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



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.



Inspiring and Preparing Students for Success with Afterschool and Summer Learning Evidence and examples on how young people are developing STEM knowledge and skills that will prepare them to be successful in school today and the workforce tomorrow. www.STEMReadyAmerica.org

The Pivotal Role of Afterschool and Cross-Sector Partnerships in Preparing the Indiana STEM Workforce

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ndiana is among the many states recognizing shortages in its resident skilled workforce. The days when Indiana employment revolved largely around farming and low-tech manufacturing are gone. Historically, Indiana employment largely revolved around farming and low-tech manufacturing, back when these sectors employed large numbers of people. With the advent of large-scale agribusiness, advanced manufacturing, and life science technologies, Indiana is now challenged to increase the skill levels of the existing workforce and to fill the pipeline with talented individuals who are prepared for the opportunities of the 21st-century economy.

Numerous Indiana-based organizations are taking innovative and aggressive approaches to addressing this tough challenge. In particular, afterschool and summer learning programs around the state are playing a major role to prepare the young people of Indiana for future workforce opportunities. They are partnering with formal educators and local businesses to help students, many from disadvantaged settings, broaden their understanding of the skills required to be successful in the Indiana economy. At the forefront of this effort is the Indiana Afterschool Network (IAN), a not-for-profit organization that provides out-ofschool time (OST) sites statewide with a wide array of services and supports that contribute to their ability to offer quality educational programming.

STEM Employment Challenges in Indiana

Today, Indiana faces shortages in many "middle-skill" employment areas, including welding, machinery repair, construction technology, advanced manufacturing technology, and information technology (IT) support. Most of these positions require less than four years of postsecondary education, and many can be achieved with a few months of training and by earning a certificate. In the Indianapolis area alone, overall IT shortages are estimated to be greater

than 20,000 jobs; less than one-half this demand can be filled by students currently in the state's IT education pipeline (Center for Education and Career Innovation, 2014).

The challenge of meeting these workforce needs is two-fold: (1) retraining today's unemployed or underemployed workers so they can gain the skills required to qualify for the increasingly technical jobs that drive the Indiana economy and (2) launching our students on pathways that will enable them to fully participate in the 21st-century technical workforce.

According to the National Skills Coalition, 65 percent of those who will comprise Indiana's workforce of 2025 were already working adults in 2010 (National Skills Coalition, 2013). But there are obstacles to

65 percent of those who will comprise Indiana's workforce of 2025 were already working adults in 2010. reskilling today's workers. Many cannot or will not return to school to earn the credentials needed to take on these more complex, and often betterpaying, positions. The Indiana Department of Workforce Development (IDWD) and the Indiana Commission for Higher Education (ICHE) have joined forces to overcome this challenge through a number of novel programs.

In consideration of the second major challenge—to inform and prepare students for current and future Indiana jobs—regional workforce councils formed in 2014 quickly realized that many K–12 schools are not in touch with local businesses, and many businesses are not in touch with local schools. To address this gap, a number of aggressive schoolbased initiatives have been created:

- Skill Up grants that enable businesses and schools to align to specific local workforce development needs;
- Indiana Career Explorer website (https:// indiana.kuder.com) that enables learners to "explore jobs in demand, assess your skills, and develop a plan to get the education and training you need to begin planning for your future today;"
- Increased internship and dualcredit opportunities; and
- "Job fairs" for youth to inform them of career choices, such as JA JobSpark, a two-day expo organized by Junior Achievement of Central Indiana and over 100 industry partners, that hosted more than 7,500 middle school students in September 2016 and will be held again in September 2017.

Expanding Indiana STEM Opportunities Through Out-of-School Time Learning

Among the business and educational communities in Indiana involved in STEM, there is a growing recognition that focusing on K-12 education is not a complete solution and that other organizations must join the effort. As a result, the Indiana Afterschool Network has emerged as a key partner in informing young people about employment opportunities and supporting the development of the technical and workplace skills required to qualify for the skilled workforce. Key stakeholders are realizing that out-of-school time (OST) programming—which, historically, has been perceived as serving the primary role of providing a safe place where kids can stay during those hours when school is not in session and parents are not home to provide care—can offer high-quality educational content that extends the learning day for students.

OST programming offers a learning environment generally quite different than the school-day classroom. While the formal school setting is strengthened by credentialed teachers and statedefined standards and assessments to guide student learning, the OST environment has the potential to provide a very different educational experience. When done well, OST programs offer a space in which students can learn through hands-on activities that develop their self-learning responsibility and decision-making skills.

Through the skilled guidance of out-of-school facilitators, kids can experiment without feeling the effects of the demands put upon formal educators, such as grading and standardized testing. Additionally, OST programs provide a flexible time when community partners can engage with young people in fun learning activities. This is particularly evident in the demanding STEM curricula. In the classroom, time constraints may restrict STEM work to only those subjects for which teachers and schools are held accountable.

There are many challenges to providing effective STEM education in the OST space, including staff preparation and experience, inconsistent attendance, limited time, and insufficient funding. However, OST learning benefits greatly from the availability of excellent STEM curricula and willing sponsors. Encouraged by, and in partnership with, the Indiana Afterschool Network, a sampling of excellent STEM programming in Indiana enable kids in OST programs to achieve the following:

- Develop basic coding skills through the Coderdojo Indiana initiative managed by the Techpoint Foundation for Youth;
- Learn how to build and program robotics in the SeaPerch program offered by the Naval Sea System Command—Crane Division;
- Design and create products with 3-D printers offered by 1st Maker Space;
- Investigate and solve environmental questions at the outdoor learning area of The STEM Connection; and
- Learn math skills (probably without realizing it) through the NBA Math Hoops competition sponsored by the Indiana Pacers.

Concerned and interested businesses and educational organizations from various areas of Indiana have, during the past five to six years, been increasingly cooperating to develop strategies and programs to strengthen the STEM education pipeline. Several leading STEM-based Indiana companies—Eli Lilly and Company, the Rolls-Royce Corporation, and Cummins Incorporated, in particular—have invested significant resources to develop partnerships and programs to address the growing STEM skills preparedness issues that they, and many other Indiana companies, are increasingly facing. They have established high school internship programs, placed volunteers in classrooms and afterschool programs, and provided ongoing funding for strategic initiatives that advance STEM.

Several leading STEM-based Indiana companies—Eli Lilly and Company, the Rolls-Royce Corporation, and Cummins Incorporated, in particular—have invested significant resources to develop partnerships and programs to address the growing STEM skills preparedness issues that they, and many other Indiana companies, are increasingly facing. Building on this growing interest of Indiana businesses and formal educators, two organizations—one focused on OST STEM programming, the other on in-school STEM learning—have led the effort of building statewide coalitions in support of quality STEM education. The Indiana Afterschool Network (IAN), in recognition of the opportunities created by extending the STEM learning day into the OST space, initiated a statewide STEM initiative in 2010. This work was catalyzed by resources from the Noyce Foundation (now called STEM Next), with ongoing support from the Mott Foundation and the Afterschool Alliance. IAN's commitment was further supported through partnerships with a number of key organizations: NASA, Wisdom Tools, the Indiana Department of Education, and the Indiana Education Roundtable.

With the purpose of clearly defining the steps that an OST program should follow that lead to a high-quality STEM learning experience, the IAN developed a research-based set of STEM standards that have been adopted nationwide. Another key outcome of the IAN STEM initiative has been the development of a STEM task force comprised of individuals representing institutions of higher education, K–12 schools, businesses, and government interested in STEM education issues and opportunities.

The I-STEM Resource Network, created in 2006 and hosted by Purdue University, also developed a coalition of similar composition—and, in fact, overlapping membership—as the IAN STEM Taskforce. Since its inception, this I-STEM group has focused particularly on STEM policy development and educator preparedness. Realizing their common objectives and partners, early in 2016 IAN and I-STEM combined their STEM coalitions to form a statewide group of diverse organizations and individuals committed to expanding quality STEM education throughout the state, both in-school and out-of-school. Currently, this ever-expanding group has a membership of more than 300 people. It meets regularly and provides a deep reservoir of resources to various STEM education projects around the state. Through the efforts of this Indiana STEM partnership group, over \$2 million has been raised to expand STEM education in 80 out-ofschool programs, reaching 5,000 kids.

Indiana STEM Ecosystems

In mid-2015, in response to a proposal coordinated by the IAN, Indiana was selected to join the initial cohort of the national STEM Learning Ecosystem Initiative—a project co-chaired by the STEM Funders Network and STEM Next—and was designated as one of four statewide STEM Ecosystem sites. Participation in the national STEM Learning Ecosystem effort catalyzed the initiation of a state-level strategy, led by IAN and I-STEM, to form and to support regional STEM ecosystem projects that utilize local resources to identify local challenges and to develop and implement local solutions.

At the foundation of the STEM ecosystem concept is a belief that it is not the sole responsibility of formal educators to provide high-quality STEM education and, thus, help prepare students for the opportunities of the modern and ever-changing workplace. STEM education is most successful when it is a community effort that involves the integration of K–12 educators, OST programs, postsecondary institutions, businesses, government offices, local STEM-rich institutions (e.g., museums, learning centers), and direct family involvement.

Currently, there are two prototype projects underway that embody Indiana's regional approach to developing impactful STEM education systems,





one in Marion County (Indianapolis) and one in Columbus. Both demonstrate the key elements of the Indiana approach to creating a successful STEM ecosystem: a local initiative of manageable scope and a partnership of local businesses and institutions with vested interests in improving STEM learning.

The Marion County STEM Coalition, a subset of the statewide STEM Taskforce, was formed in 2016 to focus on supporting quality STEM education in the region. Marion County has the largest, most diverse population in the state, with a K–12 population of 174,000 students, many of whom are challenged economically and perform poorly on required testing. However, Marion County has a large contingent of STEM-based companies and institutions, as shown in Figure 1.

Led by Eli Lilly and Company and the Rolls-Royce Corporation, both based in Indianapolis, the group is made up of representatives from businesses, local government, K–12 education, higher education, and afterschool organizations. The approach taken by the Marion County STEM Coalition to develop an impactful STEM education network in the county has been two-pronged:

- To connect in a systematic way with the countywide associations of district superintendents and school principals to lay the groundwork for the establishment of additional school/ district level STEM ecosystems; and
- To develop a prototype school-level STEM education ecosystem that can serve as a model for other schools and districts throughout the county and beyond.

At the county level, the leaders of the Marion County STEM Coalition have met several times with the local school superintendents' and principals' associations to listen to their concerns regarding the barriers that they face in offering effective STEM programming. With this information, the STEM Coalition is developing ideas for how its diverse membership may be able to influence decision makers in addressing issues such as state-required standardized testing and evaluation processes that severely restrict the time and training necessary to implement quality STEM programming.

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For the prototype school model, Liberty Park Elementary School in the Metropolitan School District of Warren Township was selected. MSD Warren leadership has already demonstrated its commitment to providing high-quality STEM programming, and the district has a history of partnering with local companies to engage their students through in-class participation of STEM experts. The science mentoring program of Eli Lilly and Company employees was already active in Warren schools and will continue its current work. Plans are being developed to coordinate the inclass STEM programing with the two afterschool providers that serve Liberty Park, the Boys and Girls Club and the YMCA. This will entail collaboration on curriculum planning, professional development of facilitators, and a well-defined communications process between in-school and OST coordinators. Additionally, the plans will include offering afterschool STEM learning events, such as multiday mini-camps, in order to engage a greater number of students and parents than those currently participating in the afterschool programming.

Comprehensive discussions with and surveys of Liberty Park teachers have been conducted to assess the current status of the STEM programming at the school and to identify the needs to address. Similar information will be collected from the OST educators. An ongoing communication process, that includes metrics sharing, is being developed to ensure that teachers, OST facilitators, parents, and community stakeholders are well aware of the STEM learning plan at the school and where their involvement would be most beneficial. The Bartholomew Consolidated School Corporation (BCSC) of Columbus is a public school district that serves approximately 11,500 PK–12 students. Each of the 11 elementary schools in the district offers before and afterschool programming that operates under the name of iCARE. Committed to taking advantage of the opportunities created by extending coordinated STEM learning from the classroom into OST settings, the district leadership has developed a comprehensive plan to be implemented at all elementary school sites in 2017:

- Classroom teachers and iCARE staff will work together to create a bank of hands-on, engaging STEM activities for iCARE students.
- Classroom teachers will be informed about the work being done in iCARE and will be expected to engage students about their iCARE work.
- Students will receive credit for STEM project work done during iCARE hours.
- The iCare STEM activities will include community connections, such as the role that local Cummins engineers are currently playing by leading inschool science programming.

An ongoing communication process, that includes metrics sharing, is being developed to ensure that teachers, OST facilitators, parents, and community stakeholders are well aware of the STEM learning plan at the school and where their involvement would be most beneficial. As a member of the Bartholomew County Outof-School Coalition, a regularly convening group of afterschool programs in the county, iCARE leadership intends to invite the nonschool-based programs throughout the area to participate in this in-school/out-of-school partnership model.

The Marion County and BCSC STEM ecosystems are now well underway, and—while the form and strategy of each local model is different—both are focused on the same principal objectives: to expand high-quality STEM learning by providing educators the support they require and enabling them to partner with out-of-school programs, businesses, and other community groups with common goals.

Remaining Challenges

Many school districts in Indiana have exemplary STEM programs. The Indiana Department of Education (IDOE) has recognized 22 schools in Indiana as "STEM Certified," meaning these schools have met a high standard of STEM education curricula and integration in the community (IDOE, 2017). These schools have trained teachers and use hands-on materials to expand STEM learning beyond the minimum, and they partner with afterschool programs that offer STEM curriculum.

Regrettably, science does not count in Indiana's school accountability model. As a result, many schools do not emphasize science in grades K–8. Indiana's current accountability model has driven behavior that contradicts the voices of educators and industry that call for more science. School administrators are held accountable only for performance in math and English/language arts. Teachers are evaluated on the same basis. Some school districts are finding ways to integrate more science into other subjects, especially at the secondary level, but the challenge is at the elementary level, where teachers are not as comfortable with STEM subjects or inquiry-based methods. Nationally, our state is "in the middle of the pack" when it comes to science achievement. In 2015, the National Assessment of Educational Progress reported that 42 percent of fourth graders and 36 percent of eighth graders in Indiana were proficient or above in science, which was better than the national average (U.S. Dept. of Education, 2016).

However, it is encouraging that an increasing number of Indiana companies and community organizations are coming to the realization that K–12 educators alone cannot provide students with the skills and experiences needed to prepare them to join the state's skilled workforce. Through the efforts of the Indiana STEM Taskforce, the STEM ecosystem model is generating growing interest throughout the state. Preliminary discussions are underway with groups in south central, northeast, and far south counties of the state to consider the development of local STEM ecosystems.

While any solution that may result from these early discussions will undoubtedly be unique to each location, the basic STEM ecosystem formula developed by the STEM coalition organized and led by the Indiana Afterschool Network and I-STEM Resource Network is expected to play out similarly around the state: recognize the needs; identify local leaders; focus on local issues; build partnerships with local community resources; develop a limited and realistic plan; and begin the tough, but very rewarding, work.

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