BRITE PRACTICES GUIDE FOR EDUCATORS

Research-based Guidance for Supporting Girls' STEM Identity Development in Online Spaces

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National Girls Collaborative Project

Thank you to our Brite project team, advisory board members, reviewers, and Brite groups for your ongoing support and contributions.

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Participating Brite Groups[1]

Arizona Science Center
BakerRiply Learning & Innovation Centers
Boys and Girls Club of Fitchburg and Leominster
Day One Tech
Doris Dan Kids Campus
Girl Scouts of Eastern Missouri
Girl Scouts of Historic Georgia
Girl Up's Women in Science & STEM for Social Good
Girls Who Code - LaCañada High School
Insights Science Discovery
Koinonia Community Solutions
Milwaukee School of Engineering's STEM Outreach Department
Morrison Mentors
NC State Imhotep Academy
OregonASK
Penn State University EnvironMentors
Sci-Port Discovery Center (Red River STEM Inc.)
Scientific Adventures for Girls
SciTech Institute
South Sudanese Girls Empowerment Front
STEAM Street
SUNY Schenectady County Community College CSTEP
The New Tenth Foundation
University of South Florida's Oceanography Camp for Girls
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[1]List includes all participating Brite Groups from 2020, 2021, 2023, and 2024. 2020 and 2021 were pilot Brite Programs. In 2023 and 2024, the National Science Foundation provided partial support.

FSU FLORIDA STATE UNIVERSITY

SMARTgirls HQ

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PURPOSE OF THIS GUIDE

This guide is designed to help science, technology, engineering, and mathematics (STEM) educators foster positive STEM identities through online and hybrid learning experiences. Whether you lead afterschool activities, guide youth in a library makerspace, or facilitate hands-on learning in a museum or community program, your role is vital in shaping how girls see themselves as capable, creative problem-solvers.

The *Brite Practices* featured here are based on lessons learned from the implementation of the National Science Foundation-funded project titled *BRITE Girls Online STEM Practices: Building Relevance and Identity to Transform Experiences* during the summers of 2023 and 2024.

The Brite Program was built around three key components shown by research to support girls' engagement in STEM:

- Community Building
- Engagement with Diverse Role Models
- Hands-On Activities

These components were adapted for virtual and hybrid learning formats to create meaningful, interactive, and inclusive STEM experiences. During Brite, some participants completed the program virtually (e.g., through individual devices) while others completed the program through hybrid formats (e.g., by gathering in person to complete icebreakers and hands-on activities while still joining the virtual role model sessions and Community Gatherings on Zoom).

You can use the *Brite Practices* in ways that best fit your program goals, audience, and setting. They can be applied as a complete online or hybrid model or integrated individually into your existing activities. The examples throughout this guide are flexible and can also be used for in-person programs.

We invite you to adapt these ideas to fit your unique setting and the youth you serve. There's no single way to bring the *Brite Practices* to life—what matters most is your commitment to creating spaces where every girl feels seen, supported, and inspired to explore her curiosity in STEM.

BRITE PROJECT OVERVIEW

BRITE Girls Online STEM Practices: Building Relevance and Identity to Transform Experiences was a Research in Service to Practice project funded by the National Science Foundation, led by Florida State University in partnership with the National Girls Collaborative Project (NGCP) and Smart Girls HQ with external evaluation by SJLR Solutions. The project refined and tested approaches that research demonstrates are effective for STEM identity development in an in-person setting and applied them to an online setting:

1) Community-building

2) Engagement with diverse women STEM role models

3) Hands-on activities

Two central products of this work are the *Brite Practices* and this guide, a toolkit to support educators in fostering girls' interest, identification, and long-term participation in STEM.

BRITE PROGRAM SUMMARY

Brite was an online, interdisciplinary STEM program for girls ages 13–16 implemented in the summers of 2023 and 2024. The program ran for three weeks in July, four days a week for three hours per day, and reached 190 self-identifying girls. The program centered on three core components:

1) Community building
2) Engagement with diverse women STEM role models
3) Hands-on activities

The central goals of the Brite Program were to:

1) Foster STEM identity: perceived competence in STEM and self-recognition as a "STEM person"
2) Build a community of girl learners and a support network among them
3) Spark curiosity and creativity

Brite featured three courses across three weeks:

- **WEEK 1: Code, Create, Collaborate, featuring role models and activities that introduced girls to careers in computer science.**
- **WEEK 2: Dream, Design, Discover, featuring role models and activities that introduced girls to careers in engineering.**
- **WEEK 3: Investigate, Innovate, Inspire, featuring role models and activities that introduced girls to careers in physical sciences.**

These three topics were selected because they have the least representation of women in the professional STEM workforce. A customized online platform, developed by Smart Girls HQ,

served as a launching pad for girls to participate in individual, small-group, and community-wide activities.

Girls participated in daily icebreakers to kick off each day, such as a technology scavenger hunt, where they identified and reflected on technology they could not live without. Girls engaged in interactive discussions and games with role models, such as Dr. Beata Mierzwa, Molecular Biologist and Science Artist, and Caeley Looney, Aerospace Engineer and CEO & Editor in Chief of Reinvented Magazine. Girls also worked on creative hands-on STEM activities, such as designing a science-inspired fashion item and creating a graphic novel to communicate STEM concepts. Each week culminated in Brite Fest, where participants presented their projects and celebrated their learning with the Brite community.

STEM programs from across the U.S. participated as Brite Groups, 10 in 2023 and 17 in 2024. Each group facilitated daily icebreakers and hands-on activities, participating either fully online or in a hybrid format. The Brite team facilitated community-wide sessions, including live role model talks and weekly Community Gatherings.

Educators received training on the Brite Platform, program schedule, and curriculum, along with strategies for supporting girls' STEM identity development. The Brite Educator Guide, developed by Dr. Amanda Sullivan, Senior Researcher with NGCP, provided step-by-step guidance for implementing all activities.

BRITE RESEARCH SUMMARY

The research included both quantitative and qualitative data focused on four constructs of identity development: competence, performance, recognition (Carlone & Johnson, 2007), and sense of belonging (Archer et al., 2016; Carlone et al., 2014). The purpose of the research study was to determine how the three core components of community-building, role models, and hands-on activities, as implemented through the Brite Program, influence girls' STEM identity.

To understand the influence of the Brite Program on participating girls' STEM identity development, the research team led by Dr. Roxanne Hughes surveyed girls before the program began, at the end of each of the three weeks (week 1, week 2, and week 3), and 6 months after the program. The surveys included Likert scale questions to measure perceived competence (Dou & Cian, 2021), recognition (Vincet-Ruz & Schunn, 2018), and sense of belonging (Anderson-Butcher & Conroy, 2002). The surveys also included open-ended questions that asked girls to provide details about aspects of the program that stood out and why. Zoom sessions were transcribed and analyzed to understand how girls engaged with the role models and each other. Finally, asynchronous engagement on the Brite Platform was analyzed to provide further evidence for performance and recognition.

The research findings of the 2024 program demonstrate that Brite positively influenced girls' STEM identity in an online environment through three design components:

- Community building
- Engagement with diverse role models
- Hands-on activities

The means for the Likert scale questions show that girls' competence, recognition, and sense of belonging increased as they participated in the program. The asynchronous and live community-building efforts helped the girls see their potential and belonging in STEM through peer, educator, and role model recognition of their STEM performances. The role model interactions prepared girls for STEM careers and acknowledged girls' value in STEM as middle and high schoolers. The hands-on activities strengthen the girls' competence development. Through community building, hands-on activities, and role model interactions, girls were able to develop STEM skills, such as curiosity and creative problem solving, perform these skills through multiple media, including asynchronous video posts, live video posts, chat comments, and live verbal interactions, and be recognized for these performances by their peers, educators, and role models.

STRATEGY
How We Developed the Brite Practices

The *Brite Practices* offer research-based guidance to help educators support girls in developing strong STEM identities in online and hybrid learning spaces. We based these practices on the following data sources from the Brite Project:

- Open-ended survey responses (Years 1 & 2)
- Transcripts from role model talks (Years 1 & 2)
- Transcripts from Community Gatherings (Year 2)

Our approach was grounded in the Brite Project's two key research lenses: STEM identity and intersectionality. We define STEM identity using the model by Carlone & Johnson (2007), which centers on three parts: competence, performance, and recognition. Girls develop competence in STEM through informal and formal learning experiences. As they develop competence, they choose to perform STEM skills, and these performances must be recognized by perceived experts such as educators, peers, and role models. Through this process of performance and recognition, individuals begin to feel they belong in STEM (Archer et al., 2017; Carlone et al., 2014; Master et al., 2016). Intersectionality helps us understand that a girl's experiences in STEM are shaped by the intersections of her race, gender, class, and other social identities (Collins & Bilge, 2020). This lens guided our analysis as we explored how these overlapping identities influence how girls perceive STEM, interact in learning environments, and access opportunities.

We used qualitative methods to identify themes that emerged directly from participants' open-ended survey responses, as well as from our analysis of role model talks and Community Gatherings. These themes align with those developed by Dr. Roxanne Hughes and her research team. To organize what we found, we developed a matrix that grouped themes across the three main components of the program. We reviewed and refined this in team meetings over several sessions.

An initial draft of the practices was created, reviewed, and edited collaboratively in follow-up team discussions. To ensure clarity and relevance, we also invited feedback from five external reviewers—two content experts and three Brite educators who had firsthand experience with the program.

The *Brite Practices* shared in this guide are the result of that collective work.

BRITE PRACTICES FOR EDUCATORS

Research-based Guidance for Supporting Girls' STEM Identity Development in Online Spaces

Building on the successful learnings of the Brite Program, these six practices are for educators to support middle and high school girls in developing positive STEM identities and can be integrated into your own programming.

Prioritize Community Building around STEM

1. Encourage girls to share their lived experiences, interests, and hobbies (both STEM and non-STEM related) through facilitated discussions.

WHY: To foster connection through shared interests with peers and educators, and help girls see how STEM connects to their lives.

HOW: Engage girls in facilitated discussions through daily icebreakers in small groups, weekly large group discussions, collaborative activities, and daily platform forum discussions.

BRITE EXAMPLE: Technology Babies Icebreaker: Girls were prompted to think back to their first memories using digital technology. *How old were you? What type of technology did you use? What else do you remember?*

2. Provide multiple modalities for girls to engage with and support peers, educators, and role models.

WHY: To help girls build connections with peers, educators, and role models.

HOW: Provide opportunities for girls to engage with others through video/audio conferencing tools, an online forum space for conversation on daily prompts, and profile features where girls can share more about their own interests, while also learning about others' interests.

BRITE EXAMPLE: The Forum was a shared space on the platform where all community members could share their perspectives on the Question of the Day, such as *What kind of music do you enjoy listening to? How can you use engineering skills to solve problems in your daily life?*

Collaborate with Role Models

3. Recruit and prepare role models who challenge stereotypical perceptions of STEM.

WHY: To provide multiple opportunities for girls to connect with STEM role models who break stereotypes about STEM people and career pathways.

HOW: Recruit and prepare STEM professionals in your community or use free digital resources like the IF/THEN® Collection to counter STEM stereotypes through role models' identities and lived experiences, career pathways, and hobbies.

BRITE EXAMPLE: Through one-on-one meetings and a virtual group training, role models were trained to share their early life experiences, STEM hobbies and interests, hobbies and interests outside of STEM, any challenges and barriers they faced, and how they persevered.

4. Prepare role models to share their STEM stories in interactive, conversational ways that encourage girls' participation and provide opportunities to recognize girls' contributions.

WHY: To support girls in sharing their skills, interests, and lived experiences through interaction with role models, while also receiving real-time recognition for their contributions from role models.

HOW: Help role models develop their STEM stories and interactive presentations through training, resources, and meetings.

BRITE EXAMPLE: Girls played Would You Rather (STEM jobs edition) with Volcanologist Jess Phoenix, an opportunity to reflect on STEM jobs they might enjoy, and to receive feedback and appreciation for their contributions from the role model. *Would You Rather—dive into the ocean's dark depths or travel to space? Would You Rather—gather lava samples at an active volcano or conduct research on dangerous viruses?*

Incorporate Hands-On Projects that Weave Art and Creativity into STEM

5. Encourage girls' creativity and self-expression.

WHY: To help girls discover new and shared interests and experience firsthand how creativity and self-expression connect to STEM.

HOW: Engage girls in open-ended activities that integrate artistic creation with STEM content, offer more/less challenging options based on age and previous STEM experiences and knowledge, offer options for how to approach an activity, and connect activities to the role models to demonstrate relevance.

BRITE EXAMPLE: Girls designed an article of clothing that combined fashion with STEM related to the work of role model Beata Mierzwa. Girls chose to design digitally using

Sketchpad or with arts/crafts supplies. The activity was simplified by focusing on the basic design, or a challenge was added by researching and writing about the science behind their design.

6. Provide opportunities for recognizing girls' projects and learning processes by peers, educators, and role models.

WHY: To provide all community members with opportunities to recognize girls' STEM interests, ideas, and skills, including challenges, mistakes, and how they persevered through an activity.

HOW: Establish ways for community members to recognize girls' projects and learnings through a live online project showcase hosted using video/audio conferencing tools. Leverage platform features, including chat, digital badges, and an online gallery space where girls are able to share their completed projects and recognize/respond to others' work through comments and likes.

BRITE EXAMPLE: Girls posted a photo or video of their graphic novels (including inspiration, design, challenges, and surprises) to the Brite Gallery. All community members could like and comment in the Gallery. Every Friday, girls shared their favorite projects and highlights in the Brite Fest Project Showcase on Zoom, receiving recognition from the host, peers, and educators.

EDUCATOR GUIDANCE FOR INTEGRATING THE BRITE PRACTICES

PRIORITIZE COMMUNITY BUILDING

PRACTICE 1

Encourage girls to share their lived experiences, STEM interests, and interests and hobbies not directly connected to STEM through facilitated discussions.

This practice aims to help girls foster connection and discover shared interests with peers and educators. To put this practice into action, engage girls in facilitated discussions through icebreakers in small groups and large group discussions. Include open-ended discussion prompts that are focused on STEM content and relevant to girls' lives to provide girls with opportunities to share their STEM experiences and highlight their social identities and interests beyond STEM. Girls' experiences may differ from those of their peers because everyone's journey is unique and varied. STEM invites many ways of engaging and experiencing—there is no single "right" path. As an educator, providing girls with opportunities to share and engage with peers can illuminate the diversity of STEM experiences, while also supporting girls in making connections with peers.

Brite Program Design Features

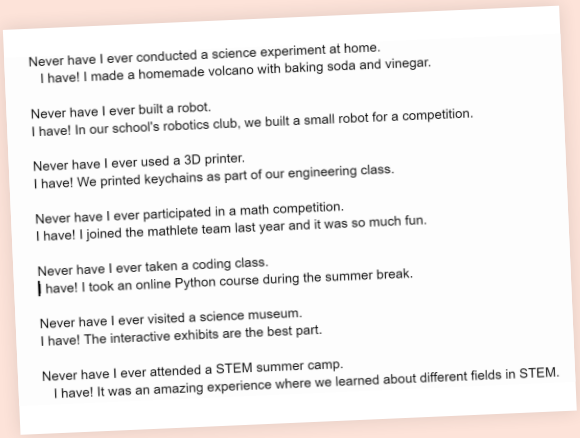
Collaborative learning during Brite centered on daily icebreakers in small groups, both in person and online via Zoom, and weekly community-wide gatherings where all participating girls joined together on Zoom to engage in large-group discussions and a collaborative activity.

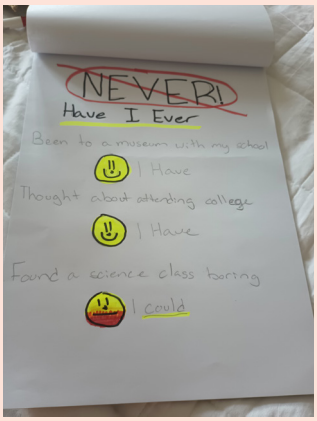
Daily icebreakers were intentionally designed to have real-world connections. Icebreakers were connected to the weekly theme, role models, and provided opportunities for girls to share their interests, experiences, and build relationships with peers and educators. These interests and experiences shared during icebreakers were connected to STEM, such as discussing a technology that they could not live without, but also surfaced girls' lived experiences, including hobbies, their cultural backgrounds, and daily life experiences.

The weekly Brite Community Gathering was a girl-centered session on Zoom that provided an opportunity for girls to share, reflect, and collaborate on new ideas and challenges that arose throughout their week. The gathering included time for girls to share their "roses and thorns" (highlights and challenges), and featured a hands-on activity, such as making a DNA necklace with colorful beads and string that girls assembled live on Zoom, or a large group discussion that used visuals, such as an

interactive, online Slido Poll about diversity and belonging in STEM. The gathering aimed to support girls in fostering a growth mindset about STEM learning and to encourage girls to collaborate and learn with their peers.

Never Have I Ever Icebreaker





INSTRUCTIONS: Girls will hear a series of statements and select either "I Have," "I Have Never," or "but maybe I could" (for some statements) and share their responses with their small group and on the Brite Platform. The Educator will ask a series of questions (see below). Girls will respond to each question with a "thumbs up" for "I have" or a "thumbs down" for "I have not". For the statements with "but maybe I could" as an option, ask the original Never Have I Ever prompt first, then pose "but maybe I could" as an option. As a group, discuss trends that you noticed. What are some things you have not done that you would like to do?

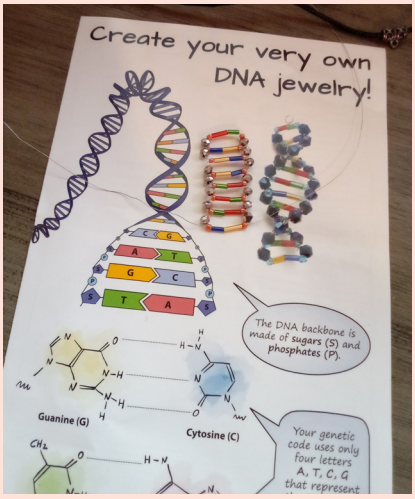
+ Never Have I Ever Prompts:

- attended a science summer camp or afterschool activity
- thought about attending college (but maybe I could)
- found science classes boring
- taken a science trip in school
- taken a school trip to a museum
- visited a science museum with my family
- talked about science outside of school (but maybe I could)
- talked with my friends about science (but maybe I could)
- talked with my family about science (but maybe I could)
- talked with my teachers about science (but maybe I could)
- met a scientist
- talked with a scientist (but maybe I could)

"I liked talking with our group in the morning because we were able to bond more closely and connect with each other."

–Brite Girl Participant

Community Gathering Activity: DNA Necklace



INSTRUCTIONS: Dr. Beata Mierzwa has a passion for combining fashion and STEM. She uses art to communicate science topics like DNA, cell division, and more! Today, you will create your own fashionable DNA necklace. The necklace will help us understand the components of the DNA backbone and learn more about our unique genetic codes! Follow along and make your DNA necklace together with your educator and peers on Zoom! Your educator will provide step-by-step guidance. There is also an illustrated step-by-step guide in your DNA necklace kit.

MATERIALS: Your DNA necklace kit: Set of colorful beads, wire, one necklace string, and an illustrated step-by-step guide.

"I love the Community Gatherings because we learn so many things about each other and get to see everything we've made"
–Brite Girl Participant

PRACTICE 2

Provide multiple modalities for girls to engage with and support peers, educators, and role models.

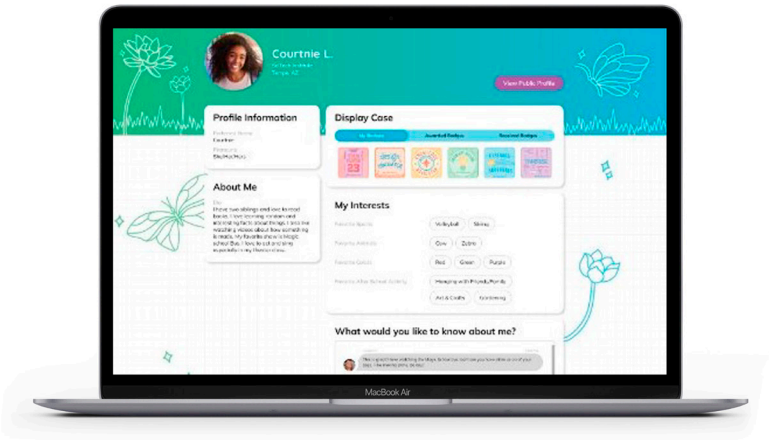
This practice aims to help girls build connections with peers, educators, and role models. To put this practice into action, provide opportunities for girls to engage with others through video/audio conferencing tools and online platform features. Integrating conferencing tools with options such as video, audio, chat, and emojis provides girls with voice and choice in how they engage with and support others. These various communication options can also support differing levels of comfort and familiarity with public speaking and STEM-related content. Additionally, integrate online platform features, such as a forum for conversation on

daily prompts, and profile features where all community members can share more about their own interests, while also learning about others' interests. Through these program and platform design features, educators support girls in discovering shared STEM interests and lived experiences with peers, educators, and role models, helping foster girls' sense of belonging in STEM and in an online community.

Brite Program Design Features

During Brite, girls could engage and support one another verbally and through chat and emoji reactions on Zoom. On the platform, key features, including Interactive Profiles and the Forum, provided multiple modalities for girls to interact and form connections with one another, educators, and role models. Interactive Profiles included a space for girls to write a bio and display their hobbies and interests, and a chat feature where they could share ideas, and other community members could share comments or ask questions. Interactive Profiles enabled girls to learn more about their peers and role models, building connections beyond structured sessions through shared interests. The Forum featured STEM-related questions, such as, *STEM relates to so many parts of our lives. What are some ways you use STEM in your daily life?* The Forum discussion encouraged interaction and provided opportunities for discovering shared interests, mutual support, and fostering a sense of belonging.

Brite Profile



FORUM QUESTION

Many of our role models combined multiple interests in their STEM careers. How might you combine your interests with STEM?

> **"I loved how inclusive and supportive everyone was in the chat on Zoom. Whenever we made mistakes, there were wonderful people who were there to explain things better along the way."**
>
> –Brite Girl Participant

> **"I think that everyone else in this program really stand out because they are here and learning with everyone together, and seeing the different people and what they have all created is just amazing!"**
>
> –Brite Girl Participant

COLLABORATE WITH ROLE MODELS

PRACTICE 3

Recruit and prepare role models who challenge stereotypical perceptions of STEM.

This practice aims to provide multiple opportunities for girls to connect with role models and STEM, helping to break stereotypes about STEM people and career pathways. To put this practice into action, recruit and prepare STEM professionals in your community and use free digital resources like the IF/THEN® Collection to counter STEM stereotypes through role model identities and lived experiences, career pathways, and hobbies. For recruitment, consider diversity broadly, including factors such as gender, race, ethnicity, ability, career stage, field, and career pathway to provide girls with multiple opportunities to connect with the lived experiences of role models.

Develop training or guidance documents to prepare role models to share the personal and professional aspects of their journeys. Encourage role models to share their early life experiences, career-related choices and interests, hobbies, challenges and barriers faced, and examples of perseverance. When role models authentically share their stories, they demonstrate how STEM professionals and career journeys are unique and varied, helping to debunk stereotypes and providing girls with opportunities to relate to role models as multi-dimensional people.

> **"Ms. Fracchiolla also stood out to me because of her divergence from the common path of getting a degree in, in her case, astrophysics and working in a lab and instead conducting research around rather than in the field. As someone fascinated by STEM but not sure white gowns and sterilized research are for me, I liked the idea of being part of a scientific discipline but not in a stereotypical or usual way"** –Brite Girl Participant

Brite Program Design Features

During Brite, role model recruitment intentionally considered specific characteristics of STEM professionals, including their intersectional identities and lived experiences, interdisciplinary career pathways and interests, field(s) of work/study, and career stage. The IF/THEN® Collection, the largest digital library of diverse women STEM professionals, was used as a recruitment tool for Brite role models. Role models were trained to share the personal and professional aspects of their STEM journeys and their multiple identities—the many parts that make them who they are. Specifically, role models were encouraged to share early life experiences, how they became interested in their current career, the challenges and barriers they experienced, and how they persevered. They were also encouraged to share their lives outside of work, including hobbies and interests. The Brite team met with role models individually to support them in preparing and sharing their stories with girls. The team also developed and hosted an online group

training for role models reflective of key learnings from Techbridge Girls Role Models Matter™ training and the SciGirls Role Model Strategies. Role models were also encouraged to participate in Techbridge Girls Role Models Matter™ training, an asynchronous training grounded in cultural responsiveness.

Dr. Beata Mierzwa
Molecular Biologist
and Science Artist

"Along my academic career path, I also create science, art, fashion, and video games to share the beauty of biology with the world. And I do that because I really love getting creative and students excited about science through art. And the reason why I really want to talk about it is because it took me a really long time to realize that combining science and art is even a possibility. When I was younger, you know, I loved creative projects like painting and crafting, and I was also really fascinated by science, but it never crossed my mind at that time that I would ever be able to combine these passions. So I love sharing the importance of combining science and art for research and communication too."

—Dr. Beata Mierzwa

"I'd just love to share a bit about my journey, about what it took to be an entrepreneur. So it started with me having this idea. What if there's a way that I can encourage more girls to believe that they can be engineers, scientists, and all these careers in STEM? And what if dance can play a role in that? What if there's a way that the fun and the joy, just like the culture of dance can attract girls to STEM? That was the idea I had. I didn't know how I was gonna do it, but I just had this idea . . . I loved dance as a young girl, you could see from the picture from before. I also loved math and science. And I used to feel like I had to choose. Like, either I'm gonna become a dancer or I'm gonna become an engineer. I never even thought as a young girl that I could combine it. And it is through the combination that I've been able to do this work."

—Yamilée Toussaint Beach

Yamilée Toussaint Beach
Founder & CEO of STEM From Dance.
She personally experienced the extraordinary benefits of STEM education and dance.

"I learned that pursuing a STEM field can be a combination of many passions, not just limited to one. I was also quite inspired by what all these role models accomplished even under hardships" –Brite Girl Participant

PRACTICE 4

Prepare role models to share their STEM stories in interactive, conversational ways that encourage girls' participation and provide opportunities to recognize their contributions.

This practice aims to support girls in sharing their skills, interests, and lived experiences through interaction with role models, while also receiving real-time recognition for their contributions. To put this practice into action, support role models in developing their STEM stories and interactive presentations through training, resources, and meetings. Provide role models with examples of how they can integrate interactivity, such as games and discussion prompts, to convey their STEM journeys and interests. When role models share their STEM stories in an interactive and conversational style, this highlights how STEM learning is collaborative, relevant, and fun, while also creating multiple opportunities for girls to share and receive recognition for their interests, experiences, and knowledge. Online conferencing tools, such as Zoom, offer multiple modalities for role models to recognize girls' contributions in real-time through audio/video, emoji reactions, and chat features. Recognition by role models is one powerful way to help girls see their contributions and experiences as valuable to STEM, supporting girls' positive STEM identity development.

Brite Program Design Features

The Brite team hosted individual meetings and a group training to guide role models in integrating interactive elements into their sessions, such as games and activities. Both the meetings and group training emphasized the importance of having conversations with girls, as opposed to a lecture, to create a comfortable and supportive space where girls could be themselves and share freely. Role models were asked to talk about their work in age-appropriate ways to make their field accessible and interesting to girls, rooted in Techbridge Girls Role Models Matter™ training.

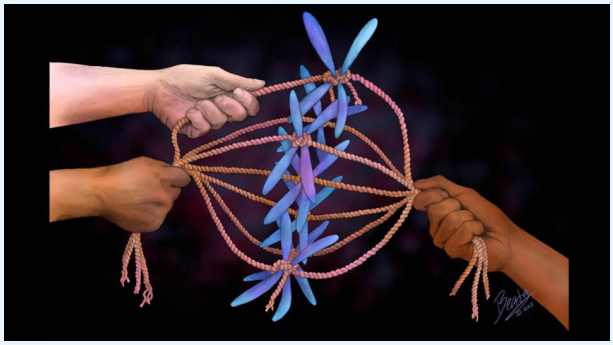
Moreover, the Brite team emphasized how role models play a key role in positioning and supporting girls to perform their STEM and other identities through conversations, games, and activities. Role models were asked to prepare for a wide variety of questions from girls about the personal and professional aspects of their journeys, and to brainstorm questions they would ask girls, including what they want to learn from girls. Through conversation with and learning about role models, girls have opportunities to discover new interests, make connections, and share their STEM skills and learnings. The Brite role model training emphasized the importance of recognition for girls' STEM identity development. During the live role model sessions, role

models not only consistently thanked girls for their contributions, but brought girls insights into the large group discussion and asked girls follow-up questions—spotlighting girls' STEM interests and learnings for the whole Brite community.

Girls played Would You Rather STEM jobs edition with Volcanologist Jess Phoenix: Girls reflected on STEM jobs they might enjoy, and received feedback and appreciation for their contributions from the role model: Would You Rather—Dive into the ocean's dark depths or travel to space? Would You Rather—gather lava samples at an active volcano or conduct research on dangerous viruses?

"I'd love to take a few minutes and play a little game. I call it 'guess that drawing.' I'd love to show you a few pictures, and you can guess what they're about. And the idea here is that you get to see some examples of the different ways science can be communicated, and it hopefully gives you some inspiration and ideas for your own drawings and art as well" –Dr. Beata Mierzwa

Girls played Guess that Drawing with Molecular Biologist and Science Artist Beata Mierzwa: Beata showed girls her microscopic drawings and girls shared their guesses about the science concepts behind the art.



"I wanted to ask you all to reflect on this question. What is an idea that combines your passions? What are some things that you're passionate about that you could combine to make something great? So think about it, and I would love to see your answers in the chat" –Yamilée Toussaint Beach

INCORPORATE HANDS-ON PROJECTS THAT WEAVE ART AND CREATIVITY INTO STEM

PRACTICE 5

Encourage girls' creativity and self-expression.

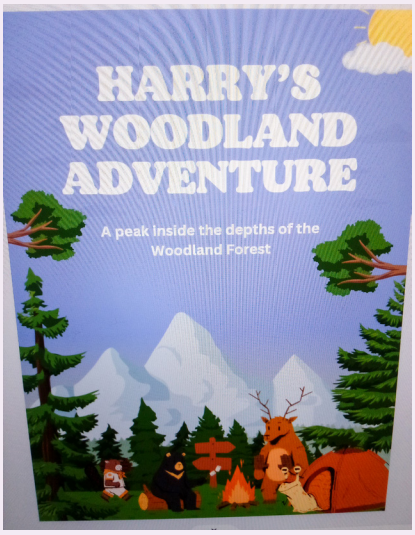
This practice aims to help girls discover new and shared interests and experience firsthand how creativity and self-expression connect to STEM. To put this practice into action, engage girls in open-ended activities that integrate artistic creation with STEM content to showcase interdisciplinary aspects of STEM, and connect activities to STEM role models to demonstrate relevance. Provide a variety of options for how girls can engage in hands-on activities. Specifically, offer more/less challenging options for each activity to accommodate differing levels of comfort and prior STEM knowledge. Offer multiple options for approaching an activity, such as using digital tools and arts and crafts supplies. Providing these various options will illuminate how there are many ways to approach a STEM activity or problem, and showcase how diverse skill sets and learning styles are valuable to STEM.

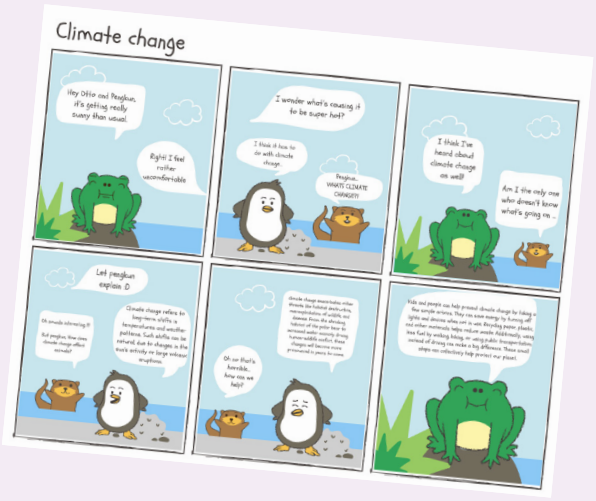
Brite Program Design Features

Brite activities were intentionally connected to the weekly themes and the careers and interests of role models. Many activities were interdisciplinary, including activities relating to art, design, dance, and writing. The Brite Educator Guide provided detailed instructions and resources for explaining each activity and the supplies needed, and made connections to the theme/role models. The Educator Guide also provided various options for how girls could approach and engage in an activity, such as online tools and physical supplies. The Guide also provided options for adding or lessening the complexity of an activity to support girls' level of comfort or familiarity.

GRAPHIC NOVEL

Instructions: Dr. Jessica Hua's lab has been creating graphic novels and comic books to help students learn about topics like biodiversity. Today, you will be creating your own graphic novels about a science topic you are interested in! Let's take a look at some examples from Jessica's lab and then we will brainstorm some of our own topics: *Gemma Jones Visits Nuthatch Hollow: A Wetland Adventure* & *Amphibian Adventures: Beyond the Vernal Pool*. Help girls brainstorm a list of topics they are interested in creating a graphic novel about. For example, they may be inspired by the Hua lab graphic novels and wish to create their own story about a wetland, marsh, or specific amphibian. However, they can choose any science topic they wish!





Supply Options: Girls can use paper and art supplies to create their graphic novel. If they prefer, they can use a digital tool such as Canva Comic Strips.

Activity Modifications:

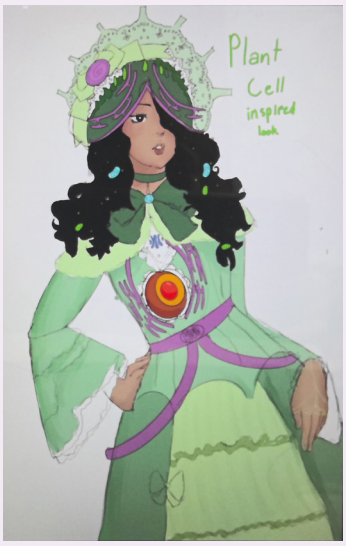
Simplify: Girls may not have time to create a full graphic novel story. Simplify this activity by asking girls to come up with a science graphic novel idea and then just create the cover (with an illustration and title).

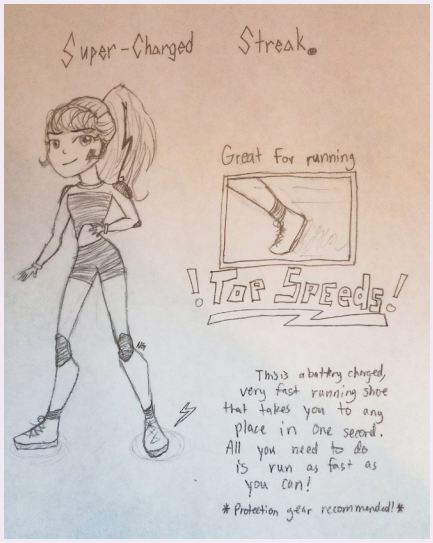
Add Complexity: Ask girls to research and weave the scientific facts into their graphic novel story.

"I enjoyed creating a graphic novel based on the scientific topic of my choice because it allowed me to integrate science and art, which made science seem more approachable and simple." –Brite Participant

DESIGN STEM-INSPIRED FASHION

Instructions: Explain to girls that Beata Mierzwa does work that combines fashion and the sciences. Today, we are going to be inspired by Beata's work and design an article of clothing that combines fashion with STEM! Watch: Beata Science Art—Fashion Show 2018 ÖGMBT Conference. As a group, brainstorm some examples of STEM-inspired fashion such as a skirt designed to move like the ocean to communicate the importance of rising sea temperatures, a jacket with the pattern of microscopic images, your dream scientist outfit, or a high-tech dress that lights up or responds with sensors.





Supply Options: Paper, pens/pencils, markers, and SketchPad

Activity Modifications:

Simplify: Instead of using Sketchpad, encourage girls to create a drawing on paper using colored pencils or other art supplies. Girls can also choose this option if they prefer a screen-free activity! For more inspiration, encourage girls to browse Beata's webpage.

Add Complexity: After their fashion designs are complete, encourage girls to think about the science behind their design. How exactly will it work (for example, will it need electronic components?). What is the message behind your fashion design (for example, are you making a statement about climate change or another topic?). Who would be wearing your design (for example, are you targeting a particular demographic?). After thinking about these details, encourage girls to write a short paragraph accompanying their illustration.

"Ms. Beata Mierzwa really stood out to me as someone who combined her passions for STEM and art into an incredible career and life. As someone who loves engineering and learning about space and biology, but has greater interests in topics such as U.S. politics and international relations, the potential to be able, at some point in my life, to thrive while combining passions was reassuring."

–Brite Participant

PRACTICE 6

Provide opportunities for recognizing girls' projects and learning processes by peers, educators, and role models.

This practice aims to provide all community members with opportunities to recognize girls' interests, ideas, skills, and knowledge, and their learning processes, such as how girls approached and persevered through an activity. Recognition by peers, educators, and role models enables girls to perceive themselves and their contributions as valuable to STEM, not only making STEM relevant to girls' lives but helping them foster a positive identification with STEM. Educators are encouraged to provide opportunities for girls to share their learnings and approach to an activity, such as challenges encountered, mistakes made, and how they persevered through an activity. This can support girls in fostering a growth mindset about STEM learning as a process that involves trial and error, problem-solving, curiosity, and creativity.

To put this practice into action, provide opportunities for all community members to recognize girls' projects and learnings through an online project showcase using video/audio conferencing tools, and through platform features, such as an online gallery space for girls to share their completed projects and recognize others' work through comments and likes, and digital badges to recognize a peer's contributions.

Brite Program Design Features

During Brite, girls shared their projects and learnings during the Brite Fest Project Showcase live on Zoom. Girls shared their favorite projects and moments from each week, as well as their learnings and challenges they encountered while working through an activity. Brite Fest was

"As you can see, that's my bracelet. I thought it was a really fun activity to do. It showed patience and resilience between, between us and the object that you're working with. It was, honestly, a bit challenging to me because of the double knots, 'cause the material would not stick. But overall, when you completed it, it made me feel good."

–Brite participant sharing about her binary code bracelet during Brite Fest

hosted by a different role model each week and provided girls with the opportunity to share their projects and ideas with and receive recognition from the role model host, peers, and educators.

Girls also showcased their projects on the interactive platform gallery, providing a space for recognition of their projects through comments and likes. Educators and girls could also give each other badges to recognize girls' identities, interests, and skills, to recognize effort, and build motivation. Some examples of badges included *Creative Coder*, *Design Innovator*, and *Research Superstar*. Various tips were included in the Educator Guide to support peer-to-peer recognition and to remind educators to recognize girls on the platform and during the small group time.

Brite Fest Badges

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