

# Big Bang! An Evaluation of NASA's Space School Musical

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## Executive Summary

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The performing arts offer a powerful way to engage students in science. Research suggests that performing arts tools, such as songs and drama, can effectively build student knowledge and interest. In providing these opportunities to students through out-of-school time programs, students have more time and freedom to explore topics.

Space School Musical offers an innovative learning and professional development opportunity that combines the performing arts with science learning. Out-of-school time (OST) facilitators participate in Space School Musical professional development and bring the information back to their students, who then can learn and build space science knowledge and interest through song and dance.

The purpose of this study was to conduct a formative and summative evaluation of Space School Musical for NASA's Discovery and New Frontiers Programs. The study answered eight evaluation questions related to professional development experiences, program implementation and perceptions, and student impacts.

### Program Professional Development

#### KEY QUESTION:

How do attendees perceive the quality and utility of the professional development sessions for Space School Musical?

Attendees perceived the professional development experience to be of high quality, with 95% to 99% of participants providing positive ratings on multiple aspects of workshop quality (e.g., format, delivery, pace). Attendees shared that the

hands-on, engaging environment, and upbeat presenter all contributed to their positive perceptions.

At the end of the professional development sessions, 84% to 96% of attendees shared that they would use the Space School Musical resources with their students.

### Program Implementation and Perceptions

#### KEY QUESTION:

How do facilitators integrate the activities into their OST programs?

Space School Musical facilitators used the program and activities in different ways in their out-of-school time programs. For example, some sites did a few songs, while others produced an entire production.

#### KEY QUESTION:

What are facilitators' perceptions of the ease of implementation of the activities and what are their suggestions for improvement? How does the program work for varied student learners?

Facilitators believed the program was easy to use, with 90% to 97% of facilitators mentioning that it was at least somewhat easy to use Space School Musical resources with their students. Additionally, the majority of facilitators (98%) thought the resources provided by the program were at least somewhat effective.

There was also a common belief that the program worked well for varied student learners. Facilitators shared that the program worked well with English language learners, special needs students, and students of different ages.

**KEY QUESTIONS:**

What did students like best and least about Space School Musical? What do facilitators perceive as program strengths?

Students greatly enjoyed a wide variety of program aspects including the different songs and performing opportunities. The majority of students (78%) did not mention anything that they disliked and the only common dislike (3%) related to specific songs.

Facilitators believed that the program excels in three main areas. First, the combination of the performing arts and activities helped build student excitement for science. Second, students had fun participating in the musical. Finally, facilitators shared that the program offers something for everyone, allowing students to participate in a variety of ways.

## Student Impacts

**KEY QUESTION:**

How does participation in Space School Musical impact student interest and engagement in space science related topics?

Space School Musical had a positive impact on student interest and engagement in space science. The majority of students (78% to 92%) and facilitators (79% to 86%) reported higher levels of student science interest and engagement after participating in the musical. Additionally, a large percentage of students (45% to 58%) and facilitators (50%) mentioned that students were more interested in science careers after the musical. Facilitators also shared that students had a growing interest in learning more about science, and showed

high levels of engagement in the program's songs and music videos.

**KEY QUESTION:**

How does exposure to project activities impact student understanding of targeted space science concepts?

Students learned a great deal about space science from the musical. The majority of students (88%) and facilitators (86%) believed that students had a greater understanding of space science concepts present in the musical. Facilitators shared that students retained what they learned and were able to share information with others.

**KEY QUESTION:**

How does participation in Space School Musical impact students personally and socially?

Students and facilitators also noted positive personal benefits of participation. Most students (70% to 76%) reported feeling better about their overall self and academic self after participating in the musical. Similarly, 60% to 68% of facilitators noted positive personal changes in students, such as higher confidence and self-esteem. In interview feedback, facilitators shared examples of students showing increased confidence, leadership, and greater creativity.

Additionally, students and facilitators referenced positive social changes. Most students (60%) and facilitators (62%) believed students made new friends after participating in Space School Musical. Additionally, 69% to 79% of facilitators observed other positive social changes, such as more positive social interactions and more peer respect and acceptance.

Facilitators shared that the musical effectively brought students together without making anyone feel isolated. There was a role and a part for everyone.

## Summary

Overall, professional development attendees, program facilitators, and students had positive perceptions of their experiences with Space School Musical. Professional development attendees found

the session to be useful and of high quality, and planned to use the materials with their students. Program facilitators believed implementation was easy and that the program worked well for varied student learners. Finally, facilitators and students shared the common belief that program participation positively impacted student interest, knowledge, personal characteristics, and social interactions.

# Acknowledgements

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We would like to thank Shari Asplund from NASA's Discovery and New Frontiers Programs for her time, investment, and support of the Space School Musical study. We would also like to thank Kellee McQuinn for her time conducting Space School Musical professional development sessions and administering surveys. We have greatly enjoyed seeing space science in a different way through the collaborative venture of Shari and Kellee. We would also like to thank the many facilitators and students from across the country that provided program feedback through surveys and interviews. Finally, we would like to thank our colleagues at Magnolia Consulting who supported this study, especially Dr. deKoven Pelton, Elizabeth Peery, and Beverly Bunch.

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# Introduction

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The performing arts offer a powerful way to engage students in science learning. Research suggests that content-rich songs enhance student understanding of science concepts by helping them develop content-based vocabulary, providing examples and explanations of concepts, and connecting to personal and situational interest in a topic (Governer, Hall & Jackson, 2013). Songs can be effective especially when combined with other methods that reinforce the concepts being taught (Hoffman, 2013), such as drama. For example, studies in English language arts find that when students use drama to plan their writing or engage in reading comprehension, they have higher quality writing and greater reading comprehension compared to students who use traditional writing and reading techniques (DuPont, 1992; Moore & Caldwell, 1993). When songs and drama are combined into an engaging science lesson, students can find personal value and enjoyment in science, which can predict further interest in engaging with science topics (Ainley & Ainley, 2011).

Out-of-school time (OST) programs offer a unique opportunity for engaging students in performing arts and science learning outside of the classroom. An OST program can have the time and freedom to incorporate longer activities in a less formal setting that builds upon learning in the standard school curriculum. To be effective, OST programs should develop thoughtful and engaging activities, build on student interest, and motivate and engage students in learning (Beckett, et al., 2009).

Building upon the understanding of the role of the performing arts in increasing student knowledge and interest, and on best practices in OST learning, NASA's Discovery and New Frontiers Programs in association with Jet Propulsion Laboratory, Marshall Space Flight Center, and KidTribe developed Space School Musical. Space School Musical consists of a set of nine songs and 36 educational activities designed to teach elementary and middle school learners about the solar system and space science. The musical follows an engaging storyline about a girl trying to complete a science project for school as she takes a "trip" through the solar system in song and dance. The Space School Musical website provides OST educators with resources to teach the space science concepts and to help educators put on their own musical. Additionally, program personnel provide professional development opportunities to OST educators to build their capacity to use the resources and incorporate the musical into their curriculum.

To understand how well the Space School Musical program is meeting its goal of preparing educators to implement Space School Musical with students, and to understand how the program is affecting interest and learning in students, NASA's Discovery and New Frontiers Programs Education and Public Outreach manager contracted with Magnolia Consulting, an external evaluation company to conduct an evaluation of the Space School Musical program. The purpose of this study was to conduct a formative and summative evaluation of NASA's Space School Musical, using the feedback of program facilitators and students. This final report describes the evaluation design, participants, professional development, program implementation, and student impacts, and is followed by a summary of results along with recommendations for improvement.

# Evaluation Design

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The mixed method evaluation design included formative and summative components. Formative evaluation information provided feedback to program developers on suggested revisions designed to improve users experience with Space School Musical. Summative evaluation information addressed progress made by Space School Musical toward intended program outcomes. The key evaluation questions were as follows:

## Formative Questions

1. How do attendees perceive the quality and utility of the professional development sessions for Space School Musical?
2. How do facilitators integrate the activities into their out-of-school-time (OST) programs?
3. What are facilitators' perceptions of the ease of implementation of the activities and what are their suggestions for improvement?
4. What did students like best and least about Space School Musical?
5. What do facilitators perceive as program strengths?

## Summative Questions

1. How does participation in Space School Musical impact student interest and engagement in space science related topics?
2. How does exposure to project activities impact student understanding of targeted science concepts?
3. How does participation in Space School Musical impact students personally and socially?

## Measures

To collect educator, facilitator, and student feedback on their experiences using Space School Musical, evaluators developed three surveys, one facilitator interview protocol, and conducted one professional development observation. Evaluators developed all measures collaboratively with Discovery and New Frontiers Programs Education and Public Outreach manager. However, evaluators were responsible for all data collection, analysis, and interpretation.

### Professional Development Feedback Survey

The Space School Musical professional development presenter administered a survey at the conclusion of one-time professional development sessions for OST program educators. The survey included 15 questions related to training organization, delivery, materials, and resources, and requested open-ended feedback related to value and suggestions for improvement.

### Educator Follow-Up Survey

Evaluators distributed a 32-question, online survey at least three months after educators participated in a Space School Musical professional development session. The purpose of the survey was to gather feedback related to program implementation, specifically how the

program was implemented, ease of use and delivery, and perceptions related to impacts on student interest, knowledge, personal characteristics, and social interactions. Respondents who provided a mailing address received a NASA Cosmic Connection poster as a token of appreciation for their time and feedback.

### Student Survey

Evaluators sent a student survey to a sample of OST program facilitators who used Space School Musical with their learners. The 19-question survey included Likert scale and open-ended items that addressed learner feedback related to formative outcomes, including interest and engagement, knowledge, personal characteristics, and social interactions.



*Figure 1. Student drawing of participating in Space School Musical (Student survey).*

### Facilitator Interviews

Two evaluators individually interviewed a sample of OST program facilitators who implemented Space School Musical using a 13-question interview protocol. The purpose of these 20-minute interviews was to gain an in-depth understanding of program implementation and perceptions of student impacts. Interviewees received a NASA Art and the Cosmic Connection poster as a token of appreciation for their feedback.

### Professional Development Observation

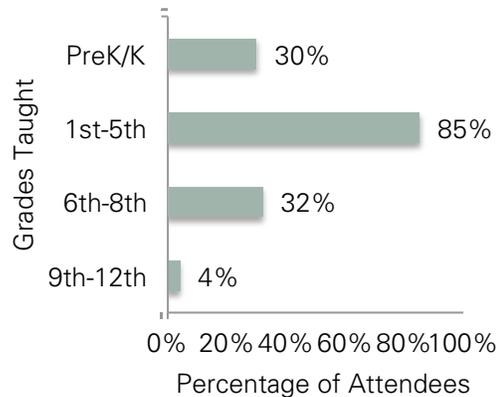
One evaluator attended a Space School Musical professional development session on January 29, 2013. The purpose of the observation was to document the nature of professional development activities and interactions among educators and the presenter.

# Participants

This section describes the participants for the professional development feedback, educator follow-up survey, student survey, and facilitator interviews, and is followed by a geographic map of data collection locations.

## Professional Development Feedback Survey

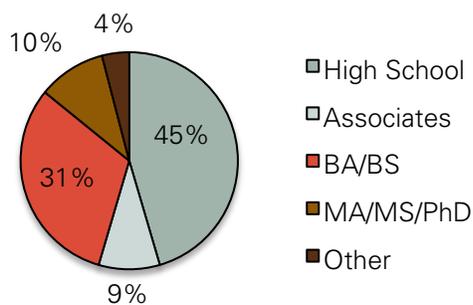
Across the study period, NASA’s Discovery and New Frontiers Programs offered 15 professional development sessions. A total of 423 multi-grade educators completed a professional development feedback survey across the fifteen sessions. The majority of attendees who completed surveys reported teaching students in grades 1–5 (85%), followed by grades 6–8 (32%), PreK/K (30%), and grades 9-12 (4%) (Figure 2).<sup>1</sup>



**Figure 2. Grades taught by professional development attendees (n = 423).**

Attendees had varied educational backgrounds, with the majority having a High School (45%) or Bachelors degree (31%). An additional 10% had a Graduate degree and 9% had an Associates degree. Finally, 4% referenced “other” degrees, such as having their teaching credentials (Figure 3).

Attendees had a wide range of past science and performing arts experiences. A total of 107 attendees mentioned a past science background, with 64 specifying different types of college courses (e.g., biology, chemistry). A total of 116 attendees had performing arts experience (e.g., dance, band, theater), with some further specifying that these occurred during high school (n = 33) or college (n = 22).



**Figure 3. Highest degree earned by professional development attendees (n = 423).**

OST programs were similar across attendees. The majority of attendees reported working in an afterschool program (n = 193) and a few worked with students before school (n = 11) or in summer/day camps (n = 7). OST programs supported students through additional academic/enrichment activities (n = 103), recreational activities and games (n = 58), homework support (n = 39), and tutoring or mentoring (n = 12).

<sup>1</sup> Percentages add to more than 100% because respondents often taught across elementary and middle school grade levels.

## Educator Follow-Up Survey

As noted, evaluators sent a follow-up survey to OST educators three months or more after they attended PD for Space School Musical. Evaluators received 97 survey responses to the educator follow-up survey, for a response rate of 24%. Despite the smaller response rate, the follow-up survey sample mirrored that of the larger professional development feedback survey population. Specifically, the majority of respondents (81%) taught students in grades 1-5, followed by grades 6-8 (39%), PreK/K (32%), and grades 9-12 (6%).

Educators reported that they reach anywhere from 8 to 15,000<sup>2</sup> students (average 435 students, total 42,172 students) in their OST programs. The majority (97%) reach students before or after school, followed by during the summer (5%), and in full day programming (1%).

## Student Survey

Over the course of the evaluation study, evaluators received 230 student surveys from five sites that volunteered to collect student data.<sup>3</sup> Approximately 60% of student survey participants were female and 40% were male. Student survey participants were mostly in grades 3–5 (n = 106), followed by grades 6–8 (n = 35), K-2 (n = 21), and grades 9–10 (n = 7).

## Facilitator Interviews

Evaluators conducted individual interviews with 15 facilitators who volunteered to complete an interview at the end of the educator follow-up survey. Interviewees reported working with students in afterschool programs (n = 13) and having a large number of Hispanic students (n = 10). Additionally, several facilitators shared that they have very diverse student populations (n = 8). All respondents reported working with students in elementary and/or middle school.

At the time of the interview, the majority of facilitators had been using the program for 1–3 months (n = 5) or 4–7 months (n = 5), followed by 8–10 months (n = 4). One facilitator was currently using the program at the time of the interview.

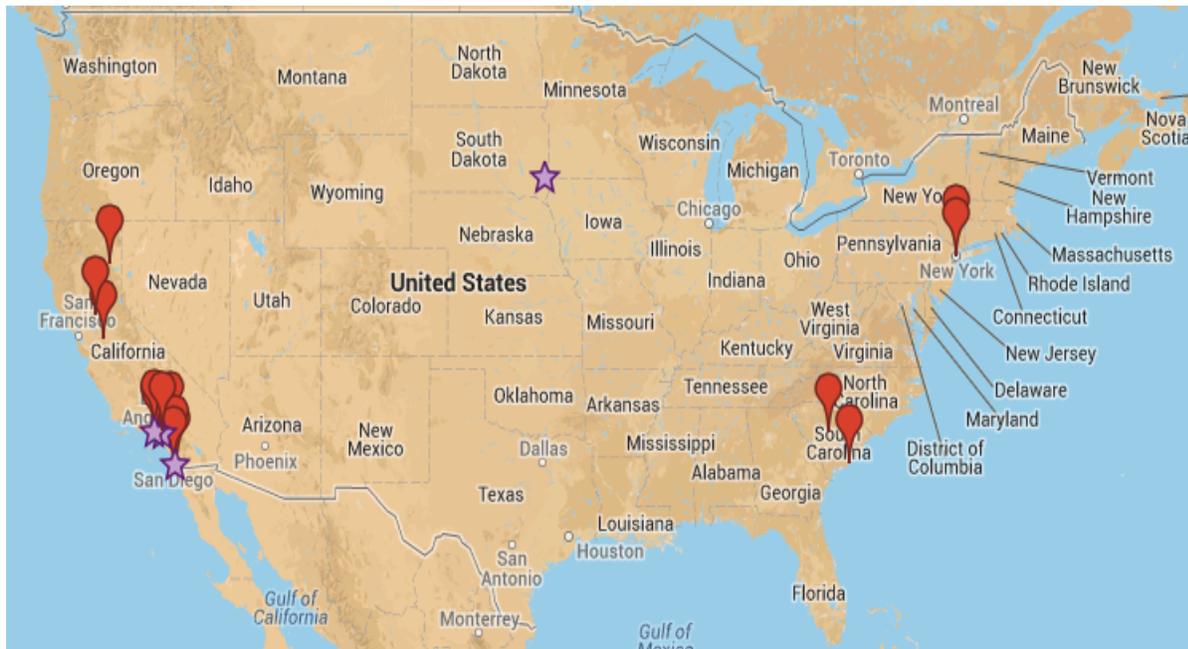
## Data Collection Locations

Evaluators collected data from a variety of locations across the United States. Programs participating in data collection activities were from California, New York, South Carolina, and South Dakota. A map of locations that participated in data collection activities is presented in Figure 4.

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<sup>2</sup> Several facilitators reported reaching high numbers of students because they supervise or support OST programming for an entire district.

<sup>3</sup> On fifty surveys from one site, student participants did not complete demographic information and 48 students did not report on which songs they performed.



**Figure 4. Locations of professional development sessions (red dots) and student survey data collection locations (purple stars).**

Note. Red dots indicate locations of Space School Musical professional development sessions from January 2012 - November 2013. Purple stars indicate locations for student surveys completed April 2013 – August 2013.

# Program Professional Development

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The following section provides a general description and example of a Space School Musical professional development (PD) session, followed by attendee perceptions of their PD experiences.

## Professional Development Description and Example

NASA and KidTribe personnel provide complimentary PD to attendees interested in Space School Musical. Typically, the PD session is located on-site in a district, is a half-day session, and is attended by OST providers, such as before/after school programs. The session involves a combination of presentation and active learning. The presenter provides an overview of Space School Musical and a walk-through of the activity guide associated with the songs. Attendees complete a sample activity from the guide and then are engaged in performing a song from the musical. The presenter then provides tips for recruiting students for the musical, auditioning, and for involving all students in some aspect of the production. The following page offers a sample vignette of a Space School Musical PD session.



*Figure 5. Space School Musical students performing “Planetary Posse” (left) and “MoonDance” (right) from the Space School Musical online musical videos © NASA.*

### A Sample of a Space School Musical Professional Development Session

Attendees from a local California afterschool program sit around a room. During this professional development session, the presenter, Kellee McQuinn provides background and context for the program, shows the musical, discusses the audition process, offers practice time with the activities, and encourages the group to perform a song from the musical.

Kellee begins the professional development session by discussing her background in obesity prevention, health and nutrition, and describes herself as a translator of content through music. She shares how she partnered with NASA to make their solar system science curriculum fun and engaging.

Kellee: “You don’t need to be Einstein to teach science, nor Steven Spielberg to put on a production. In working with NASA to write this musical, I fell in love with learning all over again. I want it to go right to the kids, right to their heart.”

Kellee shares how the musical consists of nine songs, teaching tips, and an activity guide. She adds that facilitators can use the songs however they want and make the musical their own. She then projects the 30-minute musical on a SMARTboard at the front of the room. Music pulses throughout the room in different genres and forms ranging from blues to rap. Attendees watch high school age students sing and dance to Space School Musical. [The musical ends.]

Kellee: “What did you learn from watching the songs?”

Attendee 1: “I learned about the moons of Jupiter.”

Attendee 2: “I learned about the difference between meteor, meteoroid, and meteorite.”

Other educators continue to share what they learned and Kellee transitions into implementing the musical in OST sites. She emphasizes that auditions can be a fun process.

Kellee: “In these auditions, you’re looking for spirit and willingness. Keep in mind that the auditions can take a while, but the 30<sup>th</sup> kid is just as important as the 1<sup>st</sup> who comes into the room. The environment should be nurturing, supportive and fun.”

As she discusses the audition process, Kellee continues to tell jokes and engage the audience. Many attendees are interested, engaged, and laughter is heard throughout the room. She then gives them a handout and has all of the educators up and singing the chorus to “Planetary Posse” as she practices the audition process with them. Attendees are dancing around the room and the energy level is high. Kellee then calls two people to the front to “audition” for the musical by singing the “Planetary Posse” chorus.

Participants 3 & 4: (sings) “We are the place to be in the Galaxy, The Planetary Posse for everybody to see, We are the place to be in the galaxy, If you don’t hang with me, You’re just a wanna-be!”

As participants 3 and 4 sing, Kellee stands with them to increase their comfort and emphasizes that she uses this modeling process to make her kids more comfortable with auditions. Once this is over, she offers some tips about the rehearsals, such as not bringing everyone together until it’s needed and thinking about what is required for live performances.

Kellee then transitions into an overview of the Activity Guide and has participants work in groups of four to design an Inter-Planetary travel brochure from the Guide. After this practice, participants share their brochures with the group. Kellee then transitions into the big finale and brings everyone into an open area. Kellee shares that they are going to perform “Big Bang” from the musical and breaks the song down into segments while choosing participants for roles. She coaches them on their different parts and how to move around in the song. The attendees perform the song one section at a time until the whole group is singing and dancing together.

Attendees: (sing) “Space. Solar System... Big Bang. Big-big bang! S-P-A-C-E. Space is where I’ve got to be. S to the P to the A-C-E. Space is the only place for me...”

By the end, everyone is dancing, singing, smiling, and they have practiced the finale song from start to finish.

## Participant Perceptions

### KEY QUESTION:

How do attendees perceive the quality and utility of the professional development sessions for Space School Musical?

Immediately after each PD session, attendees provided feedback related to their Space School Musical PD experience through the professional development feedback survey. Specifically, attendees addressed PD quality, preparedness to implement Space School Musical, future program use, and overall PD perceptions.

### Professional Development Quality

To assess perceptions of PD quality, evaluators asked attendees to rate the quality of seven different PD aspects of the session on a 5-point scale ranging from 5, *excellent*, to 1, *poor*. Overall, 99% of respondents viewed the training format and opportunities for participation and dialogue as *good* or *excellent*. Additionally, 98% of respondents believed the overall training, delivery, organization, and materials were *good* or *excellent*. Finally, 95% believed the training pace was *good* or *excellent* (Figure 6).

In open-ended feedback, attendees frequently shared positive comments about the overall quality of their experience. Specifically, 115 attendees noted that the session provided multiple opportunities for attendee engagement and hands-on involvement. They also noted that the presenter, Kellee McQuinn, offered the content in

a highly engaging and fun manner (n = 105). Attendees also believed the overall PD environment was energetic (n = 55) and fun (n = 47). Several also specifically mentioned an appreciation for being able to dance, move around, and be active during the session (n = 34). Twenty-eight participants shared that they loved everything about the PD and 23 participants shared that they learned a wealth of information from the experience. However, there was some division in perceptions of pacing. Some participants thought the PD was too short and wanted more time to review or rehearse songs (n = 12), whereas others thought the PD was too long and believed the presenter spent too much time on the introduction (n = 11).

### EDUCATOR QUOTE:

*I would take the training again because I enjoyed it so much. It made me feel good!* [Professional development feedback survey]



Figure 6. Quality of Space School Musical professional development sessions (n = 418 attendees).

### Preparedness to Implement Space School Musical

To gauge readiness for Space School Musical implementation, evaluators asked attendees to rate their level of preparedness on four different program aspects on a 5-point scale ranging from 5, *very prepared*, to 1, *not prepared* (Figure 7). Overall, 89% of respondents felt *prepared* or *very prepared* to access the necessary materials to use Space School Musical activities and 85% felt *prepared* or *very prepared* to facilitate Space School Musical activities. Additionally, the majority of attendees believed they were *prepared* or *very prepared* to plan Space School Musical with their learners (82%) or to produce a performance of Space School Musical (80%).

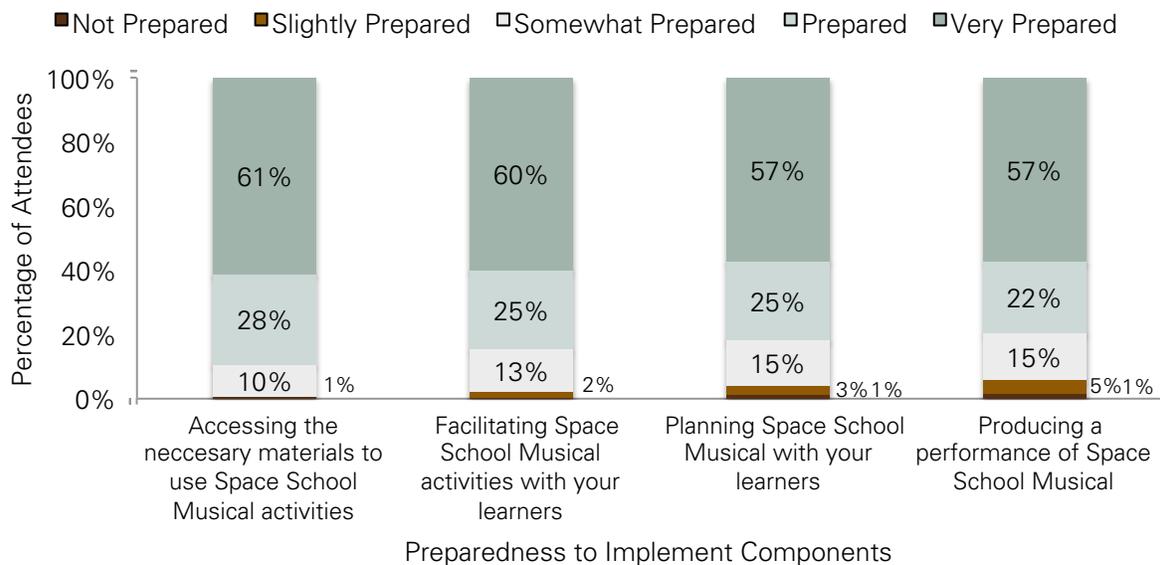


Figure 7. Attendee perceptions of preparedness to implement Space School Musical following program professional development (n = 418 attendees).

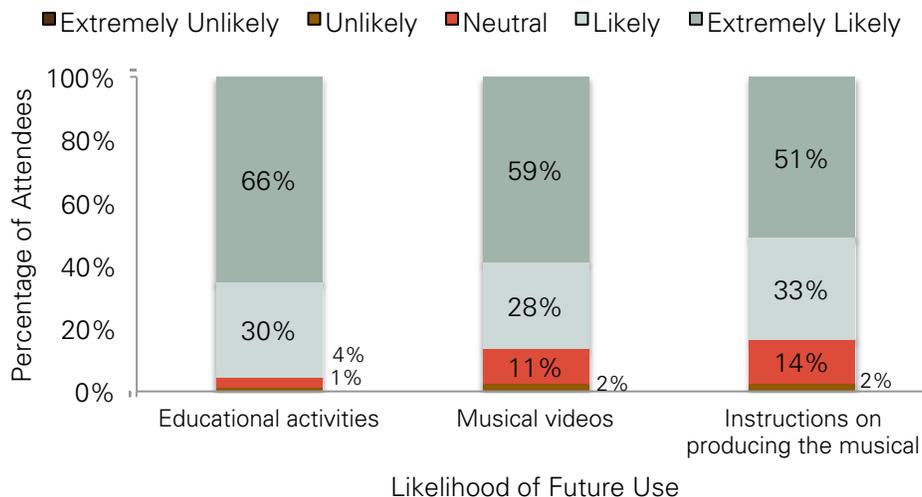
Additionally, evaluators asked attendees to provide open-ended feedback on any areas where they might need additional support to implement Space School Musical. Overall, the greatest number of attendees requested support in acquiring materials (e.g., costumes, CD players, sound equipment) (n = 26), additional support in producing the play (e.g., acting lessons, tips for every aspect of the production) (n = 7), and additional information or background on NASA and space (n = 5).

## Future Use

### EDUCATOR QUOTE:

*Seriously, this was one of the better trainings I have attended. Time well spent and very easy to take back and really implement in my program. [Professional development feedback survey]*

To determine how educators planned to use the program, evaluators asked attendees to rate their likelihood of using three Space School Musical components on a 5-point scale ranging from 5, *extremely likely*, to 1, *extremely unlikely* (Figure 8). The majority of respondents reported it was *likely* or *extremely likely* that they would use the educational activities (96%), music videos (86%), and instructions on producing the musical (84%) in the future.



**Figure 8. Attendee perceptions of the likelihood of using Space School Musical activities and resources with OST programs (n = 393 attendees).**

Attendees also shared how much of the program they planned to implement, in addition to specific songs they would like to include. Most participants planned to implement 1–2 songs (36%) or the entire musical (23%), followed by 2–5 songs (21%), other methods (e.g., not sure, varies by site) (13%), or only using the activities without the songs (8%). The greatest number of attendees shared that they would likely use the three songs, “S-P-A-C-E,” “Big Bang,” and “Planetary Posse” with their students (Table 1).

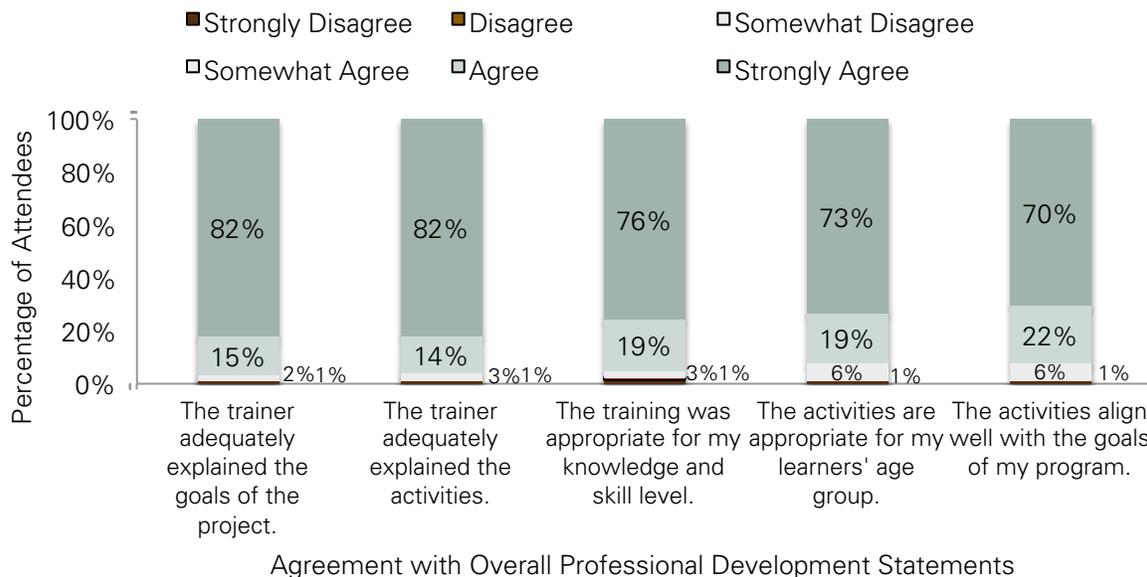
*Table 1. Planned Space School Musical songs to be performed by students as reported in professional development feedback surveys (n = 423 attendees)*

	Percent of attendees reporting future use	Rank
S-P-A-C-E	66	1
Big Bang	53	2
Planetary Posse	53	3
Moon Dance	37	4
Asteroid Gang	33	5
We're the Scientists	25	6
Orbital Mechanics/Gravity	20	7
Meteor Wrong Blues	21	8
Stand-Up Comet	18	9

### Overall Professional Development Perceptions

To assess thoughts about the overall PD experience, evaluators asked attendees to rate their level of agreement with five statements on a 6-point scale ranging from 6, *Strongly Agree*, to 1, *Strongly Disagree* (Figure 9). Overall, the majority of respondents *agreed* or *strongly agreed* with the following five statements:

- The trainer adequately explained the goals of the Space School Musical project (97%).
- The trainer adequately explained the Space School Musical activities (96%).
- The training was appropriate for my knowledge and skill level (95%).
- The Space School Musical activities were appropriate for my learners' age group (92%).
- The Space School Musical activities aligned well with the goals of my program (92%).



*Figure 9. Attendee agreement with statements related to overall professional development experiences (n = 421 attendees).*

## Summary of Professional Development Feedback

The PD opportunities provided attendees with an engaging, energetic, and immersive session into the world of Space School Musical. Attendees had positive perceptions of the PD quality, felt at least somewhat prepared to use Space School Musical resources with their students, planned to use different program aspects, and had positive perceptions of their overall experience.

### **EDUCATOR QUOTE:**

*It was very engaging and fun. I liked how she [Kellee] was very excited to be here, which made me excited to teach this to my students. [Professional development feedback survey]*

# Program Implementation and Perceptions

To understand program implementation and perceptions, evaluators analyzed data from multiple measures including facilitator interviews, educator follow-up surveys, and student surveys. The following section describes feedback from facilitators and students who implemented Space School Musical on program implementation and overall program perceptions.

Evaluators collected follow-up data from educators who had attended Space School Musical PD sessions to understand whether they had implemented the musical with their students and to gather feedback on implementation from those who used the program. Of the 97 educators who completed an educator follow-up survey, 31 did not implement Space School Musical for three main reasons including, lack of time (n = 17), lack of resources (n = 8), or lack of interest (n = 6). However, the majority of educators still planned to use Space School Musical in the future, as reported by 22 of the 31 non-facilitators.

## Program Implementation

### KEY QUESTION:

How do facilitators integrate the activities into their OST programs?

Evaluators conducted interviews with 15 program facilitators to gain an in-depth understanding of how facilitators used Space School Musical in their OST programs. The majority used the program in an afterschool setting (n = 12), but one site used Space School Musical as a winter camp, and allowed students to sign up to participate. At the camp, there was at least a 300% increase in enrollment from the year before, which the facilitator attributed to elementary-age student interest in Space School Musical.

During interviews, facilitators shared a variety of ways that they used Space School Musical with their students. The following are some key findings on implementation:

- Students interacted with the program differently. At some sites, students had the opportunity to sign up for the musical, and at others, all students had some sort of role or auditioned for different parts.
- Sites performed the musical differently. One school used a different song per grade level and produced the full musical. Another site reported making Space School Musical into a music video production, with students taking individual songs and compiling them into separate music videos. At yet another site, facilitators introduced the musical in science and dance clubs.

### FACILITATOR QUOTE:

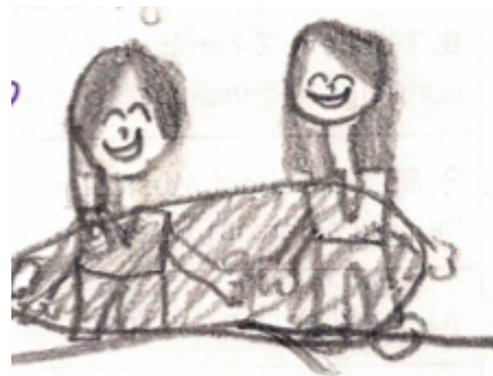
*We had auditions, so every student in every grade level had to audition for a different scene that we thought related to what they were learning during the school day. For example, 1<sup>st</sup> and 2<sup>nd</sup> graders were learning about stars and the atmosphere. [Interview]*

- Students performed for different groups. Some sites reported that students did not perform and at other sites, students performed for parents and teachers, or the entire school. Similarly, some sites performed the entire play and others focused on a few songs.
- Schools used the activity guide resources differently. Activities worked well for some students and fostered good connections to the musical. Sites reported using different activities and finding them to be equally effective. However, at one inner city site, facilitators had difficulty engaging students in the activities, but shared that engagement might be a problem overall, as they often experienced issues in getting students to do homework.

In the educator follow-up survey, facilitators who had attended PD sessions reported using 2–5 songs (35%) or 1–2 songs (26%), followed by only the activities (18%), the entire musical (15%), or other methods of implementation (e.g., some activities and 1 song) (6%).

Students reported on how they had participated in Space School Musical on the student survey. Students reported participating in Space School Musical in several different ways including,

- performing (n = 140 students),
- dancing (n = 52 students),
- lip sync or singing (n = 43 students),
- working on costumes (n = 31 students),
- working on the camera/editing crew (n = 10 students),
- working on the set (n = 9 students), and
- being an assistant director (n = 7 students).



*Figure 10. Student drawing of participating in Space School Musical (Grade 4)*

### Use of Activities and Resources

Facilitators reported using several activities and resources from the Space School Musical PD session, including the music videos (79%), educational activities (77%), and instructions on producing the musical (39%), which were mentioned most frequently. Of the 46 facilitators who reported using the Activity Guide, 74% reported using academic activities, followed by art (65%), fitness (54%), and life skills (37%).

The website provides some additional resources for facilitators and several took advantage of these materials. Facilitators reported using online photos and videos (45%), followed by information on the “Meet the Scientists and Engineers of Today and Yesterday” page (20%), and additional website activities (12%).

The majority of facilitators (n = 57) also reported sharing the materials or information about Space School Musical with anywhere from 1 to 140 colleagues. Because of information sharing among colleagues, a total of 546 additional individuals received information on Space School Musical thus widening its potential reach beyond those who attended PD sessions.

## Implementing Performances and Songs

Of the musical facilitators, 38% reported putting on a performance of Space School Musical songs or the entire musical. Out of the OST groups who performed, facilitators reported that 96% performed for parents, 88% performed for peers, 52% performed for the community, and 12% performed for faculty or staff. Students and facilitators also reported which songs students performed, with the most common songs across reporting groups being “Big Bang,” “Planetary Posse,” and “S-P-A-C-E” (Table 2).

*Table 2. Space School Musical songs performed by students as reported in student surveys (n = 230) and educator follow-up surveys (n = 66)*

	<b>Students</b> Percent of students reporting performing	<b>Rank</b>	<b>Facilitators</b> Percent of facilitators reporting use	<b>Rank</b>
Big Bang	39	<b>1</b>	50	<b>2</b>
Planetary Posse	36	<b>2</b>	50	<b>2</b>
Orbital				
Mechanics/Gravity	21	<b>3</b>	26	5
Asteroid Gang	18	4	41	<b>3</b>
S-P-A-C-E	18	5	76	<b>1</b>
We’re the Scientists	10	6	26	5
Moon Dance	8	7	36	4
Meteor Wrong Blues	7	8	24	6
All Songs	3	9	n/a	n/a
Stand-Up Comet	1	10	18	7



*Figure 11. Student drawings of participating in Space School Musical (Grades 2, 4, and 10).*

## Program Perceptions

### KEY QUESTION:

What are facilitators' perceptions of the ease of implementation of the activities and what are their suggestions for improvement? How does the program work for varied student learners?

Evaluators gathered perceptions on ease of using Space School Musical materials, effectiveness of the materials for instruction, needs for additional support, and perceptions of use with varied student learners and overall student groups.

### Ease of Use and Effectiveness of Materials

To assess the ease of implementing Space School Musical, evaluators asked facilitators on the educator follow-up survey to rate how easy or difficult it was to incorporate the songs and educational activities into their OST program on a 5-point scale ranging from 5, *very easy*, to 1, *very difficult*. Overall, 97% of facilitators thought it was *somewhat easy* to *very easy* to incorporate the educational activities, and 90% thought it was *somewhat easy* to *very easy* to incorporate the songs into their OST program (Figure 12). In interviews, all facilitators commented on the ease of program use, sharing that it was "not only easy, but it really makes you excited to do it," and "It's step-by step. This had everything together. It was a complete package."

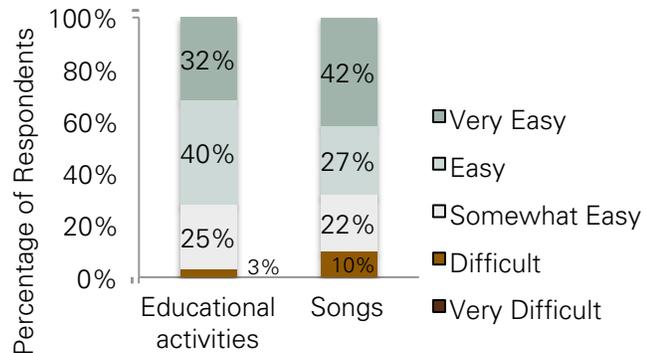


Figure 12. Facilitator reported ease of using songs and educational activities (n = 60).

Evaluators also asked facilitators for feedback on the effectiveness of the Space School Musical website materials in supporting implementation on a 5-point scale ranging from 5, *very effective*, to 1, *very ineffective*. Overall, 98% of respondents believed the Activity Guide, How to Produce the Play guide, Lyrics, and Teaching Tips and Glossary materials were *somewhat* to *very effective* (Figure 13).

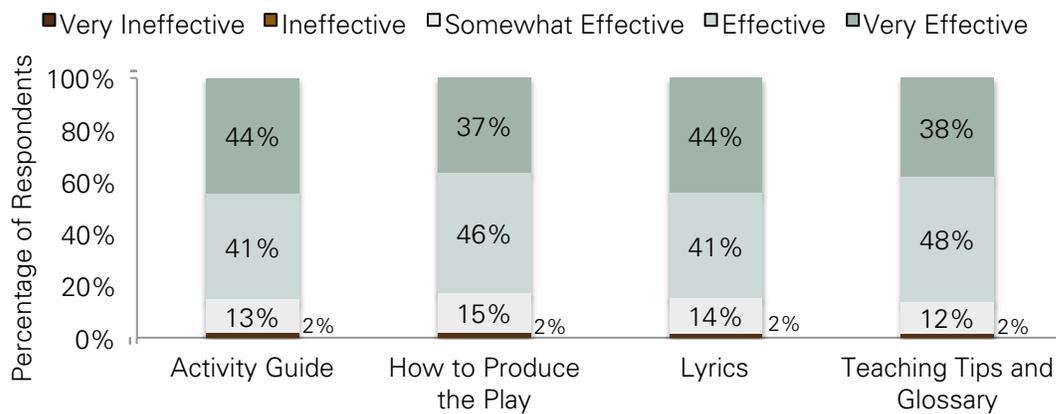


Figure 13. Facilitator reported effectiveness of various website materials and resources in supporting Space School Musical implementation (n = 63).

All 46 facilitators who used the Activity Guide resources believed that the Space School Musical activities helped to reinforce student learning. In open-ended feedback, facilitators shared that students enjoyed the activities (n = 7) and that the Activity Guide was easy to use (n = 4 surveys, 2 interviews).

**FACILITATOR QUOTE:**

*This [Activity] guide makes very easy to implement lessons about space. Before this guide and the musical, we were afraid of the word SPACE.*  
[Educator follow-up survey]

Facilitators shared that students enjoyed, “the different avenues of learning” and “had a blast” doing the different activities. Facilitators also believed the activities made learning about space easy by providing “clearly written and easy to read” information.

### Additional Support Needs and Challenges

To determine whether facilitators had additional support needs or experienced challenges in implementing the program, evaluators asked for open-ended feedback on the educator follow-up survey and in interviews. Through these different measures, several participants mentioned four different areas including:

- Finding time to perform or practice (n = 6 surveys, 1 interview). A few facilitators specified that it was difficult to find the time to practice and perform when they have so many other requirements that they need to address in OST programming.
- Maintaining children’s interest, particularly in grades 5 and above (n = 5 surveys, 1 interview). Several facilitators mentioned on the survey that it was difficult to get older elementary and middle school students excited about performing Space School Musical. In an interview, one facilitator further specified that younger kids might be more interested because they are “into music as a way to learn,” whereas middle school students “are the ones that need a little bit more, probably more lectures.”
- How to include younger children (n = 2 surveys, 2 interviews). Two facilitators on the survey noted it was challenging to include younger children, with one specifying that the songs were a little difficult for the younger age group. In an interview, one facilitator

added that some of the choreography for the videos was difficult for elementary school students to replicate. Another added that there need to be more tips on differentiating the materials for younger kids, because there is a belief that the kids in the video “were privileged high school kids,” and the musical was not designed for younger audiences.

- Difficulty in getting staff onboard (n = 3 surveys, 1 interview). Facilitators commented that many staff who did not participate in the PD were reticent about the program, with some viewing the production as difficult or NASA as being synonymous with “complicated science.” One interviewee mentioned that some staff believed they needed performing arts experience to use Space School Musical.

However, the majority of facilitators did not report additional support needs or challenges. For example, ten facilitators stated in interviews that they experienced no program shortcomings or challenges, and believed the program and implementation went smoothly.

### Program Use with Varied Learners

#### **FACILITATOR QUOTE:**

*Anytime you can correlate music with learning, people retain that information. I can sing a whole Shakira song in Spanish, I don't know what she is saying, but if I had someone there to explain what she said and I can remember the song, I might have a better idea of the language. It has that effect with the ELL. They have the lyrics and instructor can explain some of the jokes. Then they have the lyrics in their head and it can help them. Music is a universal language. [Interview]*

To gauge how well the program worked with diverse groups, evaluators asked for interview feedback on how well Space School Musical met the needs of varied learners. Three common themes arose from these interviews:

- The program works well with English language learners (ELL) (n = 8)<sup>4</sup>. Facilitators commonly shared that the program offered ELL students an opportunity to practice a second language through music. Repetition of the songs and access to the lyrics was particularly helpful for ELL students’ retention of science facts and language practice.

- Special needs students could find a role and learn from Space School Musical (n = 8). Facilitators mentioned a wide range of students with special needs (e.g., Autism, speech delays, aversion to loud sounds) who were able to participate in the musical in different ways. Facilitators believed that the program was adaptable for any student and that anyone could learn new information or participate in roles where they could see success.

#### **FACILITATOR QUOTE:**

*I was watching one student the other day that does repeat special education services, and he was amazing. He had memorized his entire song... from start to finish and was so excited to perform it for his class. That was a really neat thing to see. [Interview]*

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<sup>4</sup> Two facilitators mentioned that the program was difficult for their ELL students because of difficulties with the vocabulary and a lack of engagement.

**FACILITATOR QUOTE:**

*It definitely met those needs [of different grade levels]. The activity guide had a lot of different things, and the musical portion, it was fun to watch kindergartners sing. It was cute. The older kids and the kindergartners did it together and worked together. [Interview]*

• Space School Musical was understandable and accessible for all grade levels (n = 7). Facilitators frequently commented that the program held student interest and built knowledge across different grade levels. Facilitators also saw students of all grade levels start to come together and participate as a collective group.

**Student and Facilitator Perceptions of Space School Musical**

**KEY QUESTION:**

What did students like best and least about Space School Musical?

To assess student perceptions of the musical, evaluators asked students for open-ended feedback on what they liked best and what they did not like about the musical. The majority of students (71%) provided an open-ended response on what they liked best (Table 3). The top recurring theme was specific songs, with students mentioning “Big Bang” (n = 12) and “Asteroid Gang” (n = 6) most frequently. Students also enjoyed dancing (10%), singing (9%), and acting/performing (8%) in the musical. Several mentioned that it was fun (7%), enjoying making the costumes/sets (4%), and appreciating the opportunity to make friends and hang out (4%). Finally, 4% of students mentioned liking everything about Space School Musical.

Table 3. What students liked most about Space School Musical (n = 230 students)

Common themes	Number of responses	Percent of students (n = 230)
Specific Songs	32	14%
Dancing	24	10%
Singing	21	9%
Acting/Performing	18	8%
It was fun	15	7%
Costumes/Sets	10	4%
Social aspect	9	4%
Everything	9	4%

**STUDENT QUOTES:**

*I liked S-P-A-C-E because I got to sing and dance.*

*I like that the planets had rap solo’s[sic].*

*I like the songs because they sound cool.*

*What I liked best was that you would interact with a lot of people and it was fun.*

*I liked the fun and creative songs that really deepened my knowledge about space!*

*I like it because it was fun making a lot of stuff for it.*

*I liked Neptune because it was blue and Neptune is the roman god of water and I like water.*

*[Student survey]*

Evaluators asked students for open-ended feedback on what they did not like about Space School Musical. The most common feedback was that students had no dislikes (43%) or this question was left blank (35%). Additionally, a small percentage of students (3%) referenced not liking specific songs, including “Asteroid Gang” (n = 3) and “S-P-A-C-E” (n = 2).<sup>5</sup>

<sup>5</sup> The final 19% of responses varied (e.g., costumes, performing, sweating), with no recurring themes referenced by at least four students.

**KEY QUESTION:**

What do facilitators perceive as program strengths?

To determine areas of strength, evaluators interviewed facilitators about areas in which the Space School Musical program excels. Facilitators shared three common themes:

- The engaging music and activities helped students to learn (n = 6). Facilitators frequently commented that the music and lyrics are catchy, easy to remember, and get students excited about learning science. Facilitators also believed the hands-on activities broadened student knowledge of space science concepts.
- It is fun and exciting (n = 5). Facilitators shared that students greatly enjoyed participating in the musical and in the activities. Students also loved singing the songs and participating in interactive ways.
- There is something for everyone (n = 4). Facilitators mentioned that the musical allowed students to participate in different ways, such as singing or helping out behind the scenes. Students were able to enjoy different genres of music or performing, such as rap, comedy, or dance.

**FACILITATOR QUOTES:**

*It's just upbeat music that gets them going and gets them excited, and they're actually learning without even noticing it. [Interview]*

*I see when they have those performances,[sic] I thought that a lot of students were very happy to go out on stage and sing the songs and perform them with their t-shirts and their space planets on them. It was really really[sic] fun for them. [Interview]*

*If a kid likes rap or if a kid likes comedy or if a kid likes writing, there are so many different things when you watch the production or you look at the lyrics that you can say, 'Find something that is relatable to you that you like to do.' It is a way to get so many different types of people in one room, to do one project, and still stick with their specific interests. [Interview]*

## Summary

One-third of surveyed educators, from the educator follow-up survey, did not implement Space School Musical, largely because of a lack of time, resources, or interest. The other two-thirds of respondents were facilitators and implemented Space School Musical in a variety of ways (e.g., some students performed the entire musical, some used just the activities). Overall, facilitators found materials to be easy to use and effective and thought they worked well for varied student learners. Students also enjoyed many different aspects of Space School Musical and facilitators believed the engaging music, fun nature, and variety of opportunities were all program strengths. A small handful of facilitators expressed some challenges (e.g., maintaining older children's interest), but the overall feedback was largely positive.

# Student Impacts

To assess student impacts following participation in Space School Musical, evaluators collected data from student surveys, educator follow-up surveys, and facilitator interviews. This section describes impacts of Space School Musical participation on students' science interest and engagement, space science knowledge, personal characteristics, and social interactions.

In this section, all Likert scale questions for students were on a 4-point scale, ranging from 4, *really agree*, to 1, *really disagree*. Similarly, all Likert scale questions for facilitators were on a 5-point scale, ranging from 5, *strongly agree*, to 1, *strongly disagree*.

## Science Interest and Engagement

### KEY QUESTION:

How does participation in Space School Musical impact student interest and engagement in space science related topics?

To gauge perceptions of interest and engagement, students and OST facilitators responded to several statements related to whether Space School Musical had been engaging or interesting for students (Figure 14). Overall, 92% of students *agreed* or *really agreed* that they had fun doing the songs and activities in Space School Musical and 89% of students *agreed* or *really agreed* that the musical made learning about science fun. Additionally, 79% of students *agreed* or *really agreed* that they wished for more activities similar to those in the musical and 78% *agreed* or *really agreed* that Space School Musical increased their science interest. By contrast, 20% of students *agreed* or *really agreed* that they did not enjoy Space School Musical.

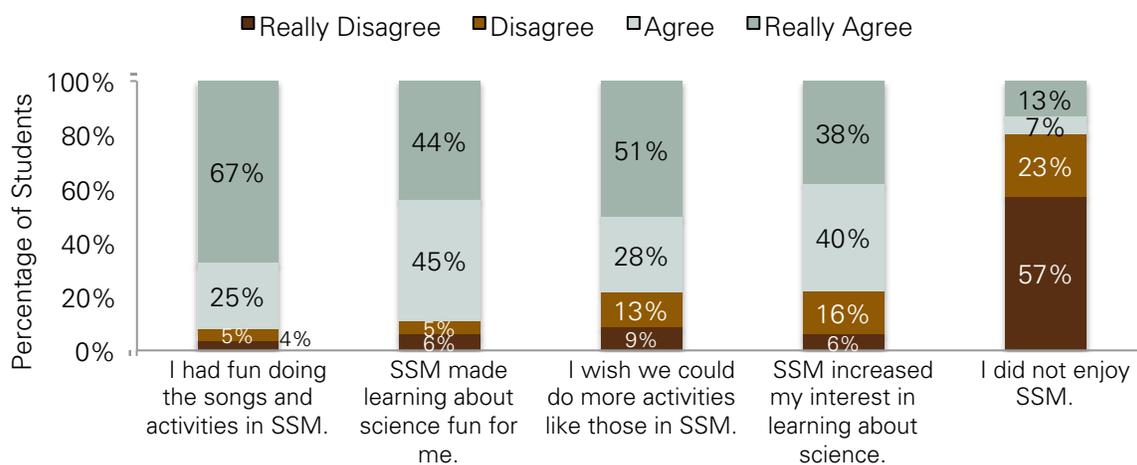
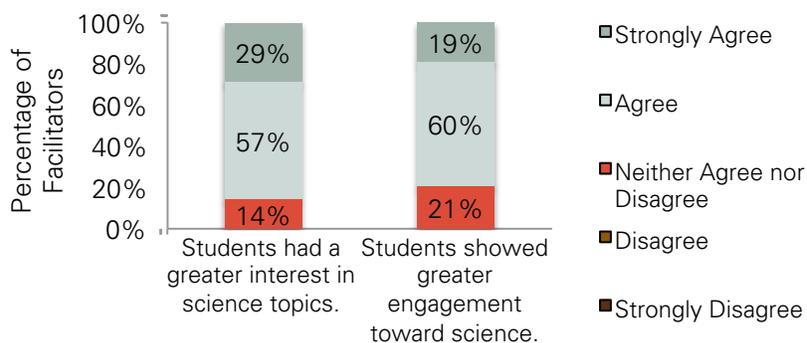


Figure 14. Student self-reported changes in personal science interest and engagement after participating in Space School Musical (n = 203 students).

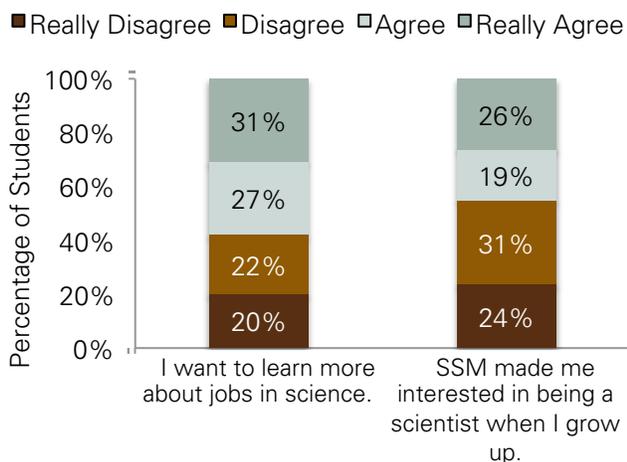
Overall, OST facilitators had similar sentiments. The majority (86%) of facilitators *agreed* or *strongly agreed* that students had greater interest in science topics and 79% *agreed* or *strongly*

agreed that students had showed greater engagement toward science after participating in Space School Musical (Figure 15).

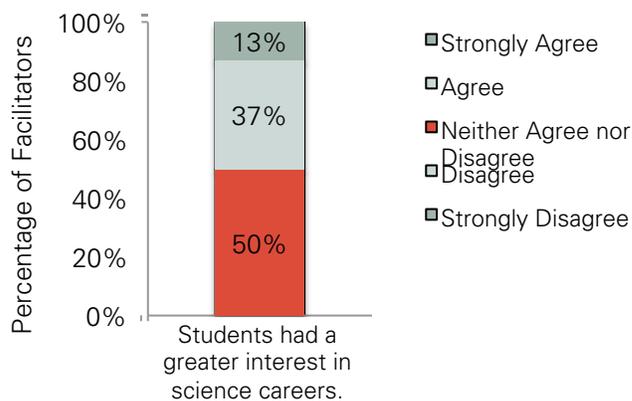


**Figure 15. Facilitator reported changes in student science interest and engagement after participating in Space School Musical (n = 63 facilitators).**

To assess potential changes in future behaviors, evaluators asked students and facilitators to rate their level of agreement with statements related to science career interest. Overall, 58% of students *agreed* or *really agreed* that they wanted to learn more about jobs in science after participating and 45% of students *agreed* or *really agreed* that Space School Musical made them interested in becoming a scientist when they grow up (Figure 16). Similarly, 50% of facilitators *agreed* or *strongly agreed* that after participating, students had a greater interest in science careers (Figure 17).



**Figure 16. Student self-reported changes in science career interest following participation in Space School Musical (n = 195 students).**



**Figure 17. Facilitator reported changes in student science career interest following participation in Space School Musical (n = 62 facilitators).**

Evaluators asked facilitators to provide examples of student interest and engagement in the educator follow-up survey and in interviews. In open-ended comments, two common themes arose:

- Students wanted more science information and activities (n = 9 surveys, 7 interviews)- After participating in Space School Musical, students wanted to know and do more

science. Facilitators reported that students asked more questions about science, wanted to do experiments, and started to participate in science clubs.

- Students showed interest in the songs and music videos (n = 5 surveys, 6 interviews). Facilitators shared that students kept singing the songs throughout the school day and enjoyed playing the different roles.

**FACILITATOR QUOTES:**

*We had a lot of class discussions and I feel that this music video made the students think about what is really out there and just sparked their interest on the planets and just everything about space. Usually space is boring[sic] but being taught through a musical with other kids definitely caught their attention and made it interesting and fun. [Educator follow-up survey]*

*They are going around singing the songs and mimicking the characters. [Educator follow-up survey]*

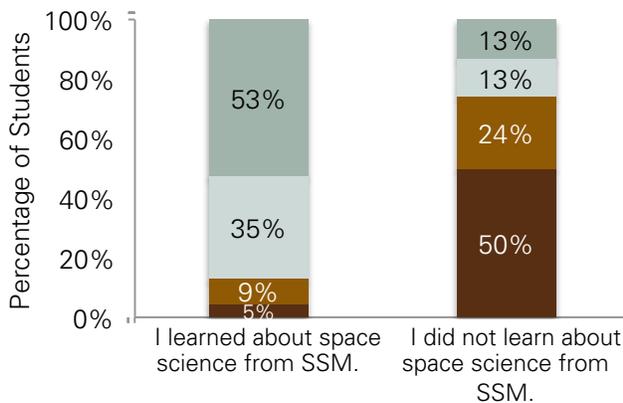
**Space Science Knowledge**

**KEY QUESTION:**

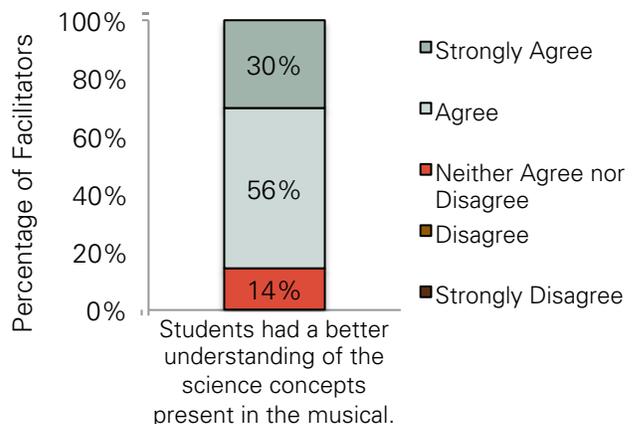
How does exposure to project activities impact student understanding of targeted space science concepts?

To understand potential increases in space science knowledge, evaluators asked students and OST facilitators for their thoughts on changes in student understanding after participating in Space School Musical. Overall, 88% of students *agreed* or *strongly agreed* that they learned about space science from the musical, and by contrast, 26% of students *agreed* or *strongly agreed* that they did not learn about space science (Figure 18). Facilitators shared similar levels of agreement, with 86% *agreeing* or *strongly agreeing* that students had a better understanding of science concepts present in the musical (Figure 19).

■ Really Disagree ■ Disagree □ Agree ■ Really Agree



**Figure 18. Student self-reported learning of space science content after participating in Space School Musical (n = 200 students).**



**Figure 19. Facilitator reported changes in student space science content knowledge after participating in Space School Musical (n = 63 facilitators).**

In the educator follow-up survey and in interviews, facilitators shared evidence of student knowledge gains. One recurring theme was that students were remembering what they learned in the musical (n = 5 surveys, 8 interviews). Facilitators mentioned that students used new science vocabulary and shared new information about the solar system with teachers and peers.

**FACILITATOR QUOTES:**

*Some of the kids who participated went on a night hike here at the camp...and I was very surprised at the information that they remembered from participating in the Space School Musical. I think that with the hands-on, the songs, the lessons, they really retained the information. [Interview]*

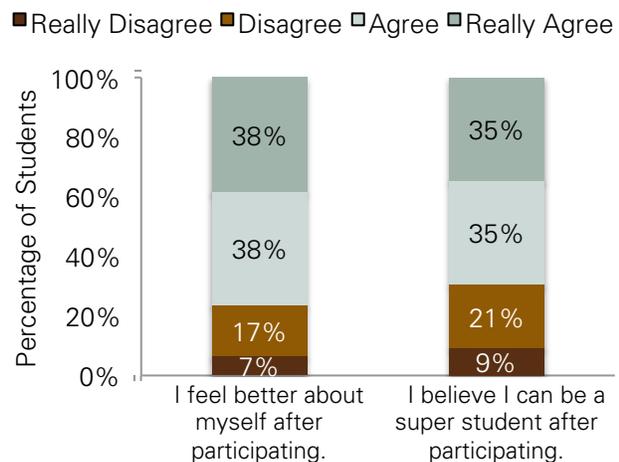
*Even the teachers thought this was awesome. We have never heard kids singing about planets and earth and the sun. They learned a lot. [Interview]*

**Personal Characteristics and Social Interactions**

**KEY QUESTION:**

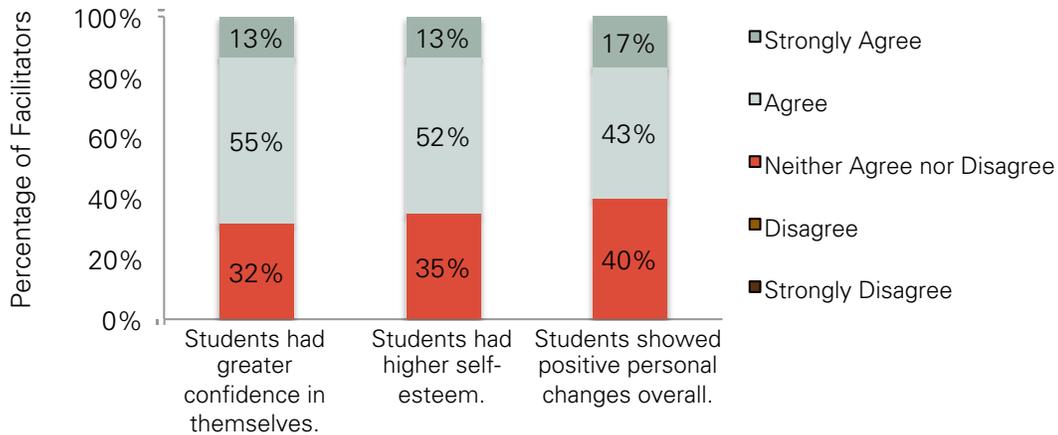
How does participation in Space School Musical impact students personally and socially?

To understand personal changes after participating in Space School Musical, evaluators asked students and facilitators to rate several statements related to self-worth and academic self-efficacy. Overall, 76% of students *agreed* or *really agreed* that they felt better about their self after participating and 70% *agreed* or *really agreed* that they believed they could be a *super student*<sup>6</sup> after participating in Space School Musical (Figure 20). Facilitators shared similar perceptions, with 68% *agreeing* or *strongly agreeing* that students had greater confidence in themselves, 65% *agreeing* or *strongly agreeing* that students had higher self-esteem, and 60% *agreeing* or *strongly agreeing* that students showed positive personal changes overall after participating in Space School Musical (Figure 21).



**Figure 20. Student self-reported changes to self-esteem and academic self-efficacy after participating in Space School Musical (n = 198 students).**

<sup>6</sup> Space School Musical refers to a *super student* in the Activity Guide. *Super students* show positive achievements in school.



**Figure 21. Facilitator reported changes to students' self-confidence, self-esteem, and overall personal changes after participating in Space School Musical (n = 60 facilitators).**

In surveys and interviews, evaluators asked facilitators to provide evidence of various personal changes in their students, including self-confidence, self-worth, and 21<sup>st</sup> century skills, such as leadership. Three key themes emerged from open-ended responses:

- Students started to show increased confidence (n = 10 surveys; n = 11 interviews). Facilitators shared that students were more comfortable performing in front of others, developed better attitudes, and were able to step outside of their comfort zones. Several facilitators also mentioned surprise when previously quiet students came “out of their shell.”
- Students became leaders (n = 1 survey; n = 9 interviews). Older students led and directed younger students. Even some shy students took on a leadership role and facilitators noticed many students took ownership over the musical performances.
- Facilitators noticed increased student creativity (n = 1 survey; n = 4 interviews). Students brought their own personalities into the performance, through different types of characters, dance moves, costumes, and so on. They created their own version of the musical.

**FACILITATOR QUOTES:**

*It's amazing to see the kids come out of their shells. We have lots of kids who were pretty shy before the musical and some of them are even still shy, but when they get on that stage, they just let it all out. They have more confidence. [Interview]*

*By giving them that role and having a helping hand next to them, but letting them grow a little bit by doing it on their own, they were able to kind of take charge, where the staff became secondary to the students, and started assisting the students. [Interview]*

*For creativity, definitely, they all came up with their own dance moves for different parts and made them unique on their own. [Interview]*

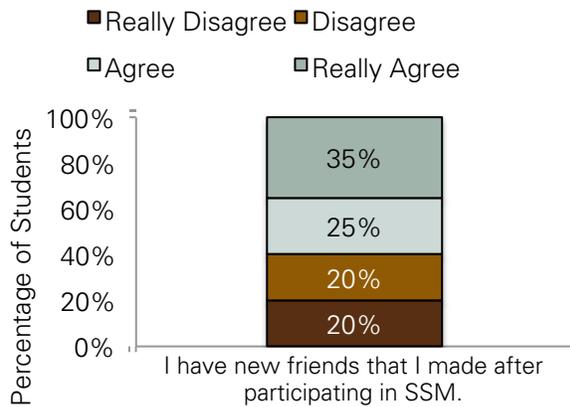


Figure 22. Student self-reported changes to friendships after participating in Space School Musical (n = 194 students).

Evaluators also asked students and facilitators several questions related to social interactions, to understand potential changes to friendships or relationships after participating in the musical. Overall, 60% of students *agreed* or *really agreed* that they made new friends after participating in the musical (Figure 22). Facilitators *agreed* or *strongly agreed* that students exhibited more respect and acceptance of their peers (79%), had more positive social interactions with other students (73%), showed positive social changes overall (69%), and made new friends (62%) after participating in the musical (Figure 23).

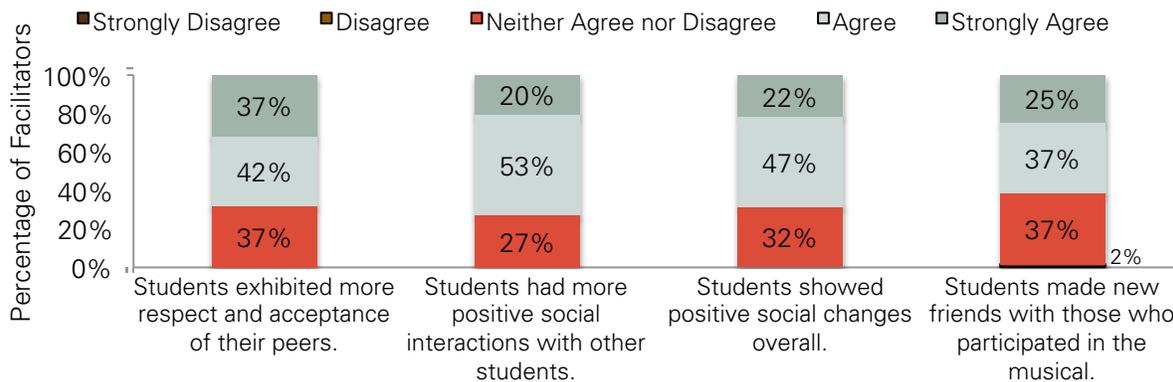


Figure 23. Facilitator reported changes to students' social relationships after participating in Space School Musical (n = 57 facilitators).

**FACILITATOR QUOTES:**

*We're a close group, but that brought us way closer. At the end of it, when we were done with it, they felt so proud of each other. They were clapping and cheering and they just felt together as a team. That's what they were, they were a team, a whole production. I can't even explain it. I get the chills. [Interview]*

*Every student wanted to be a part of it. There was something for everyone...the outspoken, the quiet/shy, the too cool...[Educator follow-up survey]*

Facilitators also provided examples of social changes on the educator follow-up survey and in interviews. Across reporting types, there were two recurring themes:

- Students came together as one, unified group (n = 11 surveys, 8 interviews). Facilitators commented that the musical made their student groups' closer and helped them to collaborate around a common purpose. Students got along well and united as a social group, helping and supporting each other along the way.
- The musical offered something for everyone (n = 3 surveys, 5 interviews). Facilitators shared that there was a role and purpose for everyone, so no students felt socially isolated. Students could choose between performing different types of characters and dances.

## Summary

There were several positive student impacts resulting from participation in Space School Musical. Students and facilitators reported that students had high levels of space science interest and engagement in performing the songs and participating in the activities. Facilitators and students believed that participants gained a deeper understanding of space science concepts and a greater interest in the science content presented in the musical. Students and facilitators reported that participants saw personal and social benefits of program participation, including positive views of themselves and positive interactions with peers after participating in Space School Musical.





With respect to Space School Musical professional development:

- When PD time is limited, consider devoting more time to the hands-on portion of the PD by reducing time for the introduction and Activity Guide. Some participants commented that they wanted more hands-on time with the musical and condensing other workshop components would be one way to accommodate this request.
- Consider expanding the section of the PD that discusses producing the musical. Facilitators would like more information on auditioning students and staging the musical. NASA's Discovery and New Frontiers Programs could also provide tips for production on the Space School Musical website.
- Consider offering an online, condensed version of the PD, with Kellee McQuinn as the presenter. Attendees continually mentioned Kellee's energy and enthusiasm as one of the program's strengths. By creating one or a series of short online PD videos, Kellee could expand the base of users who implement Space School Musical.
- If districts do not have the time or resources for Space School Musical PD, consider offering the PD in a webinar format.

With respect to implementing Space School Musical:

- Consider offering different suggestions on how to acquire production materials at PD sessions, in the Activity Guide, and on the program website. Emphasize that sites do not need fancy costumes, sets, or sound systems to effectively implement the program at their own schools. If possible, share some stories of how other elementary and middle schools have used the program with their sites. Consider including a list of possible inexpensive materials or places for acquiring materials in the Guide or on the website.
- Consider different ways to emphasize the target population for Space School Musical. Because there were high school student actors in the video, some facilitators believed their elementary students were too young to participate in Space School Musical. Alternatively, consider ways to provide tips for differentiating the songs and activities for younger (or older students).

## References

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- Ainley, M & Ainley, J. (2011). Student engagement with science in early adolescence: The contribution of enjoyment to students' continuing interest in learning about science. *Contemporary Educational Psychology*, 36(1):4–12.
- Beckett, M., Borman, G., Capizzano, J., Parsley, D., Ross, S., Schirm, A., & Taylor, J. (2009). Structuring out-of-school time to improve academic achievement: A practice guide. (NCEE #2009-012). Washington, D.C.: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education. Retrieved from <http://ies.ed.gov/ncee/wwc/publications/practiceguides>.
- Desimone, L. M., Porter, A. C., Garet, M. S., Yoon, K. S., & Birman, B. F. (2002). Effects of professional development on teachers' instruction: Results from a three-year longitudinal study. *Educational Evaluation and Policy Analysis*, 24, 81–112.
- DeMaray, M. K. & Malecki, C. K. (2002). The relationship between perceived social support and maladjustment for students at risk. *Psychology in the Schools*, 39(3), 305-316.
- Dupont, S. (1992). The effectiveness of creative drama as an instructional strategy to enhance the reading comprehension skills of fifth-grade remedial readers. *Reading Research and Instruction*, 31(3), 41–52.
- Garet, M. S., Porter, A. C., Desimone, L., Birman, B. F., & Yoon, K. S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Education Research Journal*, 38(4), 915–945.
- Governor, D., Hall, J. & Jackson, D. (2013). Teaching and Learning Science Through Song: Exploring the experiences of students and teachers. *International Journal of Science Education*, 35(18): 3117–3140.
- Hoffman, K. (2013). Songs in service of science. *Science Scope*, 37(2):70–74.
- Moore, E., H. & Caldwell, H. (1993). Drama and Drawing for Narrative Writing in Primary Grades. *Journal of Education Research*, 87(2), 100-110.
- Sarason, B. R., Pierce, G. R., Shearin, E. N., Waltz, J. A., & Poppe, L. (1991). Perceived social support and working models of self and actual others. *Journal of Personality and Social Psychology*, 60, 273-287.