



# **PROFESSIONAL IMPACTS EVALUATION: UNPACKING THE STEM IMAGINATION CONVENING AND ACTIVITIES**



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## SUPPORT FROM THE NATIONAL SCIENCE FOUNDATION

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# Executive Summary & Discussion

# EXECUTIVE SUMMARY

The Museum of Science, Boston contracted Kera Collective (formerly RK&A) to conduct a professional impacts evaluation for the “Unpacking the STEM Imagination” convening and activities. The project is funded by the National Science Foundation (DRL 1906899). 5 key findings follow.

- 1** The convening helped participants see the relevance of imaginative ways of thinking to STEM.
- 2** The convening enhanced participants’ knowledge of research on imagination’s relationship with STEM.
- 3** Potentially because of their enhanced knowledge about imagination in STEM, participants indicated less comfort in talking with colleagues about imagination’s relationship with STEM after the convening.
- 4** Participants want additional discussions on imagination in STEM. They recognized the magnitude of work that went into the convening and felt there was an incredible amount of information from the convening to mine further. They are also interested in reconnecting with participants.
- 5** The convening highlighted the need for further work to support professionals in imagination endeavors in STEM. In particular, participants who work in museums desire tools to apply the convenings’ learnings to their practice.

## Project Successes

The project was successful in its goals to (1) increase understanding of the role of imagination in STEM and learning; and (2) increase awareness of current and recent ISE initiatives in which imagination is addressed.

As a convening, the project team was focused on (a) the literature review; (b) convening a network of individuals who are working in many different ways on projects related to imagination in STEM; and (c) exploring perceptions emergent from this brain-trust through the imagination perceptions survey and workshop activities. Participants complimented the team's extensive literature review and connecting interesting people together.

## Project Challenges

The project was less successful in action-oriented goals to (1) increase or renew interest in positioning imagination as an explicit objective for future ISE work; (2) influence behavior (participants will plan initiatives that address the priority areas for future development emergent from convening proceedings); and (3) sustain interest and engagement in seeking partnerships or collaborators for future work.

One primary challenge is that the convening took place virtually due to the ongoing COVID-19 pandemic. Several said this made it more difficult for them to engage fully in the convening and impeded networking that would have happened more naturally if in person. Furthermore, a limitation of the evaluation is that it took place before the project team's full dissemination efforts have been completed, which will likely prompt some inspiration for action.

## Opportunities for the Future

The project clearly filled a need for the ISE community, as evidenced by robust attendance as well as evaluation data that showed knowledge of and comfort talking about imagination in STEM as generally low (even among a group of participants, many of whom were invited to participate in the convening because of their work in the area of imagination). As ISE professionals are well aware, behavior change is always highly challenging to promote. Yet, the evaluation data show there is continued interest and curiosity around imagination in STEM. There is also an interest to continue networking with ISE professionals to move the imagination work from theory to practice.

# Study Background

# ABOUT THE PROJECT

With funding from the National Science Foundation (DRL 1906899), the Museum of Science, Boston led the project, "Conference: Interdisciplinary perspectives in imaginative thinking in informal STEM environments," which later launched publicly as "Unpacking the STEM Imagination."

## Why this project?

The project considers how (a) research on imaginative thinking and (b) perspectives on imagination in STEM practice and STEM education, can be systematically applied to support STEM learning in museum contexts. Conceptions of science as non-imaginative are persistent, but scholarship across disciplines suggests critical roles for imagination, both in the practice of STEM and in shaping learners' perceptions of themselves as part of STEM. Further, evidence from the fields of neuroscience, psychology, child development and education suggests ways that imagination can be fostered and improved. These understandings could be applied to the design of museum experiences in order to improve STEM outcomes.

The goals of the project are to:

1. Prompt conversations about imaginative thinking across Informal Science Education (ISE), and between ISE and other fields;
2. Identify priority areas for research and development that can advance the field's understandings at the intersections of imagination, STEM, and learning; and
3. Catalyze future research and development efforts that can advance the field.

## What activities build out the project?

Project activities, led by the Museum of Science, Boston, both synthesize and generate knowledge at the intersections of imagination, STEM, and education practice.

Activities include:

- Literature review
- Document review
- Survey of ISE professionals
- Virtual convening of STEM professionals (researchers, practitioners, educators and others), which was initially intended to be an in-person convening
- Development and dissemination of products designed to inform future project development

The evaluation was conducted after the first 4 activities were completed but before dissemination has been completed.

See the project page for more information:

<https://resources.informalscience.org/conference-interdisciplinary-perspectives-imagination-informal-stem-environments>



# EVALUATION GOALS

The Museum of Science, Boston contracted Kera Collective (formerly RK&A) to conduct a professional impacts evaluation for the “Unpacking the STEM Imagination” convening and activities. The project is funded by the National Science Foundation (DRL 1906899).

## Intended Impacts

1. Increase understanding of the role of imagination in STEM and learning.
2. Increase awareness of current and recent ISE initiatives in which imagination is addressed.
3. Increase or renew interest in positioning imagination as an explicit objective for future ISE work
4. Influence behavior; participants will plan initiatives that address the priority areas for future development emergent from convening proceedings
5. Sustain interest and engagement in seeking partnerships or collaborators for future work

## Evaluation Questions

- What, if any, new perspectives on imagination, STEM, and learning did participants gain through the pre-conference activities and/or the convening?
- How, if at all, did participation in the convening impact participants’ awareness of current and recent ISE initiatives in which imagination is a thread?
- How, if at all, did participation in the convening impact participants’ interest in positioning imagination as an explicit objective to address in their work?
- How, if at all, did participation in the convening change the types of projects that participants intend to implement at their institutions, or in collaboration with other institutions?
- To what extent did participation in the convening or post-convening activities impact participant interest and engagement in seeking partners or collaborators for future work?

The professional impact study methods include:

## Survey 1 month after the convening

Kera Collective administered a 3-question survey approximately two weeks after the convening to solicit top-of-mind responses about the convening format. The survey was programmed on SurveyMonkey and administered via email. The questions were open-ended and required written feedback. n = 14

## Interviews 6 months after the convening

Kera Collective interviewed participants well after the convening to understand the mid- to long-term effects of the convening on participants. Interviews took place via phone or Zoom. The questions were open-ended and followed the trajectory of the conversation. n = 6

## Survey 3 months after the convening

Kera Collective administered a survey approximately 3 months after the convening to solicit more in-depth feedback about the convening, including ideas about imagination in STEM or interest in imagination that may have developed since the convening. The survey was programmed on SurveyMonkey and sent via email. Questions included multiple choice, scales, and a few open-ended questions. n = 42

## Attendance & observation

Amanda Krantz from Kera Collective attended all 3 panels, participated in all 4 workshops (participant observer), and joined many of the planning meetings leading up to the convening. Attendance and observation serves as context for the interpretations within the report but are not described as a method in and of itself.

# Survey 1 Month after the Convening Findings

# TOP-OF-MIND TAKEAWAYS

Respondents were asked, "What are some ideas you took away from your experience with the workshops? What part(s) of the workshops made you think about this?" The evaluator coded the written responses (n=14) into the following categories:

## Imagination as an important skill

More than one-half of responses described the importance of imagination within various aspects of life.

## Imagination and STEM

One-half described a realization about imagination and STEM. For example, one respondent described recognizing imagination as a strong interest in the STEM community. Underlying these responses was not only knowledge or realizations, but excitement about this learning.

## Imagination as a tool and practice

Almost one-third wrote about imagination as a tool or practice but in many different contexts. For example, one respondent took away imaginative facilitation ideas. Still another described tools for supporting imagination for others.

## Defining imagination

Two respondents described coalescing around and defining imagination.

**"Imagination is and should be a skill set that everyone uses throughout their lives."**

**"Although my group uses imagination as we design STEM curriculum, I hadn't realized how many other groups are doing this work (often with different lenses than ours), and even more broadly how fundamental imagination is to STEM education. It was exciting and energizing to learn about this!"**

**"My biggest takeaway was a better understanding of imagination. Hearing the definitions and how professionals view it differently but with common denominators was key for me."**

# PERCEIVED GAPS IN WORKSHOPS

Respondents were asked, "Was there anything that you felt was missing from the workshops or wish had been discussed?" Almost one-half said nothing was missing or desired. The evaluator coded the written responses (n = 14) into the following categories:

## Defining imagination

More than one-quarter wrote a comment about desiring a more concrete definition of imagination that could make the convening more actionable and shareable. This finding is seemingly related to the next finding about learning goals.

"Hm. This is tough. I think I anticipated the workshop would tie together the pieces that make up Imagination a bit more strongly, but I guess the point was more 'look at all the components/pieces!' In coming back to talk to colleagues about the workshop, I mostly am left with the takeaway 'Imagination is more than you think!' or 'Imagination is pretty complicated, when you try to break it down!' I think I was hoping for something a little more revelatory or synthesized, similar to how the panels were more directed."

## Clarifying learning goals

A few respondents said they would have liked the workshops to be framed around clear learning goals. These respondents described uncertainty about the intentions for the workshops.

"The workshop was very thorough but still the concept of imagination seems very large. If it were me, I'd want to sharpen it up a bit to make it more useful, but I recognize that different people might want to focus on or emphasize different things, so there is value in a broad definition."

## More time and context for participant discussion

A few respondents had feedback related to the discussion time. Two said they wanted more time, while another described wanting greater context for participants' experiences in order to better understand how they were engaging imagination in their work.

"The workshop felt a little more 'for the research' than 'for the participants'; while it was very collaborative and participant-led in the second half, there wasn't a clear learning goal for me from that half of the session beyond 'it's complicated.'"

# FEEDBACK ON WORKSHOP FORMAT & FACILITATION

Respondents were asked, “What feedback do you have about the workshop format and facilitation?” The evaluator coded the written responses (n=14) into the following categories:

## Liked the format and facilitation of the workshops

Many provided specific comments about how they liked the format and facilitation of the workshops. For example, one respondent appreciated the grounding of the workshops in literature and data. Others appreciated how the facilitation used Google Documents and Sheets that helped scaffold experiences.

## Enjoyed everything

One-third generally described how they enjoyed everything.

## Suggestion for small group facilitation

One person wished the facilitator in their small group had provided more prompts to guide discussion.

**“The format and facilitation were outstanding. Great thought went into this! I loved the reliance on lit. review and interviews. The organizers did a very impressive job of taking what they knew and moving it forward. They were the best!”**

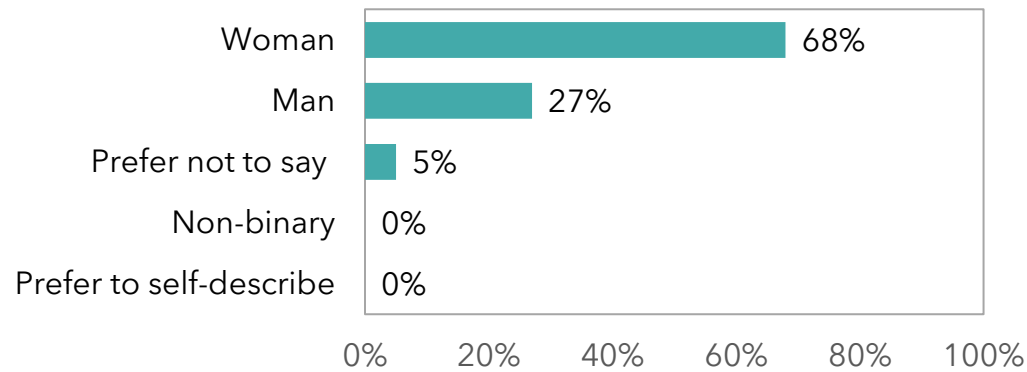
**“This was the BEST online workshop that I have attended. I loved that the ‘tools’ were so useable and therefore enhanced the conversation in breakout rooms. Particularly the last workshop was so imaginative, in itself. I felt that we were encouraged to bring our whole selves (work and personal) to the workshops. Thank you!”**

# Survey 3 Months after the Convening Findings

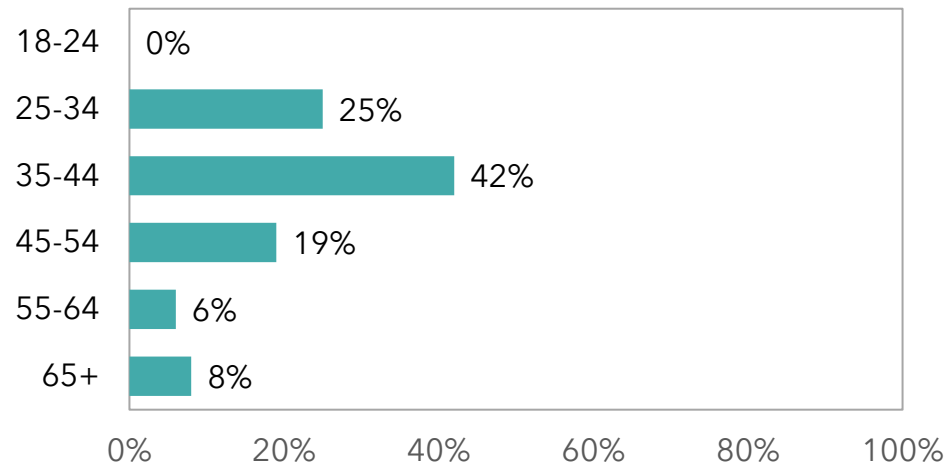
# DEMOGRAPHICS

Survey respondents were demographically similar in many ways. The majority identify as woman (68%), between 35-54 years (61%), and White (84%). Demographically, these survey participants are similar to participants in the imagination perspectives survey conducted by MOS Boston pre-convening.

## How do you describe yourself? (n=42)

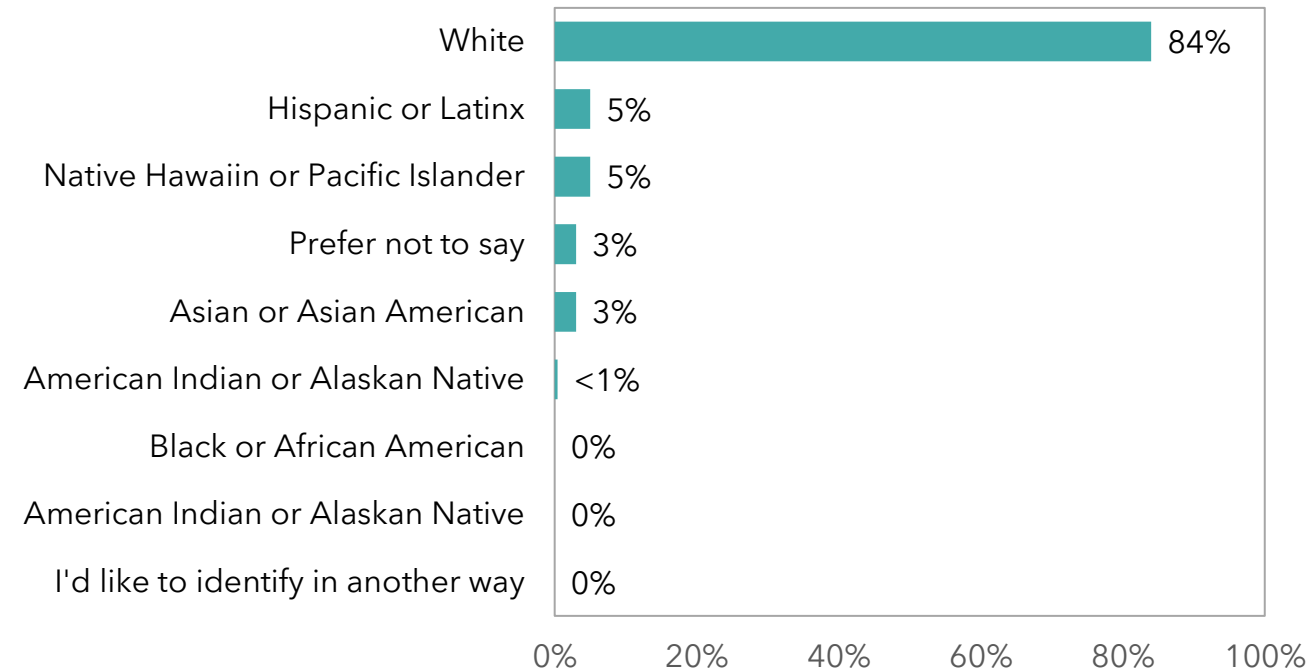


## What is your age? (n=42)



## With which racial or ethnic group(s) do you identify? (n=42)

Responses do not total 100% since visitors could select more than one category

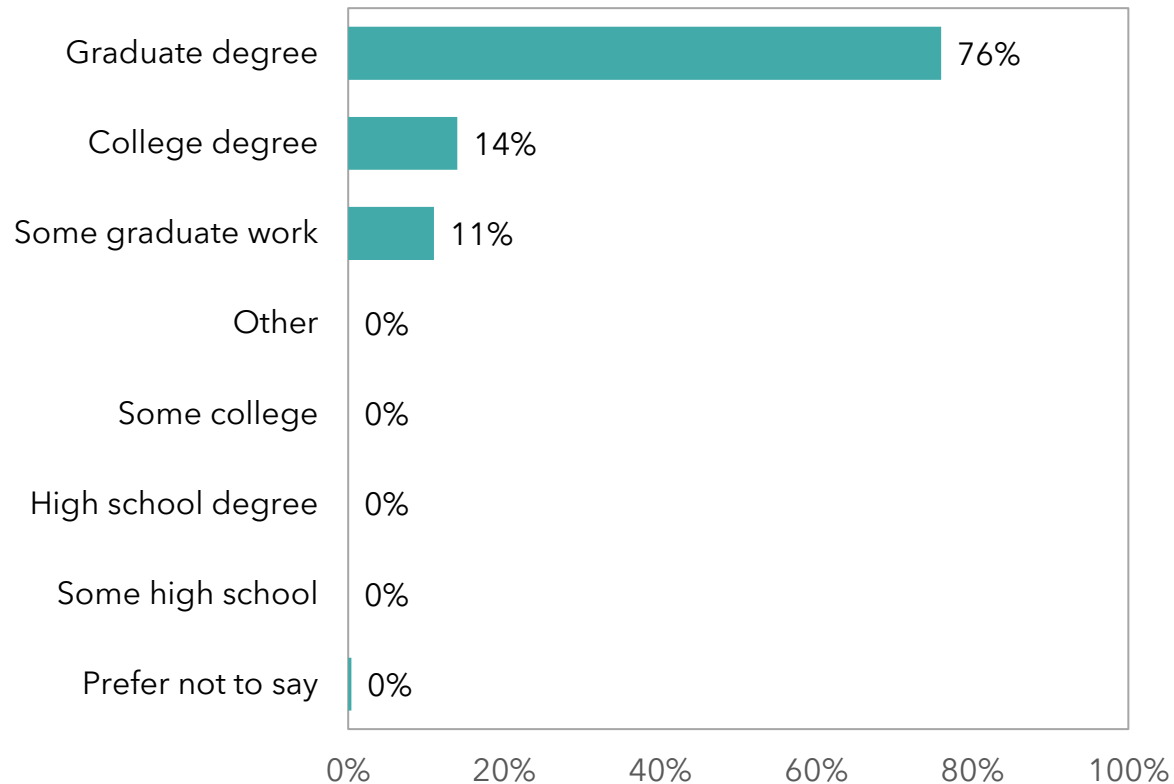




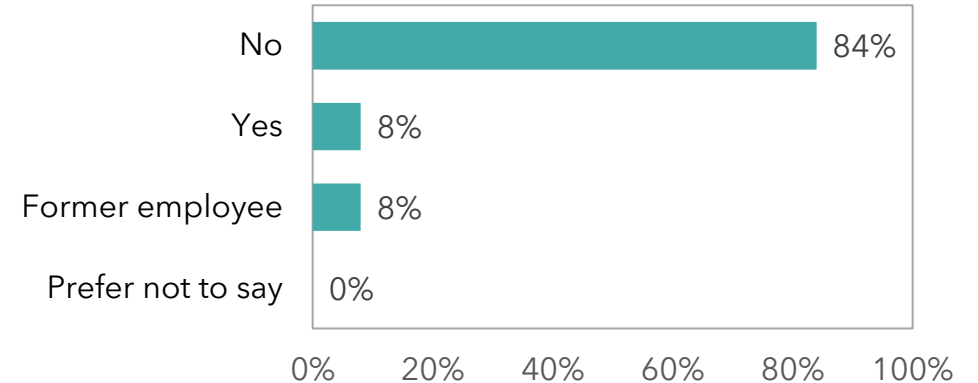
# EDUCATION, EMPLOYMENT & RESIDENCE

Survey respondents have attained high education levels (76% with graduate degrees) and are not MOS Boston employees (84%). They reside in mostly urban (46%) or suburban (43%) areas. Education and residence are similar to the imagination perspectives survey conducted by MOS Boston pre-convening (employment was not included).

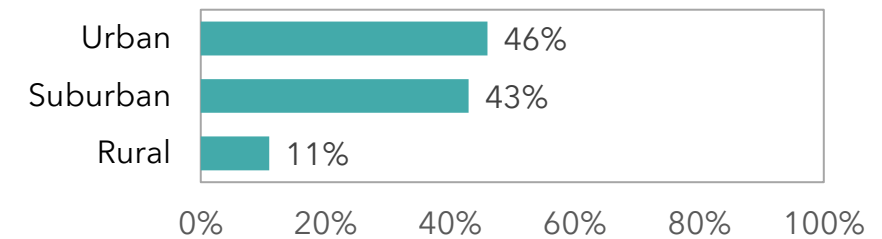
## What is the highest level of education you have completed? (n=42)



## Are you an employee (staff, intern, or volunteer) of the Museum of Science, Boston? (n=42)



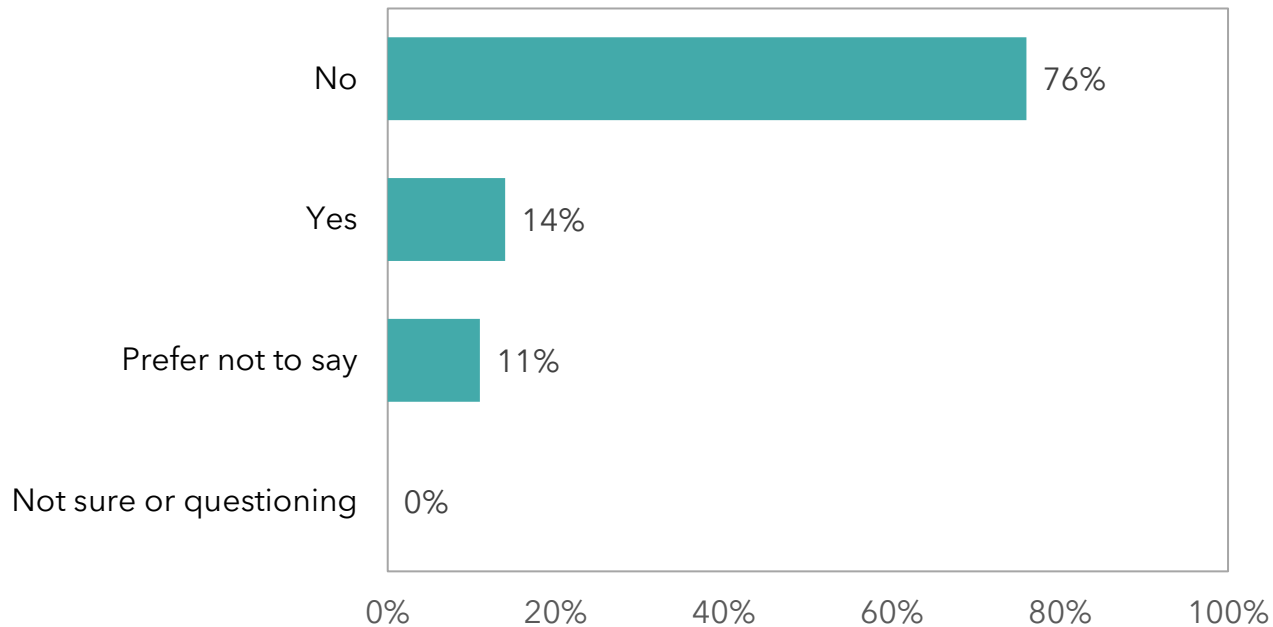
## Which of the following best describes the area where you currently reside? (n=42)



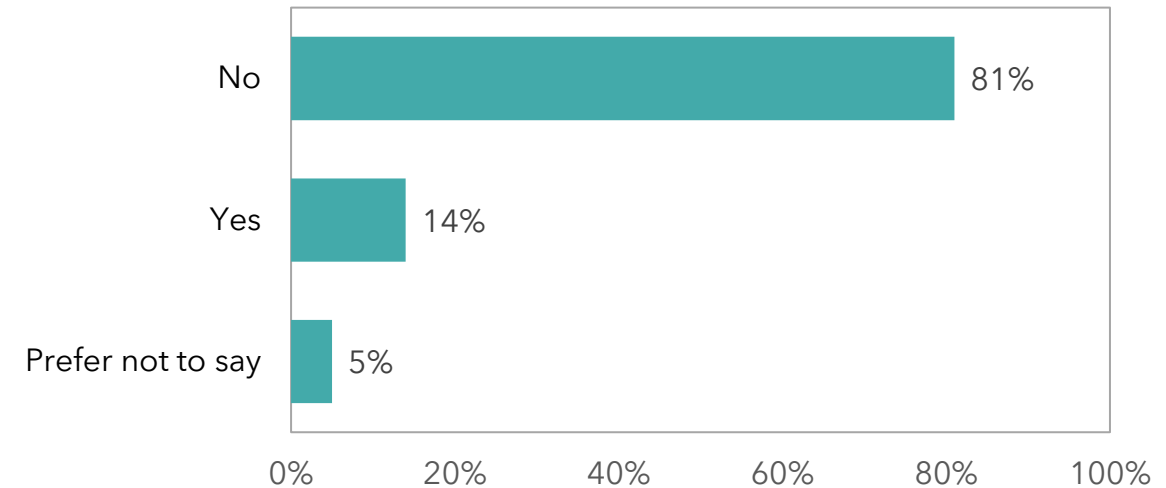
# IDENTITY

Most survey respondents do not identify as LGBT+ (76%). Most survey respondents do not have a permanent or temporary disability (81%). Identity is generally similar to that of the imagination perspectives survey but with a greater proportion choosing “prefer not to say” for both questions.

## Do you identify as LGBT+? (Lesbian, Gay, Bisexual, Transgender, +) (n=42)



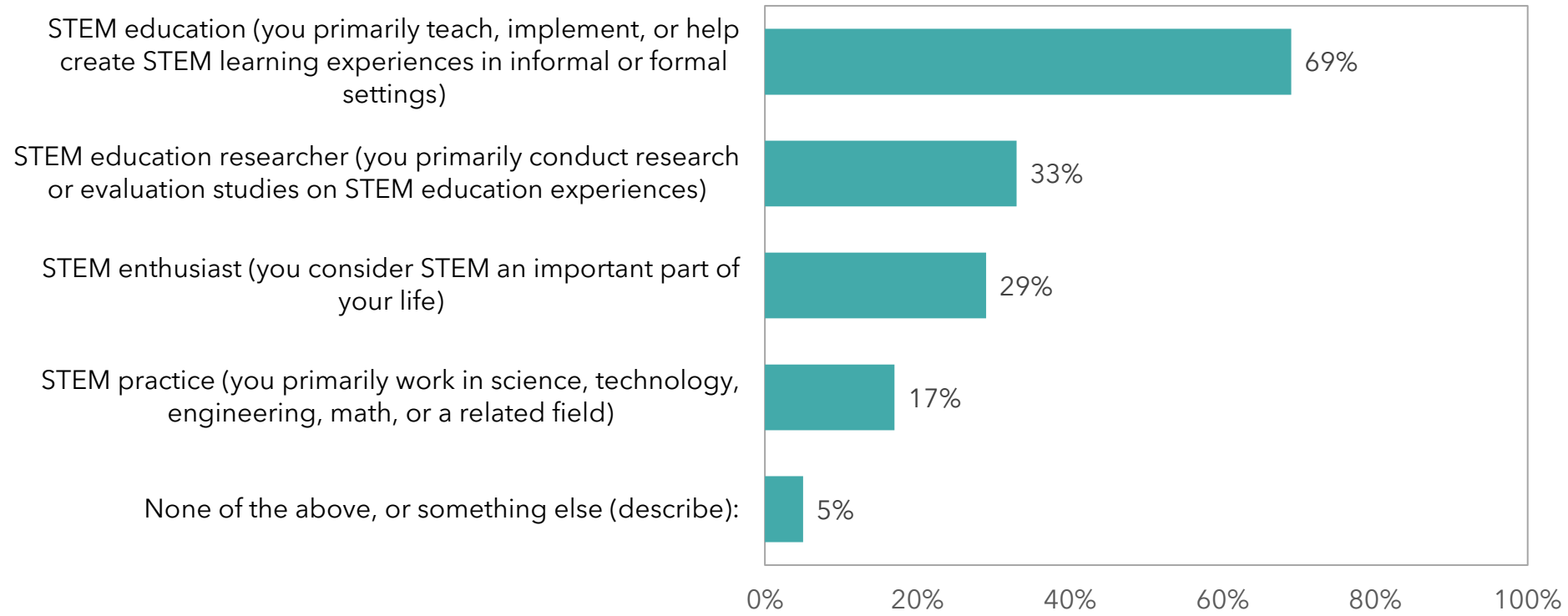
## Do you have a permanent or temporary disability? (n=42)



# RELATIONSHIP WITH STEM

Most survey respondents indicate a relationship to STEM education (69%). STEM education researcher is a distant second most indicated relationship (33%), closely followed by STEM enthusiast (29%). Responses generally match the imagination perspectives survey but with a smaller percent of respondents choosing "STEM practice."

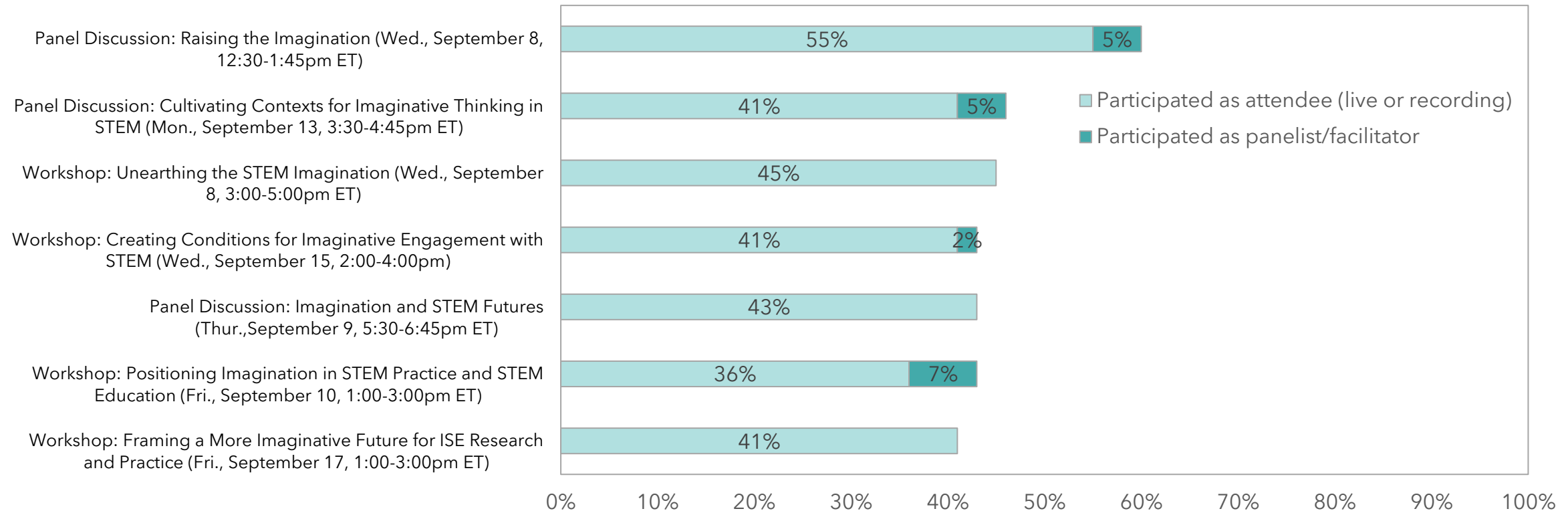
## Which of the following best describe(s) your relationship with STEM? Select all that apply. (n=42)



# PARTICIPATION IN UNPACKING THE STEM IMAGINATION

Most survey respondents participated as an attendee versus as a panelist/facilitator (see chart key). Two of the panel sessions were most attended: "Raising the Imagination," the kick-off event (60% participated) and "Cultivating Contexts for Imaginative Thinking in STEM" (46% participated). The workshops were participated in by at least 41% of survey respondents.

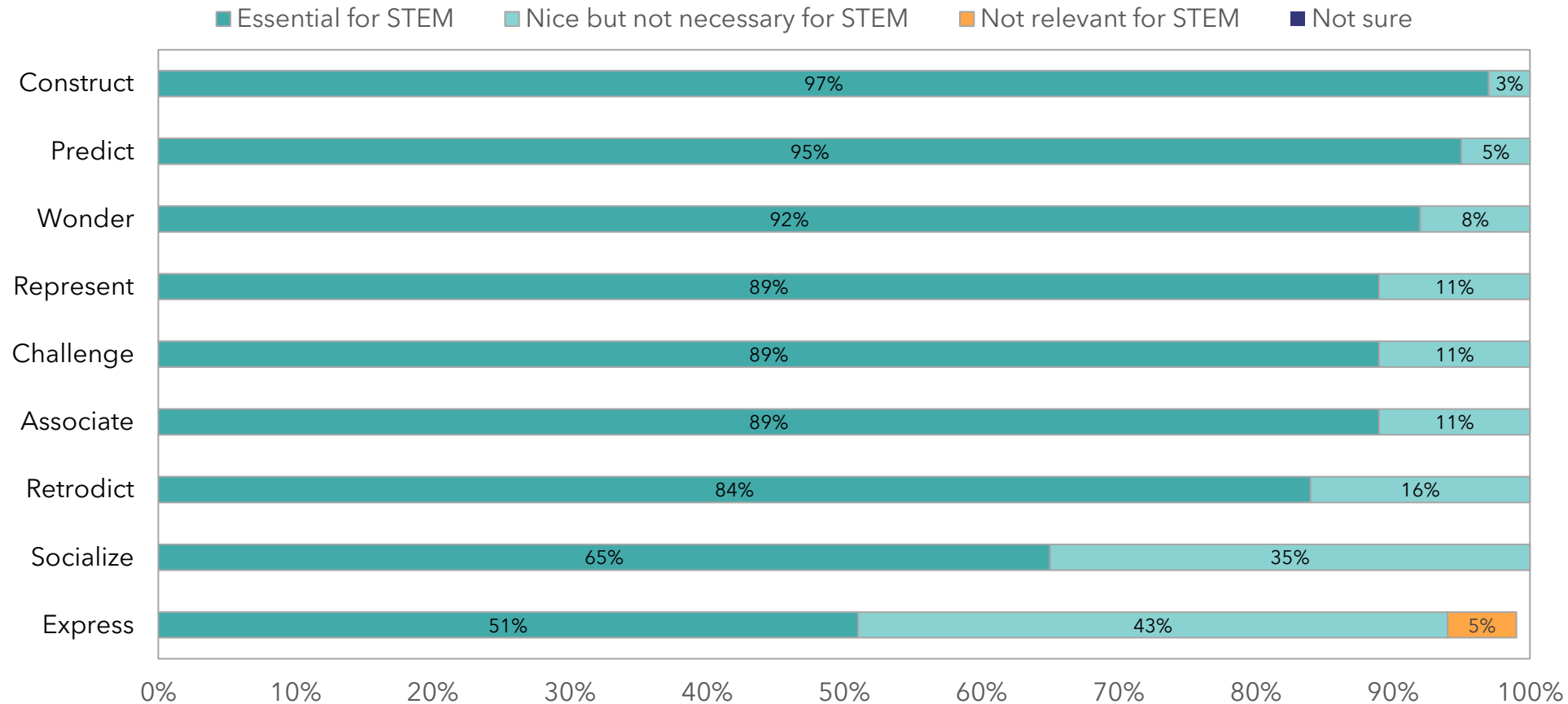
## Unpacking the STEM Imagination included multiple virtual opportunities. Which of the following did you participate in as an attendee (live or recording) or panelist/facilitator? (n=42)



# IMAGINATIVE WAYS OF THINKING

The majority of survey respondents said the imaginative ways of thinking posed to them were essential to STEM. Construct, predict, and wonder were considered essential by the greatest proportion of participants (97%, 95%, and 92%). Socialize and express received less consensus, with 35% saying socialize is nice but not necessary for STEM and 43% saying express is nice but not necessary (and 5% said not relevant).

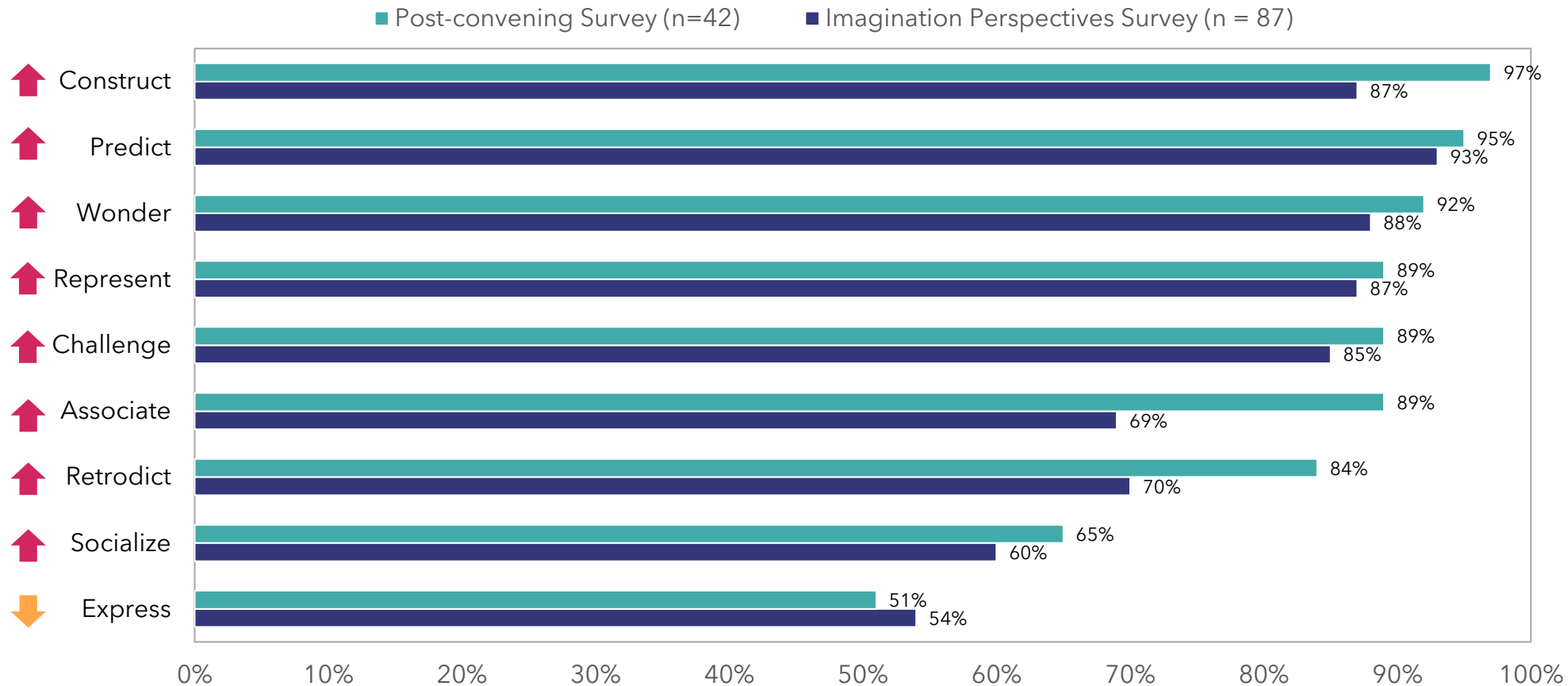
**For each imaginative way of thinking, how would you rate its relationship with STEM? Select one response per row. (n=42)**



# IMAGINATIVE WAYS OF THINKING

While not a hypothesis or necessarily an intention of the MOS Boston team, respondents in the post-convening survey agreed more that the various imaginative ways of thinking were essential for STEM than those who completed the imagination perspective survey before the convening. While not a clear pre- and post-comparison, it does suggest the convening enhanced participants perception that imaginative thinking skills are essential for STEM.

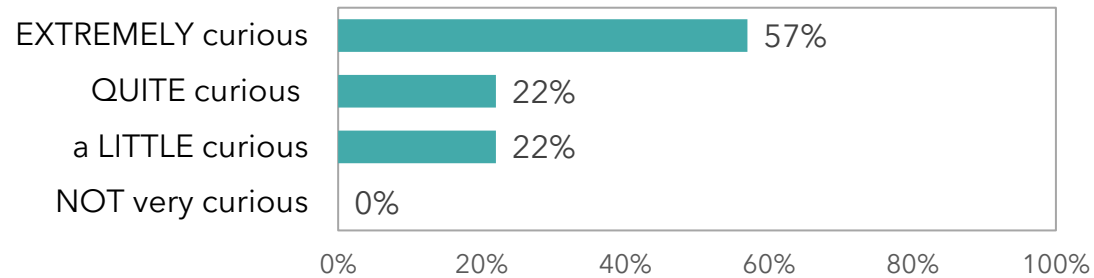
**For each imaginative way of thinking, how would you rate its relationship with STEM? Select one response per row.**



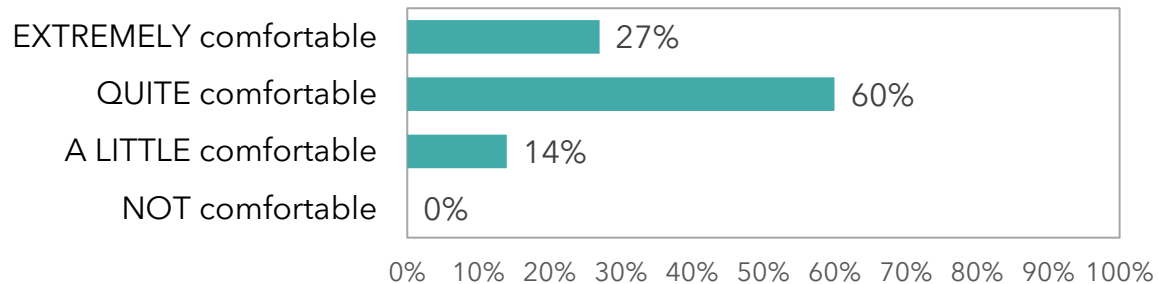
# CURIOSITY, COMFORT, KNOWLEDGE ABOUT IMAGINATION AND STEM

## Which statement best describes you:

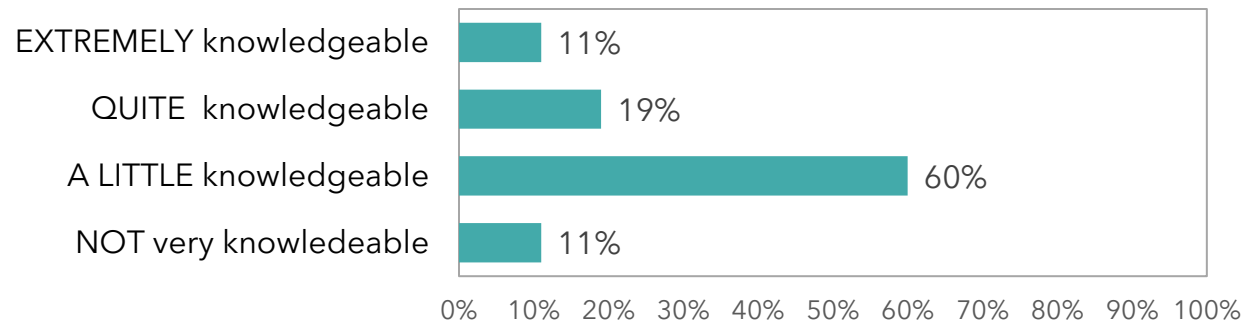
### ...curiosity to learn about different perspectives on imagination's relationship with STEM? (n=42)



### ... comfort talking with colleagues about imagination's relationship to STEM? (n=42)



### ... knowledge of research on imagination's relationship with STEM? (n=42)



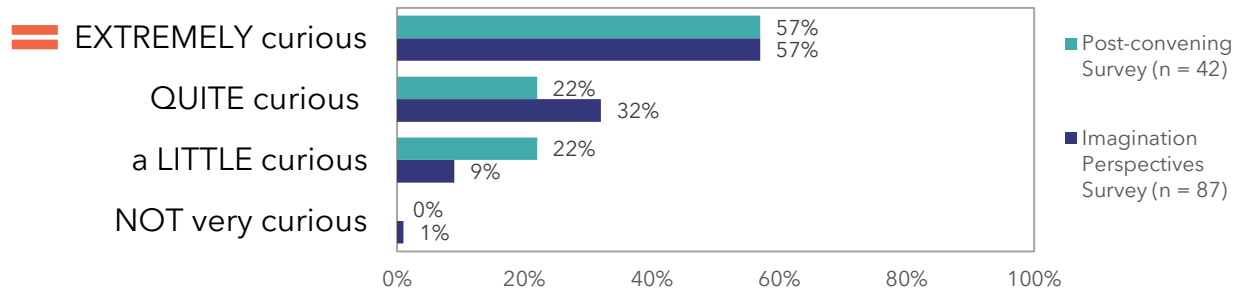
The majority of survey respondents were **extremely curious** to learn about different perspectives on imagination's relationship with STEM (57%).

But survey respondents' **comfort** talking with colleagues about imagination's relationship to STEM **was lower than curiosity** on the spectrum (60% said they were quite comfortable versus extremely).

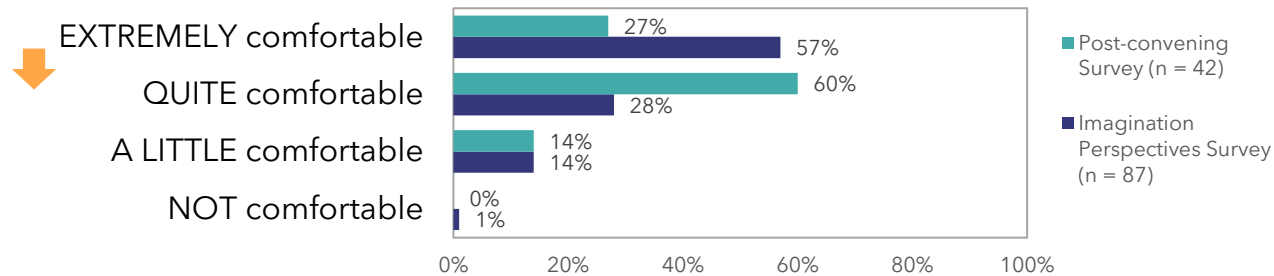
Further, survey respondents' **knowledge** of research on imagination's relationship with STEM was **lower than both their curiosity and comfort** (60% said they are a little knowledgeable versus quite or extremely knowledgeable).

# CURIOSITY, COMFORT, KNOWLEDGE ABOUT IMAGINATION AND STEM

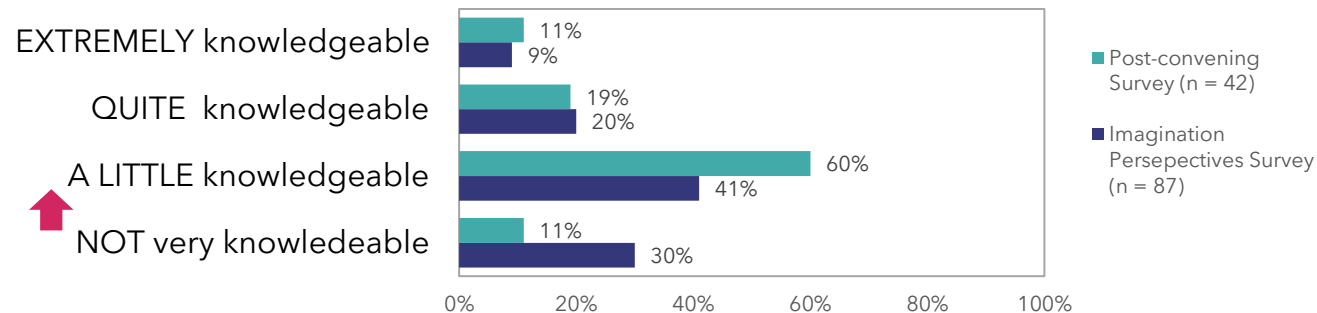
## Which statement best describes you: ...curiosity to learn about different perspectives on imagination's relationship with STEM?



## ... comfort talking with colleagues about imagination's relationship to STEM?



## ... knowledge of research on imagination's relationship with STEM?



When we compare responses from the post-convening survey to the imagination perspectives survey, there are some interesting differences:

**Curiosity is the same:** Curiosity to learn about different perspectives on imagination's relationship with STEM is approximately the same. There were some differences in selections of "quite" versus "a little," but the responses at the high- and low-end of the spectrum were the same.

**Comfort went down:** Post-convening survey responses indicated less comfort in talking with colleagues about imagination's relationship to STEM.

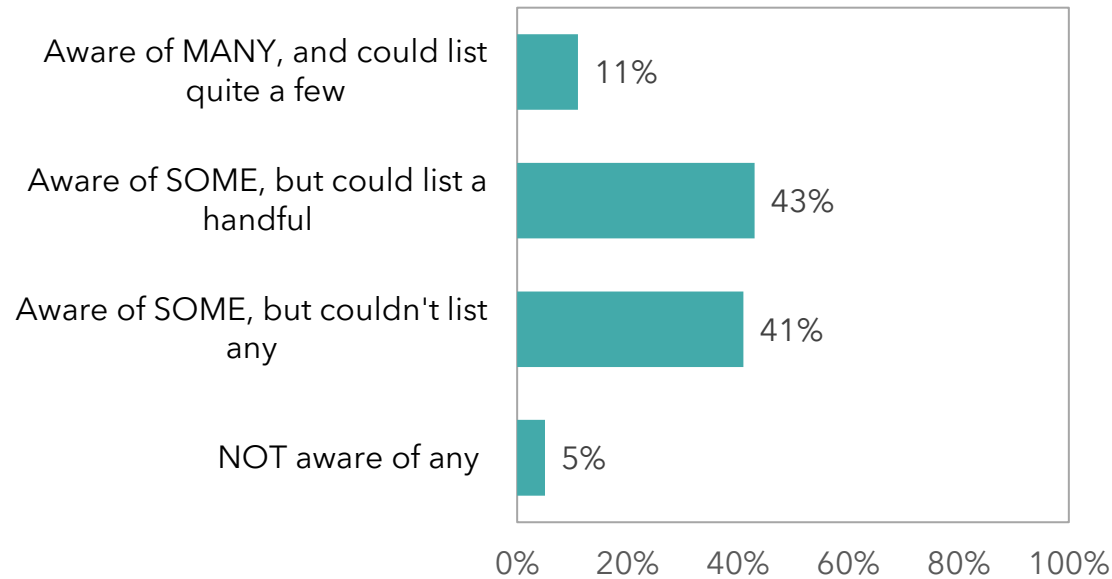
**Knowledge went up:** Post-convening survey responses indicated enhanced knowledge, although this shifts are between "not very knowledgeable" and "a little knowledgeable." There is still room for growth in knowledge given the few responses at the high-end of the spectrum.



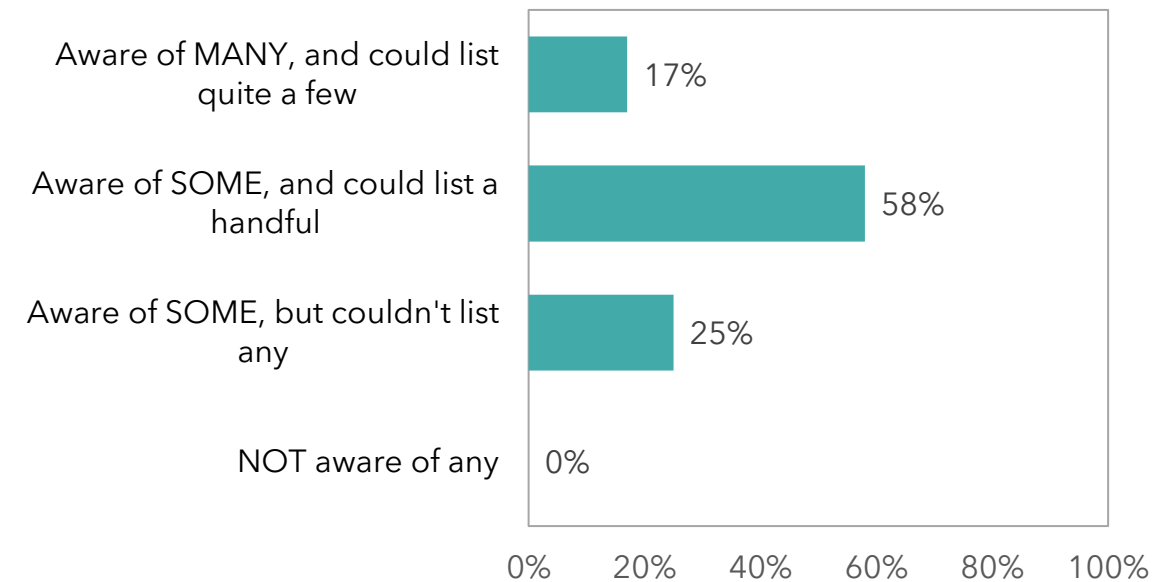
# AWARENESS IN STEM IMAGINATION

Related to knowledge (previous slide), survey respondents seem to lack awareness around other people or projects focused on imagination in STEM as well as lack awareness of ways to foster imagination. This is potentially a reason why participants joined this convening as well as an indicator of a need for more work in imagination in STEM.

## Which statement best describes your awareness of other people or projects that focus on imagination in STEM? (n=42)



## Which statement best describes your awareness of ways to foster and develop imagination in STEM? (n=42)



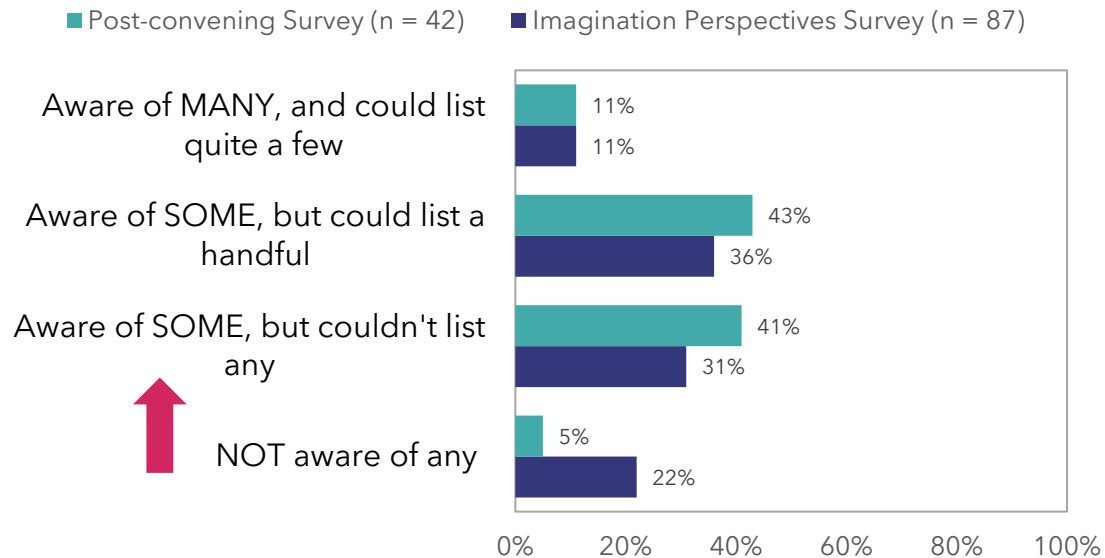
# AWARENESS IN STEM IMAGINATION

When we compare responses from the post-convening survey to the imagination perspectives survey, there are notable differences.

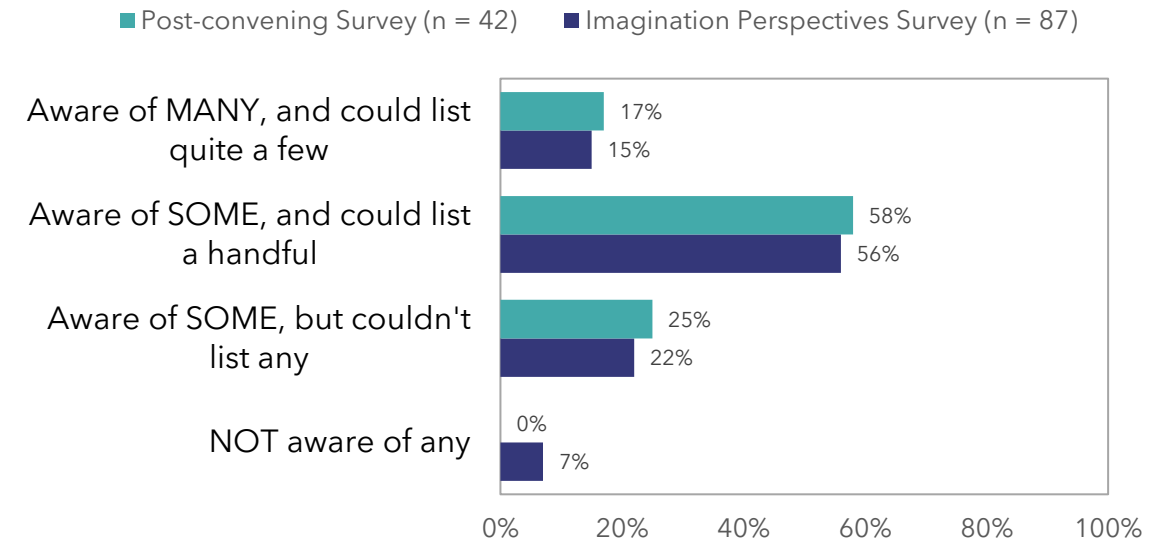
↑ **Awareness of people and projects went up:** Post-convening responses indicate participants became more aware of people or projects that focus on imagination in STEM. However, the percent who indicate high awareness is still relatively low (11%).

▬ **Awareness of ways to foster imagination is the same:** Post-convening responses indicate approximately the same awareness of ways to foster and develop imagination in STEM. Positively though, post-convening responses were at least aware of some ways (e.g., 0% selected not aware of any).

## Which statement best describes your awareness of other people or projects that focus on imagination in STEM?



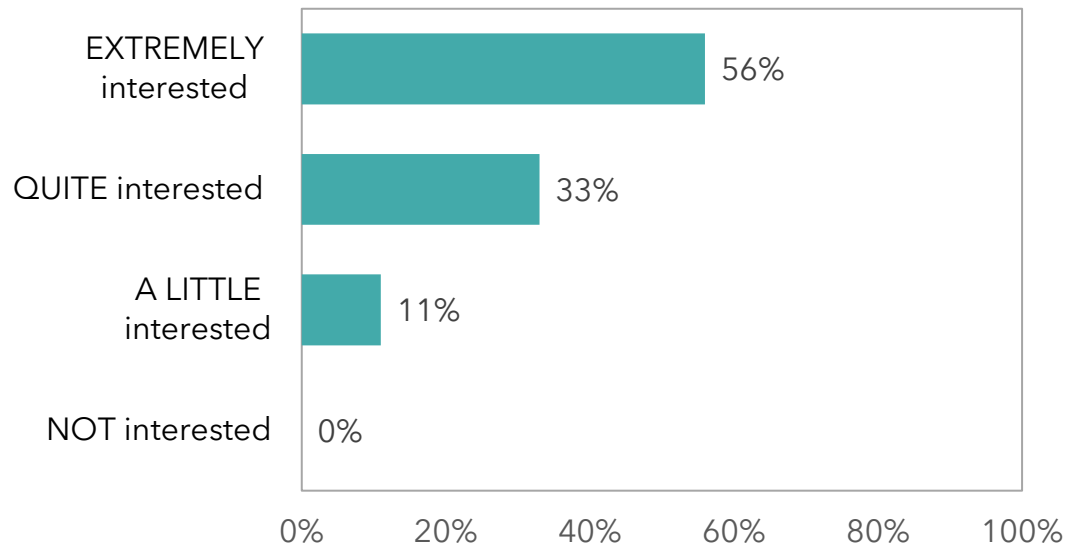
## Which statement best describes your awareness of ways to foster and develop imagination in STEM?



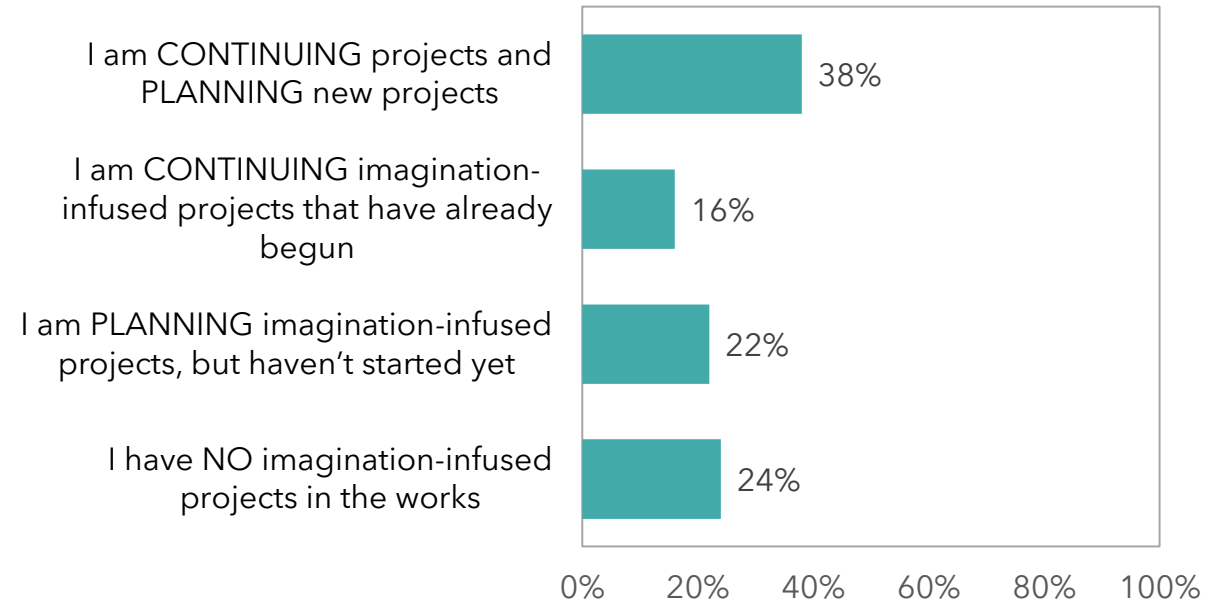
# MOTIVATION FOR PROJECTS ON IMAGINATION IN STEM

The majority of survey respondents are extremely interested in continuing or beginning projects that focus on imagination in STEM (56%), and another one-third are quite interested (33%). Yet, despite 89% being either extremely or quite interest in projects focused on imagination in STEM, slightly less are continuing imagination-infused projects and/or planning new imagination-infused projects (76%).

## Which statement best describes your interest in continuing or beginning projects that focus on imagination in STEM? (n=42)



## What are your plans to begin or continue projects that focus on imagination in STEM? (n=42)



# MOTIVATION FOR PROJECTS ON IMAGINATION IN STEM

When we compare responses from the post-convening survey to the imagination perspectives survey, there are notable differences.

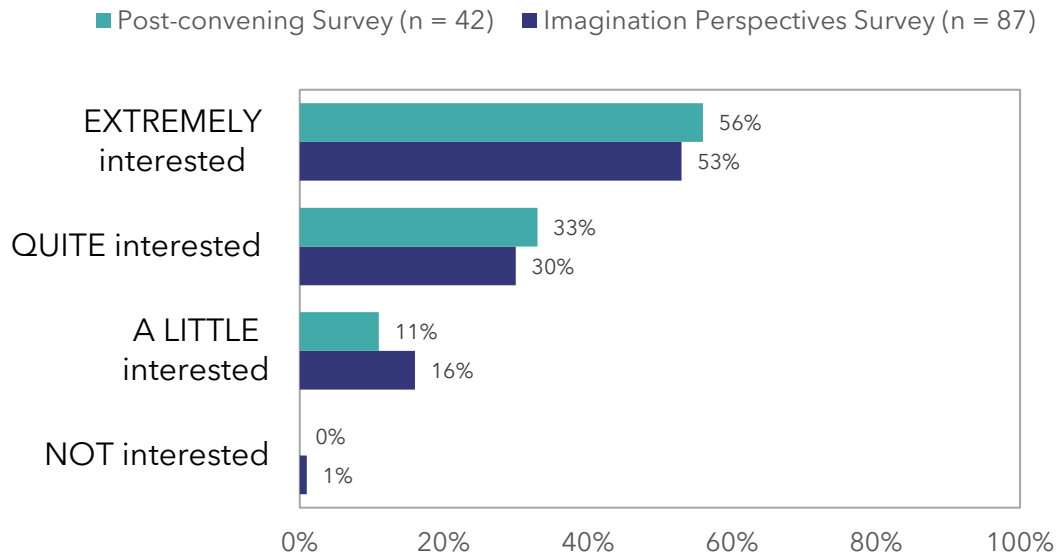


**Interest went up:** Post-convening responses indicate participants became more interested in continuing or beginning projects that focus on imagination in STEM.

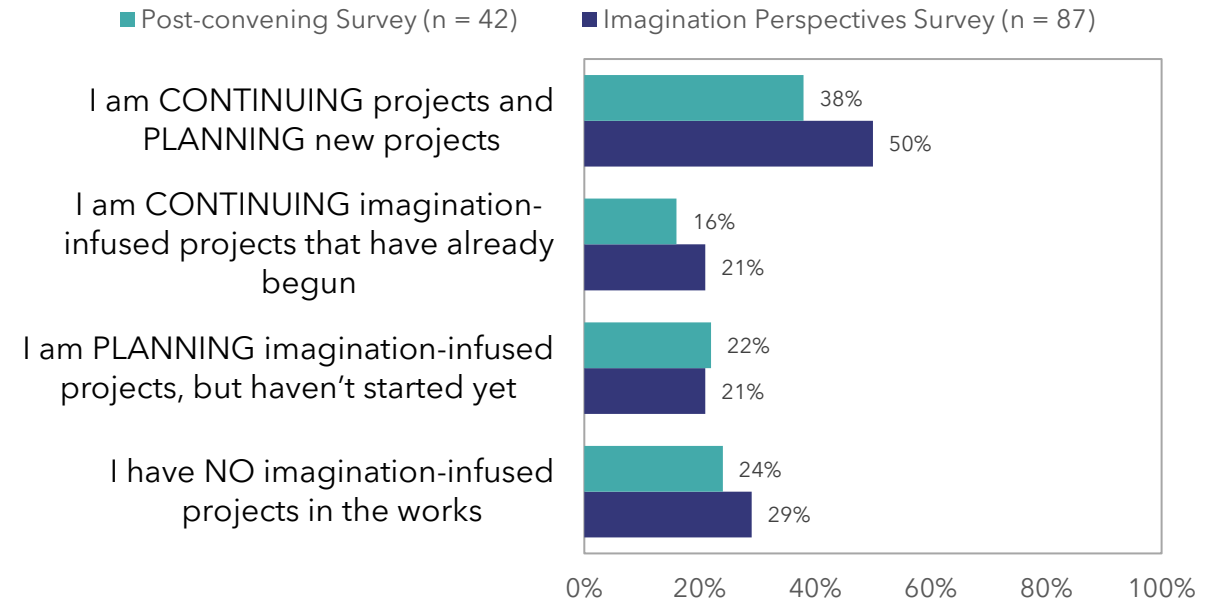


**Plans went down:** Post-convening responses indicate that actual planning around projects that focus on imagination in STEM declined.

## Which statement best describes your interest in continuing or beginning projects that focus on imagination in STEM?



## What are your plans to begin or continue projects that focus on imagination in STEM?



# Interviews 6 Months after the Convening Findings

# PARTICIPANT BACKGROUND

Kera Collective interviewed 6 individuals about their experiences with the convening:

- 4 individuals were **advisors** on the convening; they attended at least 2 of the 3 panels and at least 2 of the 4 workshops.
- 2 individuals were **participants in all four workshops**; they did not attend any of the panels.
- 3 of the 6 participants are **academics/professors**, 2 of 6 participants work in **museums**, and one works in a **museum-adjacent STEM field**.

# VALUABLE ASPECTS OF CONVENING

When asked what was most valuable to them about the convening, participants said:

## Connecting with people in different but adjacent fields

Most participants were excited to connect with the variety of people that the MOS Boston team had invited to the convening. In particular, participants liked the small group activities that let them talk about projects they were working on, which was a means to get to know each other and the work they are doing.

## Workshop activities

The majority of participants mentioned the workshop activities. As noted above, they were a means to connect and know different people, but the activities themselves were also mentioned in other ways. For example, two participants really appreciated the futures thinking activities that was imaginative in its introduction of “Fig,” an AI voice that cut into the traditional activities, but also in its focus on the future. Additionally, two other participants appreciated the imaginative nature of the activities more broadly and bravely to try out so many different strategies.

## Fore-fronting the topic of imagination

The majority found value in simply having a convening around imagination in STEM, giving their perceived importance of the topic. These participants recognized the amount of work that the MOS Boston team put into the literature review and thinking about imagination in STEM.

**“I really appreciate that it was an inspiring moment, bringing together distinct groups of people different backgrounds. It was a collective moment of thinking through imagination.”**

# QUESTIONS OR WONDERS YOU STILL HAVE ABOUT IMAGINATION

When asked questions or wonders they still had about imagination or things they hoped would have been addressed in the convening, participants said:

## Defining imagination

Two participants felt the bounds on defining imagination in STEM by the MOS Boston team were so broad that they were struggling to make meaning around imagination in STEM. (Notably, two other participants found the broadness of the definition important and valuable).

## Desiring tools to bring the convening from theory to practice

Three participants, including two museum practitioners, hoped to have left the convening with more ideas or tools on how to take the research to practice. The two museum practitioners felt value in the “academic and theoretical” discussions about STEM, but given their roles, hoped to be able to bring something shareable or actionable back to their team. Two wondered if there are things that could be made and shared now after the convening, which is part of the project’s intentions.

**“It wasn’t as obvious how to take it from literature into practice.”**

**“I want more tools or applications....How does it become really useful?”**



# INSPIRING FURTHER EXPLORATION OF IMAGINATION IN STEM

When asked about their work in the imagination realm since the convening, participants said:

## Continued interest in imagination

The majority described a continued interest in imagination in STEM. A few are already doing projects in this realm and continue to work on them. Some specific examples of manifestations of interest, include: (a) one person was inspired to address misconceptions about imagination in their daily work; (b) another was interested in making imagination visible in STEM and its relation to scientific literacy; (c) another was interested in imaginations relationship to community engagement; and (d) another was interested in exploring the relationship of indigenous and ancestral knowledge with imagination.

## Awareness of people interested in imagination

The majority of participants said the convening raised their awareness of people who are interested in and doing work on imagination in STEM. These participants generally described connections being made and a few follow up conversations, but nothing that has materialized into collaborations on projects at this time.

# ADDITIONAL FEEDBACK AND RECOMMENDATIONS

When asked questions or wonders they still had about imagination or things they hoped would have been addressed in the convening, participants said:

## Complimenting the work

Several participants complimented the incredible amount of work the MOS Boston team put into this project. Those who served on advisory roles recognized the tremendous effort to adapt the convening as a result of the pandemic and hoped they felt proud of their work.

## Desiring more

Several participants said they desired furthering the work of the convening in additional ways because the conversations felt unfinished. For example, three participants were interested in updates about the projects they heard others share during the workshops. Similarly, some participants wanted additional opportunities to connect and network with individuals, which they felt they were not able to do as fully as part of a virtual convening as they would in-person.

**“It felt so rich and deep and worth mining more, and that still needs to happen.”**

**“Want a continuation to activate resources and keep those ripples going....I feel like there were connections made and hope for a community of practice.”**