LESSONS LEARNED FROM THE LONG-TERM INVESTMENT IN THE TEAMS COLLABORATIVE

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Table of Contents

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INTRODUCTION

Over the course of three rounds of consecutive funding, the National Science Foundation (NSF) invested in the Traveling Exhibits at Museums of Science (TEAMS) collaborative. Since 1996, the TEAMS collaborative museums have developed traveling exhibitions and related education materials to circulate through each other's museums, and then more broadly to the larger field of science museums. Inverness Research[1] has served as the external evaluator on the TEAMS project for all three rounds of NSF funding.

It is rare that the National Science Foundation provides funding to the same group over such an extended period of time. As the final round of funding comes to an end, we thought it important to share our perspective on the value of this investment. In this report, we will document the theory of action of the project – the rationale for the investment in and design of the project. In addition, we will summarize what we see as the return on NSF's investment, for these individual museums, their staff and visitors, and for the larger field of informal science education institutions. Finally, we will share the larger lessons learned from this long-term collaborative.

For a more detailed summary of the findings from the third round of NSF funding, please see "TEAMS III Summative Report." In addition, for a more detailed description of the collaborative, its processes and evaluation findings, we strongly encourage readers to review reports from the first rounds of funding.[2]

[1] For more information about Inverness Research, please see our website at www.inverness-research.org.
[2] See Traveling Exhibits at Museums of Science (TEAMS): A Summative Evaluation Report, April 2005, and Teaming Up: Ten Years of the TEAMS Exhibition Collaborative, October 2005. Both reports are available at http://www.inverness-research.org and http://www.informalscience.org.

THE THEORY OF ACTION

Over the years it has been difficult for smaller to mid-sized museums to apply for and obtain National Science Foundation grants. They simply don't have the capacity to compete with larger museums for major NSF grants, nor do they have the visitorship to justify a major investment of NSF funds. It was believed, and NSF encouraged, that these smaller museums consider applying for funding as collaboratives – that by working together, they could draw on each other's capacity, leverage resources, and create a much larger return on investment. In addition, NSF wanted to increase its reach to small and mid-sized markets, and funding a collaborative of museums in these markets was viewed as a cost-effective strategy for reaching beyond the major markets and larger cities.

The main premise behind the TEAMS collaborative stemmed from a lack of high-quality, affordable, small-sized traveling exhibitions available for rent. Smaller museums looking to add traveling exhibitions to their museums for short-term runs found very few available. It was reasoned that a group of small museums working together could design and build exhibitions that were well-suited to their needs, and that likely, these same exhibitions would fill a need at other small to mid-size museums as well.

In addition, by working together, the museums could leverage resources that would help build the capacity of their staffs and institutions. For example, while it may not be cost-effective or feasible for a small museum to bring in outside consultants to train staff in formative evaluation or in how to design family-friendly exhibits, it is practical for a group of museums to do so.

Another premise behind the TEAMS collaborative in the last two rounds of funding was that regional partnerships within the larger collaborative would allow for the more experienced museums to mentor and share expertise with other

museums in their regions. Thus, the final two rounds of funding involved three of the four museums "partnering" with three nearby museums who then worked together to create one traveling exhibition.

A key design decision of the TEAMS collaborative was having a focal point for the work for each round of funding. It was reasoned that the focal point would provide an area around which TEAMS staff could learn from outside experts, experiment with design ideas through the development of exhibitions and programs, and share what they learned with one another. In the first round of funding, the focal point was family learning and to some extent, formative evaluation of exhibits. In the second round of funding, the focal point was universal design and accessibility. In the third round, the focus was on designing exhibits that better promote conversations about science among children and their accompanying adults.

Through all of this investment, the participating museums would benefit from increased staff capacity and their ability to leverage the National Science Foundation funds. In addition, their visitors would benefit from having new exhibits to interact with and learn from. The field would benefit from having new leaders developed through the collaborative work who could share their expertise with the field, and through the infusion of high-quality traveling exhibitions and programs.

THE RETURN ON THE INVESTMENT IN THE TEAMS COLLABORATIVE

From our perspective as external evaluators, we have found the TEAMS project to be highly successful, and a project that has provided multiple and long-term returns on the National Science Foundation's investment. The 13 different traveling exhibitions and their related education programs represent one obvious return. Ten of these exhibitions are still traveling, serving the visitors of small museums across the country.

In addition, over the years, we have seen significant increases in the stability, capacity and leadership of staff at participating TEAMS institutions. At the beginning of the first round of TEAMS, many of these museums had not built an exhibition before, and none had built a traveling exhibition. Staff members at these institutions have learned much from their experiences building traveling exhibitions, from their peers in the collaborative, and from the professional development the project provided to them. All of this learning is reflected in the exhibitions and programs created through this project, but also in the day-to-day work these staff members do at their institutions. In addition, all of the institutions have evolved in positive ways, in part because of their ability to leverage the TEAMS NSF resources.

None of these institutions will go about business in the same way since their participation in the TEAMS collaborative. From thinking about family learning, accessibility and conversations, to building exhibits, to engaging in formal prototyping processes, these staff members have changed, and their institutions have changed as well.

Exhibitions and Education Programs

As we mentioned earlier, there is a dearth of affordable traveling exhibitions designed to fit well into small museum spaces. The TEAMS collaborative

created 13 different traveling exhibitions, eight of which have a second copy traveling as well. Thus, the TEAMS collaborative has infused the field with 21 traveling exhibitions, built by and tailored for small to mid-sized museums.

The exhibitions have proven to be durable. Three of the exhibitions created in the first round of funding – Ithaca's *Fun 2, 3, 4* Rockford's *Amusement Park Science*, and Montshire's *AirPlay* – are still traveling. In addition to traveling to the seven participating TEAMS collaborative members, the TEAMS exhibitions have traveled to over 60 museums in the United States and Canada, and millions of visitors have interacted with these exhibitions.[3]

More importantly, we saw significant improvements in the quality of the exhibitions over the course of three rounds of funding. Through the professional development provided by the project, feedback from their colleagues, feedback from visitors through formative evaluation efforts, and staff reflection on their work, the exhibitions progressed in quality. In general, these exhibitions are appealing to a wide range of ages and provide engaging, inquiry-based and in-depth experiences for visitors.

In fact, our summative evaluations of the four exhibitions developed in this round of funding were positive overall. All are highly representative of the philosophies and goals of the institutions that created them and also reflective of the collective learning and work of the collaborative.

Vignettes of Exhibit Usage

To illustrate the richness in experience available to visitors in this round of exhibitions, we include here vignettes of exhibit usage from our summative site visits to each of the Round 3 exhibitions.

[3] Extrapolated from data on TEAMS members' websites and ASTC.

Vignette from Montshire's Toys Exhibition: Grandma, grandpa, mom, dad, 5 year old boy and toddler girl at the Pulley table

The Pulley Table exhibit consists of table tops at two heights at which visitors can experiment with a variety of pulleys. There are single and stacked pulleys, and pulleys of various sizes which visitors can connect using elastic bands and then turn.

This vignette demonstrates a family interaction at a fairly open-ended exhibit. It demonstrates the depth of experience and conversations families can have at this exhibit. It also demonstrates the connections visitors were routinely making between components in this exhibition.

> *The boy approaches the exhibit first and immediately starts to remove rubber bands and move pulleys around. Grandma tells him he should read the label, but the boy ignores her. The mom and rest of the family join them. Mom: "What's this? It's like the gear table over there, isn't it." The mom and boy begin working on their own individual experiments – the mom is trying to hook pulleys together to make one of the pattern pulleys spin, and the boy is trying to hook a rubber band diagonally from the lower table to the upper table. Mom: "This is cool. Look what this does to this pattern." Boy: "I know." Boy: "Mommy, wait. I got an idea! Connect these before the other one!" Now the mom, grandma and boy are all working together trying to connect up a series of pattern pulleys on the top table to get them all to spin. Mom: "I am trying to get see how far away I can put a pulley and make it spin fast. Ok, we've connected that one to that one. It seems like it has to do with whether the rubber band is stretchy or not." They trade out rubber bands. They all work on the boy's experiment of connecting the pulleys at an angle. The boy then returns to the top table. Boy: "These two go really fast! I know the science! I have a prediction! These go really fast but those go slower. Those are different*

sets on the top!" Mom reads the label aloud: "To turn something slowly, use a small pulley to turn a bigger one. To turn something fast, use a big pulley to turn a smaller one. Remember the gears on the other side of the room? The big gear to little gear? I wonder if it is the same concept?"

Vignette from the From Here to There exhibition: Mom and two year old son at the Feel the Friction exhibit

This exhibit consists of three connected bins set up like spokes. One bin contains a car and a bumpy dirt road to run it on; another a train track and train car; and the third contains water and a boat. Visitors can experiment with how the different vehicles and surfaces interact.

This vignette demonstrates experimentation by a two year old with the phenomenon of friction at this exhibit.

A two and a half year old boy and his mom came to this exhibit and spent about 15 minutes playing with it. The mom pulled up a stool a small distance away and let her son explore. He started with the train, pushing the train car back and forth. Then he noticed the handles on the tops of the weights. He picked up the weight from the train, then the weight from the dirt car and held them and looked at them. He then put the weights back on the cars and pushed first the train, and then the dirt car. Then he moved to the boat and pushed it back and forth. He added a weight to the boat and attempted to push it, then moved the weight back to the train. Then he came back to between the dirt and train sections. He pushed them both on their own again, then picked up the train car and put it in with the dirt car and pushed them both on the dirt. Then he picked the cars up and put them both on the train track and pushed them both on the track. He then placed the boat on the track with the other two and pushed on all three. He moved the boat back to the water and tried to put the train

car in the water; his mom intervened and told him those cars needed to be kept dry. At one point when the two cars were on the train track, the mom said: "Look, it's bumpy. Bump, bump, bump." He repeated all of these activities at least twice and sometimes three times. When an older boy approached the dirt car at one point, he raced over and put his hand on the weight and the older boy moved on. The boy continued to experiment until his mom said: "Let's go look at a new one" and they moved on.

Vignette from the Get the Message exhibition: a mom and two seven year old girls at the Crane exhibit

This exhibit consists of a large crane. The crane operator cannot see over a barricade the two places (a bin on one side and truck on the other) in which to place the load that is attached to the crane. Visitors work together, with one person out front directing the crane operator through hand signals of where and how to move the load.

This vignette demonstrates family usage of this popular component. It demonstrates how the family worked and communicated together to be successful.

A mom with two seven year old girls use this exhibit. The girls start using it on their own at first while mom finishes looking at another exhibit. One girl enters the cab and calls her friend over. As she looks for the load, she asks, "Where is it?" One girl runs around the front, finds it, then comes back. "It is right over there!" Both inside the cab, they work together to raise the load. "Watch out!" They laugh. Mom approaches, sees the labels on the front, and directs the girls to "put the load in the red box." The first girl asks, "Where's the red box?" Mom points to it and uses her hand to gesture the girls to move the load further to their left. Then she points down and the girls lower the load into the box. Mom scoots the box with her foot so it is a perfect fit. The

second girl says, "Let's go see!" They race around the front, take a quick look, then run back into the cab. Mom makes the lift gesture with her hand, and the girls raise the load. Mom gestures to them to move the load to their right, toward the truck. As the load moves, Mom moves with it. The girls tell her to move to the side. At the truck, Mom gestures to the girls to lower the load, then makes the "stop" gesture when it is down. As they lower the load into the truck, one girl says, "going down into the blue truck! Let's go see!" Once again, they run around to check out how they have done. Then it is back to the cab to raise the load again. Mom points to their left again and one of the girls runs out to join mom in the signaling department. As the mom and girl give directions through hand signals, the other girl moves the load and lowers it into the red box. Then it is back to the truck, with the mom and girl giving hand signals. After they get it into the back of the truck, the one girl raises the load and puts it down on top of the cab of the truck. They all laugh. The girl raises the load, the mom signals stop and points to the right. The girl lowers it into the back of the truck again and they all leave to let other kids have their turn.

Vignette of Spin exhibition: A four year old girl, her six year old sister, and their dad at the Racing Rollers exhibit

The Racing Rollers exhibit consists of parallel tracks with wheels on them. The track sections are of varying widths and correspond to different widths of wheel sizes on the wheels. Visitors can experiment with different track set-ups the relationship between the width of the track and the size of the wheels.

This vignette demonstrates a family interaction and experimentation at Racing Rollers.

A four year old girl and her six year old sister used this exhibit with their dad. The four year old begins using this by herself at first, rolling one of

the rollers up the track, pushing it up as high as she could and letting go. She does this again as her dad approaches and says, "Watch your fingers!" She rolls both wheels up and lets them go. Dad says, "Why do you think that it goes so much slower on this part?" The girl says, "Because I am doing this!" and she shows him how hard she is pushing off on one of the rollers. The dad says, "Try doing that on this side and see if it does the same thing." The six year old joins them at this point, asking, "Want to do them at the same time to see which one goes the farthest?" The dad reads the label to himself while the girls launch the rollers. Dad says, "Look at which wheel is touching the track there. You can move the track pieces." He changes one piece of track around, saying, "Let's see what happens." They launch the rollers, then rearrange the tracks again. They launch the rollers again, and this time, notice the difference between the fast and slowest tracks. Dad says, "That was neat!" The four year old girl says, "I love this game!" The girls start rolling the rollers, pushing them as fast as they can with their hands while they roll. "Vooma kabooma!" the four year old says. Dad says, "We should build one. Have you figured out what makes it go fast and slow?" The six year old says, "The two parts have to be together." They leave for the Air Thrusters exhibit after using Racing Rollers for over five minutes.

We chose these particular vignettes because we feel that they capture the kind of visitor behavior and conversation that TEAMS staff want to encourage through their design efforts.

The education programs improved as well. Education staffs now routinely prepare a comprehensive package of programming to accompany each exhibition, tied in to the national science and mathematics standards. The programming is well-designed to be flexible in its usage with a variety of museum audiences, from families to school groups.

Increased Staff Capacity

Exhibit and education staff members from the participating museums have grown in their capacity to create high-quality exhibit and education experiences for visitors. This increase in capacity has come about through their collective work developing traveling exhibitions and through the formative evaluation process. In addition, their participation in staff development activities through the TEAMS collaborative, as well as attendance at annual ASTC conferences, has contributed greatly to their development.

It is important to note just how far some of these staff members have developed. One exhibit developer who participated in all three rounds of TEAMS funding spoke of how little experience she had when TEAMS began.

> *We had never even seen a crate before. We had never rented a traveling exhibition before. The first truck I ever saw was the one that came to pick up the first TEAMS exhibition we built. We had never prototyped anything before, or built anything but table top exhibits. We didn't have any software to write labels with.*

This museum has created several traveling exhibitions in addition to the TEAMS exhibitions. In addition, the museum is now renting traveling exhibitions to the rest of the field.

Perhaps most importantly, the quality of conversation museum staff regularly have now around exhibit ideas and prototypes improved through each round of funding. TEAMS collaborative members engaged in thorough and thoughtful discussions with us throughout the life of the project, and the depth and quality of those conversations grew as the capacity of the staff grew. As one director noted:

It is wonderful to watch [my exhibit and education staff] work together on exhibits. It is a delicious process that you really want to savor.

Value in Having Peer Critics

In developing their exhibitions, TEAMS staff members were in communication with one another through collaborative listservs that helped in the sharing of ideas and resources. Many of these education and exhibit staff are one-person departments – they have had few chances, let alone extended opportunities, to "talk shop" with others in their field in similar situations. This aspect of TEAMS has been tremendously beneficial to the staff. In addition, because they have a strong and trusting relationship, they could serve as the fiercest critics of each other's work, which also helped build their capacity. Because of their meetings together where they shared ideas and critiqued one another's work, and because of their involvement in prototyping, all of the TEAMS staff members have become more critical and savvy consumers of exhibits. As one exhibit developer said:

The TEAMS people are a tough crowd. We have gone to these meetings and we present our ideas and it is like an art school critique. They say, "You will never get by with that," or "that is not going to work at our place. Our kids will tear that apart" or "that doesn't make any sense." That cuts out a lot of bad ideas right from the beginning. And it sets a higher standard for these exhibits and we carry that over to our work in house.

Value in Prototyping

In addition, the formative evaluation process has contributed to the growth and development of staff. Prior to the original TEAMS funding, none of these museums had engaged in much prototyping of exhibits. Their work with visitors has been an important tool in learning how to better design and build more

effective exhibits and education programs. One exhibit developer spoke of how much he learned not only from building the exhibits, but from building exhibits that turned out not to work so well.

> *I think it has raised the quality of any exhibits that we work on, for our home museums or any other project, because we have been through this process now for three iterations of TEAMS. So you look at all the exhibits that make it into the exhibitions, and all of the prototypes that we built that didn't work – that is a lot of exhibits. That has been really valuable.*

Another staff person said:

> *The prototyping phase is not just something to get past, but it really is where the exhibit happens. We learned so much from the crude, ugly things that were out on the floor that I think to the extent that the finished exhibit is successful, it is because of the time that we spent prototyping. I think having the formalized process of formative evaluation and prototype evaluation made us do what we probably always ought to do anyway, which is to pay attention.*

Other exhibit developers spoke of how the prototyping process is institutionalized at their museums:

> *We do in-house evaluation on exhibits on a regular basis now… that is something we weren't doing before.*

> Value in Professional Development

Finally, the professional development provided directly through the TEAMS collaborative – on building family-friendly exhibits, accessibility, and the research around building exhibits that promote conversations – has contributed to the

knowledge of staff. TEAMS staff have been routinely exposed to some of the leaders in research in the field through these three rounds of funding. In addition, participation in ASTC and other conferences have contributed to the capacity of these staff.

> *You start out knowing nothing. We are all professionals now.*

> *I think definitely a by-product of being involved with TEAMS is that now everything I design, I think about accessibility.*

> *I think through all of these experiences – family learning, accessibility, and now conversations – we are all more sensitive to what makes a good exhibit and that permeates the entire organization, from director through the exhibit and education staff.*

One director spoke of the increased capacity he sees in the TEAMS staff members evidenced by the quality and depth of their collective conversations over the years.

> *The quality of the sharing, the reporting on ideas, the conversations at the annual collaborative meetings is dramatically different now. The staff are so empowered, so capable….*

Another director noted the benefits of TEAMS to his staff and museum:

> *It has made an order of magnitude change in our understanding of exhibits, of how to approach the design of exhibits and our capability in designing exhibits. It has forced us to think in deeper ways about exhibit design and the prototyping process, accessibility. That on its own, without TEAMS, would not have just happened. This has really been a tremendous, powerful experience for our staff. It has been a combination*

of the overall TEAMS process and professional development, but also working with Inverness.

Stability of Staff

Perhaps because the NSF funding helped provide an ongoing and steady source of income, and perhaps because the communication helped overcome isolation, the increase in capacity of staff has served these museums well. There has been much less turnover in exhibit and education staff in the last two rounds of funding. As one director said:

The longevity of the staff has increased. There was much more turnover in TEAMS I and now, the same people who started in TEAMS II are here eight years later. I think in part it is because of the opportunities to work on a national level project like this and go to ASTC and be part of something bigger…

Value to the Field

This increase in capacity not only benefits these staff members' individual museums, but the field as well. TEAMS staff members have participated in leading sessions at ASTC and other conferences, sharing what they have learned with the field. Several directors and staff members also shared lessons learned from their work in TEAMS at the end of the second round of funding in a series of documents.[4] Directors of TEAMS museums have also served on proposal review committees for NSF and have become leaders in other NSF-funded initiatives. Some of these TEAMS museums are now participating in other collaboratives and are drawing on their TEAMS experiences to inform those working relationships. As one director said:

[4] Teaming Up: Ten Years of the TEAMS Exhibition Collaborative. October 2005.

We are now part of [another collaborative] that functions so totally different from TEAMS but I have been able to say, "This is how we did it in TEAMS…" It has been beneficial to be able to know how things could function and how they should function.

Institutional Growth and Development

All of the participating TEAMS museums have developed as institutions throughout their rounds of TEAMS funding. Several have gone through significant capital campaigns and expansions. Several have also begun to tour their own TEAMS exhibitions once they have completed their tours through ASTC, as well as small traveling exhibitions created by other museums. Many of the museums have also gone on to receive additional grants for other major exhibit and program development projects. One piece of evidence of this was that in the early rounds of TEAMS funding, TEAMS was often the main project that exhibit developers had on their plates. In the final round, TEAMS was one of many projects that these museums were working on. As one director said:

TEAMS started the whole thing for us. If we hadn't had the TEAMS project, I don't think any of the other projects would have happened. It was the confidence we got from doing TEAMS that allowed us to even think about writing a proposal for another exhibit development project. Those allowed us to write a third which gave us the critical mass of exhibits that we could begin to start touring these ourselves. And that was the catalyst for us deciding to set up this marketing capability for our own exhibits.

Another interesting return on NSF's investment is that at individual TEAMS museums, because of the work building traveling exhibitions that involved not only exhibit developers but the development of marketing and education

programs, we have seen strengthened relationships between departments within museums. Similar to the institutionalization of prototyping, having education and exhibit staff work together on exhibits has been institutionalized at many of these museums:

> *There is more communication now I think between exhibitions and education. It is so much more of a team now.*

> *I have seen a great deal of development between the interdepartmental relationships here, between graphics and marketing, exhibits and education.*

Another exhibit staff person said:

> *Partnering within departments is something we do on a regular basis now. There is always education and exhibits working together. So it is much more of a global sharing of ideas and working together.*

One museum is developing a new facility, and the experiences from the TEAMS collaborative have played a significant role in shaping the directions of the new facility. As one staff person said:

> *The exhibit we are building for TEAMS now will be a focal point in our new museum. So it has helped us think about designing exhibitry and we are trying very much to focus on visitor experience in the new place.*

The director at this museum said:

> *I think the opportunities while we are designing a new museum to include a larger shop area and to invest more in our exhibtry as far as tools, personnel and how exhibits worked with each of out other departments. In*

our new facility design, we have included a larger shop area, because we do value the opportunity to build exhibits.

HOW THE TEAMS COLLABORATIVE CAPITALIZED ON NSF'S INVESTMENT

The participating TEAMS collaborative members clearly benefited from their participation in TEAMS. In the next section of this report, we look at how this group of museums as a whole capitalized on NSF's investment.

Building off prior work and relationships

It is important to note that the TEAMS collaborative had at its foundation a core of directors who knew each other well, who had institutions of similar sizes, audiences and goals, and who enjoyed working together. Also significant was the fact that the collaborative, in its early stages, drew heavily from the work of other collaboratives, most notably the NSF-funded Exhibit Research Collaborative and the book that collaborative produced. They were not starting from scratch.

Having a focal point is key

The TEAMS collaborative did not simply come together to build traveling exhibitions. The professional development and capacity building was built into the development process. The key to this was having a focal point for the work in each round of funding. Collaborative members were not simply developing exhibitions, but rather developing exhibitions with a larger, collaborative-wide goal in mind (developing family-friendly exhibits and programs, universal design and accessibility, and developing exhibits that promote scientific conversation). This allowed for a common set of experiences for all TEAMS members, and for a common platform for conversations among the group that went beyond the nuts

and bolts. It also resulted in a level playing field – no one museum was any more expert in the focal areas than any other. They were all learning together.

Thus, the focal point raised the level of discourse among the TEAMS members. The work around the focal points was also cumulative in that the themes were not independent and isolated, but rather built from one to another, creating a deep and lasting way of thinking about developing exhibitions and programs. The depth is important here – this was not superficial professional development, but rather focused professional development that directly fed into the product development process that in turn fed into the capacity building of the staff and their institutions.

Consistency in staff/directors is key

One of the main reasons that the TEAMS collaborative was so successful was that there was no turnover at the director level, and after the first round of funding, minimal turnover in exhibits staff. The collaborative was able to capitalize on its investment in the professional development of the staff because the staff was stable, and so institutional memory was built over time. We think it was important that the external evaluator remained constant through three rounds of funding as well. Relationships were forged across institutions that have been long-lasting.

Communication

The TEAMS collaborative took the collaborating part of its work very seriously. In the very early stages of the first round of funding, listservs were created so that frequent and ongoing communication would be easy for all. In the second round of funding, web sites were set up so that photos and descriptions of prototypes and evaluation reports could be shared and readily available to the collaborative members. The communication was also transparent – all of the important

communication took place through the listservs and conference calls, so that everyone was included.

Division of labor

Another key reason the TEAMS collaborative was able to capitalize so well on NSF's investment was because of the division of labor. In the first round of funding, each of the participating museums was placed in charge of overseeing a specific area of the collaborative. For example, David Goudy at the Montshire oversaw the financial administration of the grant; Charlie Trautmann from the Sciencenter served as the president of the collaborative; Mark Sinclair from Catawba was in charge of the exhibition tour schedule; and Sarah Wolf at the Discover Center Museum oversaw public relations. This division of labor carried through all three rounds of funding, with each director responsible for overseeing or spurring on the work in specific areas. This created checks and balances that kept any one person from becoming too dominant in the collaborative.

However, we think it is important to note the key role that Charlie Trautmann played as president. The way he handled that role was viewed as significant by many of the directors with whom we spoke. As one director said:

> *I think we were very fortunate to have Charlie as the president of the collaboration, because he is sincere, bright, honest… a real professional. I think a different person in that position would have made for not nearly as successful of an overall partnership.*

Willingness to take risks

Another reason the TEAMS collaborative was able to get a quality return on NSF's investment was because the participating museums were willing to take risks and try new approaches. In the early years, they tackled the development

of exhibits on unconventional topics – such as mathematics and dirt – some more successfully than others. In the later rounds of funding, the development of the regional partnerships and the focus on researching conversations at exhibits were new approaches. All of the participating museums were willing to put themselves on the line a bit – through forging new relationships and developing exhibits and programs new to them – because of the support of the collaborative.

Willingness to learn and reflect on their learning

Most importantly, all of the members of the collaborative approached this work with a spirit of intellectualism. That is, they weren't simply interested in doing the work, but in being reflective about their work, and in taking advantage of the opportunities they had to learn and hone their craft. Perhaps because the exhibits and programs were traveling – they had to pass muster with their peers first and foremost, as well as with the larger field of informal science museums – there was an inherent interest in wanting everything to be of the highest quality. The surest way to get there was to be open to learning about exhibit and program development and meeting each other's needs.

> *Your objective can be, I need to get an exhibit out here and I need to get it done, or I am here to learn and am curious about learning more and that is my objective.*

In fact, we would argue that this collaborative was approached by its members as an inquiry. The participating museums went through their own inquiry process into how to develop and sustain a collaborative, as well as how to develop and travel exhibitions. Because they were working together to generate their knowledge, there was tremendous ownership in the work of the collaborative, and thus, long-term capacity that was created over time. As one director noted:

We had five of us and of course, we didn't know what we were doing. This is different than giving money to one of the big museums and having them say, "Ok, we are going to take you five on as our partners and tell you all the stuff that you need to know." We built our own knowledge and there is so much more value in doing it yourself. And it may take longer, but then, there is so much more depth to what you have, to that asset you have built. Now, you have the ability to collaborate well, the expertise on staff to do exhibits, to do the programs that go along with the exhibits, to market them – all of that.

The role of the evaluation

The role of the evaluation was an important component to the TEAMS project as well. The ongoing evaluation of the collaborative helped the project think about its theory of action and redesign its efforts along the way. And it helped at the level of exhibit and program design as well, through the facilitation of design charrettes and through prototype evaluations.

SUMMARY

Investing in three rounds of funding for the TEAMS collaborative was clearly a good investment for the National Science Foundation. It was a good investment for the individuals who participated, for the institutions participating, and for the larger field of informal science education institutions. There were many elements that led to the success of this collaborative, from the solid directors who were consistent throughout, to the emphasis on formative evaluation, to the establishment of mechanisms for communication, to the theme or focal point around which each round of funding was built, and the intertwining of professional development and product development.

The NSF investment in the TEAMS collaborative was both an expenditure for products – in this case, exhibitions and programs – and an investment in the capacity of these museums and their staffs. The work done in building and traveling the exhibits provided real services to real visitors. But the work also created a context for building capacity at the individual and institutional level. Hence, the TEAMS project created a symbiotic mix of service and capacity building.

We think the TEAMS collaborative shows clearly that if the NSF is going to invest in collaboratives, then it is very important for that investment to be long-term. It takes considerable time to build the relationships and trust needed to do good work. There are many barriers to overcome in the first few years of a collaborative, from communication, to creating a shared vision, to quality control – all that takes time to work through and overcome. As the TEAMS collaborative has proven, given sufficient funding and time, a long-term investment approach is merited.