

# Children's STEM-Focused Podcasts as Promising Learning Experiences: Research Summary



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# Project Goals

The informal science education field knows very little about kid-focused STEM podcasts. This is an educational medium that has been growing in popularity over the years, but we don't know the impact and value of this medium as a means for engaging children and families in science learning and discovery.

This exploratory research is an effort to begin to fill this knowledge gap by studying listeners of the children's science podcast Brains On!.

## Research Questions

1. Who is the **audience** for Brains On! and what are their **motivations** for listening to children's science podcasts?
2. How are Brains On! listeners **using** the podcast and **engaging** with its content?
3. What kinds of **impacts** does Brains On! have on its audiences?



# What is Brains On!?



Brains On! is a science-focused podcast for children ages 5 to 12 years old and their families, produced by American Public Media. A unique feature of Brains On!, compared to other children's science podcasts, is that the content of each episode is based on questions children submit to the show. Each 15-30 minute episode features a Brains On! host, a kid co-host, and a guest scientist or expert. Episodes also use humor and fun to convey information in a kid-friendly way, often using skits, characters, or a song to help explain complex scientific concepts.

As of June 2021, Brains On! has produced 200 episodes. Find them all at [brainson.org](https://brainson.org).



# Features of Brains On! Episodes



**Brains On! episodes all have the following features:**

Topics based on kids' questions

Engaging hosts

Kid co-hosts

Mystery sounds

Brains On! honor roll

← Kids interviewing scientists

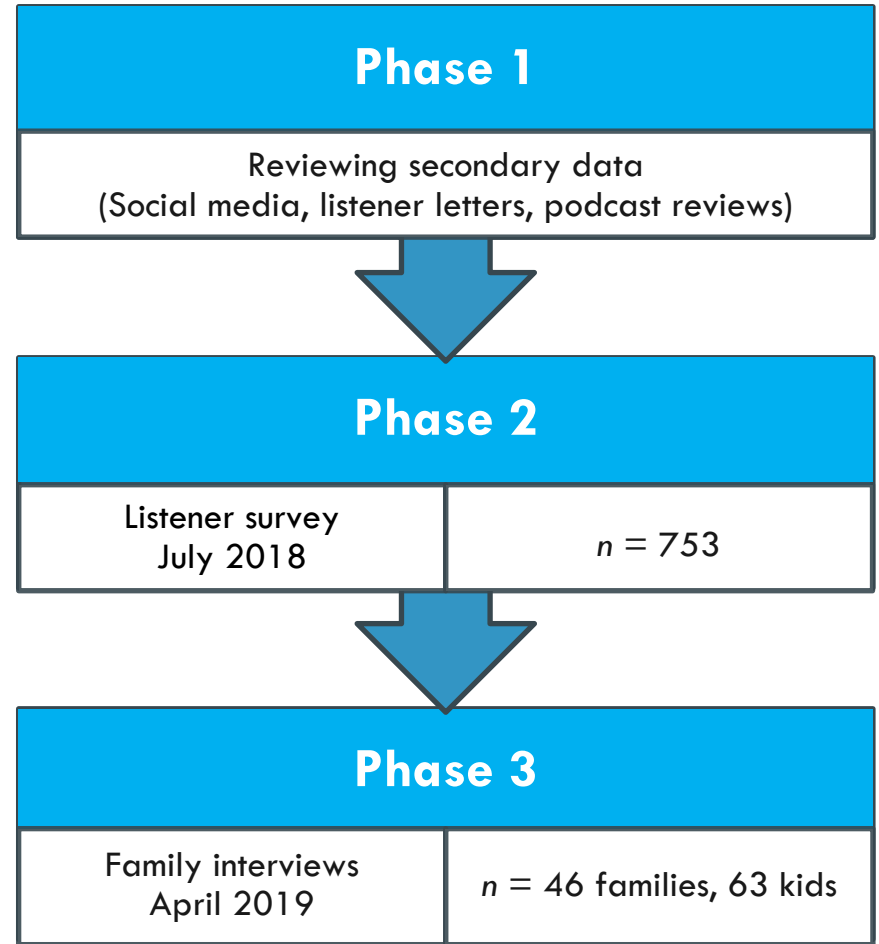
Skits ("skitsplanations") and/or songs

A request for kids to share content with the show (questions, mystery sounds, topic ideas)

# Research Design

The research questions were answered through a three-phased mixed-methods research design. Each phase informed the next, providing additional insights into answering the research questions.

This research summary provides a high level overview of our findings, but additional details about the methods and findings from each phase of the research can be found at <https://bit.ly/BrainsOnResearch>.



**Who is the audience for Brains On!?**

# Who Listens

## Brains On! 5 - 12 year-old listeners...

Are in all 50 states & around the world

Tend to be 6 - 9 years old (74%) with an average age of 8 years old

Tend to identify as white (80%)

Are more likely to identify as male (58%) than female (41%)





# Composition of Listener Households

## Brains On! listener households tend to...



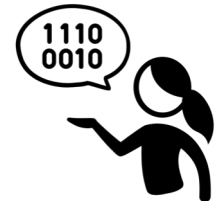
Be highly educated (64% have an adult with a graduate degree)

Have an annual household income over \$100,000 (60%)



Be public radio listeners (92% with at least one adult who listens to public radio)

Have an adult with a STEM-based job (62%)



# Multigenerational Listening

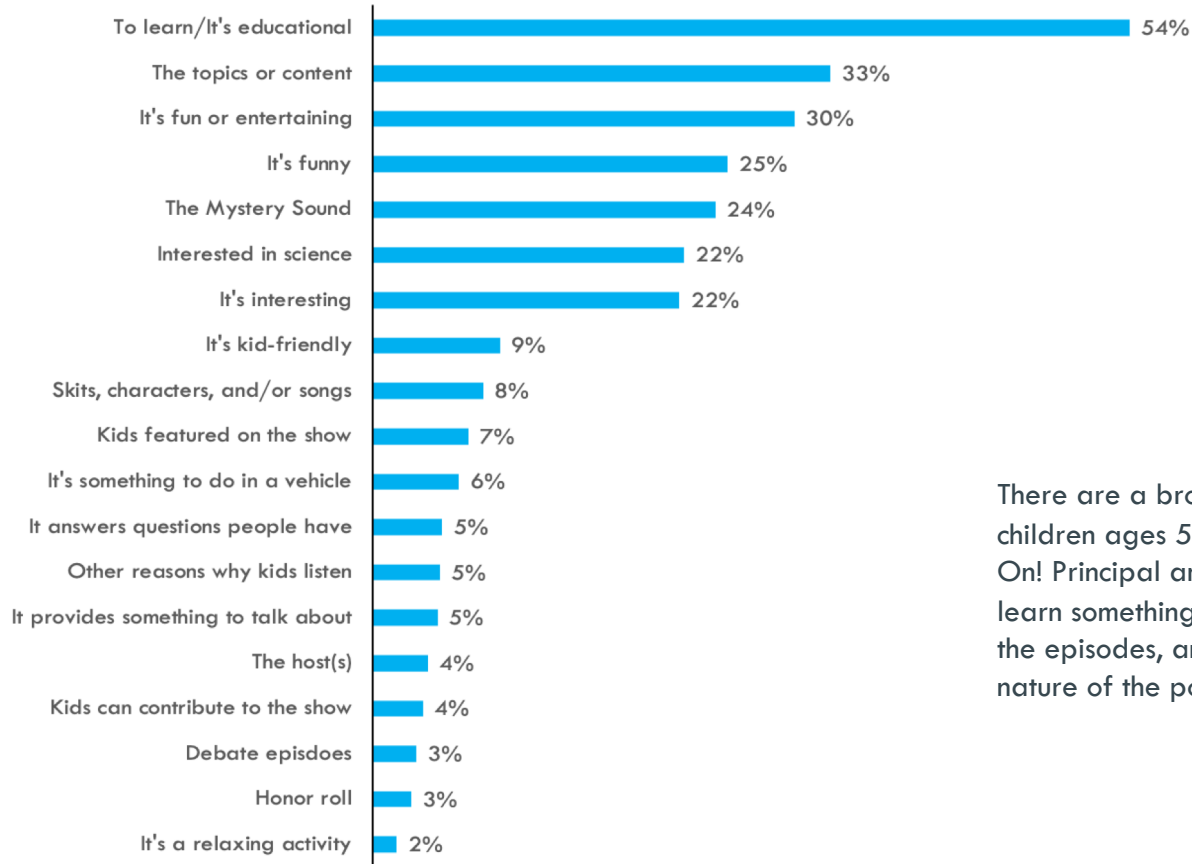
Multigenerational listening is common. Almost all (98%) listeners have listened in a group containing an adult and child.

Most adults (95%) agreed that “Brains On! is a program for kids that is also enjoyable for adults.”



**What are children's motivations for listening?**

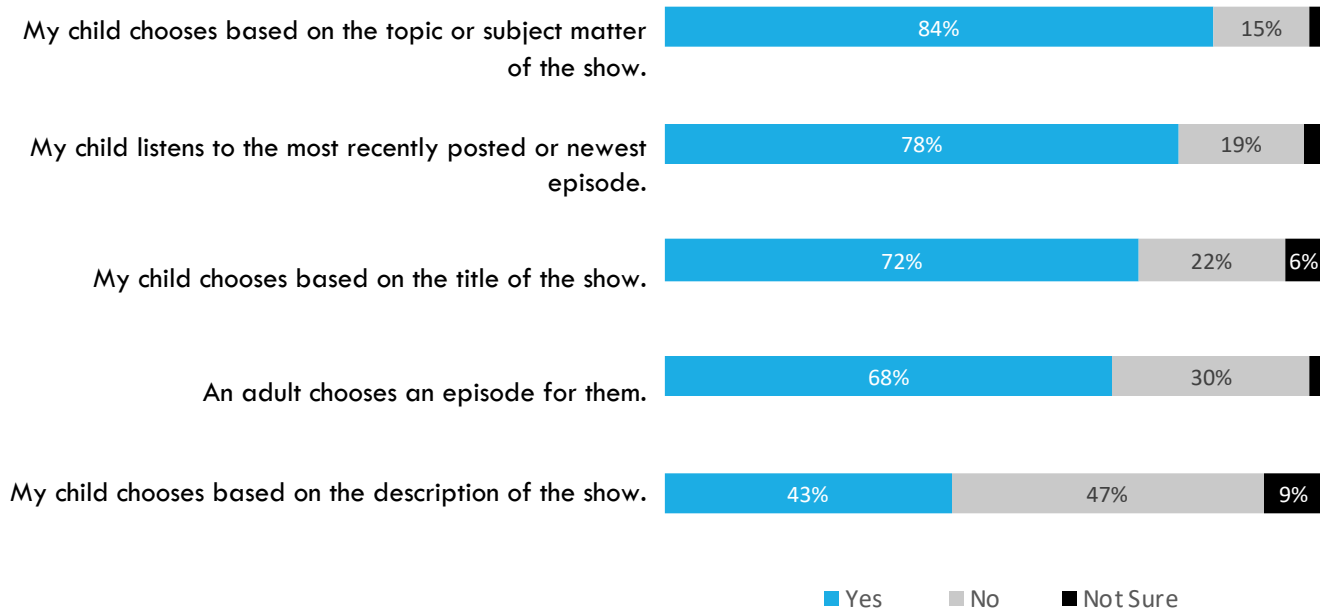
# Why Children Listen to Brains On!



There are a broad range of reasons why children ages 5 to 12 like to listen to Brains On! Principal among them are the ability to learn something new, the topics or content of the episodes, and the fun and entertaining nature of the podcast.

# How Children Decide Which Episode to Listen to

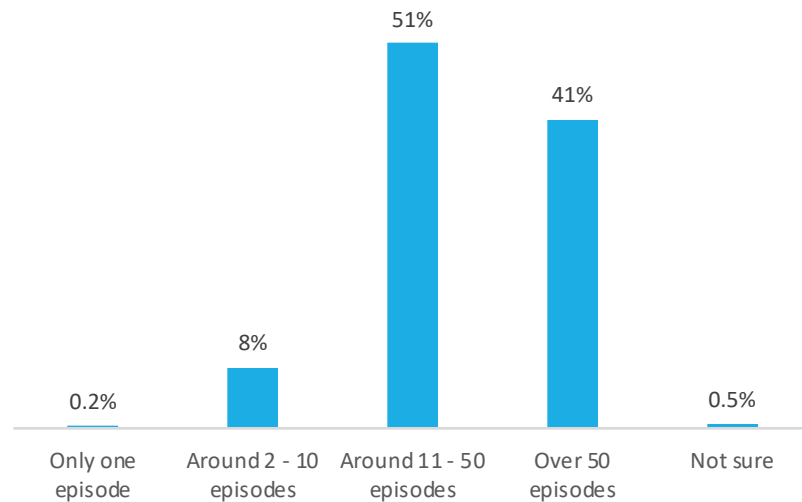
There are many ways in which children choose which Brains On! episodes to listen to.



**How are Brains On! listeners **using**  
the podcast and **engaging** with its  
content?**

# Extent of Listening

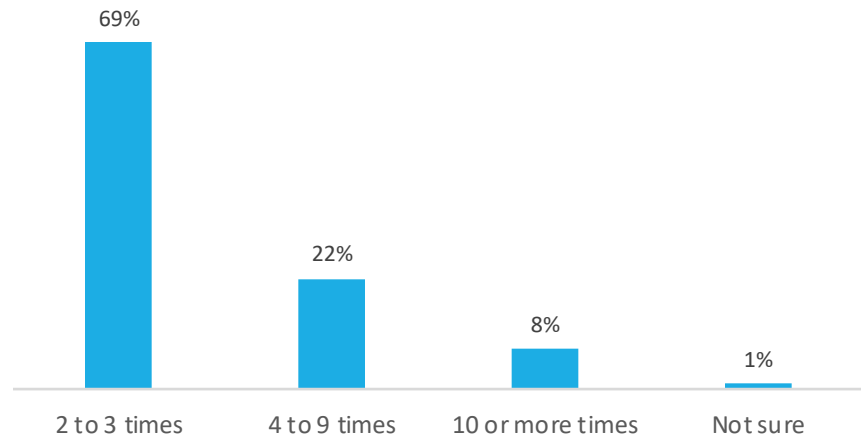
Children 5 to 12 tend to be avid listeners of Brains On!.



As of July 2018 (when the survey was administered), Brains On! had produced 120 episodes. Most children responding to the survey had listened to 11 or more episodes.

# Repeat Listening

Repeat listening is common for 5 to 12-year-olds. Close to three-quarters of children (73%) have listened to a Brains On! episode more than once.



For children who were repeat listeners, parents were asked to think about the episodes their child had listened to the most. Close to a third of children (30%) had listened to that episode four or more times.



# Where They Listen

**Kids ages 5 - 12 have listened to Brains On!...**



In a vehicle (95%)



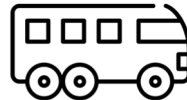
At home (83%)



Somewhere they are staying on a trip (52%)



On an airplane (25%)

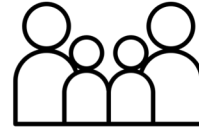


On public transportation (8%)

# Vehicle Listening Behaviors



## While listening in a vehicle...



91% of kids have listened with their family

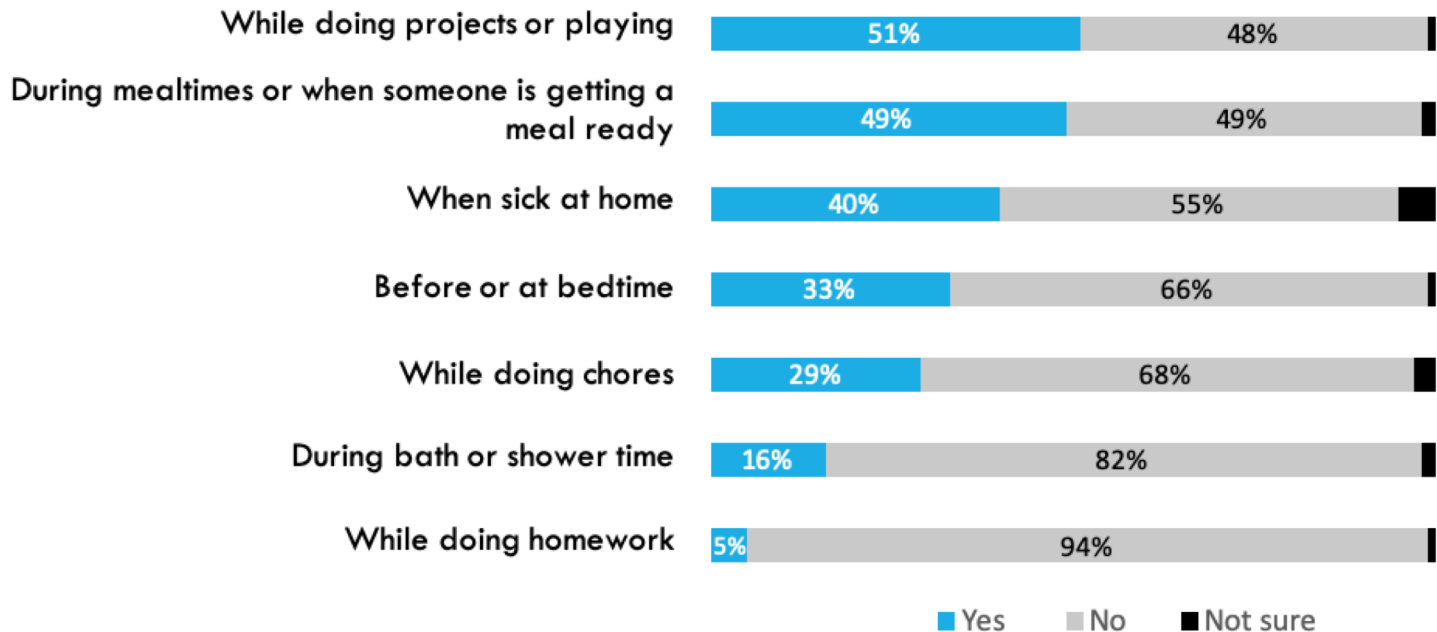


99% have had conversations with family members about what they were hearing

Vehicles appear to be a unique informal science education setting for **joint media engagement** with kids' STEM-based podcasts.

# When Children Are Listening at Home

Children listen at home while engaging in a wide variety of other activities.



# Activities Inspired by Listening

After listening to Brains On!, kids ages  
5 - 12 have...



Talked to someone about what  
they heard on the show (96%)



Quoted, sang, or acted out something from the  
show (84%)



Searched for more information about an  
episode topic (62%)



Sent something to Brains On! (52%)



Did an activity or experiment inspired by an  
episode (44%)

**What kinds of *impacts* does Brains  
On! have on its audiences?**

# Studying Impacts

With research lacking on children's science podcasts, we didn't know what kind of impacts this type of medium might have on children.

The interview protocol was developed to explore the full range of impacts Brains On!, and potentially other science podcasts, might have on child listeners.

Phases 1 and 2 of the research brought to light some potential impact areas to explore. We also looked to two key publications in the informal science education field, *Learning Science in Informal Environments* (National Research Council, 2009), and the National Science Foundation's *Framework for Evaluating Impacts of Informal Science Education Experiences* (Friedman, 2008), for additional impact areas to pay attention to in our interviews.

## Strands of Informal Science Learning

(National Research Council, 2009)

- Sparking and developing interest and excitement
- Understanding science knowledge
- Engaging in scientific reasoning
- Reflecting on science
- Engaging in scientific practice
- Identifying with the scientific enterprise

## Impacts of Informal Science Education Experiences

(Friedman, 2008)

- Awareness, knowledge, or understanding
- Engagement or interest
- Attitude
- Behavior
- Skills
- Other outcomes

# Impacts of Listening to Brains On!

Brains On! has a wide range of impacts on listeners, with all of the children we interviewed experiencing some kind of impact as a result of listening. The impacts of listening to Brains On! align closely with many of the impact categories outlined in the informal science education publications *Learning Science in Informal Environments* (National Research Council, 2009) and *Framework for Evaluating Impacts of Informal Science Education Projects* (Friedman, 2008).

The evidence of multiple impact areas that align with key frameworks for informal science learning points to the value of Brains On!, and similar children's science podcasts, as informal science educational media experiences for children.

## All of the children interviewed...

- Learned something new.

## Around three-quarters of the children interviewed...

- Engaged in science-based conversations.

## Around two-thirds of the children interviewed...

- Increased their interest in science.
- Increased their interest in learning about science.
- Listened more closely to the sounds they heard in the world.
- Increased their curiosity about the world.
- Increased their awareness of the kinds of jobs people can have in science.
- Asked more questions about the world.
- Saw themselves as someone who does or can do science.

## Around half of the children interviewed...

- Did a project or activity based on something they heard on Brains On!

## Slightly less than half of the children interviewed...

- Had changes in the types of questions they were asking.
- Increased their awareness of the different types of people that have science jobs.

# Brains On! increases children's science knowledge.

Brains On! succeeds in impacting children's science knowledge, as all children in our study **learned something new** from listening to Brains On!. Children may gain awareness of an entirely new area of science or add to their existing knowledge. Brains On! provides opportunities for children to learn about science topics they maybe wouldn't have learned or thought about otherwise. This helps to broaden children's knowledge and understanding about the world around them. The explanation of science terms in kid-friendly ways also helps children expand their science vocabulary.



# Brains On! encourages and supports children's science interest and curiosity.

Brains On! plays an important role in fostering, supporting, and sustaining children's **interest in science**. For some children, Brains On! can spark a general interest in science or an interest in a specific science topic that they didn't have before listening. However, many listeners already have an interest in science when they start listening, which means Brains On! can help to sustain and deepen a child's science interest. For some children, this increased interest in science leads to an increased **interest in wanting to learn more about the science** topics they encounter on Brains On!. This might lead to children seeking out more information about the topic of interest by searching online, checking out a book at the library, listening to a different Brains On! episode, or listening to a different podcast altogether.

Brains On! not only sparks children's interest, but **heightens their curiosity**. Curiosity is at the core of the Brains On! podcast. Brains On!'s mission is "to encourage kids' natural curiosity and wonder using science and history," using the tag line "stay curious" on some of their marketing materials. Brains On! supports children's curiosity and their tendency to ask questions about their world by using children's questions as the backbone of each episode. Brains On! places value on the questions children have and encourages them to contribute their own questions, encouraging them to engage their natural curiosity.

# Brains On! helps children practice and strengthen their science reasoning skills.

Curiosity and an interest in learning more about the world can lead to children **asking more questions** about the world around them and engaging in scientific reasoning (National Research Council, 2009). Brains On! models the scientific inquiry process for children and can lead to children asking more science-based questions as a result of listening to Brains On!. Questioning might occur directly after listening to an episode or children may come across something in their daily life which allows them to apply what they learned from an episode and want to pursue additional inquiry into the topic.

Brains On! places value on the questions children have by asking children to send in their questions and then uses those questions as the topics of episodes and Moment of Um segments. Even if children never submit their questions, our research found that the possibility of doing so can help motivate children to ask science questions and think about what they would possibly submit.

Brains On! not only promotes scientific inquiry in relation to episode topics, but leads some children to shift how they encounter the world, asking not only more questions, but **more sophisticated science questions** about the world around them. For some children, this means asking deeper or more targeted science questions than what their parents/guardians might expect from a child at that age.

**Brains On! helps  
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skills.**

Brains On!, specifically the podcast's Mystery Sound segments, encourages children to **pay more attention and listen more closely to their world**, an important part of scientifically observing the world around them. Not only while listening to an episode, but later when encountering their world, some Brains On! listeners ask questions about the sounds they are hearing, try to figure out what might be making the sound based on the features of the sound, and try to figure out why a sound might be occurring.

# Brains On! is a catalyst for engaging in science practices.

Brains On! serves as a prompt for **science-based conversations** between adults and children. These discussions can be around various aspects of a Brains On! episode such as the questions in the episode, episode topics, and Mystery Sounds. These conversations can provide opportunities for children to demonstrate what they have learned from listening to Brains On!, apply what they learned from Brains On! to a real world situation, ask questions that lead to deeper inquiry into an episode topic, and to jointly engage with family members to discuss what they are hearing during a shared media experience.

Many children may **do a project or activity based on something they heard on Brains On!**. Children may engage in their own scientific-inquiry based on Brains On! episode topics. Some episodes may inspire families to visit somewhere science-related that was featured on an episode. Some children may do activities or projects that emulate the Brains On! podcast. This includes activities such as pretending to be a Brains On! host, recreating segments they hear on the show such as *Mystery Sounds* and interviewing adults, or even creating their own science podcast inspired by Brains On!. Since Brains On! is an auditory experience, some children use their creativity and imagination to visualize something they hear about in an episode through drawing or building.

# Brains On! increases children's awareness of science role models and careers.

Brains On! provides opportunities to **increase children's awareness of the kinds of jobs people can have in science**. Brains On! features a scientist on each of its episodes, providing opportunities for children to be exposed to a broad range of science careers, the different types of work people do in science, where scientists might work, and who might be a scientist. Many times, episodes introduce children to areas of science they were not aware of before hearing about it on Brains On!. Brains On! also helps to dispel common stereotypes of who a scientist might be or where they may work, as well as humanize scientists. For some children, the introduction to various science careers can help increase their interest in a possible science career when they get older.

One of the goals of Brains On! is to **increase children's awareness of the diverse range of people that have jobs in science**. This diversity can include various aspects of someone's identity such as gender, race/ethnicity, or age. Brains On! is most effective in increasing children's awareness of women in science by hearing gender diversity represented on the show, not only coming from adults (hosts, scientists) but also from children featured on the show. Other aspects of the identity of Brains On! guests, such as race/ethnicity, age, or where episode guests are from, may also be noticed. Like gender, voice differences are used by some families as a way to notice these aspects of identity, giving them additional awareness of different people involved in the sciences.

# Brains On! fosters and supports the development of children's science identity.

Brains On! helps to support and develop children's identity of **being someone who knows about, uses, and can contribute to science.** The representation of kid co-hosts as “kid scientists” on each episode is important for helping some listeners shape their identity as kids who do or are able to do science. This is important in the construction of science identity, since knowing about other kids who are doing science allows for children to consider it as a possibility for themselves (National Research Council, 2009). It also touches on how identity formation can be a process, often thought of as “identity work,” so as children listen to Brains On!, they might negotiate how they relate to the kid co-hosts with how they perceive their own engagement and identification with science over time (Bell et al., 2018; National Research Council, 2009). Hearing a range of scientists on the show also supports children's identity development by helping them envision a possible future self who has a career in science.

**What connections are there between  
impacts and features of the Brains  
On! podcast?**

# Features of Brains On! Episodes

Feature	Description of the feature
Episode topics	Each Brains On! episode highlights a specific topic based on questions children send in to Brains On!.
Ability for kids to contribute to the show	Children are able to contribute to the show by submitting their questions for episode topics and Moments of Um, recordings of Mystery Sounds, answering callouts by the show, and submitting their own materials such as drawings.
Kids' questions featured in the episodes	Questions submitted to Brains On! by children form the basis of episode topics and content.
Moment of Um	Moment of Um is a short segment during each episode that answers a question sent in by children that is unrelated to the episode topic or content.
Mystery Sound	The Mystery Sound is a short, interactive segment in each episode that asks listeners to guess an unknown sound that is usually submitted by a child listener.
Kids featured on the show	Children are featured on every Brains On! episode as co-hosts, interviewing scientists, asking their science questions, or talking about the mystery sound they submitted. Their name may also be read as part of the Honor Roll.
Brains On! hosts	Brains On! has four hosts: Molly Bloom, Sanden Totten, Marc Sanchez, and Menaka Wilhelm. Molly Bloom is the primary host.
Scientists featured on the show	Scientists are featured on each episode to share their science expertise in a kid-friendly manner. Scientists are chosen based on the episode topic and content, and intentionally come from diverse backgrounds.
Kid-friendly	Episode topics and content are age-appropriate and child-centered. Ideas are presented with the assumption that children are on par with adults in the show.
Use of humor/funny	Brains On! uses humor in their episodes through silly characters, jokes, songs, sound effects, voices, and in some cases silly topics.
Debate episodes	Debate episodes are a particular type of episode using a debate format to highlight two different episode topics.



# The benefit of covering a variety of episode topics

Brains On! episodes cover a wide variety of topics. The **variety of episode topics** appeal to a broad range of children's interests and provide various opportunities for children to learn something new and/or build on existing knowledge. Episode topics sometimes introduce children to topics they may not have considered before or had an opportunity to learn about. This exposure can lead to increased interest in science generally or a specific science topic. More than any other feature, parents/guardians and children pointed to the variety of episode topics as a contributing factor in kids asking more questions about the world around them. Exposure to new and interesting topics provide curious kids with new things to consider, which can translate into children asking more questions or wanting to learn more about a topic. The range of topics and questions stemming from those topics also help support science-based conversations. In some instances, Brains On! introduces families to topics that they otherwise wouldn't talk about.

# The importance of children's ability to contribute to the show

The participatory nature of Brains On! plays an important role in extending science learning beyond listening to the podcast. **Children are encouraged to contribute** to the development of future episodes by submitting questions and mystery sounds. The fact that episode topics and **Moments of Um** are based on children's questions and **Mystery Sound** segments are sounds children send in appears to influence children's curiosity and interaction with the world around them. We see this evidenced in both how children are asking more questions of their world and are listening more closely to sounds around them. Even though many children may never submit a question or sound to Brains On!, the fact that it is a possibility has led to some children and families asking more questions, listening more closely, engaging in conversations around questions and sounds, and saying things like *"that would be a good question to send to Brains On!"* or *"that would make a good Mystery Sound."* For some, then, it is the mere possibility of submitting something to Brains On! that is enough to engage.

# The value of basing episode topics on children's questions

Featuring **children's questions in each episode** helps to validate the questions children might have about the world around them. This places value on the things children are curious about and encourages them to explore their own curiosity. The relevance of the questions to children's lives and hearing questions they might also wonder about helps to keep kids engaged in the episode, enhances their opportunities to learn new knowledge, and increase their interest in science. In some cases, the content of the questions can spark children's interest in a new science topic as the questions may be about an area a child listener had not thought about before. Additionally, Brains On! helps to build children's questioning skills by modeling how children can ask their own, and more sophisticated, science questions about the world.

# The importance of hearing children's voices

Every Brains On! episode **features multiple children on the show** including a child co-host, children reading questions they submitted, and children explaining the mystery sound they sent in. Hearing other children involved in science helps to engage children and increase their interest in listening to the show as well as model what it sounds like to be curious and ask questions. Children can hear kid co-hosts having science conversations with adults on the show (Brains On! hosts and guest scientists) and participating in the scientific inquiry process in meaningful ways. As described earlier, when children hear and relate to the kid co-hosts, it can also help them reflect on their own engagement with science and see themselves as someone who can do science (impacting their science identity).

# The role of adults featured on the show

Every Brains On! episode features an adult **Brains On! host** as well as a **scientist or other science-based expert**. The adults on the show provide opportunities for children to learn about the different types of people who work in science and the wide range of science jobs people can have. This knowledge can help to fuel adult-child conversations about possible science careers. Brains On! also provides opportunities for children to see themselves in the guest scientists on the show and recognize that anyone can be a scientist. Brains On! is particularly successful in helping children learn about the roles of women in science as the show's primary host is female and the show features many female scientists.

# The importance of a kid-friendly format

The **kid-friendly format** supports children's engagement, interest, and science learning. The format of the show is broken into short elements which helps to hold children's attention, keep them engaged with the content, and reinforce learning. Complex science topics are explained at a kid's level and presented in a fun, entertaining way that makes science interesting for children. The Brains On! hosts also message to children that their science questions and contributions are valued, encouraging science engagement and supporting children's identities as someone who can do science.

# The influence of humor

Brains On! incorporates **humor** into its episodes, which helps to make science learning fun and entertaining for children. The humor keeps children engaged in the content, helping to enhance opportunities for children to learn something new from the show and become more interested in science. The silly characters, songs, and skits also help children remember content and can serve as topics of family science conversations.

# Connections Between Impacts and Features

Brains On! episodes have many characteristics which play a role in positively impacting child listeners. Children and their caregivers saw connections between each of the impact areas and features of the Brains On! podcast. These connections are outlined in the table on the following page.

The features that seem to influence the most number of impact areas are the episode topics and children's questions in the episodes.

The impact areas with the most connections to features were the impacts of “learned something new” and “engaged in science-based conversations.”



# Connections Between Features of Brains On! and Impact Areas

Feature of Brains On! →	Episode topics	Kids can contribute to the show	Kids' questions in the episodes	Moment of Um	Mystery sound	Kids featured on the show	Brains On! hosts	Scientists featured on the show	Kid - friendly	Use of humor/funny	Debate episodes	Total Number of Features
Learn something new	●		●	●	●			●	●	●	●	8
Increase interest in science	●		●		●	●				●		5
Increase interest in learning about science	●		●	●								3
Increase curiosity about the world	●		●	●		●						4
Ask more questions about the world	●	●	●	●								4
Notice changes in the types of questions asked	●	●	●									3
Listen more closely to the sounds they hear in the world		●			●							2
Engage in science-based conversations	●	●	●	●	●			●		●		7
Do a project or activity based on something they heard on Brains On!	●	●			●	●	●					5
Increase awareness about the kinds of jobs people can have in science	●							●				2
Increase awareness of the different types of people who have science jobs						●	●	●				3
See themselves as someone who does or can do science						●	●	●	●			4
Total number of impacts	9	5	7	5	5	5	3	5	2	3	1	

# Broader Implications of the Research

This exploratory research is just one small step in starting to fill the gap of knowledge about the educational value of children's science podcasts.

These findings begin to shed light onto how children's science podcasts are used by both children and their families, the educational value of podcasts as evident by the broad range of impacts this medium can have on children, and the podcast design features that are beneficial for children's science learning and engagement.

Although the research focused on one children's science podcast, Brains On!, we hope the findings can be useful for anyone developing or studying science podcasts meant for children and their families.

# Areas for Future Research

## **Studying Joint Media Engagement**

Our research uncovered that it is common for families to jointly listen and engage with podcast content. For many families this happens within a vehicle environment. Our team currently has NSF-funding to study joint media engagement that occurs among family members in this unique vehicular learning space.

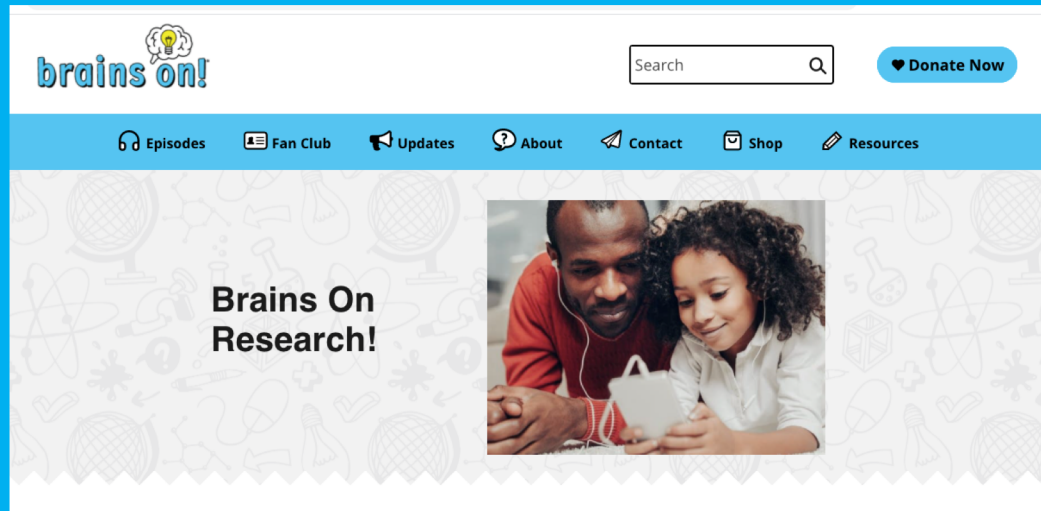
## **Understanding Family Level Impact**

Our research focused on the impact of listening on children, but our data point to the potential for family level outcomes as a result of jointly engaging with the podcast content both while listening and after. This joint engagement could lead to family level impacts such as fostering or supporting a family's science identity.

## **Impacts on a Broader Audience**

A major limitation of our study is that the listeners of Brains On! are not adequately reflective of the United States population, which means we lack sufficient insights on the impact of children's science podcasts on audiences that are often underrepresented in STEM. Brains On! child listeners tend to be white, identify as male, and come from highly educated, high income households. Additional research is needed on children's science podcasts to understand the listening habits and impacts of listening for a more diverse and representative listening audience of children and their families.

Find the full reports with more details about the methods and findings from each of the three phases of our research by visiting <https://bit.ly/BrainsOnResearch>



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