program meeting and via e-mail from the NFB staff.

Findings

In this section, findings will be principally focused on the summer 2016 PD program. Similarities and differences between prior professional development workshops associated with the NFB STEM2U programs will be made where applicable. Part of the goal of the comparison is to see if program changes appear to have improved the program, even though the data are not truly comparable. These changes included focusing more on adaptive technology, resources for use in classrooms, and process skills of science learning.

The Participants

A total of 35 teachers participated across the three workshops. As these findings focus on the PD program that occurred in conjunction with the NFB EQ workshop in 2016, survey data were collected from 13 of the 17 participants (77% response rate). The majority of these respondents (10 of 13) of the 2016 cohort were Teachers of the Visually Impaired (TVIs) who assist classroom teachers in adapting their lessons for blind students. They are responsible for a range of subject matter, including language arts, math, science and history. Two of the respondents were science teachers and one was an administrator. Three of the respondents were blind or visually impaired. Respondents had a range of teaching experience; six taught eleven or more years, three taught 6 – 10 years, and 3 taught 1-5 years. One respondent was in their first year of teaching.

Influence on Teacher's Teaching Methods

Teachers were asked to reflect on how this program might affect or change their teaching methods. Those who responded to the survey believe they expanded their knowledge of accessible lab equipment and use of hands-on science lessons (\bar{x} = 4.615 on 5-point scale). Teachers were also likely to change their use of accessible lab equipment and manipulatives to reinforce science content. (See Table 17.)

Table 17. PD program impact on teacher’s teaching methods

	Mean	Std. Dev.
Expand your knowledge of accessible lab equipment	4.62	0.650
Change your use of accessible lab equipment	4.46	0.660
Change your ability to monitor your student’s behavior in science labs	4.08	1.084
Change your use of hands-on science lessons	4.62	0.506
Change your ability to describe STEM content	3.85	0.376
Change your use of manipulatives to reinforce science content	4.46	0.776

1 (No impact) to 5 (Completely Changed)
 N varies from 23 to 25

As this was the third teacher professional development program associated with the National Center for Blind Youth in Science, the data from this program were compared to the data from the prior two programs. An ANOVA was used to determine if there were statistically significant differences in the impact of the program between the three years. Due to the low n for each of the studies, we are aware that we are violating statistical computation assumptions, but offer the results as an indicator of the significance of these differences.

It appears that changes made to the teacher PD program in year three were effective at expanding teachers’ knowledge of accessible STEM teaching methods. Teachers in the third-year program had a higher summated mean score and higher mean scores for five of the six statements used to measure the program’s impact on the teacher’s teaching methods. (See Table 18 for a comparison of means.) Additionally, using an ANOVA, a statistically significant positive difference at the .05 level was found for two statements:

- Use of hands-on science lessons*
- Use of manipulatives to reinforce science content*

Table 18. Comparison of program impact on teacher’s teaching methods

	Year 1 Mean	Year 2 Mean	Year 3 Mean
Expand your knowledge of accessible lab equipment	4.29	4.00	4.62
Use of accessible lab equipment	4.00	3.8	4.46
Monitor young student’s behavior in science labs	3.43	3.75	4.08
Use of hands-on science lessons*	4.00	3.4	4.62
Ability to describe STEM content	3.86	3.4	3.85
Use of manipulatives to reinforce science content*	3.71	3.4	4.46
Summated Mean*	3.88	3.63	4.35

* $p < .05$
 n for Year 1=7
 n for Year 2=5
 n for Year 3 = 13
 1 (No impact) to 5 (Completely Changed)

The program appears to meet its objectives for the teachers in several different ways as illustrated by the mean scores in Table 19. In addition to learning alternatives techniques to engage students in STEM learning, teachers also developed an understanding of the characteristics of a successful blind person and learned how to connect with the NFB as evidenced by mean scores greater than 4.4 on a 5-point scale. Additionally, teachers developed higher expectations for their blind students in STEM subjects.

Table 19. Overall program impact

	Mean	Std. Dev.
Learned alternative techniques I can use to engage my students so that they can succeed in STEM learning	4.46	1.127
Developed an understanding of the characteristics of a successful blind person	4.69	0.630
Learned how to connect with the NFB network for additional professional development	4.69	0.855
After the NFB EQ Teacher Workshop, I have higher expectations for my blind students in STEM subjects	4.77	0.599
Prior to the NFB EQ Teacher Workshop, I had high expectations of my students during STEM classes	4.00	0.913

1 (Strongly Disagree) to 5 (Strongly Agree)
N varies from 24 - 25

An ANOVA was used to explore statistically significant differences on impact of the workshop between the three programs, and although none were found, three of the four statements, in addition to the summated mean score, were higher in year 3 and lower than both years 1 and 2 on one item as illustrated by Table 20.

The one statement rated lower in year 3, participant's expectations of their students prior to the NFB workshop, may be due in part to the composition of the participants. The year 3 program included several blind teachers. The sighted teachers may have revised their expectations of their blind students after working with the blind teachers participating in the workshop; who contributed their perspective and completed the same STEM experiments as the sighted-participants.

Table 20. Comparison of overall program impact

	Year 1 Mean	Year 2 Mean	Year 3 Mean
N=	7	5	13
Learned alternative techniques I can use to engage my students so that they can succeed in STEM learning	4.14	4.20	4.46
Developed an understanding of the characteristics of a successful blind person	4.43	4.00	4.69
Learned how to connect with the NFB network for additional professional development	4.71	4.20	4.69
After the NFB EQ Teacher Workshop, I have higher expectations for my blind students in STEM subjects	4.00	4.25	4.77
Prior to the NFB EQ Teacher Workshop, I had high expectations of my students during STEM classes	4.29	4.60	4.00
Summated Mean (Does not include Prior to the NFB Workshop)	4.32	4.16	4.65

1 (Strongly Disagree) to 5 (Strongly Agree)

Adaptive Tools and Lessons

Ways to adapt STEM lessons for the blind was a theme found in all three workshops. Throughout the Year 3 workshop, simple, effective, accessible tools of various types were highlighted. One teacher wrote, “what stands out for me are the quick and easy adaptations such as the jingle bells or making a reed out of a straw to make noise,” and another shared, “I definitely will use the idea of the notched syringe to measure out specific amounts of fluids.”

Conveying STEM content and strengthening STEM skills can be challenging for teachers, especially those that are typically dependent on visuals like measurement and looking through microscopes. One teacher shared, “I had major questions about how to make things like microscopes accessible. I found that during this workshop I learned how to alter my thinking around the finite of the activity to include the possibility of an alternative experience of the same concepts.” Another teacher shared, “Talking through some of the chemistry experiments, and discussions about what is actually “meaningful” for certain activities (e.g., using a microscope, etc.) were priceless. The experiments were icing on the cake to engage us and allow us to see what was truly important.”

Across the years, there were concerns about materials that might not be available or might be price prohibitive. Year 3 focused more intentionally around simple, inexpensive resources and adaptations and it appears the teachers in this session had more focused positive reaction to the workshop overall.

Other themes that emerged

There were a few other themes that emerged over the workshops in both comments made to the observers and in written comments as part of the questionnaire. The following capture some of the dominant themes across the three workshops.

Blind students as active participants

The first theme was that the workshop helped teachers better understand that their students can be “active participant[s] in all labs and not merely the note taker.” Teachers also realized that they need to understand the goals of the lesson in order to adapt it. A teacher stated, “One of the many things I learned is that a microscope lesson should have a goal. The teacher should know exactly what the students will see. There are many lessons that prior to this workshop my student that reads Braille [didn’t do] because the teacher assumed that she could not complete the assignment. Now, I know that she can complete all of the STEM activities.”

One teacher wrote, “Just knowing about all the possibilities for adapting science activities will help me to change my student’s learning. When a science teacher is planning an activity, I now have more answers as to how to adapt it. There is no excuse for not adapting or having a blind student sit out.” Finally, one teacher shared, “NFB provided such a great learning opportunity that engaged us, showed us, as teachers, what our students can do, and even put us in the place of our student (i.e., chainsaw [teachers were able to cut a piece of wood with a chainsaw while blindfolded]) to demonstrate that anything is possible.”

Teacher Confidence in Facilitating STEM Lessons

Teacher confidence in facilitating STEM learning appeared more evident in year three data than prior years. One teacher shared, “Prior to this workshop I was intimidated by STEM subjects. Now, I feel much more confident. I now know how to modify labs to create full accessibility.” Another teacher shared, “I am now planning to do a science experiment a month with my Braille readers so that they have an opportunity to practice using some of the lab equipment before needing to use it in class.” One teacher felt the program provided “a safe place to reveal inadequacies that exist for me as a teacher. The learning opportunities that came out of that were most helpful.”

Technical Drawing and STEM

There is little information about how spatial learning in blind youth relates to STEM-content, so a question was added to the questionnaire in year 3 to better gauge teachers’ feelings. In addition to learning how teachers felt about technical drawing and STEM, the NFB was also interested in what teachers thought about the drawing boards used to create tactile drawings.

During the program, teachers were offered the opportunity to use a drawing board in several lessons in order to better understand the contribution of raised line drawing to spatial learning for blind youth. Teachers found the drawing board helpful for themselves, but also believed they would be helpful to blind students and general education teachers. A blind student could use the

drawing board to create a tactile graphic to share their understanding of a concept while a general education teacher could use it to provide direct instruction as necessary. One teacher shared “Greater ease means greater accessibility!” and since the drawing boards were easy to use, she felt they would increase access for her blind students.

Additionally, peers could provide graphics for blind students. One teacher wrote, “the ability to have a peer provide the information to a student is truly priceless. By using the drawing board, a student could provide a tactile for a blind peer. It goes beyond STEM to greater life lessons, including the use of social skills.”

Finally, one participant shared about the popularity of the boards, writing, “I bought one of the boards for my personal use and showed it to my O&M and VRT staff today. They each want one, so I’ll be purchasing five more for the office. They will use it to teach handwriting, quick tactile maps, and lots more. I see these as having huge applicability for STEM as well. When the TVI’s not around to make a complex tactile graphic, the classroom teacher can just sketch something out for a blind student.”

Networking Opportunities

In response to the question, “What was the most important aspect of the NFB EQ Teacher Workshop for you, as a teacher?” the majority of teachers in all three years listed networking opportunities. One teacher wrote: “the most important thing for me was to make more connections. I enjoy seeing what our leaders in the field are doing and how I can become a better teacher.” Another “appreciated the collaboration with other teachers in the field, who like me, often work in isolation.”

In the year two professional development program, the need to network was evident. During the opening session one teacher asked if they could introduce themselves to each other after listening to the lead presenter go over the schedule and various logistical aspects of the program for 30 minutes. At the end of the planned activities that first evening, teachers stayed an additional 60 minutes in order to talk among themselves. This illustrates that the teachers need for networking opportunities was greater than the program’s provision and demonstrates the adaptability of the teachers to meet their needs within the constraints of the schedule.

One of the advantages of networking was “troubleshooting activities” with other teachers. Teachers were able to discuss strategies and lessons with each other, enabling them to learn from each other. Teachers made “lifetime connections that can be future resources” which “will enable [them] to better support [their] students in all areas.” One teacher felt enabled to “meet people who can help me with topics I don’t know as much about.”

As a result of participation in the Year 3 workshop, one of the participants set up “The Teachers of Blind STEM Students email group” which saw “some nice email traffic and collaboration.”

Satisfaction

Teachers interviewed throughout the experience were highly satisfied with the program. As teachers in the previous two workshops were highly satisfied with all aspects of the teacher program, these questions were omitted from the Year 3 teacher web-based survey; however, when asked if there was anything else they would like to share about their experience, eleven respondents took the opportunity to share how much they enjoyed and appreciated the workshop. Teacher comments included:

- “I loved the EQ Teacher Workshop. The agenda and learning outcomes met my needs fully. I would attend another EQ training.”
- “It was a great workshop. I would recommend it to other TVIs.”
- “Natalie is amazing. The work she did with us and the help she provided throughout the week was above and beyond. Every teacher I spoke to had their own plans about how to clone her and take her home with us! The whole experience was beyond what I could have imagined. Natalie brought the group together and I can honestly say I made connections that I will keep for life. Several of us have created plans to get together and attend other workshops together. Even right now I am speaking to a colleague from the event about braille and adaptations. The activities and guests that we spoke to honestly created the most profound learning experience I have ever been a part of.”

These findings are similar to the comments offered in years 1 and 2. The changes made to the program to focus more on networking increased the overall satisfaction and reduced the suggestions offered by the teachers. In years 1 and 2, the pulse interviews led to mid-stream corrections that carried over so that by year 3, the overall flow and content met the needs of networking, collaboration, resource exploration, and skill development.

Engineering Quotient Program

Program Description

The NCBYS intended to extend opportunities for informal science learning for the direct benefit of blind students to consider engineering careers through the following goals.

1. Educating blind youth about the techniques and tools used to be an effective engineer.
2. Contribute to the knowledge base of effective practices regarding STEM education for the blind.

To accomplish these goals, blind high school students (ages 13 – 22) participated in the National Federation of the Blind (NFB) Engineering Quotient (EQ) Program, held once during the summer of 2015 and twice during the summer of 2016 at the NFB Headquarters in Baltimore. This residential program served up to 20 blind high school students (ages 13-22) in each week-long program focused on engineering (based on the Project Lead the Way curriculum).

The program involved teens in a project-based learning simulation where they worked in small groups to build boats and design water filtration systems. This program was composed of two types of sessions:

1. Learning sessions, designed for the entire group, involved the content expert facilitating hands-on activities to provide all participants with a baseline knowledge of the concept, including engineering concepts, water filtration, and technical drawing.
2. Building sessions, where content experts supported teens as they constructed and refined their boat and water filtration systems.

On the last day of the program, teens went to a nearby lake and tested their boat and water filtration system before sharing what they learned throughout the week in a Student Showcase.

Methods

The evaluation focused on perceptions of process and measures of efficacy around the key themes. The evaluation questions that guided this evaluation were:

1. What is the participant's interest in STEM
2. What is the participant's intention to pursue STEM study and career
3. How does this program contribute to the participant's interest and intention toward STEM

Data for this program evaluation were collected from teens using three different methods:

1. Passive observations during the NFB EQ Program in year one and year two, session two. Observations were compared with the goals of the program.
2. Brief open-ended, semi-structured interviews were conducted with year one participants and year two, session two participants towards the end of the NFB EQ program.
3. All teens in year two were invited to complete a web-based questionnaire following the program.

The interview and questionnaire focused on the teens' interest in STEM, future career intentions, and the impact of the NFB EQ program.

Findings

Participants

There were 19 blind teens in Year one (2015), and 41 blind teens (grades 10 – 12) in year two (2016) with blind college students serving as teaching assistants, and three adult content experts in each year. Teen participants were observed as being a diverse group of race and ethnic backgrounds from throughout the United States. In year one and year two, second session, 12 of the 19 teens (62.3%) and 18 of 20 teens (90%) in Year two, session two, participated in interviews. Post-experience web-based questionnaires were completed by 14 of 40 (34%) in year two, session two.

Although all teen participants were considered blind, the 14 teens who completed the web-based survey shared additional information about their identity and tools they use to access written materials and computers.¹ Only three of 14 teens who completed the web-based survey identified as blind, eight identified as visually impaired. These teens shared that they used different methods

¹ Although data were not gathered as evidence, there was anecdotal observation that the youth who completed the web-based questionnaire seemed to be biased toward those who have some vision. This might alter some interpretations of the findings.

for accessing written materials, including large print (ten), audio (five), and braille (two). When accessing a computer, eight of the 14 teens used screen magnification while 3 teens used a screen reader.

Program Challenges

In Year 1, there was some confusion about the assignment. During the first two days of the program, several teens expressed frustration over the experts' inability to provide answers to their questions. One teen shared, "no one gives straight answers here," while another felt that the expert "twists and turns" answers when asked a question. While all participants felt some level of confusion, sketch designers appeared to have the most challenges. The sketch designers were tasked with designing the boat, but the expert boat builder had laid out a plan, so there was no authentic need for them to sketch a design. Additionally, the sketch designers were tasked with designing the paddle, but the boat builders had already created one. To alleviate the confusion, the Design Expert encouraged the sketch designers to pay attention during the boat building presentation for the larger group, because while "the builders may have already created [a paddle], they may make modifications."

Construction projects typically face supply issues, and this was the true for the NFB EQ year one program. On day two of the program, several boat builders found they had different-sized pvc pipe than the design specified. The Building Expert had included "thin wall" pvc pipe on his supply list, but this apparently was not available and thicker wall pvc pipe was obtained. Boat builders assessed their boats and made changes based on available supplies, but due to the lack of a water source, they were unable to test their boats.

In spite of these program challenges; observers noted the teens interest in STEM appeared to increase as they worked to achieve their objectives (build boat, create water filtration system, etc.), with some teens asking to work on their project during recreation time.

These concerns were fully addressed in Year 2 by redesigning the challenge and shifting the program to more focus on team work. In the Year 1 NFB EQ session, teens were assigned a role (i.e., builder, water specialist, or sketch designer) and focused solely on activities associated with their role. The Year 2 teens were encouraged to support each other by working together to complete the tasks. One teen interviewed shared that s/he "acquired a lot more patience. Dealing with different opinions [meant] compromise...I had to make sure everyone's voice was heard."

The Year 2 program supported the iterative engineering design process, which was limited in Year 1 to the water filtration system. In Year 2, teens were able to test their boat in portable pools set up in the NFB parking garage. In addition to more accurately modeling the engineering process, this experience provided critical feedback when teens realized their boat may not hold water.

Participant's interest in STEM

The majority of teens who participated in the NFB EQ program were interested in STEM. Year 2 data support the Year 1 findings that teens developed an interest in STEM due to 1) positive role models; and 2) learning experiences that engaged and encouraged teens. Additionally, these data found teens' interests in STEM were nurtured by the interactive nature of STEM and their blindness. A participant who was not interested in STEM attributed her lack of interest to a lack of modifications in her school science classes.

Observers noted the NFB EQ teens appeared to be interested in STEM; they were actively engaged in the activities presented during the program. In Year 1, six of the 12 teens interviewed credited their interest in STEM due to the influence of an individual or positive experience in either a formal or informal learning environment. Of the 18 teens interviewed in Year 2, 16 shared they were interested in either science, math, engineering, or technology. Teens completing the post-experience survey also expressed an interest in STEM, as evidenced by a mean of 4.286 on a 5-point scale in response to the statement "I look forward to science class"; however, questionnaire respondents appeared only slightly interested in STEM due to a summated mean of 3.744 for all statements on a STEM scale. (See Table 21.) While half of those interviewed (nine) have "always" been interested in a STEM subject, slightly more than one quarter (five) of those interviewed became interested in middle school (grades 6 and 7).

NFB EQ participants interviewed shared they engaged in a variety of STEM activities routinely; seven of the 18 interviewed were "always in contact with technology." They said they look things up on the internet, play video games, or use their smart phone, or BrailleNote. A smaller number, four of the 18, indicated they were interested in watching science documentaries or shows on television or YouTube; three indicated they enjoyed reading books related to STEM, and three others cited they were problem solvers, who "won't stop until they solve a problem." This is supported by the teens who completed the survey as evidenced by a mean of 4.286 on a 5-point scale in response to the statement "Find the information that I need to solve difficult problems". The findings also align with the qualitative findings from Year one in which the teens interest in STEM was evident through their daily routines, activities, and things like reading or watching STEM-related programs on television or You Tube.

Almost half of the teens interviewed (14 of 30 across the two years) cited their interest in STEM developed due to the influence of an individual or positive experience either in a formal or informal learning environment. One teen attributed her interest to her "6th grade science teacher [who] was really cool--she made things easier for me," while another attributed his interest to family, "Always been a fan of math. My cousins, one is a computer hardware engineer and one is a software engineer. They got me into it." One teen shared she "took all the classes in school, they were fun." Her enjoyment for the classes appears to stem from the interactive experiences, she "graphs triangles and squares in math class with accessible peg boards and rubber bands. Can physically feel the triangle." Outside of school programs were also credited for an interest in STEM, including robotics teams and science museums.

The engaging nature of science sparked an interest in six of the Year 2 interviewees, paralleling the finding in Year 1. These teens shared they "like to build things," "play with Legos", and "do hands

on” science. Several teens were interested in technology that assists “blind people.” One teen credited his interest in technology to a challenging experience. “I’ve been interested in technology since I was 3. My first experience with the Braille and Speak 1000 ...It crashed! I was 3, so I didn’t understand. I asked ‘how could that happen?’” That’s how “I got hooked.” In year one, the moment for one teen was when she realized “I can do this.”

Survey respondents indicated they would rather solve a problem in science class by doing an experiment (\bar{x} =4.0 on 5-point scale) and believe more time should be spent on hands-on projects in science class (\bar{x} =3.86), as illustrated in Table 21. One teen interviewed shared, “Always liked science, like to build things, always been interested in the background, behind the scenes, what makes something work,” and another stated, “Always liked . . . building with Legos.” The findings also align with the qualitative findings from Year 1 in which the teens’ interest in STEM was evident through their daily routines, activities, and things like to read or watch on television or YouTube.

Table 21. Teens interest towards STEM

	Mean	Std. Dev.
I look forward to science class in school.	4.29	0.914
I look forward to math class in school.	3.50	1.345
I would rather solve a problem in science class by doing an experiment than be told the answer.	4.00	1.038
More time should be spent on hands-on projects in science class.	3.86	1.167
Science is too hard when it involves math. (Reverse Coded)	3.57	0.852
Science is a difficult subject. (Reverse Coded)	3.57	1.016
Doing experiments in science class is frustrating. (Reverse Coded)	3.43	1.222
Summated Mean (with reverse coding)	3.74	

1 (Strongly Disagree) to 5 (Strongly Agree)
N= 14

Generally, means were slightly positive, but overall the youth say they look forward to science class. One uninterested teen believed school has hindered her interest in science. She said, “Not interested in science, always had trouble with accessibility, especially in 9th grade. Bio was hard, teacher didn’t get me diagrams or braille textbook.” This statement reinforces the need for modifications to support learning in the traditional classroom.

Participant’s intention to pursue STEM study and career

The majority of the teens interviewed (23 of 30 in both years) or surveyed (9 of 14 in Year 2) plan to pursue a STEM-related career. Of those interviewed, nine hope to work with computer or video-game technology as a programmer, hardware engineer or video game designer.

Four teens would like to work in a field that supports adaptive technology, believing they can serve the blind community through technology. One teen wants to be a “software developer, especially for the blind. My dream is to work with the Accessibility Group at Google.” Another wants to be in a classroom teaching technology to blind children. Where she lives, “there’s hardly any assistance, technology-wise, for blind children.” Another wants to work with virtual reality. He believes virtual reality has the potential to not “require eyes--it’s all neuro stuff....No one knows when the

perfect mechanical eyes will come out. Also, VR is for everyone.” The fourth intends to earn a Ph.D. in physics and work in the sound industry around noise cancelling headphones.

The NFB EQ program gave teens more confidence to pursue their goals, solidified the goals they had previous to the program, or provided insight into additional STEM-related careers. In response to the interview question, did this workshop have any impact on what you plan to do when you are 30 years old? one teen interviewed shared, it gave me “more confidence to keep doing what I want,” and another stated “that no one can stop me.” Teens who gained additional insight stated, the workshop “opened my eyes to even more options in the field,” and “it gave me some confidence that I can probably do some mechanical stuff.”

The four teens interviewed from Year 2 who plan to pursue a non-STEM career intend to follow their passion, including music, social work, and teaching. The two teens in Year 1 who expressed interest in non-STEM careers believe they will integrate STEM into their chosen field, one through environmental law rather than criminal law, and the teen who plans to be a journalist believes he will focus on the sciences.

NFB EQ’s contribution to the participant’s interest and intention toward STEM

Year 2 data supports Year 1 findings on how this experience contributes to teen’s interest and intention toward STEM. As with Year 1, teen participants were asked by the experts to reflect on what they learned during the NFB EQ program that would be helpful when they returned to school in the fall. Teens participating in interviews were asked a similar question. As with Year 1, themes that emerged from the group discussion and interviews include:

- Increased interest in STEM
- Increased knowledge of STEM
- Introduction and experience working with adaptive STEM tools such as the talking tape measure, clicking rulers, and talking salinity meters
- Drawing skills
- Creative thinking and problem solving
- Teamwork

Commensurate with Year 1 findings, Year 2 data found teens interviewed went beyond STEM skills in describing the benefits of this program. Larger themes identified during interviews included:

- Increased self-confidence
- Increased confidence in specific abilities
- Opportunities to Network with like-minded peers

Teens learned “there is a lot more to engineering than putting a plan together and building.” Teens who completed the survey believe the workshop increased their interest and understanding of STEM. This is evidenced by the mean rating of statements designed to measure the impact of the NFB EQ workshop, including “The NFB EQ workshop helped them understand engineering better” (\bar{x} =4.39 on a 5-point scale) and “Increased my confidence in my ability to participate in engineering projects or activities” (\bar{x} = 4.14). See Table 22.

Table 22. Impact of the NFB workshop

	Mean	Std. Dev.
The NFB EQ workshop helped me understand engineering better.	4.39	0.870
The NFB EQ workshop led me to a better understanding of my own career goals.	3.93	0.917
The NFB EQ workshop increased my interest to study science and engineering.	3.64	1.277
The NFB EQ workshop increased my ability to understand geometric shapes and engineering drawings.	3.36	0.842
The NFB EQ workshop made me think more about what I will do after graduating from high school.	4.00	0.679
Made me think about different classes I might take in school (including college) than I had planned.	3.21	1.188
Increased my confidence in my ability to participate in engineering projects or activities.	4.14	0.949

1 (Strongly Disagree) to 5 (Strongly Agree)
N=14

All of the teens in this program were observed using the adapted construction and STEM tools; nine teens interviewed shared about their measurement experiences using talking tape measures, clicking rulers, and talking salinity meters. The development of measuring skills is fundamental to engineering and measuring can be challenging for blind youth who lack accessible equipment. Teens (nine of 18 interviewed) appreciated the introduction to and opportunity to use the adapted tools that enabled them to fully participate in activities, i.e., the talking tools and tactile drafting board. One teen who was unaware of these tools shared, “there is accessible equipment--I can use equipment that is close to what sighted people use, like braille rulers.” Another teen stated, “No one’s told me I can’t do this, but the tools weren’t always available.”

Teens in this program had the opportunity to measure using talking tape measures and click rulers; which allowed teens the opportunity to develop organizational skills. One teen stated that if PVC piping is “not measured--you have to do it again, but there’s not much left. So you need to plan ahead. Usually, I just start building and if I make a mistake, I’ll start over, but you can’t always do that.” Another teen shared, “I like to wing it, so when we were building the boat I didn’t measure carefully, and we had to go back and cut it again. ...so I learned I have to be more precise.”

Additionally, students developed their technical drawing skills and the ability to create something from a drawing. Of the teens interviewed, five noted that they increased their drawing skills and two their creativity. One teen stated, “I increased my drawing skills. The drawing board helps me--the texture, how it feels to let your emotions out with a single line.” Another stated that “visualizations have gotten easier (going from drawing to model to prototype).” One teen found the need to “be more creative. Think a little more. Picture an idea in my head before you go out and do it.” Creativity also engenders “different ways to solve a problem.”

Teens improved on the interpersonal skills necessary to complete complex engineering tasks; noting communication and teamwork are key to the success of any project, “when it comes to engineering it takes many people to get something done.” One teen interviewed stated, “You have to talk with your teammates...Working as a team, that’s the big one.” Three teens “thought engineering was a solo profession;” they “didn’t realize how many people it took to build

something.” One teen shared, “I don't like to work in teams...I just figured out if I want to be an engineer I have to work with someone even if I don't like it.”

Finally, several participants interviewed cited a feeling of accomplishment and an increase in self-confidence after successfully building a boat and filtering water, activities they typically don't do as part of their normal routine. One teen stated she “didn't know that you could use power tools to build, even if you can't see it, you can feel it and build it just the same.” She was “going to tell teacher at school that she can build something out of PVC pipes.”

NFB EQ's contribution to the participant's spatial learning

Year 1 findings uncovered that drawing appears to help blind students develop their spatial learning skills and suggested it would be beneficial to integrate technical drawing more effectively into all processes, i.e., boat building and water filtering. To better understand the impact of technical drawing on spatial learning, Year 2 teens interviewed and surveyed were asked about the impact of the drawing boards, a tool that produced raised line drawings that allowed teens to feel the drawing.

The majority of teens interviewed (14 of 18) and surveyed (9 of 14) in Year 2 found the drawing boards helpful. Those who did not (3 interviewed and 1 surveyed) tended to have more sight and did not feel a personal need for the tool.

Teens recognized the utility of the drawing boards for sharing spatial information or designs with visually impaired people. One teen stated, “normally, the lines blur in my vision, but with the board I was able to actually feel the lines,” another thought that “the drawing board helped me feel what shape I drew.”

Beyond the utilitarian aspects, 14 teens (9 interviewed and 5 surveyed) believe that the raised line drawings increased their understanding of science and math concepts, including scale drawings and isometric shapes. One teen interviewed realized the drawing board would have been helpful in her geometry class.

Other teens talked about how the drawings increased their understanding of the “relationship between art and engineering...the boards helped me realize that it's a strong relationship.” One teen shared “you need to be able to drawing something before you can build it,” and another shared “When you draw it, you can really see how it's going to come together.”

The teens who had more sight often felt bored by lessons or tools that they didn't need (or needed a different level of instruction). They would've appreciated a wider range of approaches to cater to their abilities and needs.

Resources for Engagement of Blind Youth in STEM Education

Several resources will be shared as a result of this project. The survey research, led by Dr. Tiffany Wild, The Ohio State University, was constrained by the Institutional Review Board. Three concerns led to restrictions on releasing data, including any findings, reports, or articles while the project was on-going: 1) the low number of youth; 2) the special population being studied; and 3) the video and photo capture of the youth participating. While the ultimate concern was to protect the youth participants from being identified, now that the program is completed, this has abated and the findings can be disseminated.

For those reasons, the dissemination work has just begun. Data have been analyzed and reviewed, and manuscripts are in various stages of completion. The COV has no doubts that the research will be published. Discussions with the researcher acknowledged the challenge of publishing small N projects in some journals, including some that would be highly appropriate for the content of the articles. As of the official end of the project in terms of programming, there are at least nine articles in preparation and planning.

The articles in preparation include:

1. Wild, T., Shaheen, N., Koehler, K. & Fast, D. (submitted June 2017). Students' with visual impairments level of engagement in science and engineering practices. *Journal of Blindness, Innovation, and Research*.
2. The data for the parent study is extremely rich. Additionally, it is the first time this type of research has been conducted with parents of blind youth. The first choice for this article is *Journal of Visual Impairment and Blindness*; however, the length restrictions for this journal require the researcher to present only the higher level integrative findings. This article will reference a third article, in a lower tier journal, that includes the breadth and depth of the parent study findings.
3. The misconceptions students have will be captured in a fourth article for publication later in the cycle. These data are still being coded and the writing will be done in late summer or early autumn. The target journal is *the Journal of Blindness, Innovation, and Research*.

The COV also notes the great importance of sharing this information within the NFB membership and shared that recommendation with the researcher. The findings will be important for the membership both in terms of what has been learned, and also in terms of reinforcing NFB's role in doing important work in many different areas of life.

Additional articles are planned. They will focus on the following topics:

4. Student self-efficacy was, not surprisingly, quite high for the youth as youth self-selected into the program. Dr. Kathleen Farrand is taking the lead on writing the self-efficacy study article as she is known for her work in this area. The primary article coming from this work will be completed in July 2017.

5. The teacher efficacy data revealed correlations, with a few surprises, primary of which was that the teachers felt least efficacious in teaching science to the Blind youth. This article will be completed in the early autumn of 2017.
6. One article will focus on what was learned from the museum employees. The smallness of the post data set, which makes sense given the nature of how museums work, allows for the article to be focused solely on the pre-data.
7. There are plans for integrating some of the evaluation and the research data into at least one article. Initial plans are to focus on an article for *Science Education for Students with Disabilities*, focusing on the informal constructs of learning and the elements of the program that resonated with the youth. A second article might emerge and be developed for the *Journal of Visual Impairment and Blindness* that would focus on the workshop/camp type approach and the benefits to the youth of this type of program.

There is also attention being given to dissemination at conferences. Though the presentation for the Council for Exceptional Children 2017 conference was not selected for presentation, there is a proposal submitted for the Council for Exceptional Children 2018 conference and another planned for the Ohio Center for Autism and Low Incidence conference in 2019. There are also discussions for collaborating with the evaluation team on a presentation related to the museum staff who were engaged in the project.

In final review, the COV notes that although the delay in releasing data was significant in reporting the findings, there is evidence of clear progress to finalize the research and disseminate the findings. All research questions are being integrated into the papers and presentations. Appropriate rigor was applied in both the design and in the analysis across the study components which suggest the final papers will ultimately be accepted.

Conclusions and Recommendations

Three overarching goals were framed for the project. This accountability evaluation looked across the activities and the data sources to ask the question, did the project meet each of its goals:

- Contribute to the knowledgebase of effective practices regarding STEM education for the blind;
- Educate families, blind youth, future educators, and museum personnel about the techniques and tools used to effectively engage blind youth in informal and formal STEM settings; and
- Strengthen STEM teaching resources for engagement of blind youth in STEM education.

Overall, participants were satisfied with the program. Youth liked the STEM activities, museum visit, and the meals. Parents/caregivers and teachers believe the staff went above and beyond to accommodate their needs.

Youth valued their program for providing opportunities to be independent and be with peers. They developed their blindness skills (especially cane skills), science process skills, and team building skills. Youth believed these skills would help them both in and out of school. Parents/caregivers believe the youth program helped their child develop science skills and the skills necessary to be successful in society. Youth intend to use the team building and science process skills they learned in their workshop in their science classes. They also believe that the life and blindness skills they learned/reviewed during the workshop would be useful throughout life.

Parents/caregivers and teachers valued the opportunity their respective programs provided for networking with others in similar situations. Additionally, parents learned to connect with the National Federation of the Blind, their child's rights, and how to advocate for their child within the school system.

Teachers expanded their abilities to use accessible lab equipment and hands-on STEM lessons with their students. Teachers intend to connect with the NFB network for additional professional development and expand their use of accessible lab equipment and hands-on STEM activities with their students.

Museum staff valued their training for increasing their awareness to the issues faced by blind visitors. Museum staff value all visitors and this training provided them additional skills to assist blind visitors. During the training, museum staff increased their skills to effectively describe science content and assist blind visitors throughout the museum. Museum staff feel more confident in helping blind visitors and intend to add additional braille signage and new programs which are not as reliant on visual cues.

Regarding the specific goals of the project, the accountability evaluation asks the questions, to what degree did the project meet each of its goals?

1. Did the project contribute to the knowledgebase of effective practices regarding STEM education for the blind?

To some degree. Through this project, there are several legacy outcomes. The reports of the program efforts singly are available on informal.science.org. An article entitled, *Accommodating Blind Learners Helps All Learners*, by the authors of this evaluation and Natalie Shaheen, NCBYS Program Director, was published in the *Journal of Museum Education* (March 2016). This article shares the lessons learned by the authors that highlight effective practices to enhance museum learning for blind visitors and how by using these methods, museum educators can create stronger education programs for everyone. An additional article, focused on adapting classroom science lessons for the blind, at the time of this report preparation was nearing completion for submission to the National Science Teachers Association journal *Science and Children*.

2. Did the project educate families, blind youth, future educators, and museum personnel about the techniques and tools used to effectively engage blind youth in informal and formal STEM settings?

Yes. Parents and youth valued the youth program because the children were able to learn science content and visit a science museum with other blind youth. Youth intend to use the team building and science process skills they learned in their workshop in their science classes.

Parents believe they learned alternative techniques their child could use to succeed in STEM learning and how to connect with the NFB. Parents who attended two NFB STEM2U programs, one in year one and a second in year two, noted the increased focus on STEM and appreciated learning of resources and tools that would support their child.

Apprentices successfully mentored blind youth engaged in STEM learning. Apprentices learned ways to monitor youth as they used accessible STEM equipment. Additionally, this experience supported apprentices in skill development that may support their general endeavors as blind people and their ability to take on a mentoring and leadership role with blind youth and STEM.

The museum staff training increased staffs' comfort and confidence level with blind visitors and their ability to determine and properly offer assistance to a blind visitor. Staff credit the workshop with a personal awareness of the importance of descriptive language, the development of tactile maps for the museum, and stronger relationships with existing groups that serve the blind. The museums have also all undertaken important efforts to make their facilities or programs more inclusive for the blind. The host museums are all, in their own ways and timelines, changing in ways that make them more accessible to and welcoming of the local blind communities which is an important legacy element of this project.

The NFB EQ program appears to have met its goal of nurturing teens' interest in STEM and encouraging them to consider STEM careers by providing a robust STEM program with activities

that teens were successfully able to complete. Teens in this program were:

- Introduced and gained experience working with adaptive STEM tools such as the talking tape measure, clicking rulers, and talking salinity meters
- Introduced and gained experience with drawing tools to increase teen's drawing skills
- Provided opportunities to develop creative thinking and problem solving skills
- Given the opportunity to work with others to complete a task

Additionally, raised-line technical drawing increased teen's spatial understanding of science and math concepts, including scale drawings and isometric shapes. Technical drawings also appear to increase teen's understanding of the importance of drawing as an engineering tool.

3. Did the project strengthen *STEM teaching* resources for engagement of blind youth in STEM education?

To a great degree. Teacher participants were able to learn about tools for adapting science, develop support networks, and participate in hands-on STEM activities they can replicate with their students. This has led to an increased confidence in teachers for facilitating STEM-activities for their students. The teachers were also able to experience a variety of tools and exposed to other adaptive approaches that they could share with colleagues.

To support teachers, the NFB created and maintains a website, <http://www.blindscience.org/nfb-eg-teacher-instructional-website>, to support teachers and parents with accessible STEM lessons, tools, and techniques. Lessons, with modifications to increase accessibility, are available for elementary, middle and high school teachers on a variety of topics, including alka seltzer rockets, earthquake resistant buildings, and the Enzyme Function of Liver Peroxidase (a.k.a, Catalase). To increase accessibility for all lessons, there is a list of tools (including pictures, purchasing, and use information) that can assist teachers in making STEM lessons accessible for the blind, including talking tape measures, tactile astronomy books, and molecular model kits. Finally, there are names and contact information for several blind individuals working in STEM. These individuals are willing to support teachers as they adapt science lessons for the blind.

The project supported the development of a raised-line technical drawing process which, in application, increased teen's spatial understanding of science and math concepts, including scale drawings and isometric shapes. Technical drawings also appear to increase teen's understanding of the importance of drawing as an engineering tool. These and other adaptive teaching resources used in the workshops, and tested by the youth and teachers are part of the NFB's resources for educators and families.

Appendix A

NFB STEM2U Student Post-Evaluation Questions

I'm going to read you a series of questions and responses. First I'll read the question, then I'll read all the answers, so you know what choices you have. Then I'm going to read the answer choices one at a time and ask you to stand up (by your chair) when I read the answer you agree with. Does that make sense? When you stand up to answer the question, I need to count, so stay standing until I tell you to sit down. Do you have any questions about what we are going to do?

Demographics

1. OK, the first question is—What grade are you in? Your answer choices are First, Second, Third, Fourth, Fifth, Sixth, Seventh, and Eighth. Is there anyone who isn't sure what grade you are in?

Stand up if you are in first grade. Second. Third. Fourth. Fifth. Sixth. Seventh. Eighth.

2. That went well, the second question is What is your favorite subject? I'm only giving you four choices, so you need to pick your favorite from one of these four—English, Math, Science and Social Studies. Think about it for a moment.

3.

OK, stand up if your favorite subject of the four is English. Math. Science. Social Studies.

Now I need you to sit in your seat. The next set of questions may have longer answers and each of you may have a different answer. So after I ask the question, if you'd like to answer it, please say your name and I'll call on you. Does that make sense?

Skills

4. What skills (things you can do) are you better at because of activities you did here at the NFB STEM2U program?

Value/Intention

5. How will what you learned here help you in your science or math class?
6. How will what you learned here help you outside of school, in your everyday life?

Importance

7. What was most important about the time you spent at the NFB STEM2U program? (This can be open ended or like the multiple choice questions above based on children's experiences at the NFB STEM2U program; i.e., time at the museum, building the car?)

Satisfaction

8. What was the best part of the NFB STEM2U program? Why?
9. What was the worst part of the NFB STEM2U program? Why?

Now we are going to move again. Like I did when we started, I'll read the question, then I'll read all the answers, so you know what choices you have. Then I'm going to read the answer choices one at

a time and ask you to stand up (by your chair) when I read the answer you agree with. I hope you are you still with me, we'll be finished soon. These questions

10. Did you like what you ate? Your answer choices are
- I really didn't like it and I would never eat it again
 - I didn't like it but I would eat it if there was nothing else
 - It was OK
 - I liked it and would eat it again
 - I really liked it and I want to eat it again soon

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

11. Did you like where you slept?
- I really didn't like it, I didn't sleep well
 - I didn't like it, but I slept
 - It was OK
 - I liked it and I slept well
 - I really liked it and I want to come back and sleep here again

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

12. How did you feel about the STEM activities (anything to do with designing your recycled racer)?
- I really didn't like the activities, I never want to do them again
 - I didn't like it
 - It was OK
 - I liked it
 - I really liked it and I want to do more STEM activities

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

13. How did you feel about your time exploring the museum?
- I really didn't like it, I never want to do it again
 - I didn't like it
 - It was OK
 - I liked it
 - I really liked it and I want to go back to the museum tomorrow

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

14. Would you tell a good friend who is blind and likes science and math to sign up for this program?
- I really didn't like it, so I wouldn't tell a friend to sign up for it
 - I didn't like it
 - It was OK

- d. I liked it
- e. I really liked it and I think others will like it.

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

15. Would you do it again?

- a. I really didn't like it, I never want to do it again
- b. I didn't like it, but I might do it again.
- c. It was OK
- d. I liked it, but I don't want to do it again
- e. I really liked it and I don't want to leave

Stand up if you really didn't like it. Didn't like it. It was OK. You liked it. You really liked it.

16. And for the last question, let's do this a little differently. This time, instead of standing, just raise your hand when you hear the answer you most agree with. And remember, like with all the other questions, if you feel uncomfortable answering, you can choose not to. Now I'd like to know the kind of grades you usually get in science? Once again, I need you to raise your hand to help me understand your answer. Your answer choices here are A, B, C, D. Is there anyone who doesn't get grades? Or gets grades by numbers instead of letters?

Raise your hand if you usually get an A in Science. B. C. D.

Thank you very much!

NFB STEM2U Parent Immediate - Post-Program Evaluation

To help the organizers of the NFB STEM2U program better understand your experience, please take 10 minutes to answer the following questions.

The following set of questions deal with your satisfaction of various aspects of the NFB STEM2U program

How satisfied were you with the application process for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the application process for the NFB STEM2U program
- 2. I was dissatisfied with the application process for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the application process for the NFB STEM2U program
- 4. I was satisfied with the application process for the NFB STEM2U program
- 5. I was very satisfied with the application process for the NFB STEM2U program

What did you think about the pre-visit information for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the pre-visit information for the NFB STEM2U program
- 2. I was dissatisfied with the pre-visit information for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the pre-visit information for the NFB STEM2U program
- 4. I was satisfied with the pre-visit information for the NFB STEM2U program
- 5. I was very satisfied with the pre-visit information for the NFB STEM2U program

What did you think about the meals for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the meals for the NFB STEM2U program
- 2. I was dissatisfied with the meals for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the meals for the NFB STEM2U program
- 4. I was satisfied with the meals for the NFB STEM2U program
- 5. I was very satisfied with the meals for the NFB STEM2U program

What did you think about the sleeping arrangements for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied

- 1. I was very dissatisfied with the sleeping arrangements for the NFB STEM2U program
- 2. I was dissatisfied with the sleeping arrangements for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the sleeping arrangements for the NFB STEM2U program
- 4. I was satisfied with the sleeping arrangements for the NFB STEM2U program
- 5. I was very satisfied with the sleeping arrangements for the NFB STEM2U program

What did you think about the schedule for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the schedule for the NFB STEM2U program
- 2. I was dissatisfied with the schedule for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the schedule for the NFB STEM2U program
- 4. I was satisfied with the schedule for the NFB STEM2U program
- 5. I was very satisfied with the schedule for the NFB STEM2U program

What did you think about the social time activities during the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the social time activities for the NFB STEM2U program
- 2. I was dissatisfied with the social time activities for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the social time activities for the NFB STEM2U program
- 4. I was satisfied with the social time activities for the NFB STEM2U program
- 5. I was very satisfied with the social time activities for the NFB STEM2U program

What did you think of the staff for the NFB STEM2U program? Enter a 1 if you were Very Dissatisfied, 2 for Dissatisfied, 3 for Neither Dissatisfied or Satisfied, 4 for Satisfied, and 5 for Very Satisfied.

- 1. I was very dissatisfied with the staff for the NFB STEM2U program
- 2. I was dissatisfied with the staff for the NFB STEM2U program
- 3. I was neither dissatisfied or satisfied with the staff for the NFB STEM2U program
- 4. I was satisfied with the staff for the NFB STEM2U program
- 5. I was very satisfied with the staff for the NFB STEM2U program

In the next set of questions you will be asked to consider how important aspects of the NFB STEM2U program were to you.

How important is it to you that your child learn science content? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important for my child to learn science content
- 2. It is Unimportant for my child to learn science content
- 3. It is Neither Unimportant or Important for my child to learn science content
- 4. It is Important for my child to learn science content
- 5. It is Extremely Important for my child to learn science content

How important is it to you that your child experience independence by visiting a science museum? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not AT All Important that my child experience independence by visiting a science museum
- 2. It is Unimportant that my child experience independence by visiting a science museum
- 3. It is Neither Unimportant or Important that my child experience independence by visiting a science museum
- 4. It is Important that my child experience independence by visiting a science museum
- 5. It is Extremely Important that my child experience independence by visiting a science museum

How important Is it to you that your child experience fun activities as part of the program? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important..

- 1 It is Not At All Important for my child to experience fun activities as part of the program
- 2. It is Unimportant for my child to experience fun activities as part of the program
- 3. It is Neither Unimportant or Important for my child to experience fun activities as part of the program
- 4. It is Important for my child to experience fun activities as part of the program
- 5. It is Extremely Important for my child to experience fun activities as part of the program

How important is the NFB reputation to you when choosing programs for your child? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important..

- 1. The NFB reputation is Not At All Important when choosing a program for my child
- 2. The NFB reputation is Unimportant when choosing a program for my child
- 3. The NFB reputation is Neither Unimportant or Important when choosing a program for my child
- 4. The NFB reputation is Important when choosing a program for my child
- 5. The NFB reputation is Extremely Important when choosing a program for my child

How important is it to you that your child participates in programs with other blind youth? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important..

- 1. It is Not At All Important that my child participates in programs with other blind youth
- 2. It is Unimportant that my child participates in programs with other blind youth
- 3. It is Neither Unimportant or Important that my child participates in programs with other blind youth
- 4. It is Important for my child to participate in programs with other blind youth
- 5. It is Extremely Important for my child to participate in programs with other blind youth

How important is it to you that you participate in programs with parents of blind youth? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important..

- 1. It is Not At All Important for me to participate in programs with parents of blind youth
- 2. It is Unimportant for me to participate in programs with parents of blind youth
- 3. It is Neither Unimportant or Important for me to participate in programs with parents of blind youth
- 4. It is Important for me to participate in programs with parents of blind youth
- 5. It is Extremely Important for me to participate in programs with parents of blind youth

How important is it to you that your child participates in programs with blind teens as group leaders? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important for me that my child participates in programs that have blind teens as group leaders
- 2. It is Unimportant for me that my child participates in programs that have blind teens as group leaders
- 3. It is Neither Unimportant or Important for me that my child participates in programs that have blind teens as group leaders
- 4. It is Important for me that my child participates in programs that have blind teens as group leaders
- 5. It is Extremely Important for me that my child participates in programs that have blind teens as group leaders

In the next set of questions you will be asked to consider how important aspects of the NFB STEM2U program were for your child.

How important do you think it is to your child that s/he learn science content? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important to my child that s/he learn science content
- 2. It is Unimportant to my child that s/he learn science content
- 3. It is Neither Unimportant or Important to my child that s/he learn science content
- 4. It is Important to my child that s/he learn science content
- 5. It is Extremely Important to my child that s/he learn science content

How important do you think it is to your child that s/he visit a science museum? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important to my child that s/he visit a science museum
- 2. It is Unimportant to my child that s/he visit a science museum
- 3. It is Neither Unimportant or Important to my child that s/he visit a science museum
- 4. It is Important to my child that s/he visit a science museum
- 5. It is Extremely Important to my child that s/he visit a science museum

How important do you think it is to your child that fun activities were part of the program? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important to my child that fun activities were part of the program
- 2. It is Unimportant to my child that fun activities were part of the program
- 3. It is Neither Unimportant or Important to my child that fun activities were part of the program
- 4. It is Important to my child that fun activities were part of the program
- 5. It is Extremely Important to my child that fun activities were part of the program

How important do you think the NFB reputation is to your child? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. The NFB reputation is Not At All Important to my child
- 2. The NFB reputation is Unimportant to my child
- 3. The NFB reputation is Neither Unimportant or Important to my child
- 4. The NFB reputation is Important to my child
- 5. The NFB reputation is Extremely Important to my child

How important do you think it is to your child that s/he participate in programs with other blind youth? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important to my child that s/he participate in programs with other blind youth
- 2. It is Unimportant to my child that s/he participate in programs with other blind youth
- 3. It is Neither Unimportant or Important to my child that s/he participate in programs with other blind youth
- 4. It is Important to my child that s/he participate in programs with other blind youth
- 5. It is Extremely Important to my child that s/he participate in programs with other blind youth

How important do you think it is to your child that s/he participates in programs with blind teens as group leaders? Enter 1 for Not At All Important, 2 for Unimportant 3 for Neither Unimportant or Important, 4 for Important, 5 for Extremely Important.

- 1. It is Not At All Important to my child that s/he participate in programs that have blind teens as group leaders
- 2. It is Unimportant to my child that s/he participate in programs that have blind teens as group leaders
- 3. It is Neither Unimportant or Important to my child that s/he participate in programs that have blind teens as group leaders
- 4. It is Important to my child that s/he participate in programs that have blind teens as group leaders
- 5. It is Extremely Important to my child that s/he participate in programs that have blind teens as group leaders

At the NFB STEM2U program, my child developed blindness skills (braille, cane travel, self-advocacy). Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: My child developed blindness skills at the NFB STEM2U program
- 2. I disagree with the statement: My child developed blindness skills at the NFB STEM2U program
- 3. I neither disagree or agree with the statement: My child developed blindness skills at the NFB STEM2U program
- 4. I agree with the statement: My child developed blindness skills at the NFB STEM2U program
- 5. I strongly agree with the statement: My child developed blindness skills at the NFB STEM2U program

At the NFB STEM2U program, my child developed science skills. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: My child developed science skills at the NFB STEM2U program
- 2. I disagree with the statement: My child developed science skills at the NFB STEM2U program
- 3. I neither disagree or agree with the statement: My child developed science skills at the NFB STEM2U program
- 4. I agree with the statement: My child developed science skills at the NFB STEM2U program
- 5. I strongly agree with the statement: My child developed science skills at the NFB STEM2U program

At the NFB STEM2U program, my child developed social skills. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: My child developed social skills at the NFB STEM2U program
- 2. I disagree with the statement: My child developed social skills at the NFB STEM2U program
- 3. I neither disagree or agree with the statement: My child developed social skills at the NFB STEM2U program
- 4. I agree with the statement: My child developed social skills at the NFB STEM2U program
- 5. I strongly agree with the statement: My child developed social skills at the NFB STEM2U program

At the NFB STEM2U program, my child developed skills to be successful in society. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, my child developed skills to be successful in society.
- 2. I disagree with the statement: At the NFB STEM2U program, my child developed skills to be successful in society
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, my child developed skills to be successful in society
- 4. I agree with the statement: At the NFB STEM2U program, my child developed skills to be successful in society
- 5. I strongly agree with the statement: At the NFB STEM2U program, my child developed skills to be successful in society

At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting.
- 2. I disagree with the statement: At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting.
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting.
- 4. I agree with the statement: At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting.
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned my rights and the rights of my child in the school setting.

At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting.
- 2. I disagree with the statement: At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting.
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting.
- 4. I agree with the statement: At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting.
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned how to advocate for my child if their rights are violated in the school setting.

At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren). Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren).
- 2. I disagree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren).
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren).
- 4. I agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren).
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network to acquire information for myself and my child (ren).

At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning
- 2. I disagree with the statement: At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning
- 4. I agree with the statement: At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned alternative techniques my child can use to succeed in STEM learning

What was the most valuable aspect of the NFB STEM2U program for you, as a parent?

What do you think was the most valuable aspect of the NFB STEM2U program for your child?

If there was one thing you would change about the NFB STEM2U program, what would that be?

Are you blind or low vision?

- Yes
- No

One last question, is there anything else you would like to share about your experience with the NFB STEM2U program?

Thank you so much for answering our questions. Have a great day!

NFB STEM2U Parent Delayed - Post-Program Evaluation

During the past two years, you attended a NFB STEM2U regional program with your child. We would like you to take a moment and reflect on that experience to help us better understand the long-term impact (if any) of this program. Please take 10 minutes to answer the following questions. Your answers are anonymous and all our responses are reported for the entire group. Only you can tell us how you believe this program affected your child.

In this set of questions you will be asked to consider the impact of the NFB STEM2U program on your child. Enter a 1 if you Strongly Disagree, a 2 if you Disagree, a 3 if you Neither Disagree or Agree, a 4 if you Agree, or a 5 if you Strongly Agree with each of the following statements.

After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).

- I strongly disagree with the statement: After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).
- I disagree with the statement: After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).
- I neither disagree or agree with the statement: After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).
- I agree with the statement: After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).
- I strongly agree with the statement: After attending the NFB STEM2U program, I believe my child is more interested in STEM (science, technology, engineering, and/or math).

At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.

- I strongly disagree with the statement: At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.
- I disagree with the statement: At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.
- I neither disagree or agree with the statement: At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.
- I agree with the statement: At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.
- I strongly agree with the statement: At the NFB STEM2U program, my child developed science skills (increased ability to measure, ask questions that can be investigated, record data, etc.) that they have used in school or at home.

At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.

- I strongly disagree with the statement: At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.
- I disagree with the statement: At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.
- I neither disagree or agree with the statement: At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.
- I agree with the statement: At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.
- I strongly agree with the statement: At the NFB STEM2U program, my child learned science content knowledge that they have used in school or at home.

Participation in the NFB STEM2U program helped my child better solve problems.

- I strongly disagree with the statement: Participation in the NFB STEM2U program helped my child better solve problems.
- I disagree with the statement: Participation in the NFB STEM2U program helped my child better solve problems.
- I neither disagree or agree with the statement: Participation in the NFB STEM2U program helped my child better solve problems.
- I agree with the statement: Participation in the NFB STEM2U program helped my child better solve problems.
- I strongly agree with the statement: Participation in the NFB STEM2U program helped my child better solve problems.

Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.

- I strongly disagree with the statement: Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.
- I disagree with the statement: Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.
- I neither disagree or agree with the statement: Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.
- I agree with the statement: Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.
- I strongly agree with the statement: Participation in the NFB STEM2U program increased my child's ability to work with groups of children on specific tasks.

Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.

- I strongly disagree with the statement: Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.
- I disagree with the statement: Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.
- I neither disagree or agree with the statement: Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.
- I agree with the statement: Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.
- I strongly agree with the statement: Because my child participated in the NFB STEM2U program, I believe s/he is less afraid to fail at a difficult task.

Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.

- I strongly disagree with the statement: Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.
- I disagree with the statement: Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.
- I neither disagree or agree with the statement: Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.
- I agree with the statement: Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.
- I strongly agree with the statement: Participation in the NFB STEM2U program increased my child's interested in his/her school STEM classes.

Participation in the NFB STEM2U program increased my child's awareness of STEM careers.

- I strongly disagree with the statement: Participation in the NFB STEM2U program increased my child's awareness of STEM careers.
- I disagree with the statement: Participation in the NFB STEM2U program increased my child's awareness of STEM careers.
- I neither disagree or agree with the statement: Participation in the NFB STEM2U program increased my child's awareness of STEM careers.
- I agree with the statement: Participation in the NFB STEM2U program increased my child's awareness of STEM careers.
- I strongly agree with the statement: Participation in the NFB STEM2U program increased my child's awareness of STEM careers.

Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.

- I strongly disagree with the statement: Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.
- I disagree with the statement: Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.
- I neither disagree or agree with the statement: Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.
- I agree with the statement: Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.
- I strongly agree with the statement: Participation in the NFB STEM2U program increased my child's interest in pursuing a STEM career.

At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.

- I strongly disagree with the statement: At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.
- I disagree with the statement: At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.
- I neither disagree or agree with the statement: At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.
- I agree with the statement: At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.
- I strongly agree with the statement: At the NFB STEM2U program, my child developed social skills that continue to be useful at home, school, and in the community.

At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.

- I strongly disagree with the statement: At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.
- I disagree with the statement: At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.
- I neither disagree or agree with the statement: At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.
- I agree with the statement: At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.
- I strongly agree with the statement: At the NFB STEM2U program, my child developed skills that continue to help him/her be successful in society.

After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.

- I strongly disagree with the statement: After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.
- I disagree with the statement: After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.
- I neither disagree or agree with the statement: After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.
- I agree with the statement: After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.
- I strongly agree with the statement: After attending the NFB STEM2U program, my child exhibited improved blindness skills (blind technology, braille, cane travel, self-advocacy) which continue to help him/her be successful.

After attending the NFB STEM2U program, my child exhibited signs of increased independence.

- I strongly disagree with the statement: After attending the NFB STEM2U program, my child exhibited signs of increased independence.
- I disagree with the statement: After attending the NFB STEM2U program, my child exhibited signs of increased independence.
- I neither disagree or agree with the statement: After attending the NFB STEM2U program, my child exhibited signs of increased independence.
- I agree with the statement: After attending the NFB STEM2U program, my child exhibited signs of increased independence.
- I strongly agree with the statement: After attending the NFB STEM2U program, my child exhibited signs of increased independence.

After attending the NFB STEM2U program, my child wanted to visit another Science Center.

- I strongly disagree with the statement: After attending the NFB STEM2U program, my child wanted to visit another Science Center.
- I disagree with the statement: After attending the NFB STEM2U program, my child wanted to visit another Science Center.
- I neither disagree or agree with the statement: After attending the NFB STEM2U program, my child wanted to visit another Science Center.
- I agree with the statement: After attending the NFB STEM2U program, my child wanted to visit another Science Center.
- I strongly agree with the statement: After attending the NFB STEM2U program, my child wanted to visit another Science Center.

After attending the NFB STEM2U program, my child wanted to attend another NFB program.

- I strongly disagree with the statement: After attending the NFB STEM2U program, my child wanted to attend another NFB program.
- I disagree with the statement: After attending the NFB STEM2U program, my child wanted to attend another NFB program.
- I neither disagree or agree with the statement: After attending the NFB STEM2U program, my child wanted to attend another NFB program.
- I agree with the statement: After attending the NFB STEM2U program, my child wanted to attend another NFB program.
- I strongly agree with the statement: After attending the NFB STEM2U program, my child wanted to attend another NFB program.

My child has kept in contact with friends s/he made at the NFB STEM2U program.

- I strongly disagree with the statement: My child has kept in contact with friends s/he made at the NFB STEM2U program.
- I disagree with the statement: My child has kept in contact with friends s/he made at the NFB STEM2U program.
- I neither disagree or agree with the statement: My child has kept in contact with friends s/he made at the NFB STEM2U program.
- I agree with the statement: My child has kept in contact with friends s/he made at the NFB STEM2U program.
- I strongly agree with the statement: My child has kept in contact with friends s/he made at the NFB STEM2U program.

Please share any changes in your child that you believe are a result of the NFB STEM2U program (STEM, problem solving, perseverance, social skills, blindness skills, etc.). Specific examples would be appreciated.

What about you? The next set of questions focus on how the NFB STEM2U program affected you. Enter a 1 if you Strongly Disagree, a 2 if you Disagree, a 3 if you Neither Disagree or Agree, a 4 if you Agree, or a 5 if you Strongly Agree with each of the following statements.

I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.

- I strongly disagree with the statement I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.
- I disagree with the statement: I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.
- I neither disagree or agree with the statement: I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.
- I agree with the statement: I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.
- I strongly agree with the statement: I use alternative techniques that I learned at the NFB STEM2U program to support my child explore STEM.

I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.

- I strongly disagree with the statement: I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.
- I disagree with the statement: I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.
- I neither disagree or agree with the statement: I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.
- I agree with the statement: I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.
- I strongly agree with the statement: I have advocated for my child's rights in the school setting using knowledge that I learned at the NFB STEM2U program.

I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.

- I strongly disagree with the statement: I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.
- I disagree with the statement: I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.
- I neither disagree or agree with the statement: I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.
- I agree with the statement: I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.
- I strongly agree with the statement: I have met with my child's teachers and asked for specific accommodations (that I learned about at the NFB STEM2U program) for STEM classes.

I have connected with the NFB Network to acquire information for myself and/or my child.

- I strongly disagree with the statement: I have connected with the NFB Network to acquire additional information for myself and/or my child.
- I disagree with the statement: I have connected with the NFB Network to acquire additional information for myself and/or my child.
- I neither disagree or agree with the statement: I have connected with the NFB Network to acquire additional information for myself and/or my child.
- I agree with the statement: I have connected with the NFB Network to acquire additional information for myself and/or my child.
- I strongly agree with the statement: I have connected with the NFB Network to acquire additional information for myself and/or my child.

I have kept in contact with other parents I met during the NFB STEM2U program.

- I strongly disagree with the statement: I have kept in contact with other parents I met during the NFB STEM2U program.
- I disagree with the statement: I have kept in contact with other parents I met during the NFB STEM2U program.
- I neither disagree or agree with the statement: I have kept in contact with other parents I met during the NFB STEM2U program.
- I agree with the statement: I have kept in contact with other parents I met during the NFB STEM2U program.
- I strongly agree with the statement: I have kept in contact with other parents I met during the NFB STEM2U program.

What techniques that you learned at the NFB STEM2U program, if any, are you using to support your child's interests and abilities (STEM, social skills, blindness skills, etc.)?

What was the greatest value you found in the NFB STEM2U program for you? and your child?

Do you consider yourself blind or low vision?

- Yes
- No

Which NFB Regional STEM2U program (s) did you participate? (Check all that apply)

- Baltimore, MD
- Boston, MA
- Columbus, OH
- Phoenix, AZ
- San Francisco, CA
- Minneapolis, MN

One last question, is there anything else you would like to share about the impact of the NFB STEM2U program on you and/or your child?

Thank you so much for answering our questions. Have a great day!

NFB STEM2U Teacher Post-Program Evaluation

To help the organizers of the NFB STEM2U program better understand your experience, please take 10 minutes to answer the following questions.

The following set of questions deal with your satisfaction of various aspects of the NFB STEM2U program

Please rate your level of satisfaction with the Pre-Visit Information of the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- I was very dissatisfied with the Pre-Visit Information of the NFB STEM2U Program.
- I was dissatisfied with the Pre-Visit Information of the NFB STEM2U Program.
- I was neither dissatisfied nor satisfied with the Pre-Visit Information of the NFB STEM2U Program.
- I was satisfied with the Pre-Visit Information of the NFB STEM2U Program.
- I was very satisfied with the Pre-Visit Information of the NFB STEM2U Program.

Please rate your level of satisfaction with the Sleeping Arrangements of the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with the Sleeping Arrangements of the NFB STEM2U Program.
- 2. I was dissatisfied with the Sleeping Arrangements of the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with the Sleeping Arrangements of the NFB STEM2U Program.
- 4. I was satisfied with the Sleeping Arrangements of the NFB STEM2U Program.
- 5. I was extremely satisfied with the Sleeping Arrangements of the NFB STEM2U Program.

Please rate your level of satisfaction with NFB STEM2U Program Schedule of the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with NFB STEM2U Program Schedule of the NFB STEM2U Program.
- 2. I was dissatisfied with NFB STEM2U Program Schedule of the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with NFB STEM2U Program Schedule of the NFB STEM2U Program.
- 4. I was satisfied with NFB STEM2U Program Schedule of the NFB STEM2U Program.
- 5. I was extremely satisfied with NFB STEM2U Program Schedule of the NFB STEM2U Program.

Please rate your level of satisfaction with the meals of the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with the meals of the NFB STEM2U Program.
- 2. I was dissatisfied with the meals of the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with the meals of the NFB STEM2U Program.
- 4. I was satisfied with the meals of the NFB STEM2U Program.
- 5. I was very satisfied with the meals of the NFB STEM2U Program.

Please rate your level of satisfaction with the Social Time activities provided at the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with the Social Time of the NFB STEM2U Program.
- 2. I was dissatisfied with the Social Time of the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with the Social Time of the NFB STEM2U Program.
- 4. I was satisfied with the Social Time of the NFB STEM2U Program.
- 5. I was very satisfied with the Social Time of the NFB STEM2U Program.

Please rate your level of satisfaction with Staff of the NFB STEM2U Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with Staff of the NFB STEM2U Program.
- 2. I was dissatisfied with Staff of the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with Staff of the NFB STEM2U Program.
- 4. I was satisfied with Staff of the NFB STEM2U Program.
- 5. I was very satisfied with Staff of the NFB STEM2U Program.

What was the most important aspect of the NFB STEM2U program for you, as a teacher?

What do you believe was the most important aspect of the NFB STEM2U program for the students?

In the next set of questions, you will be asked to reflect on the NFB STEM2U programs impact on your teaching.

To what extent, if at all, will the NFB STEM2U Program change your ability to monitor young students' behavior in the Science Lab? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change the way you monitor your students' behavior.

- The NFB STEM2U Program had no impact on my ability to monitor young students' behavior in the Science Lab.
- The NFB STEM2U Program had little impact on my ability to monitor young students' behavior in the Science Lab.
- The NFB STEM2U Program had some impact on my ability to monitor young students' behavior in the Science Lab.
- The NFB STEM2U Program had a great deal of impact on my ability to monitor young students' behavior in the Science Lab.
- The NFB STEM2U Program will completely change the way I monitor young students' behavior in the Science Lab.

To what extent, if at all, will the NFB STEM2U Program change your use of accessible lab equipment to blind students? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change your use of accessible lab equipment with blind students.

- The NFB STEM2U Program had no impact of my use of accessible lab equipment with blind students
- The NFB STEM2U Program had little impact on my use of accessible lab equipment to blind students.
- The NFB STEM2U Program had some impact on my use of accessible lab equipment to blind students.
- The NFB STEM2U Program had a great deal of impact on my use of accessible lab equipment to blind students.
- The NFB STEM2U Program will completely change my use of accessible lab equipment to blind students.

To what extent, if at all, will the NFB STEM2U Program change your use of hands-on science lessons with blind students? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change the way you monitor your students' behavior.

- The NFB STEM2U Program had no impact on my use of hands-on science lessons with blind students.
- The NFB STEM2U Program had little impact on my use of hands-on science lessons with blind students.
- The NFB STEM2U Program had some impact on my use of hands-on science lessons with blind students.
- The NFB STEM2U Program had a great deal of impact on my use of hands-on science lessons with blind students.
- The NFB STEM2U Program will completely change the way I use hands-on science lessons with blind students.

To what extent, if at all, will the NFB STEM2U Program change your use of manipulatives to reinforce content with blind students? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change the way you monitor your students' behavior.

- The NFB STEM2U Program had no impact on my use of manipulatives to reinforce content with blind students.
- The NFB STEM2U Program had little impact on my use of manipulatives to reinforce content with blind students.
- The NFB STEM2U Program had some impact on my use of manipulatives to reinforce content with blind students.
- The NFB STEM2U Program had a great deal of impact on my use of manipulatives to reinforce content with blind students.
- The NFB STEM2U Program will completely change the way I use manipulatives to reinforce content with blind students.

To what extent, if at all, will the NFB STEM2U Program change your ability to describe STEM content to blind students? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change the way you monitor your students' behavior.

- The NFB STEM2U Program had no impact on my ability to describe STEM content to blind students.
- The NFB STEM2U Program had little impact on my ability to describe STEM content to blind students.
- The NFB STEM2U Program had some impact on my ability to describe STEM content to blind students.
- The NFB STEM2U Program had a great deal of impact on my ability to describe STEM content to blind students.
- The NFB STEM2U Program will completely change how I describe STEM content to blind students.

At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning
- 2. I disagree with the statement: At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning
- 4. I agree with the statement: At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned alternative techniques I can use to help my students succeed in STEM learning

At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I Strongly Disagree with the statement: At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person.
- 2. I Disagree with the statement: At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person.
- 3. I Neither Disagree or Agree with the statement: At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person.
- 4. I Agree with the statement: At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person.
- 5. I Strongly Agree with the statement: At the NFB STEM2U program, I developed an understanding of the characteristics of a successful blind person.

At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I strongly disagree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development.
- 2. I disagree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development.
- 3. I neither disagree or agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development.
- 4. I agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development.
- 5. I strongly agree with the statement: At the NFB STEM2U program, I learned how to connect with the NFB network for additional professional development.

After the NFB STEM2U program, I have high expectations for my blind students in STEM subjects. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I Strongly Disagree with the statement: After the NFB STEM2U program, I have higher expectations for my blind students in STEM subjects.
- 2. I Disagree with the statement: After the NFB STEM2U program, I have higher expectations for my blind students in STEM subjects.
- 3. I Neither Disagree or Agree with the statement: After the NFB STEM2U program, I have higher expectations for my blind students in STEM subjects.
- 4. I Agree with the statement: After the NFB STEM2U program, I have higher expectations for my blind students in STEM subjects.
- 5. I Strongly Agree with the statement: After the NFB STEM2U program, I have higher expectations for my blind students in STEM subjects.

Prior to the NFB STEM2U program, I had high expectations of my students during STEM classes. Enter a 1 if you Strongly Disagree, 2 if you Disagree, 3 if you Neither Disagree or Agree, 4 if you Agree, and 5 if you Strongly Agree.

- 1. I Strongly Disagree with the statement: Prior to the NFB STEM2U program, I had high expectations for my blind students in STEM subjects.
- 2. I Disagree with the statement: Prior to the NFB STEM2U program, I had high expectations for my blind students in STEM subjects.
- 3. I Neither Disagree or Agree with the statement: Prior to the NFB STEM2U program, I had high expectations for my blind students in STEM subjects.
- 4. I Agree with the statement: Prior to the NFB STEM2U program, I had high expectations for my blind students in STEM subjects.
- 5. I Strongly Agree with the statement: Prior to the NFB STEM2U program, I had high expectations for my blind students in STEM subjects.

Will anything you observed or learned during the NFB STEM2U program change the way you teach?

Finally, we'd like to find out a little bit about you and your teaching environment. Are you blind or visually impaired?

- Yes
- No

What subject(s) do you teach? (check all that apply)

- Science - general/integrated
- Life Sciences / Biology
- Physics
- Chemistry
- Earth Sciences / Astronomy
- Math
- Computer Science / Technology
- History
- Language Arts
- Other, please specify any other subjects _____

What grade levels do you teach? (check all that apply)

- Primary grades (K-3)
- Middle grades (4-8)
- High School grades (9-12)

Including this school year, how long have you been teaching?

- This is/was my first year
- 1-5 years
- 6-10 years
- 11-15 years
- More than 15 years

Is there anything else you would like to share about your experience with the NFB STEM2U program?

Thank you for answering our questions. Have a great day!

NFB STEM2U Museum Staff Post-Program Evaluation

To help the organizers of the NFB STEM2U program better understand your experience with the museum staff training, please take 10 minutes to answer the following questions.

The next two questions deal with your satisfaction of various aspects of the NFB STEM2U museum staff training program

Please rate your level of satisfaction with NFB STEM2U Museum Staff Training Program Schedule. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with the NFB STEM2U Program Schedule.
- 2. I was dissatisfied with the NFB STEM2U Program Schedule.
- 3. I was neither dissatisfied nor satisfied with the NFB STEM2U Program Schedule.
- 4. I was satisfied with the NFB STEM2U Program Schedule
- 5. I was extremely satisfied with the NFB STEM2U Program Schedule.

Please rate your level of satisfaction with Staff and Volunteers of the NFB STEM2U Museum Staff Training Program. Enter a 1 if you were Very Dissatisfied, 2 if you were Dissatisfied, 3 if you were Neither Dissatisfied or Satisfied, 4 if you were Satisfied, and a 5 for Very Satisfied.

- 1. I was very dissatisfied with Staff for the NFB STEM2U Program.
- 2. I was dissatisfied with Staff for the NFB STEM2U Program.
- 3. I was neither dissatisfied nor satisfied with Staff for the NFB STEM2U Program.
- 4. I was satisfied with Staff for the NFB STEM2U Program.
- 5. I was very satisfied with Staff for the NFB STEM2U Program.

What was the most important aspect of the NFB STEM2U Museum Staff Training program for you?

In the next set of questions, you will be asked to reflect on the NFB STEM2U programs impact on your work at the museum.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program changed your comfort level with blind visitors in your museum? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely changed your comfort level with blind visitors in your museum.

- The NFB STEM2U Program had no impact on my comfort level with blind visitors in my museum.
- The NFB STEM2U Program had little impact on my comfort level with blind visitors in my museum
- The NFB STEM2U Program had some impact on comfort level with blind visitors in my museum
- The NFB STEM2U Program had a great deal of impact on my comfort level with blind visitors in my museum
- The NFB STEM2U Program completely changed my comfort level with blind visitors in my museum

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program altered your confidence level in working with blind visitors in your museum? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely altered your confidence level in working with blind visitors in your museum.

- The NFB STEM2U Program had no impact on my confidence level in working with blind visitors in my museum.
- The NFB STEM2U Program had little impact on my confidence level in working with blind visitors in my museum.
- The NFB STEM2U Program had some impact on my confidence level in working with blind visitors in my museum.
- The NFB STEM2U Program had a great deal of impact on confidence level in working with blind visitors in my museum.
- The NFB STEM2U Program completely altered my confidence level in working with blind visitors in my museum.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program expanded your knowledge of accessibility and universal design and how it pertains to museums? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely expanded your knowledge of accessibility and universal design and how it pertains to museums.

- The NFB STEM2U Program had no impact of my knowledge of accessibility and universal design and how it pertains to museums.
- The NFB STEM2U Program had little impact on my knowledge of accessibility and universal design and how it pertains to museums.
- The NFB STEM2U Program had some impact on my knowledge of accessibility and universal design and how it pertains to museums.
- The NFB STEM2U Program had a great deal of impact on my knowledge of accessibility and universal design and how it pertains to museums.
- The NFB STEM2U Program completely changed my knowledge of accessibility and universal design and how it pertains to museums.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program will alter your everyday museum program and exhibit experiences? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it will completely change the way your everyday museum program experiences.

- The NFB STEM2U Program had no impact on our everyday museum program experience.
- The NFB STEM2U Program had little impact on our everyday museum program experience.
- The NFB STEM2U Program had some impact on our everyday museum program experience.
- The NFB STEM2U Program had a great deal of impact on our everyday museum program experience.
- The NFB STEM2U Program completely changed our everyday museum program experience.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program changed your ability to describe STEM content to blind visitors? Enter a 1 if it had no impact, 2 if it had little

impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely changed your ability to describe STEM content to blind visitors.

- The NFB STEM2U Program had no impact on my ability to describe STEM content to blind visitors.
- The NFB STEM2U Program had little impact on my ability to describe STEM content to blind visitors.
- The NFB STEM2U Program had some impact on my ability to describe STEM content to blind visitors.
- The NFB STEM2U Program had a great deal of impact on my ability to describe STEM content to blind visitors.
- The NFB STEM2U Program completely changed how I describe STEM content to blind visitors.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program changed your ability to describe STEM content to all visitors? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely changed your ability to describe STEM content to all visitors.

- The NFB STEM2U Program had no impact on my ability to describe STEM content to all visitors.
- The NFB STEM2U Program had little impact on my ability to describe STEM content to all visitors.
- The NFB STEM2U Program had some impact on my ability to describe STEM content to all visitors.
- The NFB STEM2U Program had a great deal of impact on my ability to describe STEM content to all visitors.
- The NFB STEM2U Program completely changed how I describe STEM content to all visitors.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program changed your ability to determine if assistance is needed by a blind visitor? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely changed my ability to determine if assistance is needed by a blind visitor.

- The NFB STEM2U Program had no impact on my ability to determine if assistance is needed by a blind visitor.
- The NFB STEM2U Program had little impact on my ability to determine if assistance is needed by a blind visitor.
- The NFB STEM2U Program had some impact on my ability to determine if assistance is needed by a blind visitor.
- The NFB STEM2U Program had a great deal of impact on my ability to determine if assistance is needed by a blind visitor.
- The NFB STEM2U Program completely changed my ability to determine if assistance is needed by a blind visitor.

To what extent, if at all, do you believe the NFB STEM2U Museum Staff Training Program changed your ability to properly offer assistance to a blind visitor? Enter a 1 if it had no impact, 2 if it had little impact, 3 if it had some impact, 4 if it had a great deal of impact, and a 5 if it completely changed my ability to properly offer assistance to blind visitors.

- The NFB STEM2U Program had no impact on my ability to properly offer assistance to a blind visitor.
- The NFB STEM2U Program had little impact on my ability to properly offer assistance to a blind visitor.
- The NFB STEM2U Program had some impact on my ability to properly offer assistance to a blind visitor.
- The NFB STEM2U Program had a great deal of impact on my ability to properly offer assistance to a blind visitor.
- The NFB STEM2U Program completely changed my ability to properly offer assistance to a blind visitor.

Identify and explain 2 examples of tools, resources, services and/or environmental features that currently exist at your museum that can facilitate full participation by blind visitors.

Identify and explain at least one tool, resource, or service that you believe your museum is considering adding that can facilitate full participation by blind visitors.

Will anything you observed or learned during the NFB STEM2U Museum Staff Training Program change your work at your museum? If so, please share specific examples.

Finally, we'd like to find out a little bit about you and your museum environment. With which museum do you work?

- Port Discovery
- Museum of Science
- COSI

Are you blind or low vision?

- Yes
- No

How would you describe your role at your museum (check all that apply)

- Educator
- Exhibits Design/Development
- Marketing
- Finance
- Visitor Services

Including this year, how long have you worked in the informal learning/museum field?

- This is/was my first year
- 2-5 years
- 6-10 years
- 11-15 years
- More than 15 years

Is there anything else you would like to share about your experience with the NFB STEM2U program?

Thank you for answering our questions. Have a great day!