

Youth Development, Science Learning and Out-of-School Time: The Triple Alliance

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The Project Exploration evaluation is a very welcome contribution to the STEM field. Here is a creative, forward-looking organization with limited funding, great aspirations and a strong commitment to young people. Here is also an organization that wants to introduce minority students to the excitement of science learning and to the opportunities in STEM careers. But what differences do those hours after school make when a high school student joins a science out-of-school (OST) program? Does engagement and interest in science increase? Do career aspirations change? And is there growing commitment to formal science subjects in high school, college and beyond? I was asked to address these questions in a short response piece to the interesting and well-written evaluation report by a team of researchers from the Lawrence Hall of Science at Berkeley. My charge was to comment from the perspective of the growing intersection of the OST/STEM fields and the many local and national initiatives to strengthen after-school and summer experiences for youth through science learning. How does this report help us reflect on the growing cross fertilization between youth development, OST and informal science/STEM learning?

Let's begin with some of the consensus building elements that also guided our work in the National Research Council committee that produced the report on informal science and the compendium work entitled *Surrounded By Science* (1, 2). A short, but not exhaustive catalogue of ideas emerged there and really in almost all discussions held in museums, at foundations, after-

school intermediaries and programs, websites and media outlets and with families committed to science learning. This list can easily be extended to ten, twenty or even thirty points.

1. Youth engagement in STEM is critical for future involvement in science careers.
2. Informal science learning contributes to a science-literate citizen.
3. Exciting science and relevant STEM in OST are essential in support of formal science.
4. Touching, feeling, exploring is part of the magic of science learning.
5. Science careers become more of an option when youth learn what scientists do, watching them, talking to them and getting interested in the process of research and discovery.
6. Science learning is a relationship matter. Kids need to interact with kids, and they need adult scaffolding and support.
7. Youth development with its focus on relationships, relevance and resiliency (a new RRR!) represents the foundation for most OST programs and is also a significant foundation for informal science learning. That is why they belong together.

These emerging consensus points also define Project Exploration and provide us with one “experiment in nature,” what these elements look like when a group of dedicated educators transform them into reality.

But how do we know that these common assumptions really matter to young people? Are we really programming for them? How are young people affected over time? And do they demonstrate the aspirations of the program through their life decisions, actions and positive assessments about what they experienced?

These are the questions this evaluation can help us with, especially because it consists of a ten-year retrospective follow-up of alumni and alumnae from Project Exploration, using

interviews and surveys methods. This is the work we increasingly need, especially since Robert Tai presented his longitudinal findings (3) showing how predictive early engagement and interest in science can be. Strong longitudinal research is very expensive because it needs to happen at multiple time points, requires tight control groups, high participation rates over time and multiple data and reporter sources. Obviously, this study did not have the funds to use such rigorous design and procedures, even applied to retrospective longitudinal work. That is why the study should be especially praised, as the researchers knew from the beginning that the evaluation will not be able to rise to those standards of research (though it would be good if more of the methodological limitations would be explicitly mentioned in the report). Some techniques could have been employed to deal with the tricky question of selection bias, a question that is especially important when the response rate hovers around 30%. By comparing the responders to the non-responders with data available from the time of their program participation, we would be able to assess the extent of the bias, if any.

Even with these limitations, the study presents us with very interesting results. Project Exploration has a clear logic model and defines ambitious short, medium and long-range outcomes. What do the young people tell us about the achievement of these goals, such as seeing self in relationship to science and environment (short term), increase choice of science majors (medium range), increase under-represented populations in science careers (long term). And what we read is impressive, indeed.

I will not need to repeat the findings from the report, but ask of the results whether the former participants experienced positively and impactfully the “triple alliance” of youth development, STEM learning and OST? And the answer is overwhelmingly yes, with truly stunning results. The program participants liked the adults, felt supported, and experienced connection and engagement (all shorthand for youth development.) Science learning was

meaningful, deep, thoughtful and made a difference (STEM) and joining the program was more than wanting to be with friends; it was often driven by a pre-existing interest in science and was enhanced by interactions with real-life scientists. The fact that this kind of science learning does not typically exist in schools made it especially important that the work occurred in a separate space and time and led to a different kind of experience both in regards to adults and STEM. So there we have all the three elements: Youth development, STEM and OST. What is also interesting is that regarding many of the questions posed, the percentages of positive answers come in at around 80-95 percent (strongly agree and agree) and the quotes from the interviews (all worth reading) give depth to the experience of study participants. Clearly, even after 5, 7 or 10 years, most students who participated experienced the program as very significant, helpful and relevant to their present lives. They learned better communication skills, liked the adults and enjoyed being with other students, felt positive about science content, met “real scientists” and increased problem-solving and communication skills. What encouraging feedback! What is also interesting is that not all aspects of the programs were rated similarly strong which shows that the former students were discerning in their answers. For example, questions about leadership opportunities in the program were not rated as highly as most of the other questions.

What is also striking are the results regarding high school completion, college participation and science courses and science strands. The entry into science careers is not as impressive, but many of the study participants are still in school making career decisions, so we will not know how the younger cohorts will choose when they reach the points of choosing a career.

Back to the question of how this evaluation study connects to the larger field, or better the intersection of the three fields of youth development, science learning and out-of-school time programming. I mentioned the growing consensus, including in the NRC consensus report

and the compendium practice volume. Here is the evidence from the consumers, the kids who went through a program that was logically designed to reflect the triple alliance, had outcomes connected to each field, and aspired to achieve an integration where each component was strengthened by the other. Project Exploration's particular investment in a "relationship-based approach" is not unique among OST programs and youth workers. But it is a perspective that is not sufficiently explicit in informal science. That is what makes this work so special: fostering and supporting long-term relationships with students plays a critical role in not only program design but also organization growth and organizational priorities. The overwhelming number of students state the relationships really mattered. They understand that Project Exploration is not just about science and STEM careers, or about activities in OST. They appreciate the quality of the relationships between staff and students and thus they understand the special nature of the program's design.

Thus we now know that these study participants understood the elements that provided the identity of the program, appreciated the inputs and demonstrated (at least in their self-assessment) many of the desired outcomes. This is the kind of proof of concept that we need in regards to programming and policy. Project Exploration is not the only program achieving these goals, but it goes about its work systematically and invests in finding out about itself and its students. Project Exploration is part of a growing number of STEM programs that evaluate not only the science learning, but also program quality and youth development outcomes. But they still are pioneers, because the majority of STEM programs are not as clear in their youth outcomes and the role of relationships and can thus not study the outcomes in the same way. Also, few programs are studying the interplay between the three domains of positive youth development, OST programming and science learning. While this evaluation has not done so fully, it shows a way of how to go about asking the right questions. Going in a similar direction, my team and I have developed an OST observation

tool that help evaluators and programs to assess informal science learning from a youth development perspective. The Dimension of Success (DOS) Tool (4) is part of a larger initiative to help programs find and use instruments that can help study the quality and outcomes of the “triple alliance.” We can all learn from Project Exploration’s efforts as the field tries to increase the numbers of long-term retrospective and prospective studies, something that is also unique to this evaluation.

OST programs provide an amazing delivery system for informal STEM learning, potentially reaching millions of children and youth at a time when they can become primed for science. OST and youth development learning is usually defined as exploratory, inventive, creative, student-centered, built on peer learning and strong mentoring. The triple alliance is not an old European war block, or a new coalition fighting against an enemy called school. It is an alliance of understanding what youth need and how they best learn, a new use of time beyond the traditional school day and school year, and a recognition that STEM can be fun, magical and help identify for young people their place in the world and the universe.

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2. Fenichel, M., Schweingruber, H. (2009) *Surrounded By Science.* Committee on Learning Science in Informal Environments, Board on Science Education. National Research Council of the National Academies. The National Academies Press. Washington, D.C.

3. Tai, R. , Liu, C., Maltese, A., and Fan X. (2006). *Planning Early for Careers in Science*.
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4. Noam, G., Larson, J, , Dahlmer, C., . (2008) Dimensions of Success Observation Tool
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