BALANCING THE EQUATION: STRENGTHENING MUSEUM-SCHOOL PARTNERSHIPS THROUGH MATH
by
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I dedicate this project to all of my colleagues and teachers across the country, some of the most amazing, hard-working, and generous people in the world.
“No one ever failed a museum.” – Frank Oppenheimer, Founding Director, Exploratorium, San Francisco
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EXECUTIVE SUMMARY

Museums have always been my favorite teacher. Whenever I walk through their doors, I feel invigorated by the possibilities of what I might encounter, who might reveal themselves to me by way of their creative expressions, and what new ideas I will be pondering as I leave. Museums are centers of exploration and discovery, two experiences that are at the heart of what it means to learn. In many ways, despite the best efforts of spirited teachers everywhere, learning experiences in schools are becoming more and more removed from exploration and discovery. With the challenges mounting to public education, there is more of a need than ever to seek support from other teaching institutions to inspire students in new ways. Although museums and schools have a long history working with each other, the relationship has never been cemented in a profound way; now is the time to do so.

As an elementary school teacher for the past eight years, I have insight into the realities of the classroom from firsthand experience. I have watched as students learn concepts they didn’t think they could understand, develop confidence as they read a new book fluently, and beam when they see their writing on the classroom wall. But I have also watched as students struggle to understand a new math concept, become frustrated when they aren’t keeping up with other students, and lose motivation to stay focused when we’re discussing something that is not interesting to them. Though a range of these scenarios will happen regardless, I believe educators of all types have a duty to engage learners
to the fullest. The current realities of the classroom are making it increasingly
difficult to do exactly that: engage learners. The pressures of standardized testing,
coupled with deep budget cuts that are impacting the quality of school learning
severely, have induced a national educational crisis. Quite simply, public schools
need help.

Museums are also in a time of great transition. Though they too are
struggling with their financial bottom line, their shift can be seen in a more
positive, forward-thinking light, as many museum professionals are engaging
visitors more than in the past. As Kotler and Kotler (2000) state, “Whatever the
reason for the focus on audience…museums are seeking ways to reach a broader
public, forge community ties, and compete effectively with alternative providers
of leisure and educational activities” (p. 167). Both this momentum for visitor-
driven, participatory content in museums and the need for sweeping education
reform and make the two entities riper for profound collaboration than ever
before. Yet, exactly the opposite is happening: if schools haven’t cut field trip
budgets altogether, teachers are too focused on reaching testing benchmarks to
seek out enriching learning experiences beyond the classroom. As such, museum
educators are struggling to make significant connections with schools.

Math may well be the “hook” needed to establish that connection and get
buy-in from teachers, administrators and other important stakeholders. As the
U.S. continues to fall behind other countries in math achievement (Boaler, 2009),
even despite an increase in time devoted to math instruction since No Child Left
Behind began (McMurrer, 2007), the need to reform math education is
paramount. The Department of Education has recognized the urgency of this matter, and has published new Common Core Standards in 2010 that many states including California have already adopted. In addition to content standards that already existed (though now streamlined), this set includes process standards that call for the need for students to master a variety of thinking strategies. These process standards (see Appendix 1) have the potential to drastically reform mathematics instruction in this country, moving towards more exploratory, inquiry-based methods that involve deep thinking and divergent explanations.

The kinds of learning experiences museums can offer students are precisely the kind of practice they will need, where students use skills of investigation and inquiry to make discoveries, and have opportunities to use a range of learning modalities to explore real-world situations. Schools don’t generally have the resources or instructors who have been trained in inquiry methods and other similar strategies; in this way, museums have a chance to contribute to the transformation of the American classroom.

**Project Overview**

This master’s project examines the idea of strengthening partnerships between museums and schools; specifically, how to make them work as a growing, thriving system. For the purposes of this thesis, the term partnership will be used in a more specific way than in most of the literature on the topic. Partnership will refer to those programs in which museums and schools work together in a way that involves multiple visits by students or teachers, and in
which both museum educators and classroom teachers have had input into the structure and content of the program.

This project starts with a brief overview of the methodologies I used to research my driving questions: What have been the primary challenges for such collaboration to thrive and become institutionalized in our education system? What are some practical solutions that will help these programs become more prevalent and sustainable? In the Limitations chapter that follows, I discuss the factors that constrained the extent of this research. Next, I offer my own analysis of the robust body of literature surrounding this topic. The literature review focuses on providing historical context for these partnerships through an examination of the educational role of the museum over time, and discussing relevant learning theories that support the case for museum experiences to play a greater role in school learning. It also provides an overview of how museums and schools have interacted in the past, and examines the current educational climate – in particular, trends in math education reform. In the chapter that follows, I present my findings from the thirteen interviews that I conducted with both people who have been involved in developing or running such partnerships and people in the field of math education. I also discuss the case study that was done on the San Diego program, School in the Park. In the last two chapters, I draw conclusions from my findings in which I outline four main components of successful museum-school partnerships, and offer recommendations to the field about how real headway can be made to deepen these relationships and have them become a systemic component of our national educational experience.
METHODOLOGY

I used a variety of research methods to investigate the central issues around long-term museum-school partnerships. My research was driven by the necessity to be knowledgeable about the history of museum-school relationships, their biggest challenges to date and the most significant qualities of those programs that have been able to endure successfully. My research also explores the idea of creating partnerships focused specifically on math content as a way of making museum learning more relevant to the current testing-driven public school environment.

Literature Review

The first phase of this research was a review of scholarly writing on the main themes of my thesis. Guiding questions for this research were: How have conditions and expectations for museum-school partnerships changed over time? What have been the primary challenges for such collaboration to thrive and become institutionalized in our education system? To answer these questions, I looked at articles and book chapters on the history of these relationships to get an overview of how they have evolved over the years. Because the two institutions have always been linked in their educational mission, many forms of collaboration have taken place over the last several decades. It was important to understand the progression up until now to be able to determine the best ways to move forward. I also examined case study write-ups found in the Journal of Museum Education of partnerships from the last few years that have engaged
students for more prolonged periods than those of field trips or one-time programs. My research focused more on recent examples in order to discover the most relevant constraints that have sprung up in the current educational climate of standards-based instruction and assessment.

Fortunately, there is already quite a large body of literature written about museum-school collaboration in multiple forms: books written by museum educators, reports documenting conferences on the topic, news articles, and manuals for the field on how to build such relationships between formal and informal education institutions. *An Alliance of Spirit: School and Museum Partnerships* by Fortney and Sheppard (2010) represents the most recent, substantial document on the topic, providing information on the new realities of both the public school and museum environments. There are a few other publications that I used as my touchstones, considering they have already elucidated key challenges and opportunities for such partnerships to really work. It was not my aim to create my own list of such challenges and optimal conditions, since this has been done fairly comprehensively to date. Rather, I sought out to understand what experts have already put forth in order to develop new approaches to a decades-old challenge.

Because of this goal to move beyond simply understanding the challenges and successes of past partnerships, I also drew upon literature about optimal learning theories and the benefits of informal learning, recent research on the effectiveness (and pitfalls) of the No Child Left Behind Act that was enacted in 2001, and current thinking in math education reform. My research in these areas
focused on questions of how best to move forward to create new types of learning partnerships that permeate the formal learning landscape on a deeper level than in the past, with higher relevance and more stable funding structures. I also aimed to build an argument for informal creative learning to be seen as a principal resource for schools, instead of as an extra, nonessential learning activity.

**Interviews**

After I thoroughly reviewed this body of literature and gained a firm grasp of the historical context, I conducted thirteen interviews in February and March of 2011 with key people in both the fields of mathematics curriculum development and museum education, who have been involved with museum-school partnerships. The main questions that framed my interview conversations were about what practitioners see as the necessary ingredients for sustainable partnerships from both the museum and school perspective, what attributes they feel successful partnerships have, and what may be lacking in those that have dissolved. On the math curriculum side, I had phone conversations with David Foster, head of the Silicon Valley Math Initiative, a professional development resource for teachers in the San Francisco area that is at the forefront of math education improvement as well as the founders of the new Museum of Mathematics in New York. These interviews informed my understanding of the most current thinking in math education to help build the case for its place in building lasting relationships between museums and schools.
On the museum side, even though I set some constraints for the kinds of partnerships I want to focus on, I talked to people involved with those that fall within those constraints – as well as those that don’t – to get a well-rounded picture of the breadth of programs that have been developed. I chose to investigate a few programs that I identified as being enduring, acclaimed, and groundbreaking. They include School in the Park in San Diego, an immersive program that has been in existence for over ten years, and the Education and Arts Roundtable, a broadly recognized program at the Los Angeles Museum of Natural History. Other interviewees came from museums that have grounded relationships with schools in their areas, such as the Center for Informal Learning and Schools (CILS) at the Exploratorium and the Teacher Institute on Science and Sustainability (TISS) at the California Academy of Sciences. Outside the state, I met with a staff member at Urban Advantage, a program that originated in New York City public schools, headed by the National Museum of American History. From these interviews, I was able to build a solid knowledge base with which to analyze a handful of partnerships in-depth.

**Case Study**

I used School in the Park in Balboa Park, San Diego, as a case study of a long-term informal learning program that has fit successfully into a public school curriculum, in order to examine its greatest strengths as well as its primary challenges. In this program, elementary school students spend up to eight weeks out of their school year in Balboa Park, home to a multitude of cultural
institutions, going to various museums to learn in an informal setting. I selected School in the Park for its longevity, immersive nature, and the unique conditions out of which it was created. Through studying the program in depth, I learned about its structure, assessment and curriculum development, the nature of its secure funding, and the feasibility of its replication in other places. I was able to have an in-depth interview with the directors of the program, and to visit the program to experience it firsthand. Studying this program in greater detail than the others allowed me to gain insight into its daily happenings, struggles and strengths.
LIMITATIONS

The intent of this thesis is to examine long-term partnerships between museums and schools. In doing so, I wanted to identify key elements that ensure their success and those that challenge their pervasiveness in our education system, in order to develop new methods of collaboration between the two institutions. Because of its nature, my thesis was limited by the above stated goals and specificity of its research. It was also limited by the parameters of long-term partnerships, as defined in the executive summary, geographic and time constraints, and my bias as a classroom teacher.

My research focused on taking already-vetted ideas about the necessary components for successful long-term partnerships and using them to move forward. As such, I was not compiling a list of effective museum programs for schools, examining family programs, or focusing on audience outreach. I was not examining field trips, checkout kits, one-time classes, after school programs or other types of programs museums offer for students. Rather, I looked at programs in which museums have a long-term relationship with public schools that include some form of collaborative design by teachers and museum educators together, repeated visits by students, and may have a built-in professional development component for teachers. It was also not possible for this thesis to examine these kinds of partnerships with all types of museums. Because I was researching the viability of math content driving more relevant collaboration between museums and schools, I used science museums as the primary institutions with which these partnerships have been and can be formed. Although math content can be worked
into almost any subject matter, the ability and mission-driven ease of science museums to hone in specifically on math-related topics for elementary schools made them best suited for the research of this thesis.

In addition there are geographic limitations to my research. Because a primary component of my topic is our education system, and each state has a unique set of challenges, I concentrated on finding solutions for my home state of California. The majority of interviews and the case study came from practitioners within this state. There are, however, some very interesting programs that exist in other metropolitan areas around the country. I looked into a few that have worked in other states successfully, to build a reasonable inventory of best practices and possible solutions for California. Beyond that, time constraints and the large number of such programs that exist did not permit an exhaustive study of all relevant programs.

Specifically, my research examined the current state of math education in this country to determine how museum programs can be most relevant for schools. However, there was timeliness to this subject matter that may affect its final analysis. Because the current educational climate is largely seen as transitional by education leaders in the United States, my judgments on how best to proceed have been impacted by the information available about the direction in which national standards and forms of assessment will go. Currently many states, including California, are in the process of adopting national standards, but how this will change expectations for and requirements of teachers is yet to be seen.
Lastly, a primary goal in conducting this research was also to present my findings from the perspective of a public school teacher. Because I have eight years of firsthand experience as a teacher in a Bay area public elementary school, I used my own observations of the daily realities of teaching in our current economic and political environment as the primary source of teacher input. As such, this thesis did not focus on the breadth of teacher attitudes towards museum programs, nor did it conduct teacher surveys. This component has been explored in numerous reports similar in nature and was not a primary goal of mine, since I have ample experience to interpret the content of my interviews and observations to know what is reasonable and what isn’t going to work.

That being said, my conclusions might be colored by my life-long interest in museums as rich places of learning. Though I believe most teachers share this value as investors in learning by virtue of their profession, the degree to which I am knowledgeable about museum education practices and have a favorable opinion of their efforts, may constrain my objectivity at times. Whenever possible and wherever appropriate, I relied on teacher input data from outside sources to support my own observations.
The idea of museum-school partnerships is not new. This is the point. Partnerships of varying degrees have been discussed, attempted, written about, and implemented for many decades, yet they still have not been widely accepted as part of education in this country. So the big question is: Why have these kinds of partnerships — many of which report an increase in understanding or test scores (Bevan et al., 2010) — not become more widespread? The ones that succeed do so in part because museums and schools have always been closely tied in their educational missions, enabling them to work together towards a common goal.

Museum-school partnerships combine two very different educational styles, however: Museums provide opportunities for what is referred to by educational theorists as “informal learning,” which enables learners to choose their own areas of interest leading to more affective outcomes (hopefully positive). Schools, on the other hand, operate under the “formal education” umbrella, in which teachers are required to teach predetermined topics and students are assessed for conceptual understanding and skill mastery. Ideally, a mix of the two provides students with the most well rounded education, but this is only happening in a handful of places throughout the country where such partnerships have become sustained. For the purposes of this thesis, the term partnership will refer to those programs in which museums and schools work together in a way that involves multiple visits by students or teachers, and in
which both museum educators and classroom teachers have had input into the structure and content of the program.

In order to truly make progress on this front, it is necessary to look back. This review examines four main areas of research in order to provide historical context for future work. The first section presents a brief overview of the history of the educational role of the museum, drawn from texts that give historical and contextual insight. Next, this review looks at relevant educational theories that support the case for museum experiences to be more of an integral part of school learning, from scholars such as John Falk and George Hein. Thirdly, it gives an overview of the historical relationship between museums and schools up to the present, based on case study reports, conference summaries, and the most recent book published on the topic, *An Alliance of Spirit: Museum and School Partnerships*, edited by Kim Fortney and Beverly Sheppard (2010). Finally, this review examines the current educational climate and specifically, the ideas on math education reform for preparing American students for the twenty first century workplace.

**Museums and their Educational Goals**

From their inception, museums have had a purpose to educate. Though a handful of museums had been established in America by the early nineteenth century, the earliest museums of note blossomed in the latter half of the 19th century after the Civil War, as the country was trying to rebuild itself. The pressing issues of the country, which revolved around unifying the nation after a
time of deep division, fueled these museums’ creation. For example, New York’s American Museum of Natural History and the Metropolitan Museum of Art opened with the primary goal of educating the public, in order to advance a set of national values. These and other new museums offered lectures related to their exhibitions to the public, and many of these talks were geared specifically towards teachers (Schwarzer, 2006, p. 9).

During this time, leaders of museums and universities were also caught up in a debate about the distinct roles of the two institutions. Their missions were virtually identical, both aspiring to be premier places of research and learning. The debate was especially fierce between natural history museums and universities, since both had valuable objects important to research in areas such as paleontology and anthropology. As Conn (1998) writes, “In their new incarnations, America’s universities directly challenged museums for intellectual leadership. The stakes in this intellectual tug-of-war centered around which kind of institution would function to produce new knowledge, and which would simply diffuse the old” (p. 56). Museum leaders such as William Ruschenberg, president of the Academy of Natural Sciences of Philadelphia from 1870-1882, argued that universities were restrictive and exclusive, and museums were in a position to provide access to all for direct learning with objects (Conn, 1998). Ruschenberger fiercely believed that the role of the museum was to produce new knowledge and saw little to no value in book learning. Conn (1998) further explains that Ruschenberger and other leaders of these museums believed that “museums would provide democratic access to that knowledge and thus they would be places
where new knowledge was created within the context of American democratic aspirations” (p. 59). Eventually universities gained popularity and arguably came to be seen as the primary places of intellectual development. It is noteworthy, however, that as both museums and universities were in their early development, they were vying for the status of premiere educational institution.

Even as many museums were identifying themselves as accessible houses of learning and research, their educational roles continued to be shaped. Moving into the 20th century, the majority of museums had firmly established education as one of their primary goals, but the ways in which they went about fulfilling this goal varied greatly. Many of them lacked comprehensive collections compared to museums with richer histories in places like Europe. Some museums compensated with educational programming: they may have offered free lectures to visitors, loaned objects out to nearby schools, and had begun to introduce docent-led tours around the museum at this time (Schwarzer, 2006, p. 11).

In other museums, particularly those specializing in art, educating visitors played a lesser role, and took a back seat to collecting, displaying and preserving objects. Their leaders reasoned that museums started out as places to house objects worth preserving. This meant that educating visitors was an implied component of putting objects on display, but not necessarily a museum’s main goal. In fact, many art museums consciously moved away from trying to educate the masses and instead focused on appealing to higher classes as cultural centers and acquiring significant pieces for their collections (Schwarzer, 2006). These museums grew to define themselves primarily around the objects they housed
(Gurian, 1999). When they did consider the educational components of their missions, the resulting actions were often compartmentalized in the form of after school programs, one-time lectures or docent tours for interested visitors.

Around the same time, progressive educator John Dewey played a principal role in advocating for education as a primary function of museums. In his writings, he expressed his dismal views on the ability of our public education system to inspire curiosity and creativity in children. Under the influence of his writings, children’s museums came into existence as alternatives to formal education, providing places where children could get hands-on, real-world experiences that they did not get in the classroom (Gurian, 1998). To reiterate, these types of museums positioned themselves as alternatives to – rather than as collaborators with – formal education during this time. The early children’s museums had natural history specimens for children to hold and touch, and they often lent such materials out to schools. Then as time went on and more theories of progressive education developed, children’s museums moved into the domains of art and science as well. Notably in the 1960s, the Exploratorium opened in San Francisco under the direction of Frank Oppenheimer and the Boston Children’s Museum opened under Michael Spock. Gurian (1998) writes, “the big departure for the museum world was that this work was not based on, nor in some cases referenced to, the central characteristic of traditional museums: collections-based objects” (p. 21). This round of newly formed museums spurred a debate about whether non-collections-based museums were in fact museums at all, or if the fact
that they had no permanent objects and were created around experimentation and hands-on play, meant that they were some other kind of institution altogether.

With time, even collections-based museums made themselves increasingly available to schools for supplementary learning experiences, as the debate settled and most people accepted these varied types of institutions as part of the museum world (though perhaps of lesser cultural esteem). One of the main activities this movement produced was the field trip, and for decades it has remained one of the most popular means of museum-school interaction. It is largely accepted among people in both disciplines that the field trip has been a longstanding hallmark of the relationship between museums and schools. Many people have documented the impact such experiences have on individuals who remember them long past their immediate recall (Fortney & Sheppard, 2010, p.1). Though this thesis does not ultimately focus on field trips, they have played such a prominent role in museum-school relations, that understanding their impact on formal learning provides context within which longer-term partnerships can be examined.

In their document on field trips, DeWitt and Storksdieck (2008) report that although many studies have shown evidence of positive learning outcomes from field trips, there are also important social and affective impacts. These emotional memories help to distinguish them further from classroom learning (p. 182). Because field trips are outside the school setting, many students find joy in being with their friends away from school. This reality alone often works to elevate their feelings about the experience in powerful ways, which may work to facilitate content memory as well. Very few longitudinal studies on the effects of field trips
have been conducted, but DeWitt and Storksdieck (2008) did find evidence that students clearly retained information from a museum visit from up to two years prior.

What can be done to strengthen this recall even further? DeWitt and Storksdieck (2008) add that although affective factors are contributors, multiple visits and classroom extensions greatly enhance the long-term impact of one-time visits. They conclude that, “in fact, it could be argued that pre-visit preparation and post-visit in-class follow-up are integral parts of the overall field trip experience” (p. 187). Unfortunately even though researchers have put forth several recommendations for teachers to supplement the actual visit in these ways, this advice is not often followed. The reality is that most teachers do not have the time or the resources at school to cement learning from a field trip in meaningful ways (p. 187). The authors do discuss providing teachers with professional development or classroom materials to promote such extensions but realistically, these will not be implemented without additional support.

**Relevant Educational Theories**

All of these conclusions suggest that teachers would benefit greatly from more robust support from museums and cultural institutions, to increase the long-term effects of alternative learning experiences even more greatly. Theories abound about why even such one-time encounters in museums can be so powerful. Two of the leading theorists in the field, Falk and Dierking (2002) assert that the benefits of informal learning exceed those of school-based learning
at times, because in museums visitors are able to choose the areas of learning that are of greatest interest. Visitors bring in prior knowledge and experiences with which to interpret what they see, making meaningful connections to such experiences and placing value on learning about what they choose. Falk and Dierking (2002) define free choice learning in this way:

It is self-directed, voluntary, and guided by individual needs and interests — learning that we will engage in throughout our lives. Since it is the learning that we do when we want to, by definition it involves a strong measure of choice — choice over what, why, where, when, and how we will learn (p. 9).

Very few people would dispute the fact that learning is much easier and enjoyable when it is fun. Having the ability to make choices in the process inevitably increases the joy in any activity. If someone has chosen a given activity out of interest, then she has intrinsic motivation to learn from it and her chances to have a significant, positive outcome will increase.

Researchers point to the ‘flow experience’ as the epitome of a meaningful learning experience. M. Csikszentmihalyi (as cited in Csikszentmihalyi & Hermanson, 2004) describes a flow experience as “a state of mind that is spontaneous, almost automatic, like the flow of a strong current” (p. 150). The conditions for such an experience include clear goals and appropriate rules, opportunities for engagement that fit within a person’s capabilities, and the learner being in a positive state of mind (Csikszentmihalyi & Hermanson, 2004). Though these conditions are not assumed present in all museums by any means,
the authors assert that a flow experience is more possible in a museum than in a classroom, since intrinsic motivation is a central ingredient. The benefits of having a flow experience are wide reaching. For one, the authors strongly believe that if a person achieves this kind of optimal experience, “the individual fully expresses the self” (p. 152). The person may realize potential she didn’t know she had, or see herself in a new, more positive way. People have also described feeling deeply connected to others in flow, having a heightened sense of community. Furthermore, once a person attains flow in a given skill, this opens doors for new challenges or levels of deeper complexity of a given topic or task. Even though it is difficult to measure the effect emotional factors have on cognitive processes, being able to achieve a state of flow surely contributes significantly to a positive and successful learning experience. The fact that the classroom does not optimize conditions for such experiences is further reason to look elsewhere to help create them for students.

Falk and Dierking (2002) reinforce these concepts in their discussion of the qualities of free choice learning, many of which overlap with the qualities of a flow experience. As they write:

Researchers have found that humans are highly motivated to learn when:

1. they are in supportive learning environments;
2. they are engaged in meaningful activities;
3. they are freed from anxiety, fear, and other negative mental states;
4. they have choices and control over their learning; and
5. the challenges of the task meet their skills (p. 15).
The proponents of free-choice learning place so much emphasis on identifying its characteristics because of their fundamental views of how humans learn in the first place. These views are deeply rooted in the visions and research of educational pioneers like John Dewey and Jean Piaget, who put forth theories on experiential learning and constructivist learning respectively. These and other theorists believe that people learn best when they are engaged in activities of interest, and that people construct their understanding of the world based on what they already know and have experienced. In other words, learning something new is rarely a distinct, isolated experience. Rather, it is the act of new knowledge being incorporated into larger constructs of understanding, with these constructs constantly being adjusted and reorganized (Hein, 1995). This constructivist theory is fundamental to appreciating the value of free-choice learning and has important implications for both museum and classroom learning. As Falk and Dierking (2002) continue, “the key is in appreciating that virtually no one learns anything in one moment or in one place. Rather, learning is a constant, lifelong process of building and refining our understanding of the world” (p. 42). Though these conditions and conceptual frameworks are what most teachers aspire to provide on a consistent basis, it is unfortunately often difficult to ensure such an atmosphere with the given curriculum materials and minimal to no support for truly explorative activities.

That is not to say that these types of learning experiences have never been available in the public school environment. There have been a handful of curricula and instructional materials designed to facilitate free-choice learning in
the classroom. One example is the Full Option Science System (FOSS) curriculum. It was initially put into development by researchers at the Lawrence Hall of Science in Berkeley, California more than 20 years ago, around the theory that, “the best way for students to appreciate the scientific enterprise, learn important concepts, and develop the ability to think critically is to actively construct ideas through their own inquiries, investigations, and analyses” (2009, para. 2). However, because historically school districts switch out their curricula every several years based on emerging educational theories of the time, these kinds of progressive science programs have been used more as “trends” (if districts feel the program supports current thinking in education) than as philosophies that get entrenched in the system.

Museum-School Partnerships to Date

Historically, as previously discussed, museums and schools have been connected closely in their educational missions, but have deviated greatly from each other in terms of their approaches, core values, and measures of success. Over the decades, their interactions have weaved in and out of collaboration and competition. Programs such as field trips and teacher professional development sessions are some of the most consistent ways in which they have collaborated over the years, and museums have accepted their role in educating the American student. The sustained partnership between the two, however, where true collaboration and endurance are existing characteristics, has yet to find its way into the educational mainstream.
There have been many professionals who have put forth best practices for these types of programs, to encourage more to take shape. It is valuable to detail some of them here, to draw out common qualities. In 1996, the then Institute of Museum Services (now the Institute of Museum and Library Services or IMLS) published *True Needs, True Partners: Museums and Schools Transforming Education*. The report profiled some existing partnerships of the time, identified themes of such efforts and offered a list of twelve conditions for creating successful partnerships. Recommendations included understanding “the school’s needs in relation to curriculum” and standards, creating “a shared vision for the partnership,” and setting “clear expectations” (IMLS, 1996, p. 50). In another, more recent IMLS document (2005), the authors have a slightly more expanded view and argue that a great hindrance to wide acceptance of such relationships is the lack of support from policymakers and the public at large. They suggest “five steps to making the vision a reality: foster and sustain a network to share best practices; learn what makes partnerships work; encourage innovation; get everyone involved, including parents and caregivers; and educate and work with policymakers” (IMLS, 2005, p. 14).

Finally and most recently, Fortney and Sheppard (2010) include in their appendices a lengthy list of characteristics of an ideal museum-school partnership, developed collectively by participants at Mid Atlantic Association of Museums conference in October 2007 and at the American Association of Museums annual meeting in May 2008. Excerpts from the list of criteria they compiled follow:
The ideal partnership features clearly articulated realistic expectations from both parties, features mutual trust, has shared goals and missions, provides for mutual flexibility, conducts evaluation/feedback, leading to modifications as needed, has adequate funding, has a plan for succession, and is a rich relationship that grows. (Fortney & Sheppard, 2010, p. 104).

There is overlap among these lists; the main themes are common goals and expectations, open communication and flexibility, and realistic logistics. The overlap cements the fact that many of these qualities are indeed necessary for museum-school partnerships to be successful. In identifying these along with understanding the current climate in which to start improving on past efforts, we may finally be able to move forward.

These are some of the reasons why now is the time for museums to collaborate with schools in new ways (even as challenges mount). A weakened economy means both museums and schools are losing funding and countless resources; successful partnerships would allow them to pool resources and exchange ideas to help both achieve their shared goal of engaging learners. In addition, the momentum for change on both sides – the push for visitor-driven, participatory content in museums and sweeping public education reform – position the two entities to work more closely for mutual benefits than ever before. As Dodd (1992) writes, “A fundamental change is taking place in the relationship between the public and museums’ a change towards a collaboration of joint interest, joint views, feelings and sensitivities” (p. 133). Fifteen years after
the writing of this article, the trend still continues for museums to be more visitor-driven and collaborative within their local communities.

However, in their relationships with schools, exactly the opposite has happened: if schools have not cut field trip budgets altogether, the concern with reaching standardized testing benchmarks leaves little to no time for outside learning experiences (Fortney & Sheppard, 2010). It is now that educators and administrators most need to understand that free choice learning should not just be seen as an alternative to formal education, but as a means to engaging learners who may be disengaged from instruction within the structure of the school setting. Indeed, many in the educational field corroborate this and are working toward restructuring classroom instruction to incorporate more of the qualities of informal education. Some of the ways in which teachers are moving away from traditional methods of instruction include more group activities, workshop models in which each student is working independently and at their own pace, and inquiry-based teaching in the subjects of science and math.

Though teachers are implementing some of these strategies on their own to varying degrees, there is support to be found outside school walls, especially in light of depleting resources and increasing class sizes. For children of elementary school age, free choice learning is imperative to their development. Numerous child development experts posit that learning is an inherently enjoyable experience for young children as they make sense of a world that is still relatively new for them (Falk & Dierking, 2002). As they get older, they begin to slowly understand more abstract concepts about the world. But Falk and Dierking (2002)
explain that “schooling at this age is designed to provide children with the basic knowledge and skills they need to function successfully throughout their lives, and given the nature of schools, this learning and skill building generally occurs in the very out-of-context classroom” (p. 77). The research supports the idea that schools fail to give students what they truly need to be successful contributors to our society and that they need opportunities to pursue their own areas of interest and problem solving. If this is indeed the case, then museums are ideally positioned to not just provide supplemental learning experiences, but to become integral to achieving this new goal. As Davis and Gardner (1999) assert:

Traditionally museums have supplemented school learning – the trip to the museum of natural history lending substance to the class unit on dinosaurs, the visit to the art gallery adding colour and background to a Renaissance history project. In most cases, this supplementation has been subject-based. We, however, recommend that the educational focus be turned away from the subject-matter to the learner, from information to opportunities for individually centered learning. We maintain the uniqueness of museums as centres of learning naturally sited for the sort of individualized learning schools need to provide (p. 103).

Though the balance in a museum-school partnership between content goals and individualized learning experience goals can be difficult to negotiate, this idea of students pursuing their own interests is undoubtedly key.

Fortunately, there are a handful of successful programs to which we can look for inspiration. Great Chicago Stories is one such program, written up by
Heidi Moisan (2009) in the *Journal of Museum Education*. The project brought together educators from the Chicago History Museum, Chicago school teachers, professional writers and technology advisors for the purpose of transforming the history of the city into “powerful narratives as points of entry for exploring key humanities themes and fundamental concepts” (Moisan, 2009, p. 24). From the very beginning, the group collaborated to choose topics, stories, and materials to use, all aligned with the Illinois State Learning Standards. The project’s first step brought teachers and museum educators together over the summer to learn a new curriculum design approach with which the program would be further developed. The group started off learning something new together, and thus a community quickly developed that was engaged and committed to common goals. During the school year, museum educators came into teachers’ classrooms to facilitate the project’s tasks. Additionally, the project developer and program coordinator made classroom visits, which not only allowed them to see the fruits of their plans, but also helped make teachers feel valued in their efforts (Moisan, 2009). The project also included evaluation, the creation of resources that will live beyond the project’s scope, and new ties between teachers and museum educators in the Chicago area.

Urban Advantage in New York City is another successful museum-school partnership, profiled by Bevan et al. (2010) in CAISE’s report *Making Science Matter*. The partnership brings together multiple museums around the city to work with its middle schools in the area of science. In this program, students design their own scientific investigations to conduct from start to finish. These studies
also act as “exit projects,” a requirement for all eighth grade students. Building this opportunity to work with museum professionals and scientists into a required element of school works well to enhance the experience’s utility within the school system. Students work in small groups, are mentored by teachers and staff at various participating institutions, and make repeat visits to the sites that align best with their project goals. This program has reported an increase in the understanding of content knowledge and of the scientific process in a vast majority of the participating students. As of 2010, the program was in its sixth year and had expanded from around 30 schools when it started to over 150 schools in every borough of the city (Bevan et al., 2010, p. 40).

Programs like this, though encouraging, are a small minority. For the most part, museum educators around the country still struggle to take basic steps to establish significant connections with schools. In light of diminished support for field trips and other types of external experiences, many find it difficult to even disperse information about their resources and programs. As Fortney and Sheppard (2010) write, “Even as recently as 10 years ago, a brochure mailed to schools would start the phones ringing. But in this era, that approach will likely fail. What is needed now is an entirely new way of thinking” (p. 37). So what are these new ways of thinking? How are some museums trying new approaches with more success than before? And why, after all these years, are we still struggling to establish relationships with teachers, rather than deepening these relationships? These are the kinds of questions that remain unanswered, despite ample literature that advocates for the value of informal education, documents successful
partnerships of this nature, and proposes insightful suggestions on how to solve these problems.

**Current Educational Climate**

Educators, politicians, academics and parents worry seriously about the ability of formal education as it stands today to nurture students’ creativity and divergent thinking skills. If students are not being encouraged to think for themselves and master problem solving in a meaningful way, then they will not be sufficiently prepared to innovate and think progressively as they enter the workforce. In particular, there is concern over students’ abilities in STEM (Science, Technology, Engineering, and Mathematics) concepts. As the U.S. Department of Education’s report on academic competitiveness states, even though there have been many reforms and some improvement in achievement in K-12 students, “the results from recent national and international assessments are sobering. Although the mathematics achievement of American students in grades 4 and 8 has risen steadily since 1990, average scores remain unacceptably low, and achievement levels appear to decline as students progress to higher grades” (2007, p. 10). Researchers attribute this problem to the types of instruction found in most math and science classrooms, which historically have emphasized memorization of formulas and facts (Boaler, 2008, p. 6-11). Others hold the more recent No Child Left Behind (NCLB) Act of 2001 responsible, since most assessments for which schools are held accountable, test students in a multiple choice format and teachers spend the majority of time preparing for only math
and language arts subject tests. In fact, since 2002, districts across the country reported an increase on average of 37% more instructional time for mathematics while instructional time was reduced by an average of 32% (about 76 minutes per week) on subjects such as science, art, and physical education (McMurrer, 2007) to prepare for such standardized tests. These types of assessments cannot possibly test for problem solving adequately – after all, a student merely has to fill in a bubble to answer the question and has a twenty-five percent chance (in most cases) of being correct.

With these relatively new realities of slashed school budgets and increased class time devoted to test preparation, even the field trip has suffered. Much of this decrease in field trips is due to the requirements of schools by and the insufficient funding of NCLB. As Fortney and Sheppard (2010) state, “Funds that were formerly used for field trips are now used for remediated students. To worsen matters, NCLB initiatives have not been adequately funded, resulting in school dollars often being redistributed towards accountability rather than enrichment” (p. 16). Because math is one of the two primary subjects (along with language arts) for which instructional time has increased, it may well be the “hook” needed to get buy-in from teachers, administrators and other important stakeholders for museum-school programs.

There is no question that the need to reform math education is paramount. The Department of Education has recognized the urgency of this matter, and published new Common Core Standards in 2010 that many states including California have already adopted. In addition to content standards that already
existed (though they have been streamlined), this set includes process standards that call for the need for students to master a variety of thinking strategies. There are several process standards that are constant across the grades, having to do with “problem solving, reasoning and proof, communication, representation, and connections” (California State Board of Education, 2010, p. 1). These process standards have the potential to drastically reform mathematics instruction in this country, moving towards more exploratory, inquiry-based methods that involve deep thinking and divergent explanations. Boaler (2009) stipulates that a primary goal of schools, “is to provide stimulating environments for all children – environments in which children’s interests are piqued and nurtured, with teachers who are ready to recognize, cultivate, and develop the potential that students show at different times and in different areas” (p. 122).

This is precisely where informal learning fits in, during which students use skills of investigation and inquiry to make discoveries, and have opportunities to use a range of learning modalities to explore real-world situations. The government has fortunately also recognized the importance of informal learning in achieving the goals of improving American students’ competitiveness against other countries. In the U.S. Department of Education’s report on the topic, the authors include “informal education and outreach” as one of their primary learning environments to attend to, alongside K-12 education and post-secondary education (2007, p. 17-20). Though this encouragement by the government exists, most schools do not currently have the resources or instructors to adequately bring informal learning into the classroom in a meaningful way. As such, museums
have a real opportunity to develop rewarding relationships, strengthen their own educational practices, and make a difference in the lives of students.
FINDINGS

There is an inherent connection between schools and museums, most evident in their overarching missions to provide rich learning experiences. Historically though, as the literature in the previous section revealed, their relationship has spanned the spectrum from collaboration to competition. Today, as this country struggles to prepare American students to compete successfully in the global economic environment, collaboration appears to be growing less viable. Because math is a core subject, one in which American students lag especially behind other countries, it could play a role in strengthening the museum-school connection once again. Can museums and schools provide meaningful, long-term support to each other in our current climate?

This chapter presents summaries and analysis of the case study and thirteen interviews that I conducted in order to answer this essential question. People in three main professional areas were interviewed both in person and over the phone during the months of February and March, 2011: museum educators directly involved in long-term museum-school partnership programs, museum professionals who research and evaluate these kinds of programs, and experts in the field of math education. The content that came out of the wide range of interviews echoes much of the literature presented in the previous chapter on the benefits of informal learning, successful qualities of museum-school partnerships, and the direction of math education in the United States. However, many of the interviewees also brought up honest concerns and in some cases even a healthy dose of skepticism, for the proliferation of such partnerships. From these
conversations, I found that the creation of each program was driven by specific circumstances, thus making it difficult to extract some sort of formula for success; museums committed to such programs believe that benefits are long-term but hard to measure; experts have varying opinions on whether there is room for more of these types of collaboration; and I was unable to identify any current partnerships centered on math concepts.

**Museum-School partnerships are created out of a set of specific and localized circumstances.**

There are several examples of programs that met the definition of a sustained museum-school partnership as described in the introduction of this thesis: those in which museums have a long-term relationship with public schools, including some form of collaborative design by teachers and museum educators, repeated visits by students, and/or a robust (as opposed to a one-time workshop) professional development component for teachers. Each one developed out of a specific need of a school or district, or an interest from a museum in working with schools around a particular theme. The discussions focused on the structure of the programs, their funding sources, strengths and weaknesses, and hurdles for these types of programs to become more widespread.

School in the Park (SITP), in San Diego, California served as my case study. This program was initially created to solve an overcrowding problem at Rosa Parks Elementary in the City Heights neighborhood. Adding portable classrooms and using the multi-purpose room to house four classes at once were
quick fixes to the problem, but did not offer long-term solutions that would ensure rich, stable learning environments for students. Sol Price, a well-known philanthropist and entrepreneur in San Diego, saw a possible long-term solution to the problem that utilized the rich resources of the city’s cultural hub, Balboa Park. As Pumpian, Fisher and Wachowiak (2006) state, Price already had a vested interest in this low socio-economic and disadvantaged neighborhood through the City Heights Collaborative, which brought San Diego State University, San Diego Unified School District, the San Diego Education Association and Price Charities together to help improve learning conditions and outcomes for students (each school in the neighborhood has a free and reduced lunch rate of 99%). School in the Park began to take shape under Price’s leadership, becoming an innovative, nontraditional model of learning. Currently, SITP brings students from two City Heights elementary schools to a variety of cultural institutions in Balboa Park.

As Linda Feldman, the director of the program explained, it is structured as an immersive experience for students in third, fourth and fifth grades, from Rosa Parks and now also Hamilton Elementary, where students spend on average six to eight weeks in Balboa Park (L. Feldman, personal communication, March 14, 2011). Ideally, classes come to the park almost once a month, but sometimes because of scheduling issues – often caused by the large volume of students and limited museum space and staff – the frequency is not as consistent. Students are at a different museum each week they are at the park. For example, one week, a fourth grade class might spend a week at the Museum of Man learning how to become junior archaeologists, or a fifth grade class might be at the Museum of
Photographic Arts creating podcasts on famous American photographers. The students spend the whole morning being taught by museum educators, while their classroom teachers are making observations, managing behavior, and tending to special needs students. In the afternoons, the class stays in the park and has a classroom space where the teacher returns to standard instruction or gives lessons that integrate the morning’s activities with the necessary curriculum.

There are a variety of elements that make this program successful. Teachers who have been at Rosa Parks since the beginning of the program (referred to by SITP staff as “founding mothers”) remember having input into the design of the program at the start. Using museum resources to make the curriculum come to life was an exciting proposition, and one that students enjoy, as evidenced by their high levels of engagement at any given museum. Roberta Dawson, a fourth grade teacher at Rosa Parks and a founding mother, recalled her enthusiasm for seeing the difference between her students on a normal day at school and on a museum learning one. On my visit, ten years later, I observed her fourth grade class make shadow puppets and then use them in a shadow performance of an ancient folk tale at the San Diego Museum of Art. The students were models of good behavior, listening attentively during each group’s performance as if they were watching one of their favorite movies. Later in talking with Mrs. Dawson, she pointed out that this group has not been an easy class in terms of behavior, and that she was amazed at how strong their focus was during this activity (R. Dawson, personal communication, March 14, 2011). The director of the program echoed these sentiments, “Old students come back and
remember these activities with such detail” (L. Feldman, personal communication, March 14, 2011). The program is also very fortunate to have a stable funding source. Because Sol Price initiated the idea for the program as a way to solve the overcrowding program, Price Charities is committed to providing the program with the financial resources it needs indefinitely. Finally, the fact that Balboa Park has so many cultural institutions so close together elevates the effectiveness of the program. The diversity of subjects the students study is only possible because they are able to go to the Museum of Natural History, San Diego Museum of Art, the San Diego Historical Society and the Zoo all in the same park.

SITP, although one of the most innovative programs that exists today, also has many substantial challenges. When it was first conceived, collaboration between school and museum educators was a principal component. On some level teachers and museum educators still work together to integrate both types of learning. However, administrator and teacher turnover coupled with pressures from the state, especially when the schools’ test scores do not meet expectations, have hampered the ability for these two groups to work together in meaningful ways. In speaking with Mrs. Dawson, it is clear that expectations to teach from the core curriculum by school administrators have taken away from the overall experience. Dawson was quick to say, “The program used to be integrated more fully so that teachers could use the afternoons to do activities that directly related to their morning work” (R. Dawson, personal communication, March 14, 2011). Now Rosa Parks’ principal, in response to declining test scores that have put her
school in program improvement (a probationary status as outlined by No Child Left Behind that puts schools at risk of losing funding if they do not raise their test scores in two years), is strongly urging teachers to return to their traditional math curriculum in the afternoons and teach standard lessons. Whether or not she sees the benefits of SITP, it is impossible to ignore the reality of program improvement and the strict measures that come with it. On the other hand, for this program’s potential impact to be reached, stakeholders on all sides have to be ready to administer it in the way that it was originally intended.

According to Feldman, one of the biggest challenges continues to be how to fully integrate the museum content into the standard curriculum with enthusiastic support from administrators and teachers who desire to want to do this to the fullest extent possible (L. Feldman, personal communication, March 14, 2011). Even though the program staff constantly encourages teachers to do so and offers to provide materials whenever possible, integration happens to varying degrees. Some teachers enthusiastically look for ways to extend the museum learning or relate it back to what they learn in the classroom, while others can be resistant to supporting it fully. The coordinators of the program are always there to provide this kind of support, but do not thrust it upon teachers. Feldman explained, “In all fairness, we have some teachers who, for various reasons, all of which are legitimate – they’ve got a lot of pressure on them – will often sit in the back of the class and finish correcting their homework or what have you” (L. Feldman, personal communication, March 14, 2011). She added that she is looking for ways to have the teachers collaborate more with the museum
educators, but logistics and time often stand in the way. Thus, even though as this case study has shown that SITP is designed to be a true partnership, full collaboration still poses some of its main challenges.

The other partnerships I explored through staff interviews reveal the wide range of collaboration that exists between museums and schools. Many of these programs aren’t structured around immersive experiences for students like SITP, but rather for teachers. The California Academy of Sciences (Cal Academy) currently has two long-term programs that offer robust professional development, though they are both relatively new. I first spoke with Helena Carmena, Senior Manager of Teacher Education, who has played a major role in the development of Cal Academy’s newest program, Science, Literacy, and Art Integration in the Twenty-first century (SLANT). This program’s groundwork started in 2009 when San Francisco Unified School District (SFUSD) was exploring ways to integrate science, art and literacy. At the same time, Ms. Carmena and a colleague of hers at the de Young Museum (the art museum across from Cal Academy) were brainstorming about the same kinds of integrative programs for students using both of their museums. Capitalizing on this alignment of interest, Carmena and her colleague were able to quickly implement an experimental session of SLANT. They brought in a fourth grade class from a nearby elementary school to participate in a series of activities integrating science, art and literacy over a period of eight to ten weeks. It wasn’t the museum’s intention to grow this model of giving students direct experiences into a full-fledged program since Carmena admitted that from the museum’s standpoint, having an impact on one classroom
at a time does not prove worthwhile. She explained, “It’s not necessarily a sustainable program – we can’t serve individual teachers and students that in-depth over a long period of time, but it was a learning experience and it developed into a curriculum” (H. Carmena, personal communication, February 16, 2011).

Rather, they used that experience as a foundation for developing an intensive professional development series for San Francisco teachers on novel and engaging ways to integrate science, art and literacy through inquiry-based teaching, open-ended exploration, and opportunities for students to be creative. Carmena feels that the driving force behind this program is that “every teacher needs to teach these [science] concepts but doesn’t have a lot of time. So, how can we support individual teachers to create those kinds of connections to make things meaningful for their students and cover other subjects along the way?” (H. Carmena, personal communication, February 16, 2011).

Last summer, the program’s first cohort comprised of 35 teachers from San Francisco participated in a weeklong SLANT professional development session that focused on practices of integrating different subjects into one overall learning experience. Since then, the cohort has met several times throughout the school year to discuss their progress. Because the district has demonstrated a clear interest in wanting to provide this training to its teachers, it currently funds portions of the museum educators’ salaries and stipends for San Francisco teachers to attend. However they are also in the process of seeking additional long-term funding to secure the partnership and provide the resources for formal evaluation.
The other program offered by Cal Academy that is generating interest is the Teacher Institute for Science and Sustainability (TISS), managed by Grahme Smith. Smith explained that this program is a two-year commitment for teachers and consists of two weeklong summer institutes and twenty hours of professional development over the course of the school year. The program gives priority to teachers that apply in teams of two to five, to encourage collaboration at school sites. Each teacher is required to develop, write and teach one lesson by the end of the first year, and a unit consisting of at least three lessons by the end of the second year. SFUSD has committed to one release day a year per teacher (which isn’t much, but is more than other less intensive programs provide) to support each participant with time to work exclusively on her TISS assignments. Another component of the program is museum staff support for teachers in the form of classroom visits for co-teaching an activity, or lesson planning and observation. Finally, peer feedback is built in as well; teachers bring their lessons, student work and science notebooks to sessions to share and contribute ideas about how lessons could be strengthened even more (G. Smith, personal communication, March 15, 2011).

The program is in the midst of its second year, so the first cohort will finish in the spring of 2011. After the first cohort completes the program, museum staff will examine the process and look at the achievement outcomes of students. Because the program is only in its first round, evaluation tools are still being refined and formalized. However, Smith noted that they will look at teacher comfort and confidence with science, along with any behavioral changes being
made that they may be passing along to their students. He is also interested in studying the value of teacher teams’ participation, which he feels is a real strength of the program, and in what ways lead teachers are having an impact on the culture of their school sites (G. Smith, personal communication, March 15, 2011).

Because teams of teachers apply to the program and receive a small stipend for their participation, they come in with high interest levels and enthusiasm. The program doesn’t have long-term funding and is currently funded by three sources; the team is in the process of applying for another three-year grant.

In New York, Urban Advantage Middle School Science Initiative is a collaborative program between the New York City Department of Education and eight local science institutions. Its main goal is to support students around the city in completing their “exit projects,” long-term science investigations that eighth grade students are required to complete before moving on to high school. The American Museum of Natural History acts as the managing institution and is where the Urban Advantage offices are located. Tina Glover, the coordinator of Urban Advantage teachers and schools, explained that the program has four main components: professional development for teachers in inquiry-based science instruction; supplies for classrooms to participate in this kind of instruction; student, teacher and family access to partner institutions; and additional outreach to families of participating students. Through the intensive teacher workshops and commitment by participating teachers to apply their training, students benefit from free access to the science institutions, mentoring from scientists and institution staff, and teachers who use informal learning techniques to engage
students with science in rich and meaningful ways. The program was designed around these exit projects, because although Glover stipulated that these projects are really only examined closely if a student is in danger of not being promoted, in essence they are an effective, engaging way for students to learn.

The program is in its seventh year, and though it was designed initially for eighth grade students, it has expanded into sixth and seventh grade classrooms. In addition, Glover explained that the program started out serving around 60 teachers, but in the 2009-2010 school year it was able to reach over 400 middle school science teachers and their students. The program’s funding stands as one of its greatest challenges: it is voted on every year by the New York City Council, and can vary from year to year. In the 2010-2011 school year for example, they had to make some cuts to the number of participating schools because the budget had been reduced from the previous year. They have managed to renew funding each year keeping the program relatively stable to date, but it is never guaranteed. Glover is optimistic that results of a formal evaluation study they have just embarked on in conjunction with Michigan State University and New York University will provide further proof of the program’s value to the City Council. The evaluation project examines individual students’ scores on the New York state eighth grade science exam from schools that have UA in place and schools that do not (T. Glover, personal communication, February 24, 2011).

The last program I learned about was the Education and Arts Roundtable, which was established by the Natural History Museum of Los Angeles County (NHM) in 2002. Museum leaders there were in the process of developing a more
visitor-centered strategic plan, as the revamped mission statement became “to inspire wonder, discovery, and responsibility for our natural and cultural worlds” (Stevenson, Callow, & Ono, 2009, p. 60). The goal of the roundtable was to think about ways in which the Education department could implement different kinds of programming that would truly embody this new direction. What started out as a “think tank” of educators, artists, and museum staff, grew into an award-winning collaborative effort between NHM, public schools, and independent arts organizations. Though arguably the least structured of the programs laid out in this section, the Education and Arts Roundtable may have had the biggest impact because of the tailoring to each specific classroom’s needs. The projects started out as informal conversations and ideas, and then took shape according to the decisions that came out of these discussions. As Adrienne Lee, former manager of the program, explained, the process was “very organic. Each project grew out of a lot of small brainstorming meetings” (A. Lee, personal communication, March 17, 2011). She went on to say that it took enormous amounts of time and energy to provide the logistical support to all of the projects going on simultaneously, but to lessen these efforts would have resulted in projects that may have been more uniform and less individual. Unfortunately, funding for this program ended in 2010. Because of a change in leadership at the museum to someone who did not embrace the program’s goals of science and art integration in the same way, and was interested in reaching larger numbers of people, new funding was not sought to allow the program to continue in the same capacity.
These programs represent a broad range in the examination of their
development, structure, and outcomes. Each partnership grew out of an incredibly
unique set of circumstances including but not limited to pre-existing relationships
with nearby school districts, funding sources, and specific problems or
circumstances that needed addressing. However, a commitment to collaboration,
teacher empowerment, buy-in from administrators, and meeting a specific need
are essential components for success, found in the programs profiled to varying
degrees.

**Museums that are committed to sustained museum-school partnerships**

**believe that their involvement in such programs will help create a community**

**of engaged, interested citizens for generations to come.**

One way a commitment to collaboration can be solidified is to ensure each
partner has an equal stake in the outcome or effectiveness of the program, since
mutual gain is part of any true partnership. A goal of my interviews was to
discover what exactly museums saw as the real benefit in participating in these
types of programs. It is easy to see what schools have to gain – rich learning
experiences outside the classroom setting – but the advantages to the museums are
less clear. However, in speaking with museum educators, their investment in their
respective programs proved to serve similar purposes. All of the educators
working in science institutions believed strongly that the role of their museums
was to encourage people to be interested and passionate about the natural world in
order to better protect it. These partnerships are one way in which the museums
can reach people. As Carmena of the SLANT program at Cal Academy explained, “We are very much aware that what happens in school or what happens out of school could make or break a person to become science literate, to be able to be in touch with what problems our world is facing and how science connects to their daily lives” (H. Carmena, personal communication, February 16, 2011). It was interesting to hear Glover, of Urban Advantage, echo these same sentiments: “One of the reasons I am deeply committed to this program is to help create science-literate adults down the line. To do that, we want kids to be in the institutions and we want them to be informed. We want them to know what’s happening in the world and to be able to discuss scientific topics in a reasonably intelligent way” (T. Glover, personal communication, February 24, 2011). If these partnerships can help create science-literate students, as they get older, they will understand the value of science institutions and support their existence, continue to learn about scientific issues the world faces, and hopefully use their knowledge to be proactive in protecting our world.

**Experts offer differing opinions about the potential for sustained museum-school partnerships to expand their presence in the school system.**

Several other professionals, who contributed insights into the viability of increasing the number of quality museum-school partnerships, all had quite different views on the topic. These insights came primarily from Bronwyn Bevan, director of the Exploratorium’s Center for Informal Learning and Schools (CILS), Lydia Johnson, Associate Professor in the Museum Studies program at John F.
Kennedy University, and Chris Parsons, an independent evaluator of museum educational programs. All three have spent time thinking about or experimenting with ways to strengthen the connection between museums and schools.

Lydia Johnson, after many years working in arts administration and university museum management, suspected that the primary barriers to strengthening the ties between schools and museums lie in the current teaching environment. As a means of gaining a better understanding of what public school teachers go through, she went back to school to get her teaching credential. She then taught fourth, fifth, and sixth graders in Title I schools in the San Francisco Bay Area. Her experience proved to be nothing like she expected:

I was not prepared for how demanding the job is and how literally beyond one’s ability it is. It is a job in which a few excel, but it is literally impossible to fully succeed; the demands are too great. I was stunned. The expectations pile up higher and higher until it becomes almost inhumane. I was really surprised, and I have a completely different appreciation and understanding of teachers now (L. Johnson, personal communication, March 2, 2011).

Johnson does believe that there are plenty of opportunities for museums to work with schools, but using the teacher as the point person is not realistic anymore. She suggested that parents could play an important role in facilitating the connection. Because parents are innately interested in providing rich experiences for their children, finding one or a small group of parents at a given school to act
as a liaison between the museum educator, teacher, and students could prove an effective way to open the lines of communication. She also noted that there is no lack of entry points for connecting with schools (L. Johnson, personal communication, March 2, 2011). If museum programming were to focus less on the language of the actual standards and more on relevant curriculum content (which align themselves with the standards already), museums might be able to pique the interest of schools more easily. She added that if museums can find a way in and position themselves as a tool for lessening a teacher’s burden, there is great potential.

Chris Parsons, an independent evaluator of museum education programs, has a few more doubts about the possibility to make much headway on the museum-school partnership front, given the current climate. Though she describes some particular programs at the Monterrey Bay Aquarium (for whom she has been evaluating programs for over 20 years) as very effective, she sees three main reasons for being skeptical: “1) The funding landscape is not going to change much and will continue to be difficult for both schools and non-profit organizations. 2) The requirements for teachers will get even stricter. 3) The digital divide between formal and informal education institutions will complicate the matter” (C. Parsons, personal communication, March 16, 2011). She believes that museums are moving much faster in adopting new methods of technology to engage visitors, and schools are not equipped to keep up in the same way. However, from her experience with evaluating educational programs, she sees
commitment from both sides, buy-in from school administrators, and adequate funding as the three biggest components of a successful partnership.

Bronwyn Bevan of CILS provided a slightly different view. Her main work has been to examine ways in which informal learning can strengthen children’s experiences with science through this research arm of the Exploratorium. She thought the different objectives of museums and schools might play a role in the dearth of successful partnerships:

What a museum would say are opportunities to learn may not be seen that way by people coming out of the school system or people funding these kinds of teacher learning opportunities. It’s less about mastery of content per se, although that is certainly part of it, but the other part is something that’s more akin to developing an interest or a resonance with material, or hopefully a desire to continue an engagement (B. Bevan, personal communication, March 16, 2011).

Additionally, museums are lifelong learning institutions, and schools are not—they are for a particular age range. She concluded this line of thought by saying, “It’s a complicated thing for museums because there’s a fear of being subsumed by somebody else’s agenda” (B. Bevan, personal communication, March 16, 2011). Though in theory, museums and schools have similar overarching goals, their specific objectives in achieving these goals sometimes align themselves easily with each other, but often they do not. Museums have to understand these diverging strategies and expectations before they can be fully committed to a partnership with schools. She explained that the Exploratorium, which has two
prominent institutes for formal educators, the Teacher Institute and the Institute for Inquiry, takes the position that schools are essential to the development of scientists and an overall public interest in science, “which is why our relationships with teachers are so strong. But some in the field do not see schools as centrally implicated to our institutional missions to expand public engagement with science” (B. Bevan, personal communication, March 16, 2011).

In regards to Urban Advantage, which she researched for the report *Making Science Matter* published by the Center for Advancement of Informal Science Education (CAISE), Bevan noted that the project has been difficult to export to other cities. On one hand, it is one of the few programs that has tried to expand to other cities, which is encouraging. On the other hand, fitting a distinct need of New York City schools is one of its greatest strengths, making replicating the program in other places a challenge. Another quality specific to Urban Advantage in New York is that AMNH is well positioned to reach out because of its long history working with schools, its incredibly robust scientific research arm and its enormous collections. Finding comparable institutions that have the same depth of resources in other cities has also been a challenge.

In thinking about the mission of her own organization CILS, which is to “broaden conceptions of learning,” she feels that truly successful partnerships will not just be about one type of institution coming to the aid of the other, but rather they’ll be focused on expanding the traditional notion of what it means to learn. To this effect, there is still a lot of work to be done. Real progress on this front is hampered by the fact that there aren’t effective methods in place for gathering the
kind of simplified, quantitative data required of schools to use for informal learning experiences; these experiences are much harder to measure and are also not intended to be measured in these ways. Efforts need to be made to find a common language for evaluating such experiences that are useful to both schools and museums, because as Bevan simply put it, “people really don’t quite yet know how to do it” (B. Bevan, personal communication, March 16, 2011).

Solving such issues as measuring outcomes of informal learning, finding stable funding, and providing real support for teachers without overburdening them could help to make it possible to create more of these types of programs.

**According to my research, currently there aren’t any sustained museum-school partnerships centered on math; they could be part of the solution.**

Overwhelmingly, interviewees agreed that one of the main hindrances to museum-school partnerships becoming more widespread is the demands already placed on schools and teachers. Some of the programs detailed show that fitting a specific need of schools can increase the likelihood for success. For example, Urban Advantage in New York has local science institutions supporting teachers and students with their required long-term science investigation projects. Because mathematics is a core school subject, and has also been identified recently as an area in which American students need extra support, it is worth exploring as a way to link museums and schools on a deeper level. I was unable to find any examples of current programs whose primary goals were to strengthen an understanding of math concepts. However, the experts from the math curriculum
field with whom I spoke supported this idea. I had the opportunity to speak with
David Foster, the executive director of the Silicon Valley Math Initiative (SVMI),
Patrick Callahan, co-director of the California Math Project, and Glen Whitney
and Cindy Lawrence, executive director and chief of operations of the Museum of
Mathematics, respectively. Though they come from different aspects of math
education, they all strongly agreed that there is an immediate need to engage
students (and adults) in a more positive way with math.

One way this is already happening is with the creation of the Common
Core standards, a set of new national standards that have already been adopted in
several states, as discussed in the literature review. David Foster, the executive
director of SVMI, an initiative dedicated to improving math instruction and
student understanding, believes that the Common Core standards are a “game
changer” in math education, and will promote a deeper engagement with not just
content concepts in math, but process concepts such as problem solving and
understanding real-world applications. As such, museums may be able to help
provide richer experiences for students in the form of math laboratories, or
yearlong support to arrange math fairs or math field days at school sites. Foster
believes, “We need to get math instruction analogous to how most people believe
science is ideally taught – through inquiry, hands-on exploration and
experimentation and investigation. Math can really be understood best in the same
kinds of ways” (D. Foster, personal communication, March 8, 2011). He also
noted that soon this won’t be just a recommendation but a necessity, as required
assessments will also shift away from only multiple-choice tests and include
deeper types of problem-solving assessments. Through his work at SVMI, he has already created these kinds of assessments by contracting with the Mathematics Assessment Resource Service (MARS), and has been involved in pilot tests with these tasks as preliminary research across the country. Foster also offered the idea that museums have an immediate role to play in teacher professional development. Historically this has role has been filled by universities, where often the math departments are more concerned with higher level math research, and the education departments don’t necessarily have the pedagogical foundation to expertly train teachers in mathematics instruction. He thought that this opens the door for science and math institutions to come in and provide just the right kind of expertise (D. Foster, personal communication, March 8, 2011).

Many of these ideas were echoed by Patrick Callahan who oversees the California Math Project, another professional group dedicated to improving the quality of math instruction throughout the state. In his mind, the Common Core standards are also a marked improvement over the last round of state standards, which had “no application to the real world at all” (P. Callahan, personal communication, March 16, 2011). He added that the current standards were taken from concepts developed in the nineteenth century when it was important to be quick with calculations and operations. In the twenty-first century, those skills take a back seat to problem solving and sense-making because of technological advancements and our changed workplace. He is on a task force to organize examples of student work that show mastery of the new requirements, much of which will ask students to work through scenario-based problems. He also added
that after discussions with people directly involved with the development of these new standards and assessments, he is “happy to report that the 1,000 page math textbook is dead” (P. Callahan, personal communication, March 16, 2011).

Instead, he speculated that units of study may be available online, or workbooks will be created that do not contain pages and pages of skill practice, but will have other ways of engaging students in conceptual understanding.

Because the premise of informal learning settings is to encourage exploration and nurture curiosity, they are more in line with the kinds of practices the new standards are asking of students. Callahan pointed out that this type of collaboration should be done in ways that are respectful and supportive of teachers. Moving in such a new direction will be a struggle for many teachers, especially those who don’t have a comfort level in deeper math concepts themselves. Having respect for their difficulty and engaging them in deepening their own confidence can be a good place to start.

To this effect, the people behind the new Museum of Mathematics in New York have ideas on how engaging learners of all ages with math might be done. Glen Whitney, the museum’s executive director explained that in creating a slew of exhibits for the museum when it opens, there was a concerted effort to ensure the exhibits were as broad as possible because he sees educational standards as actually quite limiting. Knot theory, game theory, probability and finance are some of the areas he named as examples of mathematical ideas that aren’t addressed in the standards. The team focused on coming up with exhibits that engage visitors, have tactile or auditory elements, and that give visitors “aha
moments.” He discussed how research shows that when experiences affect people in a positive way, they learn better (G. Whitney, personal communication, March 15, 2011). Over time, their comfort with a particular subject could begin to shift after a series of such experiences, much in the same way Csíkszentmihály writes about “flow” (Csikszentmihalyi & Hermanson, 2004). As the Common Core standards make their way into the schools, rich math experiences such as the ones Whitney described could produce the kind of positive outcomes students need to deepen their conceptual understanding.

The research I conducted through this series of interviews and one case study shows that there is no clear solution for increasing the number of successful and sustainable museum-school partnerships. There are many elements that contribute to the development of one, and replicating a model provides its own set of challenges. Likewise, there are many external factors that determine the success of such an effort. Fortunately, there are some trends and possible directions that can be drawn out from these findings, which offer insight into how we can best move forward in strengthening and institutionalizing the museum-school relationship.
CONCLUSIONS

The findings detailed in the previous chapter revealed some significant trends that have implications for the possibility of a proliferation of museum-school partnerships. My research showed that these programs facilitate both students’ engagement with science-related topics as well as instructors’ motivation and passion for their work when done right. While the benefits of these partnerships abound, my research also illuminated the many challenges they face, especially within the context of the current educational and economic environment. To be best equipped to face these challenges, I conclude that there are several key factors that determine success, which will be discussed below.

But what does success actually mean when looking at these types of programs? It might mean something different in each one; it might even mean something different to each party involved. Fortney and Sheppard (2010) provide some guidance by explaining that, “Museum-school partnerships offer a chance to capitalize on and learn from the best teaching practices, and also become laboratories for exploring which theories have the most potential to help all students learn” (p. 28). Formal educators who reach out for stronger ties to local cultural institutions are in search of experiences to enhance student learning for which their settings may not be equipped. As such, a successful partnership from their viewpoints must be able to provide students with positive alternative learning experiences, thus improving the quality of their education. Museums on the other hand are looking for ways to strengthen their presence in a given community and foster an appreciation and awareness in their visitors for the
material they present. Reaching out to schools to provide positive learning experiences is a way to achieve these goals. If museums (science institutions in particular for the purpose of this thesis) and schools can find a way to come together to create partnerships that engage students in more meaningful ways and strengthen ties to the cultural institutions that get involved, successful programs are within reach.

How do these two institutions go about doing this? The challenge truly lies in constructing programs that interweave some essential components to ensure sustainability and consistent effectiveness in achieving their goals. Five programs were examined in-depth for this thesis: School in the Park in San Diego; Science, Literacy and Art Integration in the Twenty-first century (SLANT) and the Teacher Institute for Science and Sustainability (TISS) at Cal Academy in San Francisco; Urban Advantage in New York City; and the Education and Arts Roundtable at the Natural History Museum in Los Angeles. In these programs, the four main components that contributed most to their success were:

- Stakeholder buy-in
- Secured funding
- Teacher empowerment
- Distinct need fulfillment

As will be discussed in greater detail below, a dedicated commitment from everyone involved including support from administrators and stakeholders was an integral part of all of the successful programs I studied, and stands out as a primary part of sustainability. Secondly, funding is arguably the component at the
forefront of most people’s minds that are involved in such programs. It came up in almost every interview with both formal and museum educators as a barrier to the creation of more programs, and today’s challenging economic climate for education and cultural institutions was seen as an added hindrance. Though challenging, finding sources of money that are stable from committed funders is imperative. Thirdly, when teachers have an opportunity to feel empowered by receiving additional support for a part of their required curriculum and by being involved in its design, these programs have much a higher chance of survival than if teachers perceive them as an added responsibility without much payoff. Finally, being able to articulate a distinct need that a program can meet also enables a museum-school partnership to be direct and targeted in its scope, which often helps garner funds and develop a presence in a given community. These four components provide a robust framework with which to move forward.

**Stakeholder Buy-in**

First and foremost, having support from both school administrators and museum leaders is an essential component to a successful program. Because of the nature of these types of programs and their tendency to come and go as circumstances change, stakeholder buy-in is the one element that has to be in place from the outset for a program to have any chance at long-term survival. This aspect was visible in all of the programs I explored, and perhaps most visible in its absence in the case of the Education and Arts Roundtable. In this case, stakeholder buy-in suffered due to a change in leadership. Even though this
program was incredibly meaningful to its participants, the new vice president of education ultimately felt that a program focusing so much on arts and science integration wasn’t top priority for a natural history museum, and thus made a decision not to pursue new funding once the initial grant ran out. This example shows that a lack of stakeholder support can be damaging when it hasn’t been institutionalized.

Leadership on the school side can have the same impact. In the case of the Cal Academy programs, even though San Francisco Unified is struggling financially, the administrators feel strongly enough about the value cultural resources can add to formal education, that they place priority in maintaining these types of partnerships. Even when the district is reducing costs across the board, it is committed to seeking alternative funding and finding manageable ways to keep the city’s cultural institutions connected to its schools. In the case of Urban Advantage in New York, there is a similar sense of urban richness that holds up this partnership as well. Though the district as a whole is supportive much in the same way as San Francisco, Tina Glover, coordinator of the program’s teachers and schools, explained that at times teachers would call her office to say that they wanted to be a part of the program but that their principal did not support it; in these cases she would call principals to advocate for the program and hopefully change their minds. On the flip side, she said that other principals wouldn’t hire new middle school science teachers unless they were interested in participating in the program, which includes weekend training sessions and other added commitments (T. Glover, personal communication,
February 24, 2011). Even from this kind of inconsistency, one can begin to understand the complexity of maintaining buy-in, especially when staffs change frequently, funding amounts fluctuate and education system pressures mount. However, if viable arguments can be consistently constructed to slowly permeate the attitudes and expectations of leaders in both museums and schools, a stronger commitment to these kinds of programs may eventually be able to become more widespread and lasting.

**Secured Funding**

In much the same way buy-in is a make-or-break element, a partnership cannot exist without adequate funding. Considering the fact that both public schools and museums are facing overwhelming budgetary challenges, it is no small feat to secure funds for these types of programs. Most of the interviewees confirmed this as a central component and a major challenge. It is also evidenced by the fact that each program I looked at had its own funding structure: School in the Park has the most stable situation with its long-term private funder, Price Charities. The burgeoning programs at the California Academy of Sciences are both grant-funded, although neither had long-term grants at the time of my interviews to assure any kind of stable future. Urban Advantage is funded through public money that has to be voted for by the New York City Council each year. Finally, the Education and Arts Roundtable at the Natural History Museum in Los Angeles had a multi-year grant, and when it ended, the museum’s leadership chose not to seek renewal.
Having a long-term commitment from a funder or being able to provide funds in-house are ideal financial scenarios for a partnership. These do exist, but are very rare. As mentioned, SITP in San Diego is fortunate to have a long-term commitment from Price Charities, which is independent of San Diego Unified School District’s budget. One could argue though that if the program didn’t have such a committed funder, the program might no longer exist, given the pressures facing the district. Both participating schools are in program improvement (No Child Left Behind’s probationary status) because of their declining test scores, and the district is proposing to abandon other similar cultural programs for the 2011-2012 school year (San Diego Unified School District, 2011). In most cases though, these kinds of partnerships rely on grants, which are often short-term or year-to-year and thus make funding uncertain for the long term. In the case of Urban Advantage, the program has fortunately had its funding renewed each year by the New York City Council, but there is no guarantee for the future. Glover mentioned that even though they have been able to maintain funding, some years the program has received more money and other years they have to make immediate cuts after a new smaller budget has been passed (T. Glover, personal communication, February 24, 2011). Situations like this illuminate the fragility of these kinds of programs and the need to have some sort of more standardized funding structure in place (i.e. guaranteed federal funding for programs that meet certain criteria).
Teacher Empowerment

Another trend that proved to be an indicator of success is teacher involvement and empowerment. In many ways, teachers are the most important piece in this complex puzzle, because there is no partnership without their participation. As my interview with Lydia Johnson, Museum Studies professor at J.F.K. University, made clear: as much as they want to, museum educators cannot fully comprehend all of the pressures facing teachers today without firsthand observation or participation. This disconnect has greatly strained relationships between the two types of educators, especially as school conditions continue to change and museum educators find it increasingly challenging to make initial contact with teachers.

The highlighted programs in this thesis are all examples of cases where museums were able to make substantial connections with schools. They were able to get through to the necessary parties by creating meaningful, worthwhile ways for teachers to participate, even though this participation is structured differently in each program. In the Cal Academy programs and Urban Advantage, teachers in San Francisco Unified and New York City schools respectively choose to become involved through an application process. By setting up the programs in this way, teachers have buy-in from the start because presumably only those who are eager to participate will apply. Similar to an application process but on a much smaller scale, the Education and Arts Roundtable asked teachers to participate by invitation only. Because this program was a three-sided collaborative between the museum, arts organizations and schools, the museum first contacted the arts
organizations, who in turn brought in teachers with whom they already had relationships. This is another instance where buy-in was built in because of the selectivity of the process. Finally, School in the Park is the only program that I examined where teachers do not opt in or out, but are expected to participate; that is, all third, fourth and fifth grade classes at the two elementary schools go to School in the Park by design. This structure has proven challenging for the program’s directors in terms of figuring out ways of engaging all of the participating teachers to the same degree despite differing levels of enthusiasm. Using an application or invitation process can help ensure teachers have already bought into the idea.

Formal teacher professional development can also be an effective strategy for creating an environment in which teachers feel empowered and respected. Three out of the five programs I looked at are anchored around their professional development component: SLANT, TISS, and Urban Advantage. Teachers apply to be a part of these programs knowing that they are committing to putting in time and energy above and beyond their regular job duties, which is counterintuitive when considering the demands of their jobs. In these sessions though, not only do teachers have a chance to be reflective about their teaching methods and learn new ways to approach content, they also meet with other teachers, develop collegial relationships in their cohorts and discuss their daily successes and challenges. In a job that is inherently isolating, this can be incredibly strengthening and validating. Museums that structure their programs in this way are placing priority on developing deep relationships with teachers with the
understanding that nurturing these connections will lead to heightened local visibility and a more engaged community of learners.

The other two programs do not have formal professional development sessions as a main component. In the case of the Education and Arts Roundtable, the teachers were so intimately involved in developing the class projects though, that the whole process almost acted as professional training. They gained new skills and ideas by working closely with professional scientists, artists and other teachers on a consistent basis. In fact, participating teachers reported that their own learning throughout the process was one of the most valuable benefits of the program. They found themselves constantly reflecting on their teaching practice and took away significant lessons about fostering a classroom culture that encourages diversity and creative thinking (Stevenson, Callow, & Ono, 2009).

Due to the fact that they were all willing to become immersed in the program from the outset, these teachers were arguably the most deeply involved in their projects’ development of all of the programs studied. As explained by Stevenson, Callow, & Ono (2009), “The fact that the members created the Roundtable and its projects collaboratively and organically appealed to many of the educators involved in the group” (p. 65). This kind of structure, or lack thereof, was a unique feature of this program, and its organic process led to intensely gratifying experiences by participants. However, this same characteristic proved to be limiting when considering trying to grow the program because each project was so highly individualized.
The School in the Park program dedicates three days per year as professional development days for both the museum educators and classroom teachers. However, this time focuses mainly on familiarizing the teachers with the museum curriculum and evaluating curriculum strengths, rather than providing teachers with comprehensive integration materials or having both sides work together to create a unit from scratch. Part of the reason this component is less evolved in SITP than the other programs is because School in the Park, as the name entails, is primarily designed as a direct student experience. Out of all of the programs I studied, SITP is the one in which students spend the most time actually in museums. Linda Feldman, director of the program, explained how there are so many logistics to consider, given that each year the program serves around 800 students who spend up to eight weeks in the park at several of its museums (L. Feldman, personal communication, March 14, 2011). These logistics include ensuring that each day runs smoothly, attending to the safety and learning needs of all of the students, getting curriculum approved by the district, and evaluating the program. In addition, the district has such limited time for teacher professional development that district needs and/or other competing programs often take up this time. These constraints have made it difficult to create a robust teacher development component for SITP. As such, even though this program is successful in many ways and some teachers definitely use the program to invigorate their practice, overall, I was unable to conclude that teacher empowerment was a principal quality of this program. With some adjustments in professional development time and in educator-teacher relations, the program
could be greatly enhanced. Ultimately, if programs empower teachers and offer them substantial support and new tools, it helps ensure that they have eager participants who are willing to make a long-term investment.

**Distinct need fulfillment**

The last component that my research illuminated as important to a program’s chance for success is basing its formation on a tangible need. The fact that each program I examined sprung out of a unique set of needs and circumstances was perhaps one of the most interesting findings to come out of my research – a standard approach to these programs does not exist. Meeting an exact need is one of the most critical components for success, though it also simultaneously increases the difficulty of finding a one-size-fits-all model. This can best be seen with the example of the Urban Advantage program in New York City. The creators of the program were interested in both engaging students with science on a deeper level and increasing accessibility to local science institutions for a wider range of people. They took the required “exit project” as the basis for the program, because it is something that impacts every middle school science class in the district. As the brochure for the program explains:

UA began by assessing and responding to the science education needs of NYC middle schools. Assessment results showed a severe shortage of qualified science teachers. At the same time, a new city-wide mandate required all eighth grade students to complete long-term scientific investigations (known as “exit projects” in New York City). This provided
the program with a clear focus: eighth grade student exit projects (Urban Advantage, n.d.).

Its clear focus enabled the program to have a tangible student project from which to begin creating a variety of support strategies for teachers: rich professional development, materials for hands-on science activities in classrooms, free access to science institutions for students, teachers and families, and additional outreach to parents and families. At the end of each year, students showcase their final projects at the American Museum of Natural History where they receive medals and can act as docent to their own exhibit.

Urban Advantage is also the only program I was able to find that has exported its model to other cities. After the success of Urban Advantage NYC, a national organization was formed and over the past couple of years, programs have been established in Boston and Denver and are being developed in other cities. Glover explained what she knew of the process by saying that the new cities “had to find their partners, and figure out what their need was, what their product was going to be, and then they had to find their own funding. It’s different, and the logistics are always different” (T. Glover, personal communication, February 24, 2011). These trials speak to the fact that a focused need can be a great asset to a program’s success, but can also make it challenging to adapt the program for other places’ exact needs.

Using these four essential components of secured funding, teacher empowerment, stakeholder buy-in, and distinct need fulfillment to build programs for a greater chance at sustainability can help determine recommendations to the
field. After all, enough has been written about broadening the accessibility of museum-school partnerships. Let’s make it happen already.
RECOMMENDATIONS

Although as I stated and showed in my literature review that museum-school partnerships are not a new concept, the traditional thinking on the topic is in many ways precisely their central challenge. People have been experimenting with these types of joint learning experiences since museums were just gaining prominence in this country and our educational system was taking shape. However, decades later, these relationships still have not yet been able to get to a point where they are an accepted part of the educational experience, with best practices, consistent frameworks and ongoing program development taking place on a national level. As discussed in this thesis, the reasons for this abound, many of which stem from the fact that innovative approaches and new thinking on the subject have been slow to evolve, while the external challenges have only continued to mount.

Increasing museums’ visibility in schools to the point where teachers use them as resources in the same way they might use the library or their school-provided curriculum materials requires a mobilization of museum educators and public education advocates with a passion for the cause who are determined to ignite systemic change. Though the U.S. Department of Education has already cited “informal education and outreach” as one of its primary learning environments to attend to in its 2007 report on American academic competitiveness, I envision the momentum for this change largely starting with the people on the frontlines who know firsthand the struggles and possibilities of day-to-day realities (2007, p. 17-20). So the question becomes: How does this
mobilization gain speed and endurance? My three principal recommendations focus on making a concerted effort to strengthen communication between museums and schools, proving the value of these types of programs to important stakeholders, and using math as a core component in the development of future programs as a way to increase their relevance.

1. It Begins with Communication

As a longtime teacher, I can attest to the fact that no matter how interesting or engaging a program’s content sounds, if a teacher perceives it as more of a burden than a needed support, she will not pursue it. In revisiting Fortney and Sheppard’s statement, “What is needed now is an entirely new way of thinking” (2010, p. 37), which concerned museums’ effectiveness in reaching out to schools, this new way of thinking needs to be more aggressive than the mass dispersal of pamphlets or emails. Personal connections must be made. Establishing a regular and continued physical presence at school sites or at district meetings is an important step. Teachers and school administrators do not have enough time in their day to do nearly all that is expected of them, let alone look for outside opportunities. Because museum educators continue to express frustration with their attempts to open the lines of communication with teachers, going to schools, offering to help in the classroom and making one-on-one acquaintances with teachers can help break down these walls. Teachers are actually some of the most willing learners of all, when opportunities are made worthwhile and accessible to them.
Once initial relationships are established, deepening the connections can then best be done by offering highly engaging training and teaching materials that are practical to teachers’ needs, or by involving them in the planning of a given program from the very beginning. The teacher professional development component of a partnership should allow teachers to have a space to experiment with new teaching strategies, use materials to which they might not otherwise have access for engaging their students, and receive instructional support when needed. Having teachers apply to be a part of a program or inviting teachers who are enthusiastic about alternative learning methods can help ensure their full participation. Furthermore, if teachers are given this kind of creative space, museum staff will likely see that they are valuable resources themselves and could bring innovative ideas to help further their own work as educators, strengthening the museum’s connection to its community.

Finally, because communication between teachers and museum educators is so limited, I recommend a Web space be created where an open dialog can begin to take shape. In my preliminary research, I found so much online museum-created content for teachers, accessible through individual museum sites, which is rarely used. Most likely, it is rarely used because it requires teachers to know which museums to go to for the information they seek. Then when they find the right website, the information they are looking for may or may not be there. If teachers had a one-stop place to turn to find museum-produced content for their students, and likewise, museum staff had a forum to test out new ideas or ask for teachers’ opinions or help, these interactions could jumpstart an online
community where educators from both kinds of institutions could build relationships. This kind of centralized hub for professionals from “both sides” to interact with each other is desperately needed, since currently it is such a struggle to start a dialog. Initially, it might work to have a for-profit company like Scholastic that already has an established online presence with teachers host and fund such a site, where teachers are apt to browse already. If such a space was able to build momentum, then eventually some sort of national alliance might be able to be formed where museum educators and teachers come together on an even playing field to further the conversation about how they can help each other in the most effective ways, create best practices, and have a record of partnerships already created as reference for future programs, in order to avoid each one starting from scratch.

2. Add Stakeholder Commitment

Another clear reality that came out of my research is that because both museums and schools are struggling with so many drastic funding issues, money is only there for essential programs. In order to get funders interested in museum-school partnerships, people in leadership positions must view them as an invaluable necessity.

One recommendation that could improve administrator buy-in is to tie a program’s funding or lifespan to formal evaluation results. For example, if a program can show evidence of positive learning outcomes in the form of higher test scores or other quantitative measures of success, the district, state, or other
governing body could set aside funding for the program to continue. This concept is challenging however, because it is where I see the biggest disconnect between the worlds of formal and informal education. Schools are looking for immediate, measurable learning outcomes from their students, not because they believe these are the best measure of student learning, but because these outcomes such as higher test scores are what lead to federal funding. Museums measure these programs in a more abstract way, and the people I spoke with are more concerned with building long-term connections to develop a more informed society than with needing evidence of individual students’ learning success.

More research is needed into evaluation methods that could prove useful to both museums and schools. If a team of formal education assessment experts and museum evaluation experts could work together to develop a system that standardized evaluative practices for partnership programs and made them immediately useful to both schools and museums, the proof of these programs’ value would be impossible to ignore. Aligning their goals, or at least making them compatible, is a key step. I envision this involving conducting a series of studies that would isolate exactly what is important for museums and schools to learn about this type of experience to best help their bottom line, coming up with practical methods to measure these outcomes (both academic and affective), and standardizing these methods in a way that would work for the majority of museum-school partnerships.
3. Balance the Equation with Math

Basing new programs around a national educational need is the third principal strategy that will help these kinds of programs become more prevalent. Truly, if a real and immediate need can be filled by the existence of such programs, funding, planning and collaboration will likely follow, helping to resolve some of the other most challenging hurdles. Because a primary focus of most public schools today is math, organizing such programs around math-related content could play a role in broadening their reach. The reasons for this abound: there is no record of such partnerships rising to any prominence, math curriculum demands are changing in the public school arena with a trend towards more problem-solving based instruction, schools have a precise need to improve math instruction and student performance, and finally, math – no matter how much things change – will always be part of the core curriculum. Because there is such a demand for evidence to prove any form of instruction is effective, programs that directly relate to improving required elements of school (i.e. standardized tests) will naturally be seen as more valuable than those that are only indirectly related to core concepts. Even though science is an extremely important part of a child’s education, it is not tested at every grade level in most states, and thus is getting pushed out of the curriculum, especially in elementary schools (McMurrer, 2008). Math however, is a targeted subject, and with new forms of assessment coming soon, finding deeper integrative instructional methods is going to become even more of a challenge.
The people I interviewed who were involved in math curriculum, instruction, or museum content agreed that this seems to be the perfect time for more hands-on, concept-based programs to be developed, and that museums could play a large role in increasing teachers’ comfort level with new forms of instruction. My principal recommendation for science museums interested in developing long-term programs for elementary school students is to create programs that align themselves with the new Common Core math process standards that are consistent across the grade levels. As the California State Board of Education (2010) outlines, they propose that mathematically proficient students should be able to, among others, “make sense of problems and persevere in solving them, reason abstractly and quantitatively, construct viable arguments and critique the reasoning of others, and model with mathematics.” (See Appendix A for the full list.) These standards set the stage for mathematics instruction to be shifted away from repetitive drills and formula practice to deeper kinds of problem solving and reasoning. Eventually, when standard assessments start testing these skills, which is largely expected to follow the full adoption of these new standards, it will be essential for students to have authentic experiences with math. This necessity was voiced clearly from the math curriculum experts I spoke to, in particular when Patrick Callahan declared that the “1,000 page math textbook is dead,” and when David Foster offered his opinion that these standards, “place more emphasis on doing mathematics. This will require teachers to teach math differently than the traditional algorhythmic ways” (P. Callahan, personal

The majority of people who do not consider themselves “good at math” were most likely not given any choice or control over what concepts they wanted to explore as a student. If we now know that when people construct their own meaning and are intrinsically motivated, they achieve a deeper understanding of the material at hand, then:

One could hypothesize that when meaning-making occurs in a free-choice setting like a museum, a setting in which learners have significant choice and control over their decision-making and experiences, they should exhibit greater interest, motivation, self esteem, attribution, and locus of control. In sum, when all of these things are positive the result should be enhanced memory formation. In the few cases where this has been investigated, this is exactly what has been found (Falk, 2010, p. 143).

Free choice and control are two elements of informal learning that are not often found in classrooms, that elevate engagement and make it possible for people to understand concepts they have chosen to explore. Being highly engaged and achieving a deeper understanding of mathematical concepts is precisely what a majority of American students are struggling with in the formal educational setting. Making a case for the value of informal learning, in which students investigate to make their own discoveries using a range of learning modalities, can help change attitudes of school administrators who are focused on test preparation and skills acquisition.
Communication + Commitment + Math = Successful Partnerships

Taking these broad recommendations into account and creating integrative, hands-on math programs that bridge the realms of formal and informal learning could be quite powerful. What would this look like exactly? As Boaler (2009) says, “It is about providing settings in which children’s own mathematical ideas and questions can emerge and in which children’s mathematical thinking is validated and encouraged. Fortunately, mathematics is a subject that is ideally suited to the provision of interesting settings that can encourage this” (p. 176). She goes on to advocate for parents to expose their children to as many different types of these settings as possible, because they are not the norm in classrooms. These settings can be anything from building blocks to puzzles to almost “anything else that involves moving objects around, fitting objects together, or rotating objects” (p. 177).

One of the few examples I found of a museum spotlighting math was the Geometry Playground exhibit organized by the Exploratorium in San Francisco that was on display in 2010. In a news article describing the exhibit, a journalist wrote, “I hate math, but the exhibit…seems to have the power to make me think about geometry without that irritating urge to put my head on my desk and sleep that math tends to compel in the less numerically inclined among us” (Donahue, 2010). The exhibit provided an array of the kinds of math settings that Boaler described where people had opportunities to build sculptures out of geometric figures, climb on dodecahedrons, or find patterns in geometric designs.

Additionally, the traveling exhibition Math Midway created by Glen Whitney, the
director of the soon-to-open Museum of Mathematics in New York has already won wide acclaim for the interest it has piqued in students of all ages, and has seen higher turn-out than anyone expected at all of its locations to date (C. Lawrence, personal communication, March 15, 2011). In this exhibit, visitors can have fun with square wheel tricycles, life-sized building blocks, and unique drawing instruments, more of these essential math experiences.

These two examples provide evidence that there is a palpable need for the creation and dispersal of experiences in which people willingly engage on a deeper level with math. There is also a general acknowledgement among education policy-makers that the U.S. has fallen behind other countries in math achievement. These realities set the stage for museum-school partnerships focused on math to have a real chance at garnering long-term financial support; empowering teachers to use new, more powerful strategies for engaging their students with math; being embraced by stakeholders as an effective tool to enhance learning outcomes; and meeting a need acknowledged by parents and politicians alike. If time and care go into developing programs of this nature in such a way that all four components for success are incorporated, then we may finally be able to balance this complex equation and allow museum-school partnerships to gain momentum in becoming an accepted part of the American educational landscape.
PRODUCT DESCRIPTION

Through the process of completing this thesis project, I feel I’ve gained some valuable insights into how we can best move forward to bring museum-school partnerships to the forefront of the current educational reform movement. In order to share my findings and recommendations with both the formal and informal educational communities at large, I will write an article for distribution through a CAM conference session (see below) as well as in NEA Today, the National Education Association (NEA) bimonthly publication. This article will stand as a “call to arms” for educators to unite in support of these programs. In the article, I will present three main recommendations as necessary actions for museums to put in place: strengthening communication with schools, proving these programs’ worth to stakeholders through more practical and consistent evaluation methods, and developing long-term programs with math content at their core. I will break each one down into practical, approachable steps that should be relatively simple for museums to enact, and voice my strong opinions as a long-time classroom teacher that it is the responsibility of all educators to take up this cause.

I will also propose a session at the 2012 California Association of Museums conference in Berkeley, California, alongside JFKU professor Lydia Johnson, to present this same core information and distribute the article, in a forum that will allow for immediate discussion to take place, in which participants will leave with concrete, approachable tasks they can take back to their institutions to begin this challenging but necessary work.
REFERENCES


museum (pp. 131-133). London: Routledge.


Mathematics | Standards for Mathematical Practice

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students. These practices rest on important "processes and proficiencies" with longstanding importance in mathematics education. The first of these are the NCTM process standards of problem solving, reasoning and proof, communication, representation, and connections. The second are the strands of mathematical proficiency specified in the National Research Council’s report Adding It Up: adaptive reasoning, strategic competence, conceptual understanding (comprehension of mathematical concepts, operations and relations), procedural fluency (skill in carrying out procedures flexibly, accurately, efficiently and appropriately), and productive disposition (habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one’s own efficacy).

1 Make sense of problems and persevere in solving them.
Mathematically proficient students start by explaining to themselves the meaning of a problem and looking for entry points. They analyze givens, constraints, relationships, and goals. They make conjectures about the form and meaning of the solution and plan a solution pathway rather than simply jumping into a solution attempt. They consider analogous problems, and try special cases and simpler forms of the original problem in order to gain insight into its solution. They monitor and evaluate their progress and change course if necessary. Older students might, depending on the context of the problem, transform algebraic expressions or change the viewing window on their graphing calculator to get the information they need. Mathematically proficient students can explain correspondences between equations, verbal descriptions, tables, and graphs or draw diagrams of important features and relationships, graph data, and search for regularity or trends. Younger students might rely on using concrete objects or pictures to help conceptualize and solve a problem. Mathematically proficient students check their answers to problems using a different method, and they continually ask themselves, "Does this make sense?" They can understand the approaches of others to solving complex problems and identify correspondences between different approaches.

2 Reason abstractly and quantitatively.
Mathematically proficient students make sense of quantities and their relationships in problem situations. They bring two complementary abilities to bear on problems involving quantitative relationships: the ability to decontextualize—to abstract a given situation and represent it symbolically and manipulate the referring symbols as if they have a life of their own, without necessarily attending to their referents—and the ability to contextualize, to pause as needed during the manipulation process in order to probe into the referents for the symbols involved. Quantitative reasoning entails habits of creating a coherent representation of the problem at hand; considering the units involved; attending to the meaning of quantities, not just how to compute them; and knowing and flexibly using different properties of operations and objects.

3 Construct viable arguments and critique the reasoning of others.
Mathematically proficient students understand and use stated assumptions, definitions, and previously established results in constructing arguments. They make conjectures and build a logical progression of statements to explore the truth of their conjectures. They are able to analyze situations by breaking them into cases, and can recognize and use counterexamples. They justify their conclusions, communicate them to others, and respond to the arguments of others. They reason inductively about data, making plausible arguments that take into account the context from which the data arose. Mathematically proficient students are also able to compare the effectiveness of two plausible arguments, distinguish correct logic or reasoning from that which is flawed, and—if there is a flaw in an argument—explain what it is. Elementary students can construct arguments using concrete referents such as objects, drawings, diagrams, and actions. Such arguments can make sense and be correct, even though they are not generalized or made formal until later grades. Later, students learn to determine domains to which an argument applies. Students at all grades can listen or read the arguments of others, decide whether they make sense, and ask useful questions to clarify or improve the arguments.

4 Model with mathematics.
Mathematically proficient students can apply the mathematics they know to solve problems arising in everyday life, society, and the workplace. In early grades, this might be as simple as writing an addition equation to describe a situation. In middle grades, a student might apply proportional reasoning to plan a school event or analyze a problem in the community. By high school, a student might use geometry to
solve a design problem or use a function to describe how one quantity of interest depends on another. Mathematically proficient students who can apply what they know are comfortable making assumptions and approximations to simplify a complicated situation, realizing that these may need revision later. They are able to identify important quantities in a practical situation and map their relationships using such tools as diagrams, two-way tables, graphs, flowcharts and formulas. They can analyze those relationships mathematically to draw conclusions. They routinely interpret their mathematical results in the context of the situation and reflect on whether the results make sense, possibly improving the model if it has not served its purpose.

5 Use appropriate tools strategically.
Mathematically proficient students consider the available tools when solving a mathematical problem. These tools might include pencil and paper, concrete models, a ruler, a protractor, a calculator, a spreadsheet, a computer algebra system, a statistical package, or dynamic geometry software. Proficient students are sufficiently familiar with tools appropriate for their grade or course to make sound decisions about when each of these tools might be helpful, recognizing both the insight to be gained and their limitations. For example, mathematically proficient high school students analyze graphs of functions and solutions generated using a graphing calculator. They detect possible errors by strategically using estimation and other mathematical knowledge. When making mathematical models, they know that technology can enable them to visualize the results of varying assumptions, explore consequences, and compare predictions with data. Mathematically proficient students at various grade levels are able to identify relevant external mathematical resources, such as digital content located on a website, and use them to pose or solve problems. They are able to use technological tools to explore and deepen their understanding of concepts.

6 Attend to precision.
Mathematically proficient students try to communicate precisely to others. They try to use clear definitions in discussion with others and in their own reasoning. They state the meaning of the symbols they choose, including using the equal sign consistently and appropriately. They are careful about specifying units of measure, and labeling axes to clarify the correspondence with quantities in a problem. They calculate accurately and efficiently, express numerical answers with a degree of precision appropriate for the problem context. In the elementary grades, students give carefully formulated explanations to each other. By the time they reach high school they have learned to examine claims and make explicit use of definitions.

7 Look for and make use of structure.
Mathematically proficient students look closely to discern a pattern or structure. Young students, for example, might notice that three and seven more is the same amount as seven and three more, or they may sort a collection of shapes according to how many sides the shapes have. Later, students will see \(7 \times 8\) equals the well-remembered \(7 \times 5 + 7 \times 3\), in preparation for learning about the distributive property. In the expression \(x^2 + 9x + 14\), older students can see the 14 as \(2 \times 7\) and the 9 as \(2 + 7\). They recognize the significance of an existing line in a geometric figure and can use the strategy of drawing an auxiliary line for solving problems. They also can step back for an overview and shift perspective. They can see complicated things, such as some algebraic expressions, as single objects or as being composed of several objects. For example, they can see \(5 - 3(x - y)^2\) as 5 minus a positive number times a square and use that to realize that its value cannot be more than 5 for any real numbers \(x\) and \(y\).

8 Look for and express regularity in repeated reasoning.
Mathematically proficient students notice if calculations are repeated, and look both for general methods and for shortcuts. Upper elementary students might notice when dividing 25 by 11 that they are repeating the same calculations over and over again, and conclude they have a repeating decimal. By paying attention to the calculation of slope as they repeatedly check whether points are on the line through \((1, 2)\) with slope 3, middle school students might abstract the equation \((y - 2)/(x - 1) = 3\). Noticing the regularity in the way terms cancel when expanding \((x - 1)(x + 1)\), \((x - 1)(x^2 + x + 1)\), and \((x - 1)(x^3 + x^2 + x + 1)\) might lead them to the general formula for the sum of a geometric series. As they work to solve a problem, mathematically proficient students maintain oversight of the process, while attending to the details. They continually evaluate the reasonableness of their intermediate results.

Connecting the Standards for Mathematical Practice to the Standards for Mathematical Content
The Standards for Mathematical Practice describe ways in which developing student practitioners of the discipline of mathematics increasingly ought to engage with the subject matter as they grow in mathematical maturity and expertise throughout the elementary, middle and high school years. Designers of curricula, assessments, and professional development should all attend to the need to connect the mathematical practices to mathematical content in mathematics instruction. The Standards for Mathematical Content are a balanced combination of procedure and understanding. Expectations that begin with the word “understand” are often especially good opportunities to connect the practices to the content. Students who lack understanding of a topic may rely on procedures too heavily. Without a flexible base from which to work, they may be less likely to consider analogous problems,
represent problems coherently, justify conclusions, apply the mathematics to practical situations, use technology mindfully to work with the mathematics, explain the mathematics accurately to other students, step back for an overview, or deviate from a known procedure to find a shortcut. In short, a lack of understanding effectively prevents a student from engaging in the mathematical practices.

In this respect, those content standards which set an expectation of understanding are potential “points of intersection” between the Standards for Mathematical Content and the Standards for Mathematical Practice. These points of intersection are intended to be weighted toward central and generative concepts in the school mathematics curriculum that most merit the time, resources, innovative energies, and focus necessary to qualitatively improve the curriculum, instruction, assessment, professional development, and student achievement in mathematics.

Updated 10/18/10 2
APPENDIX B
Interviewees, in Chronological Order

1. Helena Carmena, in person
   Senior Manager of Teacher Education
   California Academy of Sciences
   February 16, 2011

2. Tina Glover, in person
   Coordinator of Urban Advantage Teachers and Schools
   American Museum of Natural History
   February 24, 2011

3. Lydia Johnson, in person
   JFKU Professor
   March 2, 2011

4. David Foster, phone
   Executive Director
   Silicon Valley Math Initiative
   March 8, 2011

5. Linda Feldman, in person
   Director
   School in the Park
   March 14, 2011

6. Roberta Dawson, in person
   School in the Park
   Fourth Grade Teacher
   Rosa Parks Elementary School

7. Glen Whitney, Executive Director &
   Cindy Lawrence, Chief of Operations, phone
   Museum of Math
   March 15, 2011

8. Grahme Smith, phone
   Manager of the Teacher Institute on Science and Sustainability
   California Academy of Sciences
   March 15, 2011

9. Chris Parsons, phone
   Principal, Word Craft
   Independent Evaluator for Monterey Bay Aquarium Programs
   March 16, 2011
10. Patrick Callahan, phone
   Co-Director
   California Mathematics Project
   March 16, 2011

11. Bronwyn Bevan, in person
    Director, Center for Informal Learning and Schools
    Exploratorium
    March 16, 2011

12. Shirley Lee, Research and Evaluation Specialist &
    Risa Wolfson, Math Coach at the Center for Mathematics Excellence and
    Equity, in person
    Lawrence Hall of Science
    March 17, 2011

13. Adrienne Lee, phone
    Education and Arts Roundtable
    Natural History Museum of Los Angeles County
    March 17, 2011
APPENDIX C
Interview Questions

For Museum Educators

1. Please describe the program with which you are involved, including how long it’s been around, and its targeted audience.

2. How is it funded? (Depending how thorough the answer) Is the funding secured up to a certain date? Are there plans in place for after that?

3. Is the program evaluated? (If yes) How is it evaluated?

4. In your opinion what are the qualities of this program that make it successful?

5. In what ways are classroom teachers involved with the program? Were they involved in the design of the program at all?

6. Do you receive any support from school administrators? If so, what kind?

7. What are some of the greatest challenges the program faces?

8. How do you think the program could be even more successful?

9. My thesis is really looking at how these kinds of programs can be more widespread in our school system. What do you see as barriers to getting more programs of this nature into schools?

10. Is there anything else you’d like me to know?
For Math Curriculum Interviewees

1. What do you feel are the greatest challenges for math educators today?

2. How do you see math education changing over the next few years, both from the government and in instructional trends?

3. What do you know about the new Common Core standards?

4. Do you see a role for informal learning (students deciding what they want to learn, hands-on, more real world experiences in problem-solving, etc.) in the classroom?

5. Could you see museums playing some role in getting students to access these kinds of experiences?

6. What would your ideal math class for elementary school students look like?

7. Is there anything else you’d like me to know?
Call for Proposals Submittal Form

Proposer (You)
Name: Alyssa Freedman
Title: Museum Studies Graduate and Elementary School Teacher
Organization: JFK University

Email Address: alyssfreedman@gmail.com

Mailing Address
Address:
City:
State:
Zip Code:

Phone Number:

The Program Committee is interested in assembling a conference program that features a wide range of subjects and entry points for learners at multiple levels.

Type of Proposal
☑ Panel (90 minutes)
☑ Dialogue (90 minutes)
☑ Lunchtime Learning Opportunity (60 minutes)
☑ 1/2 Day Workshop
☑ Full Day Workshop
☑ Other (please specify format suggestion below)

Tentative Title for Proposed Session/Workshop:
Schoolteachers’ Confessions: What We Really Want from Museum Programs

Description of Proposed Program (please limit length to 70 words or less)
Certified teachers and museum educators will discuss ways in which the traditional model for collaboration is outdated, and then invite the audience to explore innovative approaches to updating the model. We’ll focus on involving parents, using core content, and empowering teachers. We’ll finish with a call to action and invite participants to join a team to experiment with solutions. A session to report findings and share experiences will be proposed for CAM 2013.
Description of Interactive Components (i.e. how will you involve the participants)

- 20-30 minutes of Q&A/Dialogue
- 30+ minutes of Q&A/Dialogue
- Activity (briefly describe below)
- Other (briefly describe below)

After a conversation with the panel we will break out into smaller groups around the two core curricular content areas: math and language arts in which we will share classroom curriculum resources that teachers use, discuss strategies for involving parents, and develop an action team for guidance/implementation in 2012-2013.

This program is applicable to the following areas of museum work:

- administration
- collections
- education/interpretation
- exhibitions

A list of presenters, although not required, assists the Program Committee in fully evaluating each proposal. Proposals from vendors and consultants must involve working museum professionals as well, preferably as presenters.

Proposed Moderator
Name: Lydia Johnson
Title: Museum Studies Professor and CA certified classroom teacher (K-8 and GATE)
Organization: JFK University

Proposed Presenter #1
Name: Alyssa Freedman
Title: CA certified classroom teacher (K-8) and MA, Museum Studies
Organization: Pacifica School District

Proposed Presenter #2
Name: Ivy Young
Title: CA certified classroom teacher (K-8) and MA/MBA Museum Studies (pending)
Organization: JFK University

Proposed Presenter #3
Name: Cristina Trecha
Title: Director of the Fleet Institute for Inquiry
Organization: Reuben H. Fleet Science Center
Please indicate if the moderator and presenters listed above are confirmed, in process, or only proposed at this point.

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Please briefly describe why these speakers are the appropriate individuals to participate in this session.

The panel consists of an equal balance of museum educators and California certified classroom teachers, with over 15 years of combined teaching experience. Each participant has had direct experience working in both museum education and in schools, which will allow the discussion to be informed from both sides. They also have a variety of teaching experience in ethnically diverse schools with a wide range of students.

Please briefly describe the diversity within your panel. Do your panelists represent a variety of museum disciplines, sizes, and geographic regions? What is the race/ethnicity of your panelists? Is there a range of ages and genders? Please include anything you think will help strengthen your proposal.

This panel is diverse in experience, from university professor to classroom teachers to museum educators. They are from both northern and southern California, and represent a museum studies department, a small science museum and public education. Our panelists have past experience working in history, art, natural history, science, and archaeology museums, as well as in most grades in K-8 schools with diverse ethnic populations, ELL students and GATE programming.

Do you have any other comments you would like to share with the Program Committee?

I feel very passionately that this discussion needs to be taken to a deeper level than I’ve seen at other conferences. I have spent the past year on my graduate thesis on this topic, particularly looking at how math might be the key to strengthening such partnerships. Currently if schools haven’t cut field trip budgets altogether, teachers are too focused on reaching testing benchmarks to seek out enriching learning experiences beyond the classroom. As such, museum educators are struggling to make significant connections with schools. The Department of Education has recognized the urgency to shift this country’s declining academic competitiveness, and has published new Common Core Standards in 2010 that
many states including California have already adopted. These new standards have the potential to drastically reform mathematics and language arts instruction in this country, moving towards more exploratory, inquiry-based methods that involve deep thinking and divergent explanations. The kinds of learning experiences museums can offer students are precisely the kind of practice they will need, where students use skills of investigation and inquiry to make discoveries, and have opportunities to use a range of learning modalities to explore real-world situations. This push for sweeping education reform coupled with the momentum for visitor-driven, participatory content in museums makes the two entities riper for profound collaboration than ever before. In this way, museums have a chance to contribute to the transformation of the American classroom. So let’s get started.

Please feel free to contact Sarah Post, Program Coordinator, at 831/471-9970 or admin@calmuseums.org if you have any questions or comments.

**Submittal Instructions:**

When you are ready to submit your proposal, go to [www.calmuseums.org/callforproposals2012](http://www.calmuseums.org/callforproposals2012) and copy your responses into the online submittal form. **Please do not submit this form.**