Museums Afterschool: Principles, Data, and Design
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BACKGROUND
The project aims to identify design principles for high quality Science, Technology, Engineering, and Math (STEM) programming in Out-of-School Time (OST) settings, focusing on key characteristics of the learning activities that engage youth. This national project was developed in 2008 by Exploratorium, an internationally recognized institution, to respond to pressure on the OST field to provide evidence of student learning. Funding for the project provided by the Noyce Foundation and the Institute of Museum and Library Services.

National 4-H has identified a priority focus on STEM to address a growing concern in the United States that there will be a shortage of trained professionals to fill an increasing demand for STEM work. Minnesota 4-H is actively working on this initiative. National 4-H was invited to be involved in the Museums Afterschool: Principles, Data, and Design (MAPDD) project and requested a field representative from Minnesota 4-H. Rebecca Meyer was appointed from MN to serve with Pam Garza on the project representing National 4-H.

STATEMENT OF NEED
Specific to Minnesota 4-H STEM is a need to explore and describe strategies for design and delivery of effective programs. But, traditional student learning measures have been developed for the school setting, where learning is frequently conceptualized as “vertical” (that is, sequenced, structured, disembodied, decontextualized, and fast-driven). Such an approach may not be relevant to learning in MN 4-H STEM settings where learning often tends to be more “horizontal” (that is, embedded in everyday practice, building on interests and lives of children, social, and contextualized). Therefore, it is important to understand and articulate the particular range of learning possibilities OST programs provide, how they build on features of informal learning settings, to design better 4-H STEM programs. Results of Meyer’s involvement in this national study provide a detailed examination of some characteristics of 4-H STEM programming and other OST program models. These can be used to develop recommendations for the design/delivery of MN 4-H STEM.

METHODS
This project employs a modified grounded theory approach with 14 institutions to identify, document, and describe key design principles underpinning high quality science in afterschool programs. Appointed by Minnesota 4-H leadership to participate in the project, Rebecca Meyer actively participated in the meetings as an expert field practitioner. She also served as the Principal Investigator for the MN component of the project. Over the course of 1.5 years, she worked closely with 4-H afterschool science programs in northeastern Minnesota to observe and document activities using the approved protocols.

In a stepwise progression, representatives from 14 institutions met on three occasions to achieve reliability in applying a grounded theory approach to explore commonalities and differences among the key factors in our programs. During our first meeting, we explored and used a research-based model to observe and operationalize in our programs the kinds of capacities that OST STEM aims to support (see Figure 1 below). During our second meeting, we moved to develop reliable use of protocols to collect and share video of OST STEM programs in our organizations. Using a Flip Video camera, Rebecca video-taped the 4-H Afterschool Science Club program in Lake County Minnesota. These videos were edited to eliminate non-activity, and posted online with footage from other participating organizations. Using Stanford’s DIVER application, representatives collectively viewed, discussed, and analyzed important elements of the complete group of clips to refine the initial STEM model. Based on our collective analysis of video footage, we selected three characteristics of the refined model to further observe and document program design and facilitation. These will serve as footage to analyze and inform final refinement of the model. We are now in process of synthesizing our final design recommendations based on our analyses of our documentation of programs.

RESULTS
Meyer observed and documented 4th - 5th grade youth participants engaged in 4-H science activities in the Lake County 4-H Afterschool Science Club. Eight 4-H members participated in the study, four females and four males. Video clips document seven afterschool sessions providing 62 video clips or approximately 64 minutes of unedited data. Video footage was then edited and uploaded to Stanford’s DIVER application with clips from other participating organizations for discussion and analysis. Using the DIVER program, Meyer and other colleagues could watch, comment and rate aspects of interest in MN and other video clips. Using these clips as evidence, we could collectively test and refine our initial model. Some of the MN 4-H video clips collected have been utilized to detail findings of the project at national conferences and with project funders.

RECOMMENDATIONS
Discussion is on-going. However, at this point, analysis of video evidence has generated significant changes and refinements in the capacities model. We now have a draft MAPDD STEM OST Design Principles document that includes the following focus:

1. Activities – includes clear purpose; multiple pathways; inquiry; relevant real-world
2. Facilitation – should spark interest; sustain participation; develop understanding
3. Environment – inspires and models ideas and thinking; supports initiative and autonomy; allows for cross-pollination of ideas, as well as collaborations

Each of these principles has specific characteristics that underline how it operates effectively in OST STEM settings. In MN 4-H the video documentation more often focused on environment.

1. Activities –
• Create an environment that is safe for facilitators to reflect on practice focusing on activities, facilitation, and environment
• This environment provides space for youth to construct and explore STEM

2. Facilitation –
• Use activities that involve youth the opportunities to manipulate, create and question
• Encourage the deeper discussions on what constitutes effective practice
• Encourage the reflection on what these terms mean to our work

3. Environment –
• Consider using DIVER as a collaborative tool that can be used to elevate to documentation to a larger community level

REFERENCES

IMAGES
Images: Youth activities in the Lake County 4-H Afterschool Science Club, youth are developing recipes for soda beverages.

Photo Credits: Rebecca Meyer

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1. University of Minnesota Extension, Center for Youth Development
2. Exploratorium
3. National 4-H Council