

SCIENCE

STORYTELLING

with Intentionality



Reaching More Women and Multicultural Audiences
with STEM Content on YouTube and Social Media

 **PBS Digital Studios**

Introduction

In content creation, there is a prevailing misconception that targeting historically underrepresented groups in science, technology, engineering, and mathematics (STEM) fields might alienate existing audiences and limit growth potential.

However, PBS Digital Studios, in collaboration with the University of Georgia, University of Utah, and Fly Sci® Enterprise, conducted a unique research/practice partnership and found the opposite to be true. **Greater intentionality¹** in developing inclusive science content not only **broadens diversity** among audience members but also fosters **audience expansion**.

Intentionality¹

The intentional consideration for audience, definitions of science, and how marginalized identities are, and have been, represented and supported in science communication.

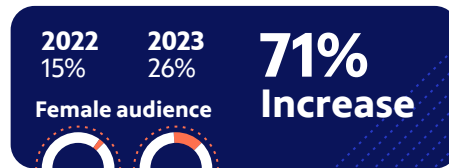
Audience Expansion on Social Media



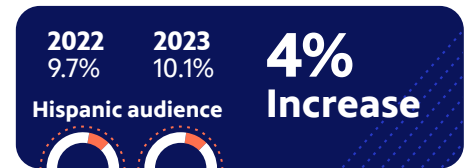
Eight new series were developed for this project² to test novel science storytelling tactics. Collectively, the series saw increases in audience diversity on YouTube.



On PBS Terra's YouTube channel, Black viewership increased from 4.3% in 2022 to 6.3% on project-funded series in 2023. The difference between 4.3 and 6.3 is 46%.



Prior to 2022, PBS Terra's YouTube channel averaged 15% female viewership. From 2022 to present, project-funded series have averaged 26% - a change of 11 percentage points or 71% increase.



Hispanic viewership increased from 9.7% to 10.1% - a change of .4 percentage points or 4% increase.

Female Audiences



On TikTok, there was higher female audience viewership for project series than for non-project series. Instagram saw no difference; however, both platforms had overall higher female audience viewership than YouTube.



These series also received more than 12.3 million views across YouTube and social media from July 2022 through September 2024.

12.3 million views



Science communicators are encouraged to **avoid seeing target audiences as separate**; content that is effective with targeted audiences can still be enjoyable to masses. In addition to sharing scientific knowledge, more intentional and inclusive science communication can **cultivate a stronger sense of belonging for audiences who have not traditionally seen themselves or the reality of their lives reflected in science content**.

How to use this guide

Science communicators and content creators of all levels of experience are encouraged to view this guide as a starting point for further exploration and introspection when considering how to attract more women and multicultural audiences to your STEM content.

Throughout the guide, “target audience” refers to Black and Hispanic groups, as well as women overall—communities that are underrepresented in STEM.

Insights and questions should be viewed as a creative challenge, not a directive.



Target audience insights P. 04

National Survey P. 04

A national survey³ evaluated target audience interest in 20 STEM topics. This section could be a useful starting point if you are looking to generate ideas on resonant topics to devise a content strategy around.

Focus Groups P. 05

Focus groups⁴ explored target audience preferences in science content online. This section contains useful tips on things to keep in mind that can add appeal or be turn offs for audiences.



Developing a Storytelling Hypothesis P. 06

Here you will find practical tips on how to deconstruct your content strategy to tell science stories in a more inclusive and intentional way to better engage women and/or multicultural audiences.



“Consider This” questions P. 08

This section is a deeper dive into questions you can pose to infuse greater intentionality into your content development process. These questions were derived from interviews with leading science communicators and creators⁵ as well as from the production of eight science series on **PBS Terra**.⁶ The topics covered include:

Audience Connection and Relatability	P. 08
Topic Selection	P. 09
Visuals and Accessibility	P. 10
Tone and Sentiment	P. 11
Talent Engagement and Collaboration	P. 12
Representation and Inclusivity	P. 13
Measuring Success and Evaluation	P. 14

Hey Creators!

Not every tip or question will apply to your series—and that’s perfectly okay.

To get the most from this guide, try concentrating on the topics that align closely with your work and focus on areas where you have the greatest potential to grow and improve.

Target Audience Insights



National Survey

In the national survey evaluating target demographics' interest in 20 STEM topics⁷...

7 TOPICS made the top 10 for all three groups.

3 Topics were in the top 10 for at least two groups.

2 Topics were uniquely popular among **women**.

1 Topic that made the top 10 for **Hispanic** groups.

Animals and Wildlife

Recipes, Food, and Nutrition

Health and Wellness

The Human Body

Plants, Nature

Climate Change

Psychology or the Study of the Human Mind

Extreme Weather **BLACK & FEMALE AUDIENCE**

Cars or Vehicles **BLACK & HISPANIC AUDIENCE**

Electronics, Technology, or Product Design

Genetics

Beauty or Cosmetic Science

Space Exploration



What do all these topics have in common?

They are relatable, approachable, and have personal touchpoints.



Focus Groups

Focus groups revealed a number of common themes on what target audiences sought from science content online.

Titles and thumbs are #1.

If your title and thumbnail are not interesting and do not foster curiosity, viewers will not click your video. Effective titles clearly convey the main content of a video and are relatable (e.g., about current events, everyday life).

Good thumbnails are aesthetically pleasing, judiciously use words, and avoid using clickbait that does not accurately capture the focus of the video.

Get to the point.

The first 30 seconds to 1 minute of your video needs a strong hook that clearly states the purpose and “payoff” of the video so audiences can quickly determine if they want to invest their time and continue watching. “Frontload the Awesome” a.k.a. use your best, most interesting soundbite first to draw viewers in.

Representation matters, but representation alone is not enough.

Audiences want to see themselves reflected beyond stereotypical representations with nuance and authenticity. **“Energy” in the video and the on-camera talent is important; audiences would rather have a non-expert who is passionate and brings energy than a dry expert.** Audiences desire credibility that can be derived from relevant expertise to the video topic as well as relatable lived experiences.

Relatability is key.⁸

Overall, audiences want relatable nuggets of knowledge that are interesting, solution-oriented, applicable to their life, and **illustrative of how science can make life better.**

Be careful with animation.

Audiences preferred real-life content over animation. If animations are used, they should feel sophisticated and not childish. Graphs and charts can also be an effective way to enhance narratives.

Humor requires finesse.⁹

Tone, context, and delivery of humor are critical; ineffective humor can come across as childish or condescending. Audiences do not want to feel like they are being spoken down to or pandered to.

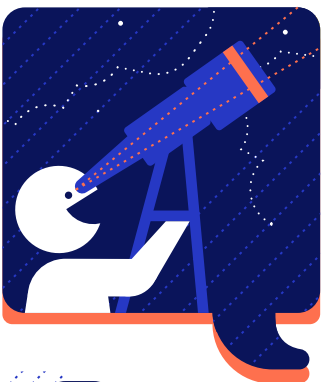
Creative science storytelling can be advantageous.

Unique approaches that incorporate science in creative ways can be engaging and fun (e.g., using the “get ready with me” format common on social media as an inviting way to talk about science).

How Mantises Become Nature's Strangest Assassins



For example, when asked which video they would watch “**How Physics Make Bikes Stand Up**” or “**Why Do Bikes Balance?**” audiences were more inclined to choose the latter.



Developing a Storytelling Hypothesis



What's Your Storytelling Hypothesis?

A carefully crafted storytelling hypothesis¹⁰ can be a useful device to help infuse your development process with greater intentionality. The storytelling hypothesis is an “educated guess” as to why your content will be effective in reaching your intended audience(s).

The hypothesis explores answers to these key questions:

Who am I trying to reach?

What is my science story vehicle?

Why will this resonate with my target audience(s)?

What is a “Science Story Vehicle”?

It is a set of storytelling elements that come together to enable science communicators to tell a more cohesive, compelling story to their audience(s).



Key elements of the Science Story Vehicle include:

CONNECTION POINTS

- Relatability factors
- Life experiences
- Big ideas

Determine how the audience will connect with the story. This can include relatability factors like life experiences or “big ideas,” which are **science topics people tend to be very passionate** about (e.g., climate change).

DELIVERY STYLE

- Breaking 4th wall
- Documentary
- Sequencing & integration
- Explainer

Consider how the communication method(s) you use will shape your science story. Some options include traditional explainer videos with hosts, documentary style, breaking the 4th wall, and hybrids that combine a few tactics.



Psst: Ladybugs Have a Killer Secret

Breaking 4th wall



How Two Sisters Are Reviving Damaged Farmland With Hemp

Documentary



How To Accidentally Invent A Color

Explainer & Breaking 4th Wall

CAST OF CHARACTERS

People

(experts, community members)

Subjects

(land, food, cultural elements)

VISUALS

Animations + graphics

Cultural motifs & codes

Settings & shooting style

Think about the “who” and “what” that will appear in your video, as well as the “why” for incorporating them. **You might feature subject matter experts, students, community members, or other practitioners.** You also might consider having your content revolve around a specific “subject” (e.g., insects, land, food, cultural elements).

Decide what vibe you are trying to create. **Consider how your visuals will contribute to the look and feel of your science story. Your visuals might also reflect the communities you seek to engage.** Think about what settings you will film in (e.g., green screen, outdoors, at home) and how your shooting style(s) and editing techniques will help you achieve your desired tone (e.g., conversational, journalistic).



Insectarium
Hosted by Jessica Ware

Here’s an example of a Storytelling Hypothesis:

INSECTARIUM will test style, location, talent, and an informal storytelling approach, specifically testing 1) centering the entomological expertise of **BIPOC and/or women scientists’** career paths at stages from high school to mid- to late-career to achieve greater visibility of women and BIPOC who are active in insect science, a field that currently lacks a diverse student pipeline and body of professionals due to significant barriers to entry and challenges in retention; and 2) **using a conversational approach** to content—reflected in both camera and editing style, as well as host presentation—showcasing experts that may upend viewers’ expectations/assumptions about what an entomologist looks like and **how entomology may relate to their lives,** using accessible and inclusive language, and featuring **rural and urban locations** that may help viewers see “in the field” opportunities at the lawn, park, or field next door.

Cast of characters Connection point

Delivery style Visuals

Additional examples of storytelling hypotheses that were tested can be found on

<https://www.pbs.org/digital-studios>

“Consider This” Questions



The questions below take a deep dive into unpacking what intentionality looks like in practice¹¹ for **developing inclusive science videos for YouTube and other social media**.

Not all tips or questions will apply to your series. Try selecting questions you feel are most relevant to your project and goals.

Audience Connection and Relatability

Have I taken time to identify and understand my target audience by exploring their interests, needs, expectations, and reasons for watching?¹²

Am I being mindful of making assumptions about my target audience and considering the nuance of their life/lifestyle in the references made in my content?

Have I considered the optimal formats and platforms for my target audience?

Instagram and TikTok may be more effective at reaching younger, more diverse, and gender-balanced audiences than YouTube. These platforms are also more amenable to re-sharing content, which could enable your content to more easily reach a wider audience.

Am I proactively including connection points in my content to suit audiences of various backgrounds?

Am I integrating science and storytelling in a relatable way to help the audience connect with the information on a deeper level?

! Enhancing connection with the subject matter can increase the audience’s willingness to learn.

How Rice is Preserving History and Rethinking Nutrition Science



Have I considered using character-driven storytelling that focuses on the passions and authenticities of featured people?

! Allowing characters to share their culture and science in an open and transparent way creates an engaging and relatable viewing experience.

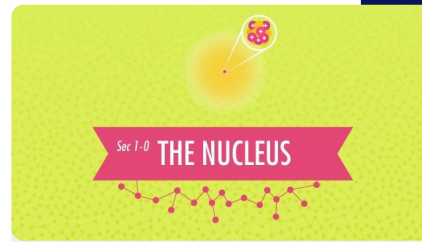
How This Aquaponics Farmer Is Reinventing Urban Agriculture



Am I avoiding jargon and communicating complex scientific concepts in clear and accessible language?

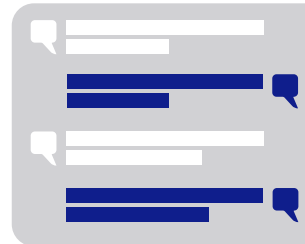
If I am creating versions of content for non-English speaking audiences, have I considered how it can be adapted to those cultures (with references, analogies, and representation) in addition to translating the language?

Am I proactively engaging with my audience by responding to comments, encouraging constructive discussions, and leveraging comment settings to support a positive online environment?



The Nucleus: Crash Course Chemistry #1

Crash Course created a culturally responsive Spanish-language version of their Chemistry course.



El núcleo: Crash Course Fundamentos de Química #1

Topic Selection

Have I considered how topic selection can make this video/science story more relatable or compelling?



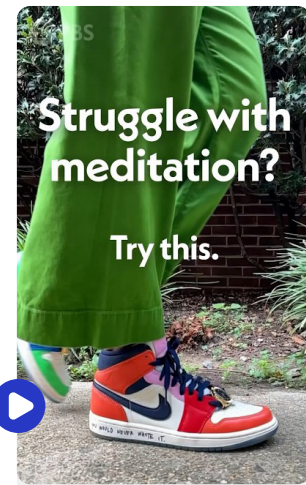
How Ants Make Our Cities Healthier

An interesting fact about a well known insect



Allergies: The Science of Why Your Body Hates You

Unpacking a common ailment



How To Meditate While You Walk (Wellness Inside Out)

Easy tip for wellbeing practice

Have I considered possible titles and ideas for thumbs during the early stages of development?



If you are unable to distill your idea into a title, it may not be as relatable or cohesive as you think.

If I have an established channel and want to explore new topics, am I fostering cohesion during the transition to new subjects to avoid alienating my current audience?



How to Successfully Pivot Your YouTube Channel: Advice from the experts!

Recognize that you don't know what you don't know.

When exploring sensitive or controversial topics, am I considering the various perspectives and proactively seeking feedback?



How This Indigenous Farmer Is Solving Food Insecurity

Am I going beyond Eurocentric perspectives and considering the contributions of historically underrepresented communities to the scientific enterprise?

While exploring topics to pursue with the communities I want to engage, am I remaining open to where the process may take me as well as the subjects I wind up exploring?

Example of Indigenous contribution to scientific enterprise

For “big ideas” (e.g., climate change), have I considered approaching it from multiple angles that are balanced with relatable themes and everyday tasks to create a more compelling narrative?

Visuals and Accessibility

Is there diverse representation in my voiceovers and visuals, including images, stock footage, and animations?



Am I providing alt text/visual descriptions, captions?

! If you are including ASL in your video, here's a [checklist](#) of things to keep in mind.

Am I monitoring color contrast¹³ and usage to enhance accessibility for individuals with visual impairments?

Am I using animations and visuals to make complex concepts more accessible?

Do my animations have inclusive character designs that avoid stereotypical features?

Are my animations reflective of the sophistication and maturity of my audience?

Am I proactively seeking feedback on visual representations?

Are my thumbnails aesthetically pleasing and do they clearly convey my video's subject matter?

Am I experimenting with thumbnails to optimize click-through rates?



Tone and Sentiment

In addition to helping audiences learn something, have I considered how I want the audience to feel (inspired, motivated, amazed, and/or more curious) during and after watching my videos?



Emotion and engagement drive content performance. Enabling the audience to connect on an emotional level can enhance their learning experience.

HAIR “TYPES”



Have I considered the emotional impact of how social injustices are depicted in my videos?

This video depicted problematic language to describe hair texture as well as the harmful practice of “hair touching.” Accordingly, additional resources for further reading on the history and nuance of discussions of Black people’s hair (women in particular) were included in the caption.



Is the tone and feel of my content also reflected in the visuals (e.g., animations), background music, and the way it’s shot (i.e., dynamic vs. static)?

To create authentic humor that resonates with target demographics, am I leveraging firsthand perspectives and personal experiences for cultural references?

If I am aiming for a conversational tone, does my content feel like a friend sharing something in a “let’s learn together” tone or does it feel like a professor lecturing?

Have I provided a clear perspective without sounding like I am trying to persuade my audience?



Talent Engagement and Collaboration

Does the culture of my work environment foster mutual respect where criticism, thoughts, and ideas can be shared in a constructive manner, regardless of perceived “power dynamics”?

Is there diversity among the experts and community members featured in my video(s) along the dimensions of age, gender, ethnicity, ability, career stage, geographic location, and/or other factors?

Am I working to create a comfortable environment for interviewees by being socially aware and taking the time to do preliminary phone calls?

Building trust and connection is critical and can significantly enhance the experiences on set as well as what is conveyed on screen. Don't just show up with a camera!

If I am including the stories of communities I am not a part of, am I operating with empathy for their experiences and being mindful of my own bias and privilege?

Have I considered hiring staff or advisors from the communities my content is featuring?

Am I proactively educating myself to expand my thinking and scrutinize my own conditioning/belief systems?

If I am highlighting inequities, am I also centering joy, prosperity, and innovation in these community stories?

Am I being mindful during the editing process to preserve the integrity of the stories these communities have entrusted me with?

Am I finding ways to co-create content with communities to ensure that it aligns with their needs, interests, and cultural nuances?

Reciprocity¹

Science communicators and audiences address past and present inequities through equal partnerships that recognize and value varied forms of expertise and ensure co-created benefit.

Am I conveying the value of lived experience as expertise and using my content to uplift the voices of historically underrepresented communities rather than simply amplifying my own perspective?

Organizations: Am I striking the right balance between giving feedback and encouraging authenticity?

Am I mindful of giving critiques of communication styles of talent from underrepresented backgrounds that encourage them to emulate dominant groups?

The New Technology Changing How We Track Sharks



An example of lived experience as expertise

Creators can maintain scientific truth while embracing their individual styles.

Representation and Inclusivity

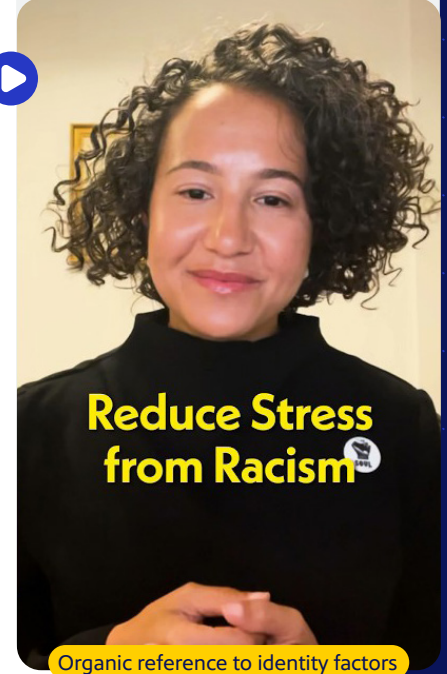
If I am referencing identity factors (e.g., race, ethnicity, religion, age, gender, veteran status, disability, sexual orientation, geographic region, socioeconomic status, or other) of hosts or featured guests, am I incorporating them in organic ways that enhance the science story?

Am I using themes and/or visuals to disrupt tropes, stereotypes, and/or what is perceived as the norm?

Am I including individuals of various skin tones, body types, abilities, hair textures/styles, and accents?

Have I considered whether certain professionalism standards in content are compromising authenticity and relatability, potentially alienating audiences?

Three Strategies To Cope with Racism
(Wellness Inside Out)

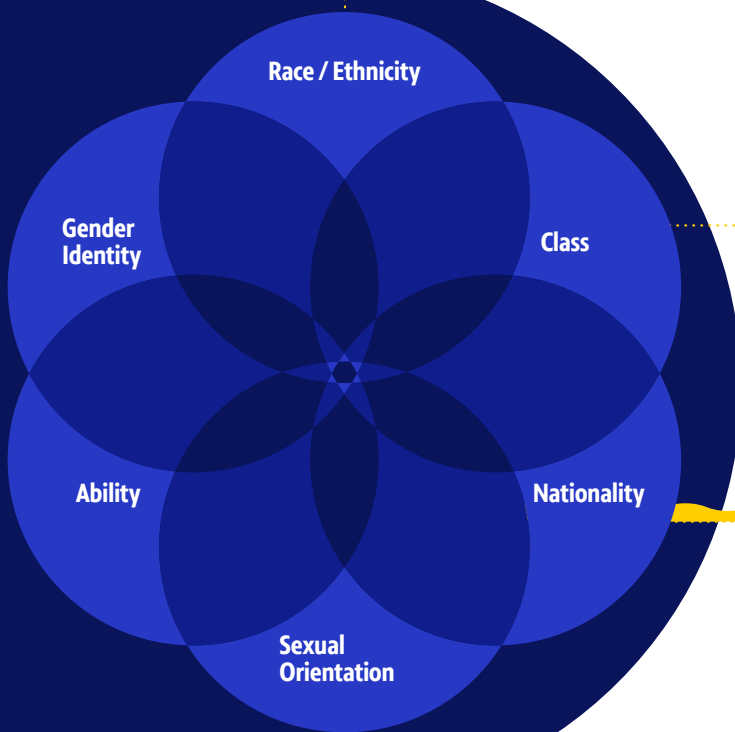


Organic reference to identity factors

If I am focused on highlighting a specific community or group (e.g., women), have I taken an intersectional approach to ensure that various identities within the group are represented and uplifted?

Intersectionality—the interconnected nature of social categories like race, gender, and socioeconomic status—and the unique experiences that arise from the convergence of multiple identities.

Am I creating culturally-responsive content where cultural context is integrated into scientific storytelling to ensure that content resonates with viewers from targeted cultural backgrounds?



Measuring Success and Evaluation

Am I creating evergreen content that will continue to provide value to audiences beyond its initial launch?

Am I strategically leveraging trends and “moments” that might aid in initial content discovery, while avoiding tokenization?

Have I set realistic goals for supporting representation within my content and on my team?

Have I reflected on my storytelling hypothesis and am I assessing the effectiveness of my content strategy through analytics and audience feedback?

Have I identified specific areas for improvement and/or ways to iterate?

Have I established benchmarks for audience composition and growth?

Have I established a methodology for measurement on platforms that provide limited audience demographic data?



Did I promote my content with supplemental materials (e.g., GIFs, vertical videos, shorts) and/or outreach to organizations with a pre-existing community of my target audience(s)?

For organizations: Were expectations, deliverables, and time demands communicated clearly at the start of the project?

Was there preliminary alignment on the vision for the project and how it would be executed?

Were the editorial workflow, communication methods, and overall collaboration process with producing partners evaluated?

Was there a culture of transparency where space was created for collaborators to feel heard if they were having issues? Were efforts made to workshop challenges and uplift tactics that worked well?

Reflexivity¹

Continuous and systematic reflection on identities, practices, and outcomes, followed by adaptation as needed to address inequitable interactions.

“Nothing in science has any value to society if it is not communicated.”

Anne Roe

Noted twentieth century American psychologist and writer



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NSF Funded Series (2022 - 2024)



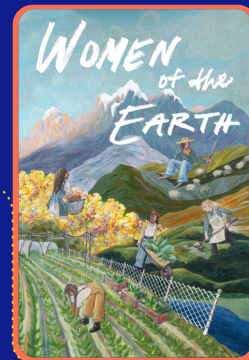
PBS North Carolina



STEMedia



Balance Media



Summer Moon Productions



Minorities in Shark Science



STEMedia & Helicase Media



The American Museum of Natural History



Brilliant B Productions



Fluent Studios



Fascinate Media



¹The definitions of the terms intentionality, reciprocity, and reflexivity used in this guide are informed by and aligned with the findings of **The State of Inclusive Science Communication: A Landscape Study**. Katherine Canfield and Sunshine Menezes (2020).

²The multi-year National Science Foundation-funded project focused on identifying and testing novel science storytelling and audience development tactics.

³Nationally-representative surveys were collected by NORC at the University of Chicago and consisted of a general population sample aged 18 and older, along with an oversample of Hispanic Americans and non-Hispanic African Americans.

⁴Each of the twelve focus groups consisted of ~8 participants, with four focusing on Black participants, four focusing on Hispanic participants, and four focusing on women.

⁵Strategies were derived from in-depth interviews with expert science communicators and executives. See <https://pbs.org/inclusiveSTEM> for the complete list.

⁶See <https://pbs.org/inclusiveSTEM> for full list of series. Content was posted on YouTube, Instagram, and TikTok.

⁷The full list of topics and data breakdown can be found at <https://pbs.org/inclusiveSTEM>.

⁸For example, when asked which video would you watch “How Physics Make Bikes Stand Up” or “Why Do Bikes Balance?” audiences were more inclined to choose the latter.

⁹Research conducted by PIs Yeo and Cacciatore show that strategic use of humor can increase people’s engagement with science on social media and enhance their likability. However, the extent to which science humor is an effective and inclusive means of communication when used by female scientists of different races is still an open question. See <https://pbs.org/inclusiveSTEM>

¹⁰NPR has a deeper dive on applying the **scientific method to storytelling** that utilizes hypothesis-driven design.

¹¹A series of in-depth interviews were conducted with expert science communicators and leading organizations. Insights from those conversations are presented as questions to consider during the development process. See <https://pbs.org/inclusiveSTEM> for list of contributors.

¹²Audience insights can also be obtained via Pew, Gallup, and eMarketer.

¹³There are **interactive tools** for validating web image compliance with ADA (Americans with Disabilities Act) contrast and readability standards.

