WIRING ACROSS SITES SO STEM LEARNING CAN FLOW

Strategies for Communicating More Effectively About Connecting STEM Learning Environments

A FrameWorks Strategic Brief

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Introduction

Advocates, educators, and supporters of STEM (science, technology, engineering, and mathematics) learning are prudently rethinking the structure of the school day and academic calendar, opening up classrooms to invite and encourage greater community involvement in STEM education, and making creative use of technology. Proponents of connecting STEM learning environments are focused on ensuring all children have opportunities to learn the skills they will need to be ready for and succeed in the world of tomorrow—skills like problem solving, critical thinking, and collaboration. All of this is possible because advocates know there are practical, proven approaches to things like curriculum, instruction, and assessment that can help students master the skills they need to join our workforce, lead our communities, and contribute to the future of the United States.

Yet, any seasoned changemaker knows that just as having a solid idea isn't enough to spark change, having a bit of momentum isn't sufficient to sustain a movement. Large-scale adoption and implementation require public understanding, public will, and even public demand—which, in turn, require advocates for change to engage the public in our collective cause. Understanding this, a group of foundations (the Heising Simons foundation, Bezos Family Foundation, and Verizon Foundation) sponsored the FrameWorks Institute to conduct a Strategic Frame Analysis® as part of the Families Learning Across Boundaries (FamLAB) project. This project, led by the Joan Ganz Cooney Center and in partnership with New York University, Stanford University, and the FrameWorks Institute, aims to mobilize a community of caregivers, educators, technology developers, and investors dedicated to building stronger connections between children's learning environments, with a focus on the roles that interactive and communications technologies can play in both strengthening different learning environments and propelling children's learning across these environments.

A Strategic Frame Analysis, an evidence-based approach to communications on complex social and scientific issues developed by the FrameWorks Institute, is one way that experts and advocates can make the most of opportunities to talk with the public about connecting STEM learning environments. Communicators using this approach learn how to make intentional, research-based choices in framing this issue for their audiences: how to start, what to emphasize, what to leave unsaid, and how to make the "whys and hows" of connecting STEM learning as comprehendable and memorable as possible.

Strategic framing develops communicators' ability to engage the public in productive conversations about connecting learning environments in order to build optimism and support for effective change.

The recommendations outlined in this Strategic Brief have been empirically shown to shift public thinking, attitudes, and policy preferences related to connecting STEM learning environments. They do this by deepening the explanation of how learning environments can be connected, what doing so looks like in practice, and why it matters, which enhances knowledge and encourages greater appreciation among members of the public for this goal. The recommendations also help experts and advocates affirm that all children deserve high-quality STEM learning opportunities, and illustrate how connecting learning environments addresses differences in access to STEM learning. Finally, the recommendations advise communicators to demonstrate how connecting formal and informal sites of learning helps to support, rather than replace the work of teachers and schools. Ultimately, the communications strategies presented here will help advocates build greater public understanding of how and where STEM learning takes place, and encourage support for programs and policies to strengthen connections between formal and informal STEM learning environments.

Evidence Base

Three main sources of data inform the framing recommendations included in this report.

ON-THE-STREET INTERVIEWS

On-the-street interviews involved rapid face-to-face testing of frame elements for their ability to prompt robust understandings and productive discussions about connecting young children's STEM learning across different environments. A total of 52 interviews were conducted in May 2018.

EXPERIMENTAL SURVEYS

One experimental survey was completed in January 2019 by a sample of 1,404 participants, which matched national demographics of the United States in terms of age, sex, race and ethnicity, annual household income, educational attainment, and political party affiliation. This survey tested the effects of various ways of framing connecting young children's STEM learning across different environments on public understanding of this topic and on support for policies to facilitate connections.

An additional experimental survey on the topic of family, school, and community engagement was conducted in December 2018.[1] This survey similarly focused on identifying ways of building understanding and support for strong relationships and engagement between actors and institutions involved in children's learning: families, schools, and community organizations and institutions. This survey was completed by a sample of 2,400 participants that also matched the demographics of the US population, and tested the effectiveness of various ways of framing engagement between schools, communities, and families.

PREVIOUS FRAMEWORKS RESEARCH

This strategic brief reviews and synthesizes almost a decade of other research projects conducted by the FrameWorks Institute. It integrates this previous work with our most recent research conducted as part of the FamLAB project

to offer a robust strategy for communicating about connecting children's STEM learning across sites. To assemble the brief, FrameWorks' researchers reviewed the Institute's portfolio of research and framing strategies across a range of issues—including informal STEM learning, education and education reform, and digital media and learning.[2]

Crossing the Boundaries: Mapping the Gaps between Expert and Public Understandings of Bridging STEM Learning Environments. This report explores public thinking about where kids learn about STEM subjects and how to connect and integrate learning that happens in different settings.

The Power of Explanation: Reframing STEM and Informal Learning: A FrameWorks MessageMemo Supported by the Noyce Foundation. This report, supported by the Noyce Foundation, summarizes the findings from an investigation of how Americans view STEM education, with a particular focus on informal learning contexts. It recommends specific reframing tools that demonstrate strong effects in addressing the conceptual challenges faced by communicators in translating expert views on this topic.

A Hands-on Approach to Talking Learning and Digital Media: A FrameWorks MessageMemo. This report summarizes the findings from FrameWorks' research and provides front-line communicators with a communications map for improving the public's understanding of digital media and learning both in and outside of the classroom, and for increasing support for digital media and learning opportunities in education.

Framing Education Reform: A FrameWorks MessageMemo. This report pulls together several years of FrameWorks' qualitative and quantitative research on how Americans think about the education system in general and education reform in particular. It includes recommendations for using values and explanatory metaphors to frame a wide array of issues and policies related to pre-K through higher education.

Framing Recommendations

Strategic framing is about knowing both what to *say* and what to *avoid saying* to help people reason productively about a topic. The strategies described below were designed to equip experts and advocates with tools to communicate more effectively with members of the public about connecting STEM learning environments. These strategies build people's understanding of how STEM learning environments can be connected and why this is important. They also increase support for initiatives that build connections between learning environments for all children.

> **Say the Words:** Most people are unfamiliar with the acronym "STEM," and those with a basic knowledge of STEM tend to associate it mostly with science, ignoring the other three fields. To broaden public understanding, communicators should name all four fields represented in the acronym—"science, technology, engineering, and math"—whenever and wherever possible.

Recommendation #1: Paint a picture of how STEM learning environments can be connected and what flows from these connections.

The challenge

The American public does not fully appreciate, or even think much about, intentionally connecting learning environments. While people do acknowledge that learning can happen in lots of different places, they typically place schools at the center. They understand learning in other environments to be secondary to, and about simply reviewing or reinforcing, what happens in the classroom. An added challenge is that people think about many informal settings as places where kids can and should take a break from "real" learning, and fail to see how learning in these contexts enhances STEM knowledge and skills. In sum, the public tends to see informal environments as supplementary to, and separable from formal learning environments. They also think about the relationship between learning environments in hierarchical rather than ecological terms, with informal settings at the bottom and schools at the top.

What framing can accomplish

A carefully rendered image can help people see what connecting learning environments looks like and why it matters. It provides people with a clear illustration of meaningful connections and how these can amplify learning. In addition, effective communications demonstrate that connecting environments makes learning more inclusive by giving children who have access to different kinds of environments the ability to contribute what they have learned, wherever that may be.

How to do it

Give the public a visual. In order to appreciate the value of effectively connecting STEM learning environments, people need to be able to envision what this looks like and how it works. This happens when communicators offer vibrant details and provide information that is specific enough to make the potentially abstract notion of connected STEM learning feel more concrete. Two specific framing tools can help accomplish the task:

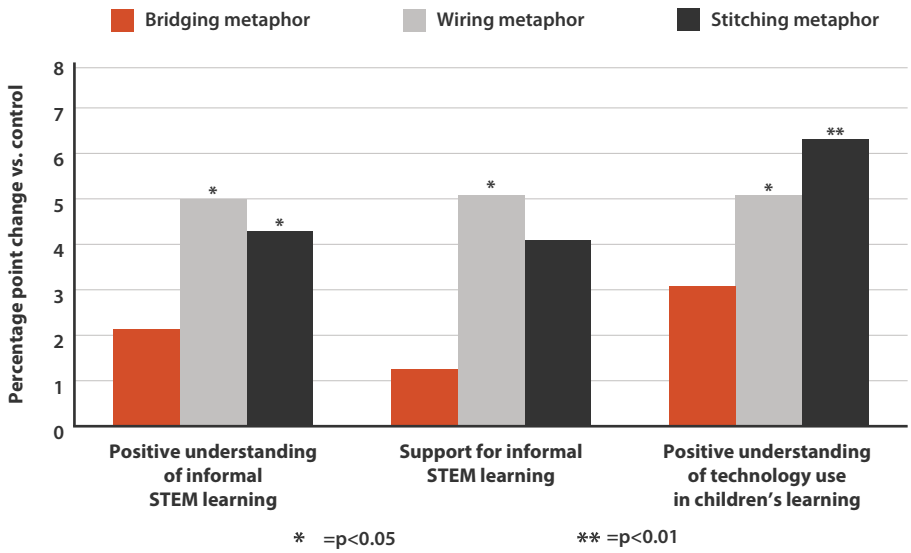
Framing Tool: Use the *Wiring Learning Environments* metaphor to depict interconnection as an active and engaging process and explain how it energizes learning.

Wiring Learning Environments is an explanatory metaphor that builds understanding about the essential connections between formal and informal learning environments, and expands appreciation for multiple learning modalities among people who have limited familiarity with these concepts. Here's the idea:

> Young children learn STEM—science, technology, engineering, and math—in lots of different places: at home, in school, at libraries, in daycare, at after-school programs, and at museums. But often, these places are disconnected, like parts of a machine that aren't wired together. And just like how electricity can't flow between parts without the proper wiring, when the places where kids learn aren't connected, the ideas and skills gained in one place don't flow to the others. We need to make sure that all the places where kids learn STEM are wired together so that skills and knowledge can flow between them, and learning is powered up.

In a survey experiment conducted as part of the FamLAB project, FrameWorks tested different ways of framing the importance of strong connections between environments where young children can learn STEM. Results from that survey reveal that *Wiring* has the broadest, most robust frame effects, as displayed in the graph below.

Figure 1: Effects of explanatory metaphor messages



The graph shows the positive effects of the *Wiring* metaphor. Compared to survey participants who received no message at all, those who were exposed to the *Wiring* metaphor expressed a more positive understanding of informal STEM learning, higher levels of support for informal STEM learning, and a more positive understanding of the use of technology as a component of children's STEM learning. While the metaphor of *Stitching* together informal STEM learning environments—like the pieces of a quilt—also had desirable effects, people who read this message did not express significantly higher levels of support for informal STEM learning than participants who received no message to read. Finally, we found little evidence that the metaphor of *Bridging* informal STEM learning environments—which is currently used by some advocates—is an effective way of framing this issue. There were no statistically significant differences in responses between people who read a message using this metaphor and those who read nothing at all.

The *Wiring* metaphor not only helps people understand that formal and informal environments play complementary roles in a broader system of STEM education but—more importantly—that connecting these environments enhances learning. People understand the parts of an electrical system as interdependent and reliant upon a network of wiring, and they can transfer this understanding to reason about connections between different learning environments. And by helping people recognize the importance of informal environments like aquariums, community gardens, and museums within a broader, connected system that includes classrooms and schools, the metaphor leads people to recognize informal environments as *vital components* of STEM learning. A wiring system transfers energy back and forth between locations, which helps people think about the *mutual* benefits of connecting environments.

These entailments of the metaphor thus steer people away from thinking that different learning environments should operate independently of one another, and that informal environments are supplementary or less important.

Framing Tool: Offer concrete examples of interconnection between STEM environments.

Because connecting learning environments is an abstract idea for many people, communicators must offer concrete, real-world examples that illustrate how connections can and should work. Examples provide conceivable scenarios and can be used to give substance to the *Wiring* metaphor. In short, the *Wiring* metaphor opens up a productive channel for thinking about the idea and value of connecting learning environments, while examples fill in the blanks with specific and durable details about what it could look like in practice. The following (fictional) example shows how to use these communications tools together:

> Eastbrook County recently launched our Sci-DIY program—a collaborative effort between elementary school teachers and librarians that's designed to enhance kids' STEM skills. The program wires local schools and the library together into a tightly connected network. Following a jointly developed curriculum, the library sets up a Do-It-Yourself station every Saturday morning where kids can engage in hands-on STEM learning activities. Teachers then connect these activities to their lesson plans for the rest of the week. Last Saturday, some first graders learned how to make their own slime, which they then brought into class on Monday to learn about viscosity. Eastbrook kids got a memorable, albeit slightly messy, hands-on lesson that that utilized a transfer of energy and insights between the library and the classroom to power up their learning.
>
> Sci-DIY is helping the whole community stay charged up about STEM education. Young children are building and sustaining their energy levels in and outside of the classroom, with teachers reporting improved learning outcomes. Eastbrook librarians, who are evaluated on their outreach work, are gaining recognition and appreciation too. Sci-DIY is therefore part of a county-wide plan for civil servant workforce development. As a result of having more opportunities for collaborative curriculum development, school administrators are reporting an energized sense of community and surge in worker satisfaction among all education professionals. And these innovative young slime creators will no doubt power up our STEM workforce of tomorrow.

FrameWorks' earlier research on informal STEM learning also revealed that concrete examples not only enhance people's understanding of how informal STEM learning works, they boost public support for increasing and expanding informal STEM programs.[3] Through this current project, qualitative analysis of on-the-street interviews further suggests the need to provide concrete examples that illustrate how STEM learning environments can and should be connected. In fact, examples of connections can simultaneously advance understanding of the distinctive and essential features of informal STEM learning environments, while boosting appreciation for the importance of connecting these environments with formal learning.

Examples also help to displace unproductive assumptions about STEM learning. For instance, explaining how connecting learning programs improves education outcomes can counter the public's tendency to assume that outcomes are only improved through the actions or characteristics of individual teachers and parents. Likewise, drawing on examples to demonstrate how curiosity and learning about STEM can only power up if different environments are connected helps to break down the public notion that STEM learning is or even should be confined to particular places.

When deciding on which kinds of examples to incorporate and how to incorporate them, communicators should consider the following guidelines:

- **Explain how connecting learning environments accomplishes specific outcomes.** Because the benefits of connecting learning environments, and the distinctive role that informal environments play, are not entirely visible, it is important to be specific about what connecting a diverse network of sites can accomplish. Whenever possible, communicators should connect learning activities in different environments to tangible rewards or improved outcomes.
- **Highlight the roles that other actors—beyond parents and teachers—play.** Members of the public tend to ascribe more importance and responsibility to parents and teachers than to other environments and actors. Shining a spotlight on other environments and the educators who work there—such as librarians, museum docents, or zookeepers—can help the public cast a wider net in thinking about who is responsible for making sure children develop strong STEM skills.
- **Feature younger children.** The public assumes that science and math, to an extent, but especially engineering and technology are advanced subjects, and only appropriate for older youth. Communicators should demonstrate how connecting STEM learning environments works for younger children, and feature programs involving early age groups. Use multiple cues to help people understand just how early in a child's development STEM learning can be fostered, for example by mentioning specific age ranges or grade levels.

- **De-center schools.** While schools should definitely be included in concrete examples of connecting STEM learning environments, communicators can expand public thinking by showcasing non-school environments as important hubs. Using the *Wiring* metaphor to set up a networked and non-hierarchical relationship between multiple learning environments can help. It is also useful to think about order in communications: Try focusing on informal environments first before connecting them to formal ones.

Consider examples of technology that highlight its interactive, transportational qualities.

People think of technology primarily as a range of devices that children use in isolation—removed from social interaction and supervision. Rather than enhancing children's development then, technology represents a passive form of learning that undermines social connections—it distracts from or prevents children's active engagement. According to this way of thinking, use of technology in learning must be restricted and curtailed rather than actively promoted.

As noted above, the *Wiring* metaphor helps people to see technology in a more positive light. The metaphor can be used to explain how technology can function as both a site of collective learning and a tool that connects children and their learning across different places. Communicators can leverage this metaphor by using concrete examples to illustrate how technology enables meaningful connections across people and places.

In describing such examples, communicators should highlight practical and applied forms of technology to build on the public's existing positive associations with hands-on, interactive learning. By emphasizing the ways in which children interact with each other through technology, communicators can make a stronger case that technology is a necessary and socially relevant learning tool.

When highlighting the boundary-defying and multi-locational experiences that technology provides, communicators should also focus on how and in what contexts technology facilitates rather than impedes adult supervision and involvement. This is an effective strategy for navigating around the public's dominant idea that, in addition to being isolating or distracting, technology use is often removed from educators' and responsible caretakers' view.[4]

Recommendation #2: Make clear that connecting STEM learning environments is vital to ensuring that *all* children have the opportunity to succeed.

Experts are clear that connecting STEM learning opportunities across formal and informal learning environments is essential to ensuring all children have the opportunity to succeed in life and learning. Unfortunately, high-quality STEM learning opportunities are not equally available or accessible to all children. Opportunities to engage in STEM learning in both formal and informal environments are often less accessible to girls, children from lower-income families, children from rural communities, children whose second language is English, and Black and Latino children. For this reason, experts and advocates of connecting learning environments see this as a social justice issue. By making STEM learning more accessible to a wider swath of our young population, especially those who have been historically underserved by formal school environments, developing connections between spaces that can promote and foster STEM learning is a powerful lever to not simply enhance, but also ensure greater equity in learning and life outcomes.

The challenge

Members of the public underestimate the social consequences of connecting STEM learning environments. They also have hardened ideas about why some children do—and don't—perform well in STEM. In a way that mirrors public thinking about educational outcomes more broadly, people rely on highly individualistic explanations for why some students struggle with STEM subjects and others do well. They often draw on assumptions and stereotypes about differences in "natural" aptitude and personal beliefs and interest to explain varying achievement levels. Students who excel in STEM subjects are just assumed to be inherently gifted at or interested in STEM, more driven, or to belong to families or larger communities who care about education and STEM more than others. Conversely, students who perform poorly are assumed to lack ability or interest in STEM, or other personal attributes.

What framing can accomplish

Effective communications will help people see the implications of connecting STEM learning environments for society, as a whole. They will also encourage a more structural understanding of racial, economic, gender, geographic, and other disparities in STEM learning, rather than an individualistic one. This enhanced knowledge can lead to recognition that learning environments need to be connected, and that systemic, collective actions are necessary to make them so.

How to do it

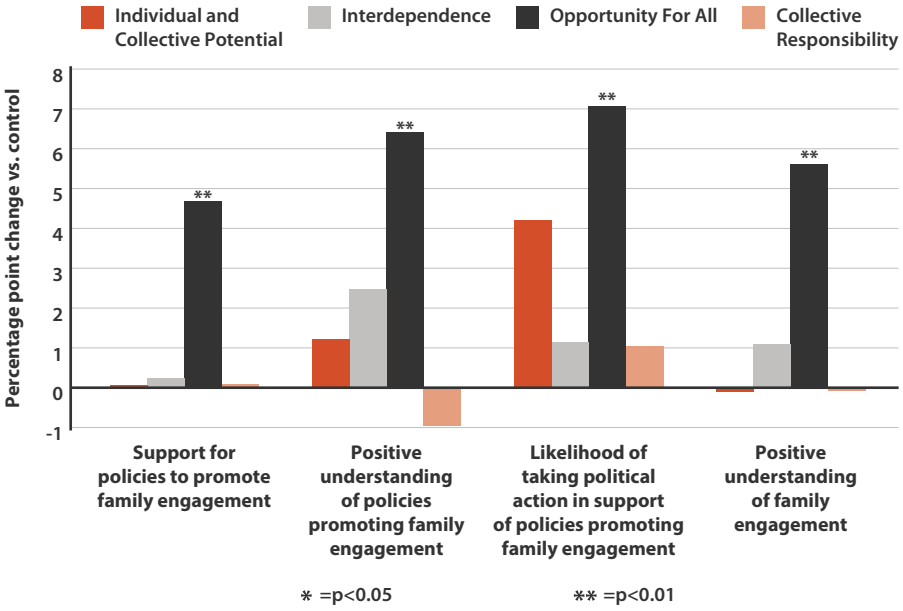
Two complementary tools can be used to generate greater appreciation of the importance of connecting STEM learning environments, and greater understanding of the relationship between strong connections and reduced disparities in STEM learning outcomes. The first tool is the value of *Opportunity for All*. Values are ideals or principles that people hold and use to orient their decision-making. Connecting issues to people's values helps them to understand why an issue should matter to them and provides them a reason for supporting some type of action or change. The value of *Opportunity for All* frames connecting learning environments as a matter of ensuring all children have the same chance to learn and thrive at STEM. The second tool, a *Charging Stations* metaphor, offers an explanation of how to make this aspiration a reality.

Framing Tool: Use the value of *Opportunity for All* to emphasize that connecting STEM learning environments is about making STEM learning accessible to *all* children.

To help make the case for connecting learning environments to members of the public, communicators can draw on the value of *Opportunity for All*. This value reminds people of our shared belief and aspirational vision of a society in which all people should have a chance to do well. FrameWorks' research shows that the value of *Opportunity for All* powerfully orients audiences to the idea that connecting STEM learning environments is key to achieving this. Here is the core concept of the value of *Opportunity for All*:

> We're committed to making sure that all children have the same opportunity to succeed, no matter who they are or where they live. That's why we need to build strong connections between different kinds of learning environments. When different places where children can learn are connected to one another, this makes it possible for children from all different backgrounds to deepen and sustain their interest in learning. By connecting the places where children learn, we can make sure that all our children have a chance to develop, contribute, and succeed.

Figure 2: Effects of value messages



The above graph displays the results of a recent survey experiment testing different ways of framing the related topic of fostering engagement between families, schools, and others involved in children's learning. The results provide evidence that *Opportunity for All* is an effective value to frame the importance of building strong connections between the different people and places involved in children's learning. The graph shows that, compared to those in the control group who read an unframed message about a policy proposal to foster family engagement, participants who read this information framed through the value of *Opportunity for All* expressed higher levels of support for, and demonstrated a more positive understanding of, policies promoting family engagement. They also indicated a higher likelihood of taking political action in support of such policies, and generally, a more positive understanding of family engagement. As the graph shows, these differences are statistically significant. In contrast, the responses of participants who read the other values-based messages were no different than those of participants who read the unframed message—there were no statistically significant differences in responses between the control group and those who read any of the other values-based messages tested.

In the context of connecting STEM learning environments, the value of *Opportunity for All* builds on the belief that all children should have the same opportunities to learn to explain why STEM education is a collective concern and requires policy intervention. This helpfully brings into view the idea that, even with hard work and dedication, children cannot advance in their learning without being able to access and transfer their learning across different environments.

Framing Tool: Use the *Charging Stations* metaphor to explain how structural inequities in STEM education cause disparities in STEM learning—and how systemic improvements can benefit all.

The *Charging Stations* metaphor was originally designed as part of a previous FrameWorks project called Core Story of Education. The metaphor offers a way of explaining how structural differences in opportunities lead to disparities in learning and outcomes.[5] The metaphor was later applied to differences in STEM learning opportunities, with a focus on informal settings, and was recommended as a way for communicators to talk about unequal access to STEM learning environments.[6] The metaphor can be effectively and easily combined with the *Wiring* metaphor. Here is what this looks like:

> STEM skill-building sites are like charging stations that power up kids' learning. Some students are in high-wattage, densely networked systems that provide lots of opportunities to get charged up. Everywhere they go offers a grid of interconnected power stations like great libraries, museums, science centers, and after-school programs. But other students have to operate in dead zones, where there just aren't many high-quality learning opportunities to plug into. Our current system is patchy—it's built in a way that energizes STEM learning for some of our nation's children but not for others. We can rewire our power generation systems across the country so that all kids, no matter where they are, have high-quality opportunities to engage with STEM subjects and charge up their learning and skills.

The *Charging Stations* metaphor enables people to connect differences in access to formal and informal institutions to differences in learning prospects and outcomes. The metaphor suppresses individualistic assumptions that dominate American culture about the reason for differences in educational outcomes (that is, that they exclusively reflect differences in individual determination, drive, and natural ability), and brings systemic-level differences to the fore. The metaphor trains attention on the idea that disparities are a problem of inequity in access, opportunity, and resources.

The metaphor also helps people to see that collective solutions can address inequities in learning outcomes. The idea of *spotty* charging stations suggests a system that is not functioning well, but also not beyond repair. This helps people see that policy changes are needed and possible. Strengthening or repairing charging stations frames the issue as a collective one because it becomes a matter of addressing a common infrastructure.

Recommendation #3: Foreground how connections provide support for teachers and schools.

The challenge

Numerous FrameWorks research projects have found that people ascribe schools and teachers a primary role in children's learning, and in children's STEM learning especially. STEM topics are thought of as specialized, serious, and complicated, so the place where kids should learn about them is in school. In other words, schools and teachers are primarily responsible for STEM education. At the same time, this research shows that many people believe teachers are tasked with too much and rightfully feel overburdened. This can make people skeptical of programs that aim to better connect learning environments or improve family and community engagement, which seem like they will just involve more layers of work that teachers and schools shouldn't have to do. When reform initiatives seem like more work or an unfair burden for schools and teachers to take on, they are vulnerable to public dismissal or even outright rejection.

What framing can accomplish

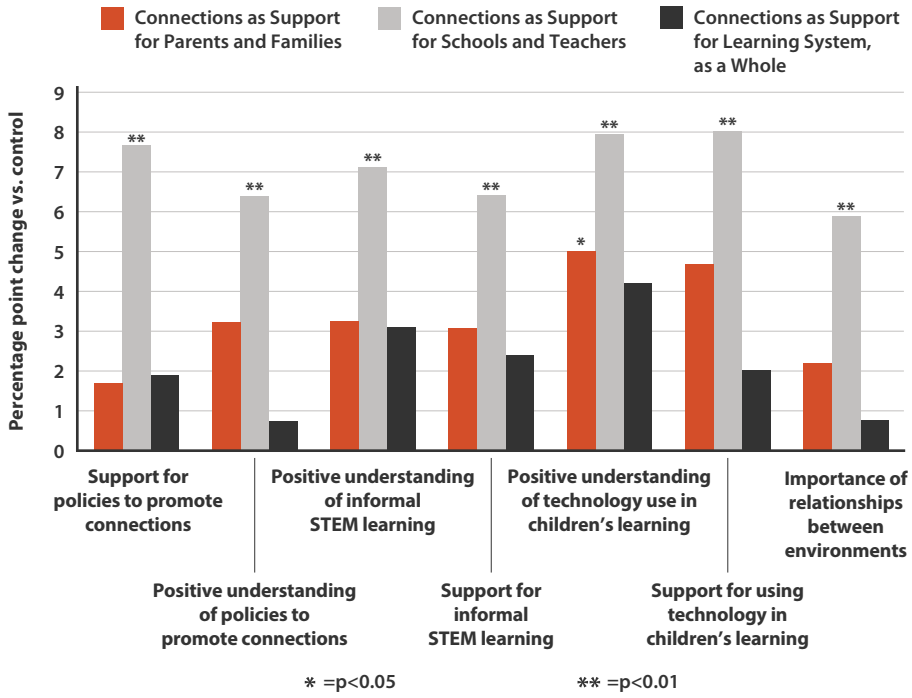
In order to build support for connecting STEM learning environments, people need a better sense of how this will enhance and support the work of the formal education system. Talking about how learning environments support teachers provides an opportunity to help people think about how children's learning is a collective effort. Informal learning environments matter too and they can help lighten the demands placed upon schools and teachers, rather than add to them. Greater attention can also be paid to the role of available resources, and less to the individual-level characteristics of teachers and administrators, like their work ethic or passion for educating children.

How to do it

Communicators need to highlight how connecting STEM learning environments benefits or supports the ongoing work of schools and teachers. Here is an example of how to do this:

> Schools and teachers are generally enthusiastic about and capable of helping students learn STEM—science, technology, engineering, and math. But many schools and teachers are unsure how they can best support younger kids to develop STEM skills. They need ways to connect to other places where children learn STEM: like homes, libraries, daycare and after-school programs, and museums. Linking up with these other places through technology, coordinated programming, and other joint initiatives" will make it easier for schools and teachers to help their students learn STEM and allow them to take advantage of all kinds of STEM learning opportunities in the community.

Figure 3: Effects of issue definitions



The graph displays the results of a survey experiment that tested different ways of defining the issue or problem that connecting learning environments might address. This experiment was conducted as part of our work for the FamLAB project. The graph shows that focusing on *Connections as Support for Schools and Teachers* is a more effective way of defining the issue than focusing on connections as *Support for Parents and Families*, or as *Support for the Learning System*, which framed connections as support for everyone involved in children's learning. Compared to people who read unframed information about a policy initiative on connecting learning environments, people who read a message that framed these measures as ways of supporting teachers and schools expressed higher levels of support for the policy initiative, a more positive understanding of policies to promote connections between learning environments, a more positive understanding of informal STEM learning, higher levels of support for informal STEM learning, a more positive understanding of the use of technology in children's STEM learning, higher levels of support for using technology in children's learning, and higher levels of importance of strong relationships between learning environments. The parental support frame only produced a statistically significant difference in responses on one outcome, while the learning system support produced no significant results.

It is important to note that these findings do not suggest that communicators cannot talk about benefits of connecting learning environments to other actors and stakeholders. Talking about supports for parents and families or the school

system as a whole did not backfire; it did not decrease understanding or support for STEM related initiatives. Rather, the findings suggest that communicators *should* include explicit discussions of the benefits that will accrue to teachers and schools in their discussions of connecting learning environments wherever possible.

Conclusion

The recommendations described in this brief are intended to establish some general guidelines and evidence-based best practices for experts and advocates who are communicating with non-experts about the importance of connecting learning environments. They are proven to build greater understanding, encourage generative thinking, and spark productive discussions—all of which increases the potential for widespread implementation and adoption of practices that can connect children's learning environments and, ultimately, improve learning outcomes for all children.

Endnotes

1. This survey was generously supported by the National Association for Family, School, and Community Engagement, the Heising-Simons Foundation, the W.K. Kellogg Foundation, and the Nellie Mae Education Foundation.
2. To access FrameWorks' full research portfolios of each of these topics, please see: http://frameworksinstitute.org/stem-learning.html; http://frameworksinstitute.org/k-12-education.html; http://frameworksinstitute.org/digital-media-and-learning.html; http://frameworksinstitute.org/u.s.a.html
3. Volmert, A., Baran, M., Kendall-Taylor, N., & O'Neil, M. (2013). *"You have to have the basics down really well": Mapping the gaps between expert and public understandings of STEM learning*. Washington, DC: FrameWorks Institute.
4. To learn more about FrameWorks' prior research on how to talk about digital technology, see Bales, S.N., Lindland, E., O'Neil, M., Simon, A., Lorick-Wilmot, Y., & Kendall-Taylor, N. (2012). A hands-on approach to talking learning and digital media: *A FrameWorks MessageMemo.* Washington, DC: FrameWorks Institute.
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6. Bales, S.N., Volmert, A., & Kendall-Taylor, N. (2015). The power of explanation: ReFraming STEM and informal learning: *A FrameWorks MessageMemo* supported by the Noyce Foundation. Washington, DC: FrameWorks Institute.

ABOUT THE FRAMEWORKS INSTITUTE

The FrameWorks Institute is a nonprofit think tank that advances the nonprofit sector's communications capacity by framing the public discourse about social problems. Its work is based on Strategic Frame Analysis®, a multi-method, multidisciplinary approach to empirical research. FrameWorks designs, conducts, publishes, explains, and applies communications research to prepare nonprofit organizations to expand their constituency base, build public will, and further public understanding of specific social issues—the environment, government, race, children's issues and health care, among others. Its work is unique in its breadth, ranging from qualitative, quantitative and experimental research to applied communications toolkits, eWorkshops, advertising campaigns, FrameChecks® and in-depth study engagements. In 2015, it was named one of nine organizations worldwide to receive the MacArthur Foundation's Award for Creative & Effective Institutions.

Learn more at **www.frameworksinstitute.org**.

ABOUT THIS PROJECT

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Learn more at **joanganzcooneycenter.org/initiative/families-learning-across-boundaries**.

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