REPORT IN BRIEF

Board on Science Education

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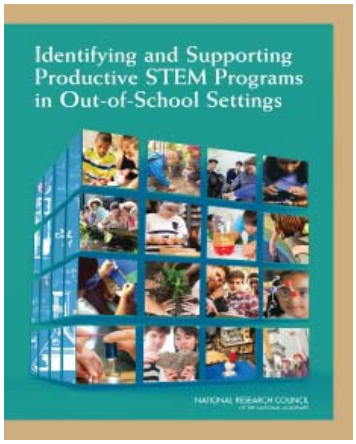
DIVISION OF BEHAVIORAL AND SOCIAL SCIENCES AND EDUCATION

Identifying and Supporting Productive STEM Programs in Out-of-School Settings



More than ever, young people now have opportunities to learn science, technology, engineering, and mathematics (STEM) in a wide range of settings, including clubs, summer programs, museums, parks, and online activities. There is growing evidence that opportunities to learn STEM outside of school directly affect what is possible inside classrooms, just as what happens in classrooms affects out-of-school learning.

The National Research Council appointed a committee of experts to identify criteria that policy makers can use to identify effective out-of-school STEM programs. The committee's findings are presented in the report *Identifying and Supporting Productive STEM Programs in Out-of-School Settings*.

CRITERIA FOR IDENTIFYING PRODUCTIVE PROGRAMS

Studies have shown that effective out-of-school programs can contribute to young people's interest in and understanding of STEM, connect young people to caring adults who serve as role models, and reduce the achievement gap between young people from low-income and high-income families. Given the wide variety of out-of-school STEM programs and the difficulty of measuring their outcomes, the research findings are not yet robust enough to determine which programs work best for whom and under what circumstances.

However, research findings are strong enough to identify three criteria of programs that produce positive outcomes for learners. Effective STEM out-of-school programs:

- **Engage young people intellectually, academically, socially, and emotionally.** Productive programs provide firsthand experiences with phenomena and materials, engage young people in sustained STEM practices, and establish a supportive learning community.
- **Respond to young people's interests, experiences, and cultural practices.** Productive programs position STEM as socially meaningful and culturally relevant, support young people in collaborating and taking on leadership roles in learning activities, and position staff as co-investigators and learners alongside young people.
- **Connect STEM learning in out-of-school, school, home, and other settings.** Productive programs connect learning experiences across settings, leverage community resources and partnerships, and actively broker additional STEM learning opportunities.

To better understand how productive out-of-school STEM programs contribute to young people's interest in and understanding of STEM, evaluations must address individual, program-level, and community-level outcomes. Building the capacity to generate evidence at these three levels will lead to a clearer picture of how programs affect outcomes across settings and time.

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ACTIONS TO DEVELOP AND SUPPORT PRODUCTIVE STEM PROGRAMS

The committee identified six actions that policy makers, program developers, and other stakeholders should take to develop and support productive out-of-school STEM programs:

- **Build a map and bridge the gaps.** Mapping existing STEM learning resources and gaps is a critical first step in supporting a robust STEM learning ecosystem that can meet the needs and interests of all young people through a wide variety of intellectually compelling and culturally responsive programs.
- **Connect young people with opportunities to learn.** To support equitable access and participation in out-of-school opportunities to learn STEM, there is a need to identify and train brokers or develop brokering mechanisms that can help families and young people access programs that can help the latter take the next step in their STEM learning.
- **Support innovative evaluation approaches.** To evaluate out-of-school programs, the field needs innovative measures that will not impinge on the nature of out-of-school learning experiences, are culturally responsive, and are flexible enough to address a wide range of program goals.
- **Provide professional development.** To support productive and responsive STEM teaching and learning in out-of-school settings, program staff need opportunities to develop their ability to nurture young people's interests in and understanding of STEM content and practices.
- **Build an infrastructure that will last.** To develop an effective, sustainable STEM infrastructure in out-of-school programs, funders, community leaders, and program leaders need to work together to identify areas for investment, expansion, or redirection.
- **Explore how STEM learning ecosystems work.** To expand research-based knowledge about productive strategies to support out-of-school STEM learning, investments are needed in research that documents both the learning that occurs in individual programs and also how STEM learning develops across settings and over time.

All of these actions need to be undertaken with sensitivity to young people who have historically been underserved by STEM learning programs, including girls, ethnic minorities, and those from economically marginalized communities. Some actions can only be undertaken at the local level, while others will require national-level involvement. Together, they can support productive out-of-school STEM programs.

COMMITTEE ON SUCCESSFUL OUT-OF-SCHOOL STEM LEARNING

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For More Information . . . This brief was prepared by the Board on Science Education (BOSE) based on the report *Identifying and Supporting Productive STEM Programs in Out-of-School Settings*. The study was sponsored by the National Science Foundation. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the authors and do not necessarily reflect those of the sponsor. Copies of the report are available from the National Academies Press, (800) 624-6242; http://www.nap.edu or via the BOSE web page at http://nas.edu/bose.

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