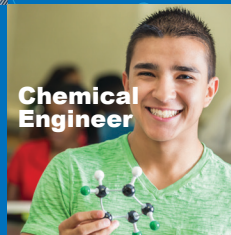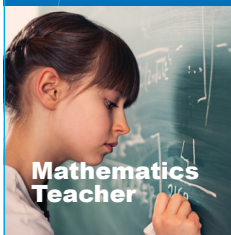# STEM READY AMERICA

Inspiring and Preparing Students for Success With Afterschool and Summer Learning

This collection of articles is excerpted from a new resource, *STEM Ready America: Inspiring and Preparing Students for Success with Afterschool and Summer Learning.* In this volume, Executive Editor Ron Ottinger and Contributing Editors Cary Sneider and Ian Hickox have collected expert perspectives on the state of the field of STEM learning—especially in afterschool and summer learning opportunities.

Collectively, these writings from more than 40 thought leaders highlight how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow.

The articles provide persuasive evidence and real-world examples to inform effective partnerships, policies, and actions to bring quality STEM learning to children and youth across the nation. This volume is focused in three key sections:

▶ **The Evidence for STEM**

▶ **Partnerships for STEM Learning**

▶ **Ensuring Access to Quality STEM Learning**

Biologist

AI Coder

Acoustics Engineer

Mathematics Teacher

Technology Manager

Chemical Engineer

Developed by STEM Next with support from the Charles Stewart Mott Foundation, *STEM Ready America* builds on the award-winning 2013 publication *Expanding Minds and Opportunities: Leveraging the Power of Afterschool and Summer Learning for Student Success* edited by Terry K. Peterson, Ph.D., which made the definitive case for the power and effectiveness of afterschool programs and summer learning.

For more information about STEM Ready America and to download articles visit: www.stemreadyamerica.org.

STEM READY AMERICA

Inspiring and Preparing Students for Success with Afterschool and Summer Learning

Leveraging STEM Investments for Long-Term Impact: The Clubhouse Network as Case Study

Gail Breslow

Mark St. John

Since 1993, The Clubhouse: Where Technology Meets Imagination (formerly the Computer Clubhouse) has provided a creative and safe afterschool learning environment where thousands of young people (ages 10–18) from under-served communities work with adult mentors to explore their own ideas, develop skills, and build confidence in themselves through the use of technology. In Clubhouse settings, youth develop STEM-rich projects based on their own interests, designing their own animations; building kinetic sculptures and robots; programming their own computer games; developing their own websites; telling stories through music, art, and video production; and more.

When the first Clubhouse opened in Boston in the early 1990s, community technology centers were springing up around the country, many in low-income neighborhoods, with an eye toward addressing what eventually became known as "the digital divide." But many struggled to find ways to attract youth in meaningful ways, instead providing Word or PowerPoint classes, computer games, or (later) free access to the Internet. Community leaders would often visit the Clubhouse and marvel at the fact that teens chose of their own accord, day in and day out, to come to a place where game-playing was not allowed and where the Internet was a tool not for passive browsing but for finding inspiration to express your own ideas and then communicating those ideas to the rest of the world. Interest in the Clubhouse—in what made it work and how to go about starting more of them in other under-served neighborhoods—began to grow. Today, nearly 100 Clubhouses serve more than 20,000 youth each year in 20 different countries. Clubhouses are housed in community centers, teen centers, and a wide variety of other kinds of agencies in low-income, underserved communities. In collaboration with the MIT Media Lab, the Clubhouse Network supports the worldwide proliferation of the Clubhouse learning approach.

Girls represent 42 percent of the Clubhouse's global membership. This high participation rate is notable in light of persistent societal biases against women in technology and, more broadly, in all STEM fields. An independent evaluation by

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Inverness Research found that an overwhelming majority of youth participants report that—thanks to the Clubhouse—they are more confident using technology and better understand how to use it to pursue their own interests and projects. They also express a strong interest in STEM fields and careers: 80 percent of boys and 74 percent of girls say they are interested in studying some aspect of STEM as they look to the future, and most—especially the girls—attribute that interest to their Clubhouse experience (Inverness Research, 2016).

Walk into a Clubhouse at any given time and you're likely to see a pleasantly chaotic scene and a variety of activities underway. STEM learning experiences are youth motivated and open-ended, enabling young people to tap into their own interests and engage in a way that feels meaningful, relevant, and authentic to them.

The Clubhouse approach isn't just about STEM learning. It's also about providing youth with adult mentors who serve as role models and believe in them, encouraging each young person to do and be their best. Clubhouses play a central role in the lives of many youth. Most go at least once a week, and half go almost every day. That deep engagement pays off: 93 percent of Clubhouse youth are interested in continuing their education after high school—this against a disturbing backdrop of high school drop-out rates and low college participation for youth in many Clubhouse communities—and over 90 percent care more about doing well in school and report that they try harder. Even more striking is the fact that youth feel more optimistic about their future (93%) and more confident they will have the personal skills to be successful in a future career (92%) (Inverness Research, 2016).

The numbers are compelling, but you can learn even more about the impact of the Clubhouse by watching this brief video of alumni reminiscing about their Clubhouse experience: https://www.youtube.com/watch?v=mj-keQhAkmQ

What Makes the Clubhouse Uniquely Successful?

The success of each Clubhouse begins with a shared set of values and a common learning approach developed over two decades ago by Mitchel Resnick and Natalie Rusk, both of whom are now at the MIT Media Lab. In many respects, the Clubhouse of today resembles what would be described by many as a "makerspace." Access to high-end technology tools is a key element of the Clubhouse approach, and this access is combined with a warm, inviting, collaborative physical space that encourages innovation and creates a strong sense of community among the members.[1]

Nevertheless, the Clubhouse goes beyond its high-end technology tools, the things you can make with them, and the place where you can make them. The Clubhouse learning approach is grounded in research from the fields of education, developmental and social psychology, cognitive science, and youth development. It draws on research on the role of affect and motivation in the learning process, the importance of social context,

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1. Clubhouse youth are called "members" rather than "students," as everyone acts as an engaged participant who is actively responsible for the Clubhouse community. Plus, everyone is a learner, so we avoid labels that would distinguish "students" from "educators."

and the interplay between individual and community development. It leverages new technologies to support meaningful learning experiences and engage young people who often have been alienated by traditional educational approaches.

The Clubhouse has also served as a crucible for further research studies. One group of investigators conducted a study of 536 youth, ages 8–18, at a Computer Clubhouse in downtown Los Angeles over an 18-month period. Clubhouse youth were learning to use Scratch, a visual programming language developed at MIT's Media Lab. The researchers found that youth members discovered and used key programming concepts such as loops, conditionals, and communication and synchronization, even in the absence of instructional interventions or experienced mentors (Maloney, Peppler, Kafai, Resnick, & Rusk, 2008).

These results are indicative of how afterschool can advance computer science learning. Indeed the kinds of informal computer science learning the Clubhouse facilitates will be especially important in the years to come. In fact, the K–12 Computer Science Framework (https://k12cs.org), released in 2016, notes that "informal education organizations are essential to the computer science education" system.

Another unique research project was an in-depth "technobiographical" case study of an individual Clubhouse youth over a period of years (Barron, Wise, & Martin, 2011). The researchers charted his experience and the impact of sustained engagement on his depth of expertise, self-identity, and aspirations for the future. One of the key findings of the study was that the Clubhouse was "critical for the development" of the youth's "skill and identity as a producer of stop-animation films" and that the resources available to the youth supported his interests and helped him develop his abilities.

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The Clubhouse experience is a deep and lasting one for youth. Youth members average 4.6 years of engagement. Many describe it as a second home, where they feel a sense of belonging that is missing in other parts of their lives. On September 11, 2001, for example, many teens whose schools had shut down came streaming into the Clubhouse because that is where they felt safe.

Beyond access to technology and a physical space that is conducive to learning, the Clubhouse approach depends on the staff who work with youth day in and day out. We find that the consistent presence of a caring, curious adult who is enthusiastic to explore, discover, and learn shoulder-to-shoulder with youth is essential. Top-down commitment from the hosting organization and the

support of volunteer mentors who complement the skills and qualities of the coordinator are also key, but in the end, the culture of a Clubhouse is fostered by the staff who are there each day.

Many people who find themselves in the role of Clubhouse Coordinator say that it's a dream job, but it's not for everyone. Every day is different; there are no lesson plans, and "learning outcomes" can be hard to measure. But, for someone who loves working with youth, has a creative zest for life, and is eager to learn something new—often from a young person—every day, it's the best job in the world.

Professional development to nurture and support these Coordinators is essential, and that leads to a powerful factor that helps make each of the Clubhouses successful: their connections to the global Clubhouse Network. While many other OST STEM programs also see outstanding results, a primary differentiator of the Clubhouse program is the global network that supports the Coordinators and connects all the individual sites. In addition to start-up support and ongoing professional development, the Clubhouse Network provides many other resources and benefits to its affiliate sites. Because technology is always changing, ideas about the application of new technologies for Clubhouse implementation are essential to keep the Clubhouse learning experience relevant. The Network serves as a catalyst for Clubhouses to experiment, share with each other, learn from the MIT Media Lab and others, and foster innovation.

The Network also promotes global connections and collaborations among the youth members. Many Clubhouse youth rarely leave their own neighborhoods, but the Clubhouse Network exposes them to the broader world through the Clubhouse Village—an online social learning network for sharing projects, exchanging ideas and "how-to" information, and collaborating— and through the Teen Summit, a biennial youth

leadership opportunity for Clubhouse youth to come together from around the world. In these venues, teens work in groups on a social issue or challenge faced in their respective communities, share their learning, and connect with other youth from different countries and cultures.

Many other structures have evolved to foster sharing and learning among Clubhouses around the world. The Network provides ongoing support through regional hangouts, one-on-one check-ins, and periodic site visits, as well as through the Clubhouse Commons, a central repository for mentoring resources (such as the Mentor Toolkit and the Mentor Handbook), fundraising and marketing tools, and programming resources such as advice about Clubhouse-to-College/ Clubhouse-to-Career (C2C). The Clubhouse Network also recognizes the importance of evaluation and assessment, and ensures that Clubhouses have the tools to measure their own effectiveness and to capture evidence of their impact on young people's lives—and share that evidence with others.

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None of these success factors would be in place without the support of foundations, government agencies, companies, and individuals who believe in the Clubhouse mission and the value provided by the Network. In particular, a 15+ year investment by Intel Corporation and a thriving, more recent partnership with Best Buy have fueled the growth of the Network, providing generous financial support for sustainability as well as a successful model for public-private collaboration.

The Advantages of Networks and the Challenge to Investors in Educational Improvement

People ask us about the secret to the long-term success of the Clubhouses. The answer, we think, lies in the unifying fabric of shared mission, core values, and mutual support that comes from the fact that we are a network. In fact, the Clubhouse Network is a good example of all the benefits that can come from a network organization (Everett, 2011). It has a strong central hub and strong affiliate organizations, and the relationship between them is win-win. The Network benefits from its members, and each member Clubhouse benefits from the strengths of the hub as well as the other members.

In its work studying investments in educational improvement, Inverness Research has had the opportunity to research and support several powerful, large-scale network organizations. The National Writing Project, for example, is a large, longstanding (40 years), and successful network that has supported millions of teachers (Stokes & St. John, 2015). Similarly, the Community Science Workshop network has supported its affiliate sites and young people in very poor neighborhoods over the past two decades in doing science, neighborhood investigations, and local design and making activities. The Knowles Science Teaching Fellowship is a network that for nearly 20 years has supported promising young teachers in their development both as teachers and as leaders.

Longstanding networks like these provide an alternative and more compelling form of leverage than short-term, episodic project investments, and are a proven mechanism for philanthropic and government dollars to be used effectively and efficiently. Often, discrete initiatives and programs are like apples on a tree. If you look at them individually, you might well ask how they might be replicated, institutionalized, or more broadly shared. Often ignored is the fact that the apples are the fruit of a healthy tree, and that the tree itself is a part of a larger orchard.

Philanthropies, federal and state agencies, and individuals seek to make grants and gifts that promote the development of healthy youth and then—through various forms of leverage—return a high yield on their investment. Such leverage might come from matching gifts, from creating a program that is later institutionalized, or from supporting a model that is inspirational to others and therefore widely replicated.

In many cases, though, short-term projects that aim for these lofty goals fall short. Too often projects and programs receive short-term episodic investments that create a temporary state of excellence or achievement, but are neither sustainable nor replicable.

The late engineer, inventor, and Internet pioneer Doug Engelbart argued that humans

are still focused around projects and task forces with short-term expectations and short-term lifecycles, and have been too much in love with chasing after the latest tools and technologies…The most important activity we can do is to develop the improvement infrastructure… and to encourage and fund cross-functional "improvement communities" whose members work on common challenges to explicitly improve improvement…and then that community itself thus becomes a knowledge accelerator. In essence, the human network, supported with a stable, sound technology network, is the way to get better at getting better (as quoted in Gonzalez, 1998).

Foundations often wonder how their grants can be "scaled." Networks such as The Clubhouse Network and the National Writing Project already operate at scale, and they organically support the development of their affiliates over time across the world. They allow for and promote quality control. They promote community learning and codevelopment. They provide resources and support for their affiliates in ways that they never could achieve on their own. They allow for principled growth, evolution, and adaptation. In short, networks are a highly efficient mechanism for focusing and leveraging external investments in educational improvement.

Implications for Funders and Policymakers

Those seeking to invest in the development of healthy youth and stronger communities should consider investing in long-term, focused networks of affiliate organizations. The Clubhouse Network is an outstanding, and rare, example of a network organization that has persevered, expanded, and evolved over more than two decades. Networks can not only provide strong economic and substantive support for youth programs but also create a shared culture of values and ideals that permeate all of its member programs.

Long-term networks allow not only for expansion and growth but also for increasing levels of quality and depth in the work. The Clubhouse Network is able to promote and ensure high-quality work, and also help evolve it into the future in ways that no individual site could do on its own. This exemplifies the cumulative capacity-building that comes from consistent investment over a long period of time. The return on investment from steady, even low-level, long-term funding is something that both philanthropies and government agencies should examine more closely.

The biggest bang for the buck comes often not from the most innovative new idea but rather from the steady long-term support of the largest and most effective network organizations that can promote powerful ideas, and can realize visions at both quality and scale.

For specific activity ideas and facilitation tips, see Martin, D., & Panjwani, A. (2016). *Start making! A guide to engaging young people in maker activities*. San Francisco, CA: Maker Media

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About the Authors

Gail Breslow has led the Clubhouse movement since 1995—a global network of community-based centers where youth create STEM-rich projects based on their interests using a variety of tools and technologies, supported by mentors. Under her leadership the Clubhouse won the Peter F. Drucker Award for Nonprofit Innovation and has grown from a single location in Boston to 100 Clubhouses in 20 countries. Gail has spearheaded initiatives such as *Hear Our Voices*, a program for young women funded by the National Science Foundation; and *Clubhouse-to-College/Clubhouse-to-Career*, which helps young people leverage the technology experience they get at the Clubhouse to realize their potential and fulfill their dreams. Previously Gail spent 12 years as a management consultant with Gemini Consulting, and 3 years as Program Director at the American Association for the Advancement of Science. She holds an MBA from Stanford's Graduate School of Business and a BA from Oberlin College.

Mark St. John, Ph.D. is the founder and president of Inverness Research. His educational background includes aeronautical engineering, physics, science and mathematics education and evaluation. Located in Northern California, Inverness Research studies improvement efforts in STEM and other disciplines in the both the formal and informal domain. Inverness projects range from exhibit evaluations to the study of professional development designs to the evaluation of large national networks to supporting teaching of science to Buddhist monks. Through the evaluation of hundreds of projects, Dr. St. John and his group have had the opportunity to study a wide range of investments in the improvement of education. He has worked with the National Science Foundation, the US Department of Education, states, and many private foundations in helping to design and evaluate their educational initiatives.