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Ideas at Work

Bridging Formal and Informal Learning Environments

Abstract

Out-of-school time programs that provide science, technology, engineering, and mathematics (STEM) educational content are promising approaches to develop skills and abilities in students. These programs may potentially inspire students with engaging hands-on, minds-on activities that encourages their natural curiosity around STEM content areas. However, it is also important to align out-of-school time learning activities with what is being taught in the formal classroom so that the experiences are congruent. Two examples of congruent programs are described in this article.

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Introduction

Science education conducted in out-of-school time (OST) informal learning environments has the potential to fundamentally improve science learning and broaden participation of youth at a national level (NRC, 2009). It is widely known that the United States educational system needs to improve the number of youth who pursue careers and academics in science, technology, engineering, and mathematics (STEM) in order to remain competitive in the global marketplace (NRC, 2010). The 2010 *Rising Above the Gathering Storm Revisited* report indicates that our future economy and the creation of jobs will be directly tied to innovation derived from advances in science and engineering. "While only four percent of the nation's work force is composed of scientist and engineers, this group disproportionately creates jobs for the other 96 percent (NRC, 2010 p.2-3)."

Current research indicates that OST programs can be effective avenues for promoting learning in STEM content areas (Barker & Ansorge, 2007; Barker, Nugent, & Grandgenett, 2008; Clarke, 2010; McGrath, Lowes, McKay, Sayres, & Lin, 2012; NRC, 2009; NRC, 2012). Effective OST programs should be student-centered, employ cooperative learning strategies, and foster skills and attitudes towards STEM through "authentic, hands-on activities" (Hussar, Schwartz, Boiselle, & Noam, 2008, p.8). In many ways, OST instructional environments can help make STEM concepts more real to youth and

provide a mix of engaging and interesting activities to enrich STEM instruction (Hoachlander & Yanofsky, 2011). While afterschool programs can provide important learning experiences, these programs may not necessarily align with what the child is learning during the school day. When formal and informal learning goals and experiences are congruent, the young person's learning becomes more meaningful and relevant to them (Noam, Biancarosa, & Dechausay, 2002; Skelton & Seevers, 2010). In their 2009 report *Learning Science in Informal Environments* the National Research Council determined that the goals between formal and informal educational environments complement and overlap each other (pp. 296). However, there are also unique challenges to STEM learning in informal environments, including different goals and measurements from formal learning environment, poorly articulated STEM learning goals, and fewer financial resources available for informal learning environments (NRC, 2009).

This article introduces two programs that attempt to bridge the formal and informal learning environments through the work of local school districts, 4-H Youth Development Extension programs, and 21st Century Community Learning Center Programs.

Programs That Bridge Formal and Informal Learning Environments

Nebraska Building Lasting Afterschool STEM Teams (BLAST!)

The first program, Nebraska Building Lasting Afterschool STEM Teams (BLAST!), is a partnership between the Nebraska Department of Education (NDE), Nebraska 4-H Youth Development, and NASA Nebraska Space grant, and is funded through the NASA Summer of Innovation grants competition. The BLAST! program serves middle school students participating in the Nebraska 21st Century Community Learning Center (21st CCLC) programs that include 4,518 students in fourth through eighth grades. Approximately 48% were female, 57% were from an underrepresented minority, and 72% were eligible for free or reduced lunch.

One of the goals of the program is to increase the STEM content delivered in the 21st CCLC afterschool programs statewide in order to increase interest in STEM content and provide youth with hands-on, engaging opportunities to apply academic skills taught during the school day. To achieve this goal the program has developed integrated teams of certified teachers and afterschool staff that work to bridge the formal and informal learning environments. To develop expertise in the STEM areas, professional development workshops are offered to teams in the areas of Robotics, Astronomy, High Altitude Ballooning, and Aviation and Aeronautics.

Another objective of the program is to connect afterschool staff with local, regional, and state experts in STEM education. As a result, workshops are designed and delivered by NASA curriculum specialists; faculty from the University of Nebraska, including the Aviation Institute; and specialists from the NASA Nebraska Space grant. Workshop attendees are also introduced to local STEM experts interested in sharing their expertise, such as members of local astronomy clubs and regional 4-H professionals. Once trained, teachers and afterschool educators work to deliver a congruent STEM learning strand during the school day and in the afterschool program. In the third year of the program, 64 certified teachers received training, and 61 informal educators were trained throughout Nebraska. Together

these teams reached 1,304 students attending summer programs.

4-H Tech Wizards

Another program funded by the Office of Juvenile Justice Delinquency Prevention through National 4-H Council is 4-H Tech Wizards. Originally developed by Oregon State University Extension, Nebraska 4-H Extension replicated components of the program during the afterschool hours in two urban middle schools. Nebraska 4-H Tech Wizards uses traditional school day teachers, afterschool staff, and volunteers to teach robotics, Geospatial (GIS/GPS), and filmmaking to youth in grades six to eight. Traditional school day teachers lead robotics, GPS, and filmmaking learning experiences. Afterschool staff and volunteers provide assistance with lesson implementation and serve as mentors.

The young people have created and broadcast daily announcements, made a welcome to school video, produced their own film shorts, and participated in First Lego League regional and state competitions as a result of the combined efforts of traditional school day educators and afterschool staff. To date over 200 youth have been engaged the Nebraska 4-H Tech Wizards project.

Conclusion

Both example programs share in common external funders who have acknowledged the need to bridge formal and informal learning in order to broaden program participation and excite or engage young people about science. This space enables youth to engage in science in a variety of ways, develop new skills, and build positive relationships with adults. The partnership developed between Nebraska 4-H Extension, public schools, and 21st^{t} Century Community Learning Centers illustrates how formal and information education can work together to align educational experiences to ensure that youth possess skills needed in the 21st century workplace.

Researchers have developed and tested formal-informal science partnerships models that have been successful in developing rich and compelling learning environments (Bevan et al., 2010). However, additional research is needed to determine the impacts of such models. While more research is needed, this approach of bridging the formal and informal learning environments is critical in providing a congruent and effective learning space for youth.

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