Evaluating the Effectiveness of the Science Museum of Minnesota's Traveling Theater Program

A THESIS
SUBMITTED TO THE FACULTY OF THE GRADUATE SCHOOL
OF THE UNIVERSITY OF MINNESOTA
BY

Sarah Hopkins Cohn

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF
MASTER OF ARTS

Keith Russell, Jean A. King

October, 2010

Acknowledgements

A number of people saw me through this experience. My parents, Tom and Sally Cohn, never stopped asking me about the project. Dr. Richard Rodgerson supported my efforts and pushed back in numerous ways to help me achieve clarity of thought and writing. Dr. Kirsten Ellenbogen, my boss and mentor, offered excellent supports at various times, illuminating the opportunities I was missing and presenting alternative ways of thinking. My coworker, Amy Grack Nelson, offered her insights and knowledge of the thesis process, and I am grateful for her experiences. Stephanie Long, Jennifer Scott, Mahmoud Hakima, and Rebecca Wall-Sclavi gave of their time, their thoughts and effort, and consistently performed great programs that I was given the opportunity to observe. The faculty who advised me along the way – Dr. Jean King, Dr. Richard Rodgerson, Dr. Keith Russell, and Dr. Stuart Yeh – all helped me focus, direct my attentions, and understand the true nature of the evaluation's capacity and promise. Finally, my wonderful partner, Joy, pushed me to finish the project in the last hour. Without these people, this piece would simply not be complete.

Abstract

The following case study discusses the development and evaluation of a traveling science theater program produced by the Science Museum of Minnesota. This evaluation was designed to study the effects of the traveling science theater programs on students and teachers, but the study also assessed the effects on participating actors. The programs were put on by the Science Museum of Minnesota actors at schools throughout greater St. Paul and Minneapolis; program topics were nanoscale science, race, and animals at risk. This case study examined the nanoscale science program and answered the following questions: 1. How effectively does the program convey new information and generate discussion on each topic? 2. How effectively do teachers incorporate the program topics into their classroom and curriculum? 3. What do students and teachers gain from the programs? 4. What effects do the programs have on classroom conversations for the following 2 weeks? and 5. How does the process of creating a program and an evaluation affect the actors involved?

The outcomes of the first year of The Science Museum of Minnesota's Traveling Theater program were informative for future outreach efforts. The data show that the initial traveling theater program has the capacity to educate students but requires further support and clarity to have a greater effect on participating students.

This study also supports efforts to understand educational theater in its various formats. While much work has been done to understand theater as being educational through student production and participation on stage, it has not been thoroughly studied in the United States as a way to educate about other topics. This case study shows that theater can educate by engaging audiences, both physically and emotionally.

Table of Contents

List of Tables

List of Figures

Introduction

The Science Museum of Minnesota is a leader in science education and museum exhibition development and is "known worldwide for its interactive exhibits, dynamic traveling exhibitions, and internationally distributed large format films" (Science Museum of Minnesota, 2008, par. 5). Creating traveling exhibitions and exhibits for diverse museums around the country, the Science Museum of Minnesota develops strong, well-crafted products for conveying knowledge to visitors through the use of exhibit elements and design.

Founded in the 1970's by Sondra Quinn, the Science Museum of Minnesota's theater program has developed numerous plays on scientific topics from cryogenics and animal habitats to nanoscience and nanotechnology (Bridal, 2000). The department has been a formidable force in museum theater, creating the Theater in Museums Workshop in the early 1990's and continuing to create scientifically accurate and compelling plays (Bridal, 2000). "The museum was an early innovator in the use of live theater as a humanizing interpretive tool and continues to be a training ground for other museums wishing to include live programming in their exhibit halls" (Bridal, 2000, p. 16). SMM's current definition of theater is:

> Theater Programs encourage audiences of all ages to explore science by presenting information, challenging stereotypes, and examining issues through the emotional and personalizing power of drama. Theater presentations are scripted, structured and contain conflict or a goal/task the character must overcome or achieve. (Long, February 26, 2009)

Through theater, the museum works to help visitors understand various aspects of science and the scientific process. The actors perform in the museum every day from 11am until 5pm, allowing the majority of visitors the opportunity to watch or participate in various shows during their museum visit.

Part of the Science Museum of Minnesota's 2004 and 2008-10 strategic plan is to move the museum's influence beyond the physical boundaries of the museum building and its location in downtown St. Paul to becoming a regional and national presence in science learning and informal learning environments. To respond to this strategic plan and to fulfill the museum's mission statement of "Turn on the science: realizing the potential of policymakers, educators and individuals to achieve full civic and economic participation in the world" (Science Museum of Minnesota Board, 2008, p. 5), the theater department generated hour-long programs for school groups based around two 10-minute plays with follow-up discussions on each play. Three programs were created to span the elementary and secondary education grades Pre-Kindergarten to 12.

Over the course of the 2007-2008 school year, the three theater programs were performed for various audiences around the greater metropolitan area. As the project unfolded, evaluative components assessed the effectiveness of each program. Teachers who ordered the performances were informed of the incorporation of an evaluation into the project, were made aware of the presence of possible observers, and were told that their group would need to complete surveys at the end of the performance. The teachers present at each program were requested to participate in an interview a few weeks later; they were informed that their time and efforts would be rewarded with passes to the

Science Museum of Minnesota and the possibility of winning a $50 Target gift card upon completion of the interview.

Evaluation

The current study was based on the evaluation interests of the theater department. While the theater director wanted to know how the well the programs engaged the students, the study also assessed the extended impact of the program on classroom discussions. The theater department hoped that the programs would generate continuing discussion on the various topics, but post-program activities and supports were neither planned for nor supported through the programming or orchestration of the theater outreach efforts. This effect was studied by the primary investigator and analyzed in addition to the work done for the theater department.

This evaluation generated data that led the principal investigator in a second direction as well. The study collected data and outcomes in line with process use evaluation (Amo & Cousins, 2007; Carden & Earl, 2007; Harner & Preskill, 2007; King, 2007; Patton, 2007; Patton, December 2007). Process use evaluation focuses on what participating stakeholders learn and act upon based on their participation in an evaluation (Patton, 2007). Through the process of creating both a traveling theater program and an evaluation plan to assess that theater program, SMM actors developed new processes of reflection and discussion around their work. The actors showed increased critical thinking and critical reflection about aspects of the programs through their work in helping develop evaluation strategies and instruments for the project. The development of the actors' evaluative skills and thought processes was captured during debriefing conversations held after each performance. In addition, a final interview was conducted at

the end of the school year that put into perspective the various actors' frames of reference about the program and its intended effects. The debrief discussions and additional conversations between the actors and the principal investigator showed additional effects of the development process that were unintended. This aspect of the case study was used only for the purposes of this study and was not an integral aspect of the project to the theater department.

Finally, understanding of the effects and outcomes of this specific study within the framework of the current literature and larger field of research on theater and education was not a priority of the theater department's efforts. Most of the evaluation moved ahead of the literature review, thus some research directions found through the inquiry process were not attended to in the study. Because of this, this case study acts as the ground work from which future research and evaluative inquiry can grow, both for the field of evaluation and for this theater department.

Purpose Statement

The intended purpose of this study was to explore what effects the Science Museum of Minnesota's Traveling Theater programs had on student knowledge and conversations about the program topic. The evaluation sought to understand how the incorporation of the programs affected class curriculum, topics, and conversations. The study also, unintentionally, focused on how the participating actors changed through the course of developing the evaluation and program. The final evaluation aspect came as an extension of the first two points of interest.

The study sought to answer the following questions:

1. How effectively does the program convey new information and generate discussion on each topic?
2. How effectively do teachers incorporate the program topics into their classroom and curriculum?
3. What do students and teachers gain from the programs?
4. What effects do the programs have on classroom conversations for the following 2 weeks?
5. How does the process of creating a program and an evaluation affect the actors involved?

Explanation of Programs

Three packaged programs were used through the duration of the first year of the traveling theater case study. They were each built around two 10-minute plays that had previously been performed independently of each other on the museum floor. The theater director created these three programs specifically because of their ability to be easily adapted from independent shows and combined for broader educational purposes. The variety of packages was created for the express purpose of attracting multiple audiences and age groups. For the purposes of this study, only the *Nano* package will be discussed. Only the *Nano* program is explained due to lack of extensive data on either of the other two shows. The *Nano* package had additional funding and support for assessing its effectiveness, so the evaluator was able to observe more performances and spend more time on this program.

Nanoscience Package

The *Nanoscience* package (Nano) was created for 5th to 12th grade students. It discusses the new field of nanoscience from two angles through the plays "Same Sides" and "Let's Talk about It." It was based around two 10-minute plays that had previously been created for nano forums and shows on The Science Museum of Minnesota's exhibit floor. "Same Sides" and "Let's Talk about It" discuss differing aspects of the technological advances in nano and nanotechnology. Copies of each play are provided in Appendices A and B.

"Same Sides" shows a pair of sisters arguing over a new job one of them has taken; she is leading a group of scientists working with nanoparticles to create the Voluntary Standards of Care (the current laws regulating work around nanoparticles). The two sisters argue over the possible harm nanoparticles could do to the environment.

The play "Let's Talk about It" is also about a pair of sisters; these sisters are packing up their mother's home as she has moved to hospice care. Their mother is well past the stage where an experimental treatment for cancerous tumors could be useful, but the sisters argue about the potential problems and possible side effects from a new treatment (the use of gold nanoshells). The play ends with the sister who is seeking out the treatment sharing that she has breast cancer.

These plays are the foundation for the *Nano* package. The actors give a brief introduction to inform the audience about the size and scale of "nano" and then they perform "Same Sides." The audience and actors then engage in a 10-minute discussion about the show and the issues that came up between the sisters about nanoparticles in the environment. The actors then move on to "Let's Talk about It," and they follow up with a

second 10-minute discussion, where they ask the audience to share what they would do in the same situation. “What would you do? Would you want to look into it if someone in your family had a big disease? Would you want to take a risk?” (Long, October 1, 2007)

The goals of the *Nano* package were basic. The *Nano* package hoped to teach that “things at the nanoscale are super small, really different and have surprising properties” (Long, 2007, p. 1) and that the nano field has great potential as well as risk. “Same Sides” tried to demonstrate positive and negative impacts that nanotechnology could have on the environment while portraying both sides of the argument around nanotechnology. This show also introduced the audience to “Voluntary Standards of Care.” “Let’s Talk about It” introduced nano-goldshells and tried to get students thinking and talking about the impacts nanotechnology could have on the future of medicine.

The following piece depicts the work, experiences, and outcomes the Theater Department at The Science Museum of Minnesota had as a result of building new programming and conducting theater in various educational settings. The literature review gives an explanation of how museum theater has developed and had previously been used as well as a background in theater and education. Definitions of evaluation and evaluation use, specifically process use, are also discussed, as it is distinctly different from formal research.

Literature Review

The Science Museum of Minnesota's Theater Department intended to evaluate the effectiveness of their traveling theater project to teach about science topics, encourage discussions, and support classroom curriculum. Though they did not explicitly adopt a theory from which they crafted the theater programs, the actors and Science Museum Theater Department recognized the need for facilitation, control, and supports to be in place to ensure that the programs had an effect. This Literature Review examines learning from theater programs through the use of theater in education, the history of museum theater, and the forms of evaluation that were used throughout the study.

The main focus of the project was evaluating the development of the theater programs for use in schools and other community locations. The forms of evaluation developed in line with this focus, but additional forms of evaluation were adopted as the project progressed; process use, as defined by Michael Quinn Patton, was incorporated into the study as the primary investigator recognized the presence of marked differences in the actors' perceptions of how well programs were reaching their intended goals.

Theater and Education

Theater, while both an action within and a product of any given culture, has always been part of human history. Children pretend and act as a way of learning about and practicing for adulthood (Brownlee, 1997; Landy, 1982). Humanity has embraced theater and drama as forms of learning and ways to exchange knowledge. Theater is acting or performing for others, whether imagined or real, and the focus is on creating a final product, while drama is more focused on the process of acting rather than the performance (Landy, 1982). Drama and theater create a continuum of performance, as

dramatic actions can lead to a final production of a show but can also be done simply for the sake of acting. The following pages focus on the theater-specific end of this continuum and not on drama.

Theater can take on many forms to support its final goal of causing individuals to think, feel, and learn. The specific attributes of theater are actor, script, and audience (Landy, 1982). Interpretation, demonstration, improvisation, puppetry, speeches, and formal theater are all theatrical productions.

> Tribal people all over the world use dramatic dance to promote the mental health of the community, and the ancient Athenians used it for both education and therapy. Rhetoric was at the heart of medieval learning. In the Renaissance the speaking of Latin dialogue and the staging of plays were components of the school curriculum. (Landy, 1982, p. ix)

Theatrical pieces may not be written with education and learning as their focus, but the simple act of performing for an audience causes the audience to become educated in some way. Mirror neurons are visuomotor neurons in the brain that respond when one watches as others act (Rizzolatti & Luppino, 2001). Audience members observe two actors discussing a topic, and the various mirror neuron centers in the brain allow them to experience the discussion, the emotions, and the resolution as though they were a part of the conversation (Rizzolatti & Luppino, 2001). Mirror neurons, the interdependence of learning and emotion (Hinton, Miyamoto, & Della-Chiesa, 2008), and the drive of theater to connect the audience to the topic of the show (Bridal, 2004) support that learning is an outcome of experiencing theater. In addition, experiencing the theatrical performance in a live fashion, rather than watching it televised or as a movie, affects the actors and

audience in ways that cause the event to be special and specific (Prendergast, 2004). The presence of the audience allows spectators to "play between the performance and their own lives" (Prendergast, 2004, p. 43). By viewing the play, the audience relates aspects of the performance to their own experiences, thus educating each spectator in different ways. In addition, using artistic structures to present classroom issues supports improving problem solving skills, understanding others' perspectives, and developing new ways of seeing and thinking about situations and the world (Thomas & Mulvey, 2008).

Numerous studies show support for educational impacts through theater. Gliksman, Douglas, and Smythe (1983) studied the incorporation of theater into an alcohol education program in Canada. Students were pre- and post-tested using a self-report questionnaire that assessed the students' knowledge, attitudes, motivation, and behavior with alcohol. The outcomes of the study showed that, in this case, the use of a one-hour performance did as much to influence attitudes, motives, and behaviors as the four-hour lecture did. Holschlaw (1996) also assessed the use of theater in an alcohol prevention program. His study looked at the use of the Theater In Education (TIE) model to educate. In this study, the TIE program consisted of actors performing alcohol-related dramas and, at the end, turning to the students to help them get through the different situations. Holsclaw compared a TIE program with a lecture program. Holsclaw found that both groups did better than the control group, but the TIE program group did not have a statistically significant shift in attitude and motivation in comparison to the traditional group.

Unfortunately, the Gliksman, Douglas, and Smythe (1983) study was just a test-case in whether or not theater would have an effect as an alcohol education program. This

is supported in their study, as they found a relationship "between [sic] attitudes, motivation, and behaviors in the area of alcohol use" (p. 245). They also found that theater alcohol programs impact behavior, and that a "one-shot alcohol program, if well developed and well presented, can have as efficacious an impact as a more formal four-hour presentation" (p. 245). The researchers did not study the nature of the environment in which this group was being educated, so they had no ability to identify why the treatment did not work, and, in fact, increased some students' drinking habits. This lack of an explanation for why the treatment had unintentionally negative effects identifies the need for further research on theater in education and theater as an educational tool to support more traditional lessons.

Holsclaw (1996) used Gliksman, Douglas, and Smythe (1983) as a setting off point for his research. He selected a program that would seem to be the most effective form of theater to convey knowledge and show a difference between theatrical and lecture-based programs. Unfortunately, his study was unable to draw strong conclusions because of the various limitations of using two treatment groups in the same school. Because of the limitations of his study, he could not show that TIE programming is more effective than traditional didactic programming, but he did show that it works just as well. The results of these past studies support the current study's theory that theater can be as effective at conveying knowledge and teaching about a given topic as a traditional lecture. Further, the current study seeks to clarify issues and limitations present in past educational theater research to enhance the field's knowledge and understanding of educational theater.

Theater In Education (TIE) goes well beyond the realm of theater and often delves into the dramatic end of the performance spectrum. Jackson (1980, 1993) illustrates the general format of TIE as child-centered instruction that directs both the students and the teacher to engage in the seeking out of knowledge through a theatrical and dramatic social dynamic. TIE does not have any specific form or boundaries, as the shows are created specifically for a school and are acted out in a manner the actors think most effectively fits the current environment (Berghammer, 1988), and TIE utilizes social learning theory to educate its audiences (Holsclaw, 1996). The most crucial piece in TIE programming is that the actors are specifically trained as Theater In Education actors (Berghammer, 1988; Holsclaw, 1996; Jackson, 1980, 1993; Landy, 1982). They are one part actor, one part teacher, one part facilitator, and one part improviser. In this way, the current study's programs and actors do not adhere to TIE theater. While very similar, the current study adopts a more applied theater perspective, where a specific community is incorporated into the theater program's production and dissemination (Dalrymple, 2006). In the current study, the actors act as the community members working to convey information and generate dialog around specific science topics.

Theater In Education programming goes beyond the format of the current theatrical programming in numerous ways. TIE incorporates student participation through asking the actors questions, creating dramatic presentations themselves, or changing the play to bring about a different result. Berghammer (1988) states that a play and follow-up discussion is one form that TIE takes, but the level of intensity of the discussion and the length of the program are greater than the current study's programming. Furthermore, the current study is not viewed as a Theater In Education piece because the actors are not

trained TIE actors and the main focus of the programs is more theatrical than they are educational (Long, December 7, 2007).

Dalrymple (2006) studied the effects that "applied theater" had on young people in South Africa. In this study, the researcher denotes "applied theater" as "the practice of drama and theater-based activities outside the formal school curriculum and traditional theater buildings" (p. 201), as a community is incorporated into the production and dissemination by focusing on issues of importance to the community. The author's organization, DramAidE, used applied theater to generate awareness and provoke responses to social issues around HIV and AIDS. "All the evaluations demonstrated that the objectives of the project had to some extent been achieved but none were able to show that these projects had definitely contributed to a reduction of infection with HIV" (p. 210). A second project created a space for individuals living with HIV to speak about their experiences in a community that spurns them. Through breaking the stigma around HIV, the project hoped to generate more discussion about the topic. Through a "big screen and forum theater" (p. 211), the topic of date rape was openly discussed; people discussed subjects that had been previously forbidden. The event attracted and engaged students, "created a space in which students could engage in meaningful discussion about HIV/AIDS and sexuality" (p. 212), and increased individuals' self-efficacy about keeping themselves safe from HIV/AIDS, as stated by the students.

Dalrymple (2006) and DramAidE's ongoing problems have been to effectively produce data that can be directly related to their programs. In a country with an ever increasing HIV/AIDS epidemic, being able to show that applied theater programs are causing more young people to protect themselves or get checked would be hard. The

most effective form of research that could address this issue would be longitudinal studies, but programs like USAID do not provide funding that would sustain an organization for that length of time.

Nisker, Martin, Bluhm, and Daar (2005) used theater to engage the public around health-related policies in Canada. The study showed that the theater program was effective as a public engagement tool, as audience members reacted to and discussed the play. The play also created a space for numerous health-policy opinions to be discussed. "By educating and engaging relatively large numbers of individuals, theater has advantages over other forms of public participation" (Nisker et al., 2005, p. 268).

The Nisker et al. piece (2005) shows the potency that theater can have on eliciting comments and conversations about topics the audience may or may not know much about. This study did not add to the literature as much as it could have due to the lack of a truly facilitated discussion. If misleading or confusing comments were made by audience members, the facilitator would clarify them; otherwise, the facilitator did nothing to direct, lead, or encourage the discussion following the play. The current study seeks to flesh out this issue. By having a generally formatted discussion time after each play, the actors/facilitators were able to guide the thoughts and ideas of the audience to enhance knowledge-building.

Gesser-Edelsburg (2005) studied something a bit different. This researcher looked at the effects *Backyard Games*, an "educational drama about gang rape" (p. 139), had on students. The author examined a popular Israeli youth education play through its script and performance. The researcher examined the creation of the play, explaining the masculine gaze of the play and the sexism present throughout the play's writing, stage

directions, and set design. The study found that, after watching the play, students blamed the girl for the assault and thought that boys could be more easily pulled into situations where they will rape. The study also found that preparatory talks that teachers had with the students did nothing to support the notion that the girl was innocent. In this case, the education and knowledge that is being conveyed is not the information that the schools wanted to portray. The author claims that some teachers were aware of this happening, but no one with the power to change the situation did anything about it, thus raising issues about ethics and adult responsibility for youth education.

The Gesser-Edelsburg (2005) article raises larger questions for theatrical audiences. Considering the problems raised by *Backyard Games*, what are the ethical responsibilities of producers, creators, actors, schools, and organizations regarding dramas that deal with sensitive social issues and are performed for school audiences? This piece calls for continued investigation into the ethical and social dilemmas present in delivering theatrical productions to student audiences.

Museum Theater

The Science Museum of Minnesota (SMM) recently celebrated its 100th birthday. Since 1907, SMM has brought "science" to the public; initially, it was a collection of artifacts owned by a few St. Paul residents as well as donations of specimens and collections, but it expanded to become a renowned and respected museum of science in the United States in the 1960's and 70's (SMM, 2008). As a respected and innovative organization, the museum incorporated live theater as an interpretive, communicative, and educative art form in the 1970's (Bridal, 2000). At that point, as Bridal (2000) points out, "[t]he idea that dramatic presentations might further the understanding of science

was unexplored in the field" (p. 16). At a time when museum theater was just coming into its own and was still untapped as a venue for enhancing the visitor experience, the Science Museum of Minnesota began creating shows to educate the public (Bridal, 2004).

The use of theatrical techniques to support education in museums is a longstanding tradition (Serkownek, 1998). Museum theater is a theatrical form that has grown out of documentary theater, children's educational theater, interpretation, and living history theater. Theater easily entered museums because it was an obvious extension and expansion of the theatrical techniques that had previously been adopted by museums to entertain and interest visitors as they looked at the objects on display. Museums commonly used objects such as costumes, props, sets, lighting, and even lectures and demonstrations to improve the visitor experience with the exhibits (Casey, 2005; Serkownek, 1998). Museums used theatrical staging to extend and embellish the presentation of cultural artifacts and exhibits (Casey, 2005). Many museums were known to have theatrical shows as early as the 1840's (Serkownek, 1998).

Though aspects of theater have been commonly used in the creation and portrayal of objects in the museum, live theater has struggled in being adopted across all museums (Baum, Hughes, 2001; Casey, 2005; Jackson, 2002; Jackson & Rees Leahy, 2005). Many museum professionals often see theater as "an inherently fictionalizing medium of interpretation" (Jackson & Rees Leahy, 2005, p. 305). Jackson and Rees Leahy (2005) show that the largest issues around adopting museum theater revolve around the questions "what theories of knowledge and learning underpin contemporary practice?" and "should the museum's narratives exceed the 'stories' told by its collections, in order to fill in gaps in the collections and offer alternative points of view?" (p. 305). Casey

(2005) argues that the museum has been built and purposefully formatted as a theatrical and dramatic endeavor in which live performance would support the efforts of conveying cultural ideology and educating the visitor.

In the United States, the expanded use of sets, costumes, and designs to enhance the objects and case displays began to develop late in the nineteenth century, which led to the acceptance of theater as an interpretive method (Serkownek, 1998). It began as an additional way to present historical objects; actors would act as frozen figures, imitating popular sculptures or art. Early in the twentieth century, costumed guides were incorporated into museums and costumed interpreters were present at living history parks and outdoor museums. The use of costumes and props for tour guides expanded the visitor experience and supported the continued development of educational theater in museums across the country. "The current use of theater in museums is not a radical departure from museum tradition, but rather an evolution of museum practices" (Serkownek, 1998, p. 18). Casey (2005) makes the argument that museum theater is a direct extension of the staging that traditionally occurs in museums. While curators often see the use of theater as a disruption to a visitor's experience, the use of museum theater could actually build on and enhance the museum experience (Casey, 2005).

Museum theater is often seen "as a way of linking scientific concepts with their human contexts, and presenting complex and potentially controversial issues in an understandable and multifaceted way" (Black & Goldowsky, 1999, p. 3). Theatrical performances communicate the intersections of the "museum space, viewer, and object" (Casey, 2005, p. 85) in new and different ways that engage and educate the audience. Uses of museum theater have been found to increase the staying time of visitors at

specific exhibits (Hughes, 2007), as well as draw visitors to museums (Harris, 1989; Hughes, 2007).

Though adopted by many museums beginning in the 1960's and 70's, museum theater still does not have a distinct definition. Some authors claim that "[w]hile theater can be enlightening, it is not generally bound to the idea that it must teach something. In museum theater, the genesis usually has contained within its seed the understanding that the piece will relay some educational idea to an audience," while others have said that "museum theater exists to make the visitor care enough to learn" and "to evoke emotion for the purpose of learning" (Bridal, 2004, p. 3-4). The nature, form, and focus of museum theater is varied based on the audience, location, and topics being covered. What is not different is the purpose: education through entertainment, which has been the goal of museum theater since its inception (Bridal, 2004). The problems around defining museum theater are based in understanding its boundaries; what theatrical techniques create theater and what are simply demonstration or presentation? Bridal (2004) cites numerous directors of museum theater and many museums that employ theater, each having a slightly different definition and vision of what is and what is not museum theater. In the end, she states,

> I believe that *what* is presented, *where*, *by*, and *for whom* define museum theater, and that this definition matters to the institution utilizing theater, to theater practitioners, to audiences, and, ultimately, to program funders… Museum theater begins with *content-based educational performances*, typically shorter than those in theater venues and frequently interactive, performed *in formal and informal theater spaces*, both within the museum and as outreach, *by trained museum*

theater professionals for museum audiences of all ages and for school audiences. (p. 5, italics in text)

Bridal's final definition of museum theater leaves the theatrical form open for interpretation and flexibility, but the requirement of the performance being done by trained museum theater professionals would, in the end, define whether a performance could be a demonstration or theatrical production. In the end, museum theater has emerged as an additional way for the museum to communicate to its audience (Serkownek, 1998).

Few studies have assessed museum theater in the United States. Catherine Hughes and Tessa Bridal have done most of the work in the field at assessing and understanding the impacts of museum theater on museum patrons. Bridal (2000, 2004) wrote works about its history as well as defending the impact and strength of museum theater. Hughes (2008) assessed the impact of museum theater on emotions and spectator perspective. Using pre- and post-surveys, focus groups, follow-up interviews, and observations of shows put on at two different museums, Hughes found the strong presence of empathy in spectators of museum theater.

> The human dimension, the interaction between spectator and actor, is of central importance in engaging spectators to museum theater. A performance provides a structure in which humans can focus their attention and create empathetic connections in their minds and bodies in order to make meaning. (Hughes, 2008, pp. 214-215)

In addition, Hughes identified varying connections to and understandings of the performances based on individuals' lived experiences and social context. Older

individuals felt more strongly about war, for example, than did younger individuals (Hughes, 2008). People connected to the performances and observed the actors' actions through the lenses created by past experiences, knowledge, and cultural symbols and tools. These aspects shaped the way each spectator understood, related to, and created meaning out of the play. The comments spectators shared showed how they were "making meaning through themselves" (Hughes, 2008, p. 230); visitors were using their prior knowledge, experiences, and understanding of culture to connect and engage with the performances.

One of the foundational works in assessing theatrical performances in museums is that of Black and Goldowsky (1999). Their research assessed how high school students responded to, understood, and then grappled with the information presented through the play "Mapping the Soul." Using student interviews, pre- and post-performance interviews, and observations, the researchers evaluated the strength of the theatrical performance in teaching students about the Human Genome Project. The authors found that students enjoyed the play, but, more importantly, they "understood the play as one way to educate, inform, or teach science, but also clearly indicated that they preferred the theatrical medium to their view of a science class" (Black & Goldowsky, 1999, p. 6). Student responses also showed that they felt that watching people working through actual situations helped them learn the information more clearly. The play incorporated two points when the audience would participate and interact with the characters. Most of the students found this to be helpful, as they liked to be involved in the discussion, and it "helped students to better understand, and gain a wider perspective of, the topic. In particular, students reported that they found it useful to hear the opinions of their

classmates" (Black & Goldowsky, 1999, p. 10). Finally, students were more capable of connecting the aspects of the Human Genome Project to their lives, allowing them to more effectively grapple with the social, ethical, and moral implications of the project (as seen through changes in responses to similar pre and post survey questions).

Museum theater in the United Kingdom has been assessed by the Manchester Center for Applied Theater Research (CATR) for a number of years (Jackson, 2002; Jackson & Rees Leahy, 2005). Jackson and colleagues assessed the impact of museum theater on the learning processes, understanding, and recall of children from a trip to a social history museum. The study followed eight classes of students before, during, and after visiting one of two museums: the People's History Museum in Manchester and the Imperial War Museum in London. Two schools at each museum experienced a theatrical production while touring the museum, allowing the researchers to assess the learning potential of the museum with and without the use of theater. Working with such young students (aged 10-11), the researchers used pre-visit teacher-led discussions to assess what the students knew ahead of time. They used semi-structured group interviews, drawing, and creative writing both immediately after and two months following the visit to see how much students remembered and understood. The authors never shared exactly how many students were followed, noting only that it was a "relatively small number of children" (p. 306). The researchers found that the children who watched a theater show or listened to an audio-tape recording of a real life event experienced greater recall and empathy about the time period and information being displayed. The youth experiencing a theater production were able to more effectively generate a timeline and connect disparate collections in their understanding of the museum visit and time period (Jackson

& Rees Leahy, 2005). Though the theatrical performances were made up, the use of characters and situations made aspects of the rest of the museum and the information shared during the performance more authentic. Researchers found that the children sought out pieces that were highlighted in the performance through their tours of the museum (Jackson & Rees Leahy, 2005).

Another study reviewed evaluations of theatrical productions at the Museum of Science, Boston over a ten year period (Baum & Hughes, 2001). This metaevaluation of the museum's theater evaluations shows that visitors learned specific content from the plays, at least for short periods. The studies also found that visitors felt the theatrical experience added value to their visit and reinforced and educated visitors about aspects of an exhibit they may not have seen or understood. The most compelling outcome of the metaevaluation is that visitors showed connections to complex and abstract ideas – an outcome that is difficult, if at all possible, to achieve through exhibit pieces (Baum & Hughes, 2001). Finally, many of the studies showed the myriad connections visitors had to the shows. They raised questions and comments that were based in their past experiences, religious beliefs, and personal values as they thought about and discussed the plays. "We believe that the rich context of theater provides opportunities for shared experiences between a grandparent and grandchild, a husband and wife, or between old friends, which in the end, are quite individual for each" (Baum & Hughes, 2001, p. 5).

Museum theater is strongly affected by its location within the halls of a specific type of museum (Hughes, 2008). All three of the above-mentioned evaluations of museum theater relegated the theater productions to the galleries of the museum. Hughes (2008) did not look beyond two specific venues; all performances occurred in one

location at each museum. She identifies the science museum's specific cultural context at play in shaping the spectators' experience but did not try to assess its impact. Black and Goldowsky (1999) did not take into account the cultural context present in the different data collection sites; nine school groups saw the show at their school while the other four experienced the performance at the Museum of Science, Boston. The researchers did not look at the responses of the students based on where they experienced the science-based theater piece. The authors also did not assess how the teachers were using the piece to support classroom curriculum. Though different questions are asked in the current study, it seeks to identify the interplay between museum theater and the classroom, gymnasium, or alternate setting. How is learning supported, altered, or impeded by bringing the theatrical production to the youth rather than engaging them in a museum's deliberate cultural setting? This study hopes to illuminate aspects of location on audience engagement, connection, and learning from a theater program.

Since 1970, SMM has had theater programs running in the exhibit halls. As an additional form of communicating scientific issues to its visitors and audience, museum theater was adopted by Dale Jones after Sondra Quinn created a puppet show about a moon rock on display in the late 1960's (Bridal, 2004). Due to budget shortfalls in 1982, the theater programs were cut, but were resumed in 1984 with the advent of a theater department with four full-time actors and a department director (Bridal, 1998). Today, there are numerous occasional actors, two part-time acting staff, two full-time actors, and the department director.

An evaluation of SMM's theater programs was carried out in 1989 (Harris, 1989). The study was done "to understand better the interpretive strengths and limitations of

theater in the museum" (p. 1). Four-hundred and fourteen adults were interviewed as they left the theater area at the end of a program; visitors were asked about their rating of the performance they saw as a learning experience, an entertainment experience, and an emotional experience on a scale of one to ten. The evaluation showed that 85% of the visitors enjoyed the program and thought that the program was a good learning, entertaining, and emotional experience. Four out of five visitors felt that viewing the program enhanced their visit to the museum (Harris, 1989). Large majorities of both men and women agreed or strongly agreed with all questions the interviewers asked, from showing interest in the presence of theater in the museum to recommending friends to see the performance. The only statements that people disagreed with were "I would return to the museum just to see a performance like this" and "this is the most exciting part of the museum" (p. 14). Only 52% agreed with the first statement, and 28% agreed with the second. Overall, the study showed that people enjoyed the theater programs they saw, felt that they supported their education on the topic, and enhanced their museum experience.

Aside from the 1989 study, no further work has been done to show that the Science Museum of Minnesota's Theater Department continues to increase knowledge or support scientific learning within the museum. This study maintains the museum's goal of recognizing and supporting the program efforts produced in the museum's various departments. SMM seeks to better understand the effects of all of its programs and ensure that programs that are being created are achieving their goals as well as supporting the mission of the museum. Though occurring in a different format and in a different setting, the theater shows the department is using for its outreach are the same as those put on in the museum during business hours.

Theater as Outreach

It is surprising that Bridal (2004) equates museum theater outreach with museum theater. This seems counterintuitive because the environment of the museum is a more contextual factor for understanding visitor responses than Bridal states (Bell, Lewenstein, Shouse, Feder, Eds., 2009). She cites Lee Oestreicher as saying, "museum theater pieces are created for museum visitors" (p. 3), highlighting that these individuals did not come to the museum to view theater but, rather, stumbled upon theater as an additional educational form available at the museum. This is an important distinction between a museum audience and an outreach audience; an outreach audience would conceivably have different expectations and ideas about the performance than would an audience within the museum.

Though seemingly disparate forms of theater, museum theater is seen as an excellent form of outreach for museums (Serkownek, 1998). Museums have created museum theater outreach programs to supplement and support school curriculum, to serve audiences that would otherwise not experience the museum, to increase education around specific objects or collections within the museum, and to prepare students for an upcoming museum visit (Serkownek, 1998). Most museums create specific touring shows to be used for school groups instead of using in-house shows as touring programs (Serkownek, 1998). This fits more with the idea that topics like science would be better conveyed if the shows were reactive to context-dependent factors such as the location of an audience within a school or within a science museum.

A few science museums have produced traveling theater productions. The Museum of Science, Boston has done numerous studies of their various theater programs.

"Since 1985, the Science Theater Program at the Museum of Science has been producing and presenting plays and other programs at the Museum and as outreach" (Baum & Hughes, 2001, p. 1). As noted previously, the research of Black and Goldowsky (1999) occurred in both school and museum settings. The Franklin Institute performs traveling science shows every year (Taylor, 2008). Unfortunately, the evaluations conducted by Black and Goldowsky (1999) and Baum and Hughes (2001) did not take context into account as they analyzed their findings or assessed the impact of the theatrical performances on student learning. In addition, existing traveling theater productions by various science museums and centers are not widely publicized or known. If any others evaluated, the outcomes of the evaluations are neither published on the organizations' websites nor well known to current museum staff at the museums. Each organization seems to mostly be working on its own, save the annual workshops held by Tessa Bridal on creating museum theater (Bridal, 2000, 2004).

While not communicating across similar institutions, many theatrical departments look to their local acting community for help in developing and effectively deploying traveling theater programs. The Science Museum of Minnesota is among those that reach out to their community for help and suggestions. Minneapolis and St. Paul have been long known for creating high quality theater (Minneapolis Public Library, 2001). Currently, there are over 200 theater companies in the Twin Cities (Minnesota Citizens for the Arts, 2008).

Starting in the late 1900's, traveling theater was created in Minnesota as an alternative form of education (CLIMB, 2007; Seive, 2008). The CLIMB Theater and Mixed Blood Theater organizations in the Twin Cities are known for their theater

outreach programs. The topics chosen for Mixed Blood's theater programs are culturally specific topics that are performed for all ages (Seive, 2008), while CLIMB often creates shows that are tailor-made for the specific audience in attendance (2007). Most of their works are not evaluated, or their evaluations are not shared publicly.

Recently, CLIMB Theater had a program evaluated. Two plays, "B.U.D. and the Bully" and "Ride of Your Life," are plays performed for grades K-2 and 3-5, respectively (Schauben, Mueller, & Schultz, 2006). Second and fourth grade classes from four schools participated in the CLIMB Theater outreach on bullying, and two additional schools were used as controls. The study found that two months after participating in the bullying program, participating students experienced less bullying than did those from schools not participating (Schauben et al., 2006). While incidences of bullying increased in the control schools, bullying acts and observations of others being bullied decreased in participating schools. In addition, greater learning and retention of information of what bullying is and how to respond to it was seen across both 2nd and 4th grade students in the program, even when asked after two months. These data show that the use of theatrical techniques and acting out the preferred actions may have strengthened the students' learning and retention of how to confront a bully.

The Minnesota History Center has provided school outreach for over five years (Mannes, M., personal communication, March 28, 2008). During hour-long programs, a single actor portrays an important individual from Minnesota history. They use props and audience participation to teach about the impact of the individual as well as the community and political climate of the times in which they lived. Similar to the current study's programs, the History Players began as supplements to exhibit galleries at the

Minnesota History Center and grew into a school outreach program. The History Player in the Classroom program has numerous activities developed around each story. The teachers are provided with pre- and post-activity packets that prepare the students for the program and continue to build on aspects of the programs. In addition, each program is explicitly linked to state educational standards in history and other areas depending on their relevance. The positive feedback and ever increasing number of orders for the program shows that the teachers and school districts support the History Player in the Classroom program as an effective program for teaching about history (Mannes, March 28, 2008).

The Science Museum of Minnesota has been doing science outreach for some time. Activities span assemblies about "Antarctica" and "Explain Your Brain" to week-long programs where each day builds on themes like "Crime Lab Science" and "Archaeology." Though the outreach program has had a lot of experience with developing and running school outreach programs and demonstrations, its work has not been formally evaluated. The theater outreach was a new direction for the larger Education Department, and it began as simple modifications of on-site plays. Unfortunately, the theater department staff did not formally request help or ask for advice about how to plan, prepare, or otherwise develop the programs from others in the department.

Qualitative Research and the Case Study

Qualitative research is human nature's most basic form of learning and understanding. It is through observation, asking questions, and pushing limits, that children come to understand their world. Babies watch the world work around them as

they develop their senses, the control of their bodies, and their connections to the environment (Ashford, Wonston LeCroy, & Lortie, 2006; DeHart, Sroufe, & Cooper, 2000). Qualitative research and evaluation stem directly from this most basic form of human inquiry.

Case studies are the traditional research and evaluative process in which qualitative research methods are used (Gall, Gall, & Borg, 2003). Beginning with smaller units or objects of study, humans seek to understand the world around them. Children create ideas of how others will act, interact, and react to them from the caregivers in their lives; they then test and retest their ideas of behavior and social interaction with the other individuals they meet. This is the basis of the case study (Yin, 1993, 2009). In research and evaluation, case studies were created as a response to the limitations of quantitative research (Yin, 1993); case studies more effectively explore topics and issues that may have ambiguous or unknown relationships (Gray, 2004). A case study "brings a phenomenon to life" (Gall, Gall, & Borg, 2003, p. 434) through "intensive descriptions and analyses" (Merriam, 1998, p. 19). Gray (2004) explains that case studies are used to illuminate causal relationships within the topic being studied. Not only does a case study fully describe a situation, program, or person, it also works to illuminate a version of 'how' or 'why' something is happening (Gray, 2004). While case studies are not used to generalize a theory to an entire population, case studies are the foundation from which generalizeable theories may arise. Garson (2008) believes that the case study's strength is in its ability to see more interactions than a quantitative study does: "it has the capability of uncovering causal paths and mechanisms, and through richness of detail, identifying causal influences and interaction effects" (para. 1). By focusing the case study from the

entire context to specific aspects of the context, a given theory can be either created or replicated.

For those with a quantitative mindset, the inability to generalize case studies may be seen as a weakness. This is not the case for those who use the case study as their form of research. Case studies are used because of their ability to be more illuminating to a particular situation (Gall, Gall, & Borg, 2003). As more case studies are done on the same topic, the more they can support a generalization of a given theory through meta-analysis, but single case studies do not have the statistical significance to support generalizability beyond themselves or other cases that are similar in important features (Creswell, 2003). Case studies are the primary form of evaluation, as evaluations are frequently intended to shed light on a particular program to assess its impacts on participants (Gray, 2004).

Case studies are not intended to generalize beyond their bounds because the context within which a case study is performed is necessary to understanding the findings (Yin, 1993, 2009). Feagin, Orum, and Sjoberg (1991) note that the case study is grounded in multiple forms of data collected from the natural world, allowing for more defined forms of generalizability: "The detailed and rich data offered by the well-crafted case study permit the analyst to develop a solid empirical basis for specific concepts and generalizations" (p. 7). This, they contend, is in stark contrast to quantitative work, most often used to try to access the same information. "[T]he flesh and bones of the everyday lifeworld is removed from the substance of the research itself, thereby diminishing the usefulness of the research for subsequent investigations" (p. 9). The case study allows researchers to study human actions in a natural setting (Feagin, Orum, & Sjoberg, 1991).

Unlike other qualitative approaches to research and evaluation, the case study uses multiple forms of data collection (Creswell, 2008; Yin, 1993, 2009). This not only grounds the study in the natural setting and context but also thoroughly informs and strengthens any theoretical claims the researcher may make. Donmoyer (1990) sees case studies as being the most effective in expressing the complexity of human action through the researcher's epistemological lens. Because of the presence of the researcher's epistemological stance on reality and truth, case studies recognize the human biases throughout the process (Merriam, 1998). In case studies, though numerous forms of data are collected, the researcher is, most often, the instrument; observations and interviews require the researcher to process the information and create data from it. Thus, the researcher's perspectives become encoded throughout the data. Recognizing this at the outset, case studies and qualitative data accept the more subjective form of data collection as part of the process.

While case studies have traditionally been seen as being specifically a qualitative form of research, case studies are a design rather than a form of data collection (Yin, 1993, 1994). "The case study as a research strategy comprises an all-encompassing method – with the logic of design incorporating specific approaches to data collection and to data analysis" (Yin, 1993, p. 13).

In this case study, basic theories of what the theater programs would accomplish previously existed as program goals. The evaluation was created through the generation of initial questions about these goals. This case study included various forms of data collection: observation, surveys, interviews with different stakeholder groups, and debriefs with actors after programs. While there are numerous types of case studies, the

current case study was descriptive. It aimed to describe, in detail, the phenomenon of the Science Live Traveling Theater program. It sought to describe the development of the program through its first school year.

This was an exploratory, developmental study – finding out just what effects the program has and how to make sure they are achieving their goals and causing the effect they deem most important. It was exploratory because the museum had never before taken theater out of the museum in a purposeful way; some shows had previously been requested to be performed to specific groups, but the theater department had never explicitly created outreach theater. The evaluation supported the development process of the programs through providing immediate feedback and generating ideas, thoughts, and changes throughout the process.

Evaluation and Process Use

Evaluation aims to understand and describe a program or project for a specific audience. Most importantly, evaluations often try to identify the merit and worth of a given project. While research studies a given project from afar, evaluations often get into the middle of a program to fully understand what is occurring. The main focus of most research studies is to explain the "how" or "why;" evaluations drive at those same goals, as well as determining the merit and worth of a project, with an intention of being useful to those who are involved. Use of evaluative findings, beyond the evaluation itself, is paramount in many forms of evaluation (Patton, 2008). Though there are many different forms of evaluation, this study adopted a utilization-focused form of evaluation: "evaluation done for specific intended primary users for specific, intended uses" (Patton,

2008, p. 37). The evaluation findings were meant to be fully adopted and embraced by the actors of SMM's theater department.

Recently, Michael Quinn Patton formulated a theory around the impact on practitioners and other stakeholders active in the evaluation process.

> Process use refers to and is indicated by individual changes in thinking and behavior, and program or organizational changes in procedures and culture, that occur among those involved in evaluation as a result of the learning that occurs during the evaluation process. (Patton, 2008, p. 155)

Process use is the individual impact of engaging in evaluative activities (Patton, 1998; Patton, 2007). For most organizations and individuals, the evaluation process is a new experience. Learning occurs through the evaluation process, as stakeholders reflect on questions, think deeply about their organization's procedures and culture, and engage in critiquing the work in which they are involved. Evaluation is inherently a social process, as individuals interact and form shared understandings of the topic (Amo & Cousins, 2007). Evaluations are also often cross-cultural experiences as stakeholders and participants experience new ways of thinking and viewing the world through the process (Patton, 1998). Studying process use attempts to recognize and assess these impacts on all individuals involved.

While process use assesses the learning that occurs through participation in an evaluation, it also includes how individuals use that learning. Harnar and Preskill (2007) state that process use describes stakeholders applying their learning as it occurs rather than waiting for the evaluation to be completely finished. Patton (2008, p. 157) identifies six ways of seeing whether process use is occurring:

> (1) enhancing understandings about the program among those involved (for example, the program logic model); (2) reinforcing the program intervention; (3) increasing commitment and facilitating the learning of those involved; (4) program and organizational development… (5) infusing evaluation thinking into an organization's culture; and (6) instrumentation effects (that is, what gets measured gets done).

Patton (2007) argues that these are not indicators of process use but are "specific sensitizing categories within the broader sensitizing concept of process use" (p. 103). These six domains of action are possible ways of recognizing the occurrence of process use.

Process use is often an unintended effect of the evaluation process. This was specifically the case in this evaluation. Neither the evaluators nor the actors expected to experience large shifts in thinking as the program proceeded. The process use of the project did not explicitly begin until late in the school year, after the actors had performed and the primary investigator had observed and discussed numerous productions. After recognizing shifts in the nature of discussions and the questions that actors posed, the primary investigator began formally assessing the effects of participating in the evaluation process on the actors. Since the actors were already engaged in reflecting on their work, no changes were made to the structure of the evaluation to incorporate process use evaluation. Instead, the evaluator used the debrief conversations to study the evaluation process impacts. The impacts were coded using the six markers listed above. In addition, the evaluator interviewed the actors at the end of the school year to ask specific questions about personal changes they may have experienced during the process.

Methodology

The distinctions made between research and evaluation are varied. It should be noted here that the primary investigator's perception of the difference between evaluation and research is in line with that of Dr. Jean King. "Evaluation is done for a specific client or program; research is not" (King, September 7, 2006). Through the process of creating the evaluation and studying the traveling theater program, the evaluator recognized and responded to the voices of the theater staff. Continuous efforts were made to incorporate their ideas, thoughts, and preferences for what data and information was to be collected into all evaluative formats. The primary investigator's focus was more on the utility of the data by the theater department than The Science Museum of Minnesota or the larger museum, theater, or academic communities.

Case Study

> Case study research is a qualitative approach in which the investigator explores a bounded system (a ***case***) or multiple bounded systems (cases) over time, through detailed, in-depth data collection involving ***multiple sources of information*** (e.g., observations, interviews, audiovisual material, and documents and reports), and reports a case ***description*** and case-based themes. (Creswell, 2007, p. 73)

The formative evaluation of the Science Museum of Minnesota's Outreach Theater Program was designed to assess whether the traveling theater programs were meeting their goals, conveying new concepts and knowledge, and increasing student discussion and interest. The design was built around the structure of the theater programs, the purpose of the evaluation, and certain methods used in formative evaluations. The

study was created in sync with the creation of the traveling theater project and the three programs for schools. Aspects of evaluation were incorporated into all steps of this endeavor, beginning with a needs assessment in the spring of 2007 (Grack Nelson, 2007). The Department of Research and Evaluation in Learning at the Science Museum of Minnesota sent out surveys to teachers throughout St. Paul asking them if they would consider inviting a traveling theater program into their classroom or school. "Educators expressed high levels of interest in the program with a little more than two-thirds (69%) giving a rating between 8 and 10" (Grack Nelson, 2007, p. 1) after reading small summaries of five different theater shows. Teachers showed interest in having the shows performed for grades Kindergarten through 12th grade, and 4th and 5th grade classrooms received the most support (Grack Nelson). While funding was a barrier for the participating teachers using the theater outreach shows, over three quarters (77%) thought they were likely to "use the program" (p. 7). The results of this needs assessment, as well as the new Strategic Plan of the museum, supported the development of a traveling theater program.

The evaluation of the theater outreach program provides feedback for the museum in a number of ways. While assessing the strength of the outreach itself and whether or not theater outreach is appropriate for the museum to engage in at this time, it also assesses the programs being created and provided by the museum's theater department. Through the museum's continued efforts to be innovative in the science museum field, supportive of educational efforts in all areas of the community, and expanding and providing educational and scientific connections outside of the museum, the museum theater outreach program was developed. Studying the program was a requirement from

the start of the program because of the museum's respect for and commitment to evaluation findings and their impact on program improvement. The program was developed from existing plays and pieces performed in the museum. Using previous personal experience and models of traveling theater, the actors crafted the program structure around the facilitated discussions.

August 2007 marked the start of this evaluation. The Director of Education and the head of the theater department had created the format for the traveling theater programs, and the theater department director met with the evaluation team to discuss evaluating the formative year of the museum's traveling theater program. At this point, the design of both the theater programs and the evaluation came together. The data collection strategies were chosen to address the main questions of the evaluation, namely:

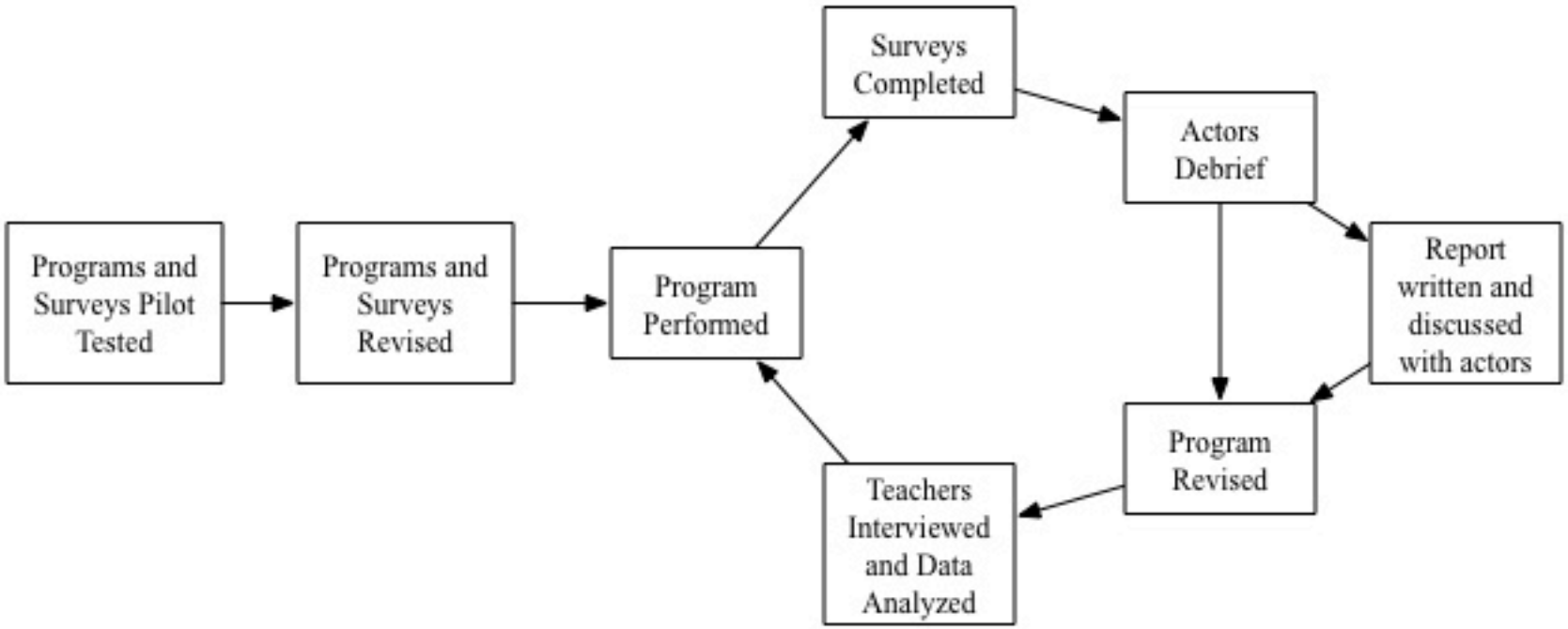
1. How effectively does the program convey new information and generate discussion on each topic?
2. How effectively do teachers incorporate the program topics into their classroom and curriculum?
3. What do students and teachers gain from the programs?
4. What effects do the programs have on classroom conversations for the following 2 weeks?
5. How does the process of creating a program and an evaluation affect the actors involved?

From the needs assessment and the initial meeting of the evaluation and theater departments, a theoretical framework of the effects of the theater program was developed. This framework diagrammed how the actors perceived the programs to affect audiences

and support student learning. The primary investigator created the framework, as the program theory was not clearly articulated by the department or actors. The implicit theory of program effect (Rossey, Lipsey, & Freeman, 2004) was found through document analysis of the program goals and brochures and through initial discussions with the theater department about the program's intentions. This framework was later referred to, as described below, as the data was collected and analyzed to understand the distinctions and similarities between the initial theory and observed outcomes of the project.

Figure 1 illustrates the continuous revision and growth of the program and the evaluation through the course of the school year. As the school year progressed, it became clear that an analysis of the first set of shows could be reported on and responded to before the spring shows began; a two-step process was created on the fly by the evaluation team and the theater department. Aside from the continuous, minor improvements made through the process of developing, performing, and talking about each show, the inclusion of a mid-year review and discussion of the actors' perceptions and ideas for the program proved more beneficial for the program development process than an end of the year report. The actors were able to see what had transpired from a more removed position and make larger, more comprehensive changes from that perspective.

Figure 1. Evaluation Cycle



Phase One included the pilot testing of the programs and the evaluation as well as the analysis of fall semester programs. The data collected, and not collected, during Phase One laid the groundwork for revisions and improvements to be tested during Phase Two. Phase One also highlighted the need for the inclusion of educational leaders and more experienced outreach staff to support program development.

Phase Two involved the continued collection of evaluative data. Due to a lack of potential outreach programs, school groups coming for fieldtrips to the Science Museum of Minnesota were invited to participate to increase data collection. Students were surveyed, teachers were surveyed and called, and actors debriefed after each program. At the end of Phase Two, the Science Museum of Minnesota's Traveling Theater Program had more age appropriate plays that focused on education, and they had decisive ideas about program changes to be made before the start of the next school year.

The evaluation spanned the 2007-2008 school year, beginning in August 2007. Two classes pilot tested the program in October of 2007, and the program was formally evaluated from October 2007 through June 2008. Phase One ended in February of 2008, and the mid-year review was disseminated and discussed in March 2008. Changes to the programs were made throughout March and implemented in April. Phase Two ran from April through June 2008. The information collected through Phase Two was analyzed and reviewed in June 2008, giving the theater department two and a half months to make further revisions before the start of the next school year.

The case study collected data through a post-program survey and follow-up interview. Observations of the program were also conducted, as were post-program debriefing interviews with the participating actors. The current study included passing out

teacher surveys at the end of the program and conducting follow-up interviews. These aspects of the study were approved by the University of Minnesota's Institutional Review Board[1]. The student surveys were collected by The Science Museum of Minnesota's evaluation department and were incorporated into the current study as secondary data.

Due to the nature of the programs – an introduction, a play, discussion time, a second introduction, a play, discussion time – and the fact that preliminary information was not sent to the schools or teachers, a post-program survey for students and teachers was created. A two-week follow-up interview with the teachers was conducted to assess whether any continued affect on student learning was seen.

Forms of Data Collected

The *Nanoscience* program [*Nano*] student post-surveys were written at a fourth grade reading level, even though the youngest students to receive the surveys would be fifth graders. Language within the surveys was kept at a lower grade level so most of the students in the sample would understand what was being asked (Gray, 2004). The *Nano* program survey draft was pilot tested on 30 6th and 7th grade students. These classes were purposefully used to pilot test the *Nano* program due to the school's relationship with the Science Museum of Minnesota and the teachers' willingness to have their classes participate in a newly developed theater program. This purposeful sampling provided an adequate sample size, an appropriate environment for both the performance as well as the data collection, and acted as a typical case from which to make appropriate assumptions about modifying the surveys for the study (Creswell, 2007; Patten, 2001). In addition, the

[1] The Institutional Review Board reviews research projects that use human subjects to ensure that human subjects are not coerced or put in too much risk. Due to the benign nature of the questions posed to teachers, this study was deemed exempt from the IRB proposal process.

students were of the grade levels that had reserved the *Nano* program for the school year. From the piloted responses, more specific questions were created and some language was changed to generate more program-specific answers. For the final version of the student surveys used for the programs, see Appendix C.

The teacher surveys were created to assess teachers' perceptions of the theater shows, the discussions, and the overall utility of the outreach program for their curriculum and class. Some of the questions were similar to those asked of the students; this was done to both support the triangulation of the data as well as to understand the various perspectives on the same topic. The teacher surveys were pilot tested on five teachers. The teachers used for pilot-testing were the first teachers participating in the traveling theater program. For the final teacher survey, see Appendix D.

The teacher interview questions were created as follow-up questions to the post-survey, with more attention focused on how the individuals and the classroom discussions or topics seemed to be affected by the programs. The interview protocol is shared in Appendix E. This was piloted on two teachers. The interviews were semi-structured, allowing for the interviewer to follow-up on any relevant comments made by the teacher or ask additional questions as they saw appropriate.

The fourth form of data was incorporated into the evaluation as the study progressed. The museum evaluators initially went to the first few programs to understand how the plays and follow-up discussions were conducted and how the audiences were responding to the program. After recognizing the variability of each audience and performance, the need for observational data in the study was recognized. The primary investigator thus observed as many of the programs as possible, noting the activity,

attention, and discussion levels of each audience group. A formal observation protocol was created when the primary investigator noted consistent patterns of behavior emerging across the performances. After collating the observational data from the fall shows and asking the actors what audience behaviors or actions depict high levels of engagement with the show, the primary investigator created a list of quantitative and qualitative behaviors that should be specifically observed and noted (see Appendix F). The observation sheet was thus only used for the programs performed on April 1, 2008 for schools visiting the museum on field trips.

The final data form developed over the course of the study. After every program, participating evaluators and actors met to debrief the program. No formal interview protocol was ever created, but the same questions were asked at each debriefing. These questions can be viewed in Appendix G. The evaluators asked questions to understand how the actors felt about the program, from their performance and their facilitation of the discussions to their perception of audience interest and engagement. During these debriefs, numerous ideas were generated to improve different aspects of the program. More of the changes and improvements to the program came out of the ideas generated through these debriefs than from information that came from the surveys and interviews.

In sum, data were collected in the following ways: student surveys, teacher surveys, teacher follow-up interviews, observations of the programs, and debriefing conversations among actors and evaluators. These five forms of data collection worked both in conjunction and opposition with one another. Collecting the various forms of data allowed for robustness of the study through triangulation, but the data also often worked in opposition, as actors perceived very different responses from audiences than were

actually present. These forms of data helped the evaluators and actors more fully understand the audiences' responses to the program.

Data Analysis

Data analysis occurred in various ways throughout the case study. The primary investigator was the formative evaluator of the program as the theater department worked to create and improve the program it was developing; reports were created at different points in time as the data for each performance were analyzed and reported back to the theater department. In addition, the primary investigator was acting as an external evaluator to understand both the development process as well as the effectiveness of the outreach theater program beyond what the museum's theater department was interested in. The formative evaluator role allowed the primary investigator to observe all aspects of the project's development, giving a rich and full understanding of the various obstacles present during the development process.

As the formative evaluation had shorter timelines than the external evaluation of the data, reports were created throughout the 2007-2008 school year that the theater department and actors used to make improvements. A report was generated at the end of the fall semester; the theater department did not have any shows between the end of December and March, so they used that time to make improvements to the traveling programs based on the feedback obtained through the fall. A final, all encapsulating report across all three traveling programs was not created. After the winter report was created, the theater department only conducted the *Nano* program for school groups on field trips to The Science Museum of Minnesota. These performances were analyzed and the data were reported on so the theater department could make changes over the summer

months for the following year's performances. The data used for these two reports included evaluators' observations, teacher and student surveys, and the evaluator-actor debriefs.

Qualitative and quantitative analyses were conducted on the open and close-ended questions from the surveys and interviews. The coding of the open-ended questions was done in two ways. The open-ended questions on the surveys were of two different types: some were asking specifically about what the student or teacher learned from the program, while others asked about suggested changes to the program. The coding themes for the knowledge-specific questions were created directly from the learning goals of each program; the suggested meanings of each answer were identified in light of the intended knowledge being conveyed through the program. The questions based around improving the program were openly coded; instead of applying a coding scheme to the data, the responses were coded and clustered based on the data. Suggested changes were clustered based on similar meanings and ideas present in each response. The names for each cluster were identified to most effectively capture the meaning within each cluster (Miles & Huberman, 1994). In some instances, no coding was conducted for some of the data due to low response rates. In these cases, all answers were shared in the reports as they were written on the surveys.

While the external evaluation would use some of the analysis from these reports, the scope of the current study was much more long-term and all encompassing. Each performance of the school outreach programs would be reflected upon, but the results and conclusions would be drawn more from the entirety of the school year rather than from each singular performance. In addition, the nature of the case study was to assess how the

project developed through its first year, so the data were analyzed from beginning to end rather than at each point.

All of the data were separately coded and analyzed, both at the level of data type and across all of the data generated for that performance. Open coding without pre-defined codes was used for the teacher interviews, actor debriefs, and evaluator observations of the various performances. Each data type was separately coded using the same open coding techniques. After all forms of data were analyzed, the codes from the various data types were combined and compared for each program. The data were analyzed as a whole using the theoretical framework built around understanding the evaluative questions.

Results and Discussion

The following chapter depicts the data collected for the *Nano* package. Each theater package performance is explained through observations by the evaluators and actors. The various performances for the package are then compiled and assessed based on the five main questions of the evaluation:

1. How effectively does the program convey new information and generate discussion on each topic?
2. How effectively do teachers incorporate the program topics into their classroom and curriculum?
3. What do students and teachers gain from the programs?
4. What effects do the programs have on classroom conversations for the following 2 weeks?
5. How does the process of creating a program and an evaluation affect the actors involved?

Nanoscience Program

The *Nanoscience* package was performed four times for school groups. Though the plays were performed for the Minnesota Pollution Control Agency and as forums, for the purposes of this study and the assessment of the package and traveling theater program, only the school group performances will be discussed.

On October 1, 2007, the actors performed the *Nano* package for twenty-nine 6th and 8th grade students from a St. Paul parochial school. The program was held in a classroom that was not decorated for any particular subject. Two teachers sat off to the side of the room next to the stage area, facing the students. Though these teachers were

supposed to be active participants in the program, they neither engaged in the discussions nor helped regulate student behavior. Five students actively participated in the discussions; two asked questions and three others responded when the actors asked the audience questions.

On December 11, 2007, the program was performed for around forty 4th through 6th grade students and eight teachers at another private school in St. Paul. This program was held as an end-of-the-day activity, and all students in the 4th through 6th grade who were waiting for buses or for their parents to arrive were present. This program was held in a corner of the cafeteria; students sat on the floor while teachers sat in chairs around the back of the audience. This school group had been more thoroughly prepared before the start of the program; they had explicitly stated that they wanted teachers to sit among the students, watch the plays, participate in the discussions, ask questions, and help support student learning. Though the individual who had reserved the program had been given all of this information, it was apparent through observation that the teachers either did not receive the information or chose not to follow-through. No teachers asked or answered questions, and one teacher started chatting with a student next to the stage while the actors led the discussion. Though many of the students were younger than the requested age range for the topic (5th to 9th grade), the majority of the students who spoke, asked and answered questions, and remained engaged throughout the entire program were the 4th grade students.

On April 2, 2008, the actors ran the traveling theater program for two groups of students who were visiting The Science Museum of Minnesota on a field trip. These sixty-nine students were 6th and 7th graders, and the thirty-six participating adults were

both teachers and chaperones. The programs were held in the Science Live Theater, a space that holds around seventy people and is designed specifically for theater productions. When the actors started their shows, the lights would dim on the audience and come up on the stage. When the actors led discussions, the lights would shift and illuminate the audience. The dimmed lights silenced the audience and cut down on distractions during the shows, as evidenced by fewer students talking and whispering, and more focused comments and questions during the discussion time. Teachers and parents asked the actors questions and interacted with the students when questions were posed to the audience.

Data were collected for three of the four performances. The total number of students responding to the survey was 163; 17 were collected at the first performance and the rest were collected at the museum on April 2. Six teachers and thirty parents also filled out surveys for the in-house performances on April 2. The students were evenly split male and female, and most of them were in 6th grade; 50% were in 6th grade, 20% were in 7th, 18% were in 8th, and 12% were in 9th grade. The vast majority of the students who participated in the programs were white (76%). Most of the remaining students were of mixed descent (11%) while a few were American Indian (3%), Hispanic or Latino (4%), or Asian American (6%). Demographic information was not collected from the adults in attendance.

Nanoscience Knowledge Transference

The students, teachers, and chaperones were asked a number of questions related to what they learned from the program. A vast majority of the students felt that they

learned more about nano and nanotechnology from the show than they knew previously (see Figure 2).

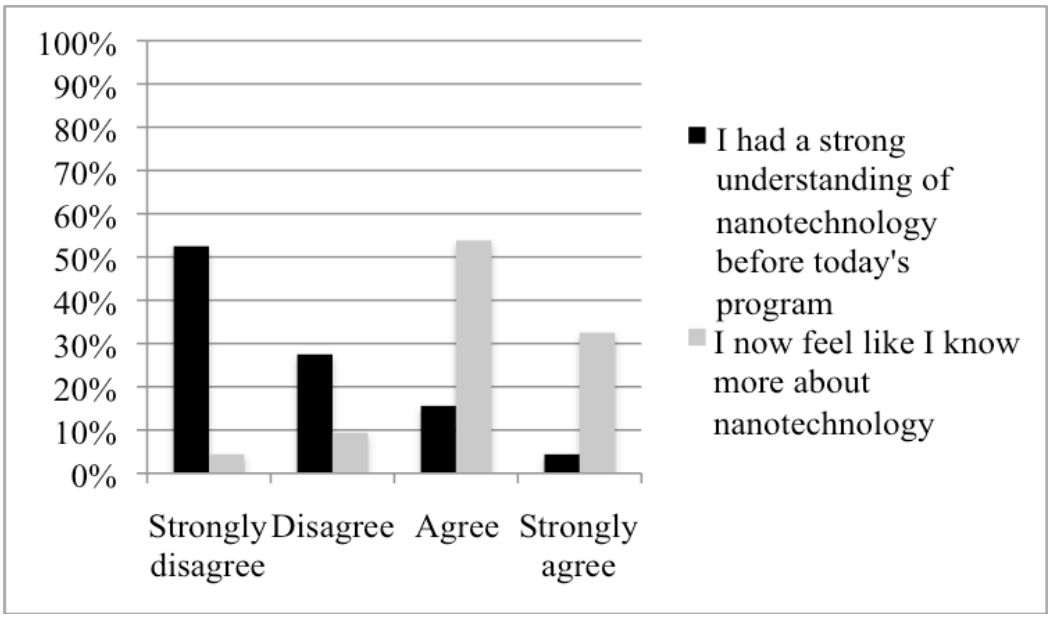


Figure 2. Comparison of What Students Knew Before and After the Program About Nanotechnology (n=163).

Students were asked what they learned about nano; the question was changed after the pilot test due to students not understanding the word "nano." After piloting, students were asked to share two ways to describe what things are like at the nanoscale. Many were able to share various ideas that they had learned (see Table 1). Their answers were coded based on the learning goals of the program. These answers show that students grasped some aspects of the nanoscale better than others.

Table 1

Ways Students Described the Nanoscale (n=163)

Descriptions	Percent of Students
Small	44%
Dangerous	31%
Helpful	16%
I don't know	17%
Properties change	7%
Shake, stick, slide*	3%
Still studying it	2%
Other	1%
No response	19%

Note: Students gave more than one answer.

*Shake, Stick Slide denotes specific behavioral actions that occur at the nanoscale, also known as Van der Waals forces.

Teachers and chaperones were asked how well different properties of the nanoscale and nanotechnology were addressed through the program. In support of the students' abilities to recall these topics, the adults in the audience thought that most of the topics were moderately to well addressed through the program (see Table 2).

Table 2

Adults Assess How Well Topics Were Addressed (n=36)

Topics	Not at all addressed	Minimally addressed	Moderately addressed	Well addressed
The size of things at the nanoscale	0	8%	28%	64%
The properties of things at the nanoscale	0	19%	53%	28%
The positive impacts nanotechnology may have on the environment	0	6%	56%	39%
The negative impacts nanotechnology may have on the environment	0	6%	44%	50%
The potential use of nano in medicine	0	11%	50%	39%

Students were asked what benefits and risks they learned about through the program. Most of the responses were direct issues raised during one of the two plays (i.e., cancer, environment, too small). Close to a tenth of the students stated that they had not learned either a benefit or a risk of nanotechnology during the program (see Table 3). A number of the responses students shared for benefits of nanotechnology were actually risks, suggesting that the risks of the new technology were much more alarming and pertinent to students than the benefits were.

Table 3

Benefits and Risks of Nanotechnology (n=140)

Identified Themes	Percent of Responses
Benefits	
Cures cancer	33%
Generally helpful	11%
Specific examples from show given	10%
Helps the environment	9%
Didn't learn benefits	6%
It will cure you	4%
Risk listed	4%
Benefits and risks listed	3%
We need to learn more	3%
Cure diseases	2%
Live longer	2%
Risks	
It could kill us	25%
Cause bodily harm	20%
Harm the environment	17%
Lack of knowledge	7%
It's too small to control	6%
Didn't learn about risks	6%
Benefits and risks listed	3%

Student responses, supported by teacher perception, show that the two plays were providing information about nanoscience and nanotechnology in accessible ways for middle school audiences. Though relying on immediate recall, the students identified quite a few ideas and issues raised through the program, supporting the program's goal of conveying new information.

Program Responsiveness

Audience members were asked a number of questions in relation to the program's accessibility, topics, and comfort in engaging in dialogue about the program. The vast majority of the audience enjoyed each of the two plays and felt that they were easy to understand (see Table 4). In addition, two thirds of the audience expressed comfort in talking with others, asking questions, and voicing opinions in their group about nanotechnology and the issues that were raised through the plays (see Table 5). This information shows that the audience members were engaged in the program, even if they did not talk a lot during the discussion times.

Table 4

Enjoyment, Interest, and Understanding of Plays (n=162)

Statement	Strongly disagree	Disagree	Agree	Strongly agree
I enjoyed the play "Same Sides."	3%	6%	71%	19%
The play "Same Sides" was easy to understand.	5%	20%	58%	17%
I enjoyed the play "Let's Talk about it."	5%	15%	57%	23%
The play "Let's Talk about it" was easy to understand.	9%	22%	48%	20%
Today's theater program helped me think about my own views of nanotechnology.	5%	13%	54%	28%
I am interested in talking to my friends or family about what I learned during today's program. (n=143)	18%	24%	49%	9%

Table 5

Comfort in Discussion (n=157)

Statement	Very uncomfortable	Uncomfortable	Comfortable	Very comfortable
I felt comfortable voicing my opinions during the discussions.	11%	20%	57%	12%
I felt comfortable asking questions during the discussions.	14%	17%	56%	10%
I felt comfortable responding to others' comments during the discussions.	13%	16%	57%	15%

Students felt that the program made them think more about nanotechnology and the issues surrounding nanoscience developments (refer to Table 3). Many of the students did not believe that they would take the information or the conversation home and talk about it with their parents or friends; only half of the students expressed enthusiasm towards continuing the conversation about nanotechnology with family or friends after the program ended.

This information reveals a number of attitudes and behaviors of the students participating in the program. The audience members, who were students, teachers, and adults, enjoyed the structure of the program for learning about nanoscience and technology. While very few individuals actually participated in the discussion portions of the program, over two thirds of the audience expressed comfort in engaging in the conversation. Unfortunately, fewer students became so interested in the topic that they

thought they would speak to friends and family about what they had seen, learned, and discussed beyond the close of the program. Though the context was great for generating interest, engagement, and learning of the topic, the theater shows did not immediately support continuing conversations or knowledge development in the participating students.

Conversations in the Classroom

Teachers were interviewed two to three weeks after their classes participated in the *Nano* program. Through a semi-structured interview, they were asked questions related to how the program fit into their curriculum, what types of conversations and questions were raised after the program, and how the students seemed to retain the knowledge transferred to them through the theater productions. Only one teacher out of the six participating teachers agreed to being interviewed after the program. This teacher was associated with the first program, performed at the St. Paul Catholic school. Linda (name changed) thought the program was fantastic. She thought it was "a great way for kids to understand what nanotechnology is." Conversations after the program included how the students felt, what they thought, and "how they would be affected by it in the present and future." Students asked her a number of questions, which she felt quite comfortable answering because "I pretty much knew it all. I knew a lot about the topic before the program, so I didn't learn anything new."

The *Nano* program was not incorporated into the class curriculum. Instead, it acted as a one-off, special program for the students. The theater program ended up being an hour-long special for educating students about nano-related topics. Due to its independence from formal classroom topics, Linda did suggest that a bigger introduction to the topic of nanoscience and technology would have been more helpful. "The kids

could have used more information at the beginning to understand the topic better." Due to the lack of responsiveness from other participating teachers, it is likely that the program was not effectively incorporated into other work and curriculum that was occurring in their classrooms. This lack of incorporation is not surprising due to the lack of pre- and post-program activities or additional information for the teachers to use to support classroom discussions.

Actor Effect

The actors and evaluators debriefed after each program, discussing audience engagement, any problems or questions that arose that the actors did not have answers for, and any possible improvements to the program for future shows. Each show debrief is discussed separately here, and they are compiled at the end.

The first *Nano* package was delivered for Linda and her students at a St. Paul parochial school. After this first production and run through of the program for its intended audience, the actors had quite a bit to say about what they could do to improve the program and better engage the audience. The issues and ideas ranged from trying to get the girls and the teachers to talk during the discussions, changing the language of the questions to be less academic and more discussion oriented, and changing the introductions to the shows to share more information. Though few students engaged in the discussion, the actors thought that the show went well "because the teacher said that it was the best way to teach nano and she thought they got it." The actors generated a number of ideas to better engage the teachers and the audience: create small group discussions to support conversations, improve the introductions to the two plays to give more background for the students, send information ahead of time that includes

expectations of the teachers and how to help support the conversations after the program, and bring additional visual aids and supports for the students to feel more comfortable asking and answering questions.

The next time the *Nano* package was performed for a group was three months later. Though the actors had previously come up with numerous ideas to get the teachers and students more engaged and involved, most of the ideas went unfulfilled. The actors did not create materials to send ahead to prepare the class or teachers for the program, nor did they provide additional visual aids. The introductions to the plays were further developed to give more background on what the plays were discussing, as well as to include more basic information about the nanoscale. During the discussions, the actors incorporated a Think-Pair-Share strategy to get students thinking about the question, discussing their answer with a partner, and then sharing their ideas with the group. After the program, the actors felt the Think-Pair-Share went very well, as more students began answering questions and more conversations were occurring during the discussion time. After this second program, the actors again identified the need to send preparatory work and information ahead of the show to help get the classes engaged and interested in the topic and show. Due to the location of the program (in the lunchroom) and the lack of teacher involvement, the actors did not have good control of the students. They recognized the need for heightened expectations for the teachers and possibly incorporating space specifications when scheduling the programs. Unlike the first debrief meeting, the actors did much of the questioning and evaluating of the program on their own. The actors came to the meeting with a number of issues and ideas to help improve the audience participation in the program.

The third debrief occurred after the two programs were performed in the museum. This was the last debrief of the school year, and each actor had, by then, participated in at least three debrief sessions on the different programs. These two programs were successful, arguably because the programs were held in a traditional theater space with lights that dim over the audience. At this point, the actors felt comfortable performing the program, and no major changes had been implemented since the December performance. The actors had many positive comments about how the program went: the audience, both students and adults, were engaged in the program and asked numerous questions about the nanoscale, and the actors did not use note cards because they knew the scripts. The actors were less focused on making improvements to the program in this debriefing. The school year was ending and this was their last performance of the *Nano* package. They did express intentions of making improvements on the program before the next school year, though they did not verbalize all that it entailed. The actors did recognize the effects of the space on the audience experience and the quality of the discussions with the students.

A final interview was conducted with each of the actors involved in the traveling theater program. The interviews occurred after the last outreach program was conducted but before the April shows performed in the museum. The final interview included questions ranging from what the actors thought the purpose of the project was to what they learned through being part of launching SMM's traveling theater program. Stephanie, the director of the theater department, and Jen, Mahmoud, and Rebecca, actors for SMM, shared their thoughts and perceptions about the first year of the program. Though they were not terribly reflective of their practice, nearly all of them reported

learning through developing and being part of the project. Stephanie did not think that she learned anything through the process, nor did she do anything differently with the museum outreach than she had previously done with theater outreach at other organizations.

> It was the same things. You know, different contact person, the school's late, unruly students, so I, not that we can't find ways to improve on that, but I think that's the nature of the beast. I don't think it reflects on our programming. But again, not that we can't find ways to improve on it and make our lives easier. Um, we definitely can do that. (Stephanie)

Jen, Mahmoud, and Rebecca each identified ways that they had developed through the process of implementing the traveling theater program. They identified that their facilitation skills improved or that they developed new ways of acting for groups when not in a traditional theater space. All of the actors identified the use of evaluation as being helpful in making changes and identifying problems with the process or execution of the outreach. Stephanie expressed thanks that this work had been done: “Our department doesn’t usually have the money to evaluate something, so this has been wonderful for us. […] It has been very helpful. Just to have someone, just to have it in a formal idea, as opposed to little notes after every meeting, or someone stopping in after an outreach saying hey this really isn't working.” Rebecca recognized the observers as seeing more than the actors could when in character and focused on performing: “I think that it's been good to have those evaluation forms and I think the couple times that you came out and watched the shows and kind of saw what was happening, just being a part of some of the program versus just saying oh this is what we think or this is what we're

guessing you should do. It's been nice to have evaluations and seeing people come and check in, ‘cause it's still in development.” Mahmoud seconded the benefit of observers: “And also having like a third eye at the show is very helpful.”

In these interviews, none of the actors verbalized their use of increased levels of evaluation and reflection on themselves and their performances. Though many changes within the actors were observed throughout the process, by the end of the season, the actors did not feel that they had made changes in their ways of thinking or acting. In response to the question of what problems came up that they did not expect would be problems, Rebecca shared that she could not identify any: “I can't really think of anything right now cause anything that needed to be adjusted or tweaked we just did.” Jen and Stephanie recognized that many of the ideas have not been incorporated into the programs, but they planned on making changes to the programs over the summer to fit in the ideas: Stephanie – “I would like to see us install some of the ideas that our staff has had and teachers have had. I'd like to see those implemented, for improvement.” Jen – “Um, if we have to do outreach, which it sounds like we do, I'd probably, yeah, all these, the changes we've talked about to just kind of hone stuff up.”

As the project developed through the school year, the theater staff adopted and incorporated aspects of the debriefs and evaluations into the way they thought about and reflected upon their work. Initially, the actors required guidance and direction to recognize that different aspects of the program did not work as well as they thought. By the end of the project, they were incorporating changes and planning on reviewing and reworking many aspects of each program to improve the experience and the interactions of the audience members. After the first debrief, the nature of the debrief conversations

changed; the actors were more aware of the problems inherent in the program, if not in the audience response. They also developed ways of talking with each other about what could improve the program. They became open to offering ideas and discussing possible solutions. The acting staff seemed to take on more responsibility for making the program work as the season progressed.

Conclusions

This case study assessed the outcomes and development of a traveling theater program hosted by The Science Museum of Minnesota. The key questions addressed through the program evaluation and this study were:

1. How effectively does the program convey new information and generate discussion on each topic?
2. How effectively do teachers incorporate the program topics into their classroom and curriculum?
3. What do students and teachers gain from the programs?
4. What effects do the programs have on classroom conversations for the following 2 weeks?
5. How does the process of creating a program and an evaluation affect the actors involved?

Multiple forms of data were collected to answer each question and triangulate the results (see Table 6). The programs were observed in action to assess program follow-through and audience participation. Students and teachers were surveyed at the conclusion of each program to understand knowledge acquisition and perceived engagement. Teachers were interviewed two to three weeks later to examine the longevity of impact and curricular connections of the program. Actors and evaluators debriefed after each show, discussing what worked and did not work about the program; the evaluator was also able to observe the effects the program's development and evaluation had on the actors through the debrief sessions.

Table 6

Evaluation Question Assessment through Data Collection Methods

Evaluation topic	Observations	Student surveys	Teacher surveys	Teacher follow-up	Actor debriefs
Conveying new information and generating discussion	X	X	X	X	
Incorporation of program topics into classroom and curriculum				X	
Student and teacher Gains		X	X	X	
Discussions following programs				X	
Process use effects	X				X

This chapter explains the overall outcomes of the program evaluation and shares recommendations for SMM's Theater Department on how to continue improvements. The outcomes of the process use evaluation for the actors and suggestions for future evaluations of this form of theater will be discussed. In addition, the implications for the field of museum theater, museum outreach, traveling science theater, and process use evaluation will be shared, and suggestions will be made as to what future research efforts should work to assess.

Nanoscience Package Effectiveness

The traveling theater program, which included two introductions, two plays, and two facilitated discussions, did not strongly connect with all of the students for whom it was performed. Within the Department of Evaluation and Research in Learning at The

Science Museum of Minnesota, a program "passes" if 80% of visitors give it positive ratings. For the *Nano* package, students did not feel that the plays were easy to understand (see Table 4), nor did they feel comfortable discussing the topics during the discussions (see Table 5).

The teachers and students did find the plays both enjoyable and informative. Less than a tenth of the students were unable to share something that they had learned with regard to the benefits and risks of nanoscale science, but a fifth did not think that they could describe the nanoscale if asked by a friend. This outcome shows that the way the plays, introductions, and discussions explain the nanoscale and nanotechnology was not easily accessed or understood by all members in the audience. Nearly all of the "I don't know" responses came from 6th grade students, as did the non-respondents to the question (see Table 7), showing that the vocabulary or storyline used to convey the information was not appropriate for younger students.

Table 7

Describing the Nanoscale Crossed with Grade

Description	6th Grade	7th Grade	8th Grade	9th Grade
Small (n=71)	39%	15%	25%	20%
Dangerous (n=51)	35%	29%	24%	12%
Helpful (n=26)	65%	27%	8%	0
I don't know (n=28)	75%	18%	4%	4%
Properties Change (n=11)	0	36%	9%	54%
Shake, Stick, Slide (n=5)	20%	20%	20%	40%
Still studying it (n=4)	50%	50%	0	0
Other (n=2)	50%	50%	0	0
No response (n=21)	71%	10%	10%	10%

While the teacher responses seemed to support the goals of the plays and program (they all felt that the topics were moderately to well addressed, as evidenced in Table 2), the student responses showed more tentativeness in feelings of confidence around information retention. The student reactions to the program seemed to play out more in the long run; teachers did not incorporate the information into classroom lessons or topics, and the class discussions about the program did not advance beyond immediate feedback and follow-up clarifying questions.

As it stands, the *Nano* package does not fully reach its intended audience. The program is sold as a package for 5th through 12th grade students, but the 6th and 7th grade students in the study were unable to remain engaged and follow the stories that conveyed the new science information. The vocabulary and terms were pieces of the program that

the actors identified as troubling. To augment the high level language used in the program, more information was included in the introductions to each play, but all of the "I don't know" responses came after the additions (all were from the April programs). To improve the effectiveness of the program and ensure that each intended audience learns from the plays, each script's language should be modified and rewritten for the intended audiences.

To further support the incorporation of the topic, information, and program into classroom activities and curriculum, the Theater Department should develop pre- and post-activities and information to share with each group. The theater department had initially planned to create supporting material, but this never came about. With the development of supporting material, not only would the audiences be better prepared and knowledgeable about what the program would be about, but they would also be able to continue the conversations and learning after the program ended. Much like the supporting materials that the History Player in the Classroom programs programs at the Minnesota History Center have created, these materials would support the development and continuity of discussions around the topics of nanoscience and nanotechnology.

The location of the theater production significantly controlled audience behavior. Three types of locations were used for performing the *Nano* package: a classroom with tables set up to view the front as a stage, the corner of a large cafeteria with no seating, and a formal theater space. Each location offered the audiences different affordances; the theater and classroom disallowed high levels of interaction and activity among the students while the cafeteria was loud and allowed for activity among the audience members. The well-defined spaces supported attention, listening, and appropriate

interactions throughout the program, whereas less delineated areas did little by way of supporting the audience attending to the actors and program. Learning and knowledge retention would be greatly supported and enhanced if the SMM Theater Department required enclosed areas and seating arrangements that afforded students less flexibility in interacting with their neighbors and decreased ambient noise and activity.

The *Nano* package and the Theater Department of SMM adopt a sociocultural theory of learning. Sociocultural theory posits that development and learning occurs as an interaction between individuals' developing abilities and their social situations (Astor-Jack, Kiehl Whaley, Dierking, Perry, & Garibay, 2007), and these social situations are mediated and constructed by cultural resources (Bruner, 1996; Ellenbogen, 2003). In this theory, the nature of human education is a cultural construction from which a limited set of behaviors, knowledge, and understandings of the world can develop (Bruner, 1996). The Theater Department's theory of theater describes their work as connecting the audience to science through emotion and personalization (Long, February 27, 2009). The scripts are written and updated to best depict the scientific information while staying current and relevant. The scripts are also written in a manner similar to theatrical productions developed in the United States, often leaning towards classroom-based modes of teaching. For many of the plays, there is an introduction or background piece that ensures that all members of the audience understand basic content pieces before the play begins. Through basic education, interaction between the actors and the audience, and the depiction of everyday interactions and behaviors, the Science Museum of Minnesota's theater department's scripts use a sociocultural theory of learning to educate the audience. While the theater department recognizes a sociocultural theory of learning,

no serious efforts have ever been made to build on and implement aspects of a theory of learning into the programs.

The *Nano* package would be greatly improved if the actors specifically worked towards learning goals that were supported through audience observation, the intentional use of peer conversations, and setting the environment to most effectively afford learning. As the shows were written with an older audience in mind, namely adults and family groups that would then talk about the shows through facilitated conversations, the ability for students to effectively reflect on and connect with the actors on a personal level is minimized. If the language of the plays were written such that a fourth grader could understand the story, the program might greatly improve the students' capacities to capture the learning goals. In addition, the facilitated discussions did little to allow the students to actively reflect on specific parts of the plays. The students might learn more if the discussions contained more structured questions and allowed students more specified time to think and then talk.

Process Use

Using Patton's six sensitizing categories for process use, the evaluation showed that the actors developed new ways of thinking about their work, interacting with one another, and developing their programs. Observing the various debrief sessions showed that each of the six sensitizing concepts changed over time. By the end of the program, the actors 1) showed heightened levels of understanding around their program's effectiveness and strengths, 2) discussed ways to improve the program strengths for conveying knowledge and integrating audience members in discussion, 3) verbalized dedication to improving the programs and supporting student learning of nanoscale

science and technology, 4) continued to develop and embellish upon the program, 5) developed critical and constructive ways of thinking about the programs they develop, and 6) discussed the issues that were being raised through the various forms of data collection.

While numerous points were observed where learning seemed to occur throughout the project, at the end of the year of evaluation and programming, the actors did not reflect the same insights. This is notable because, during the project, there were multiple times when the actors realized that the changes they made to the programs came directly out of the debrief sessions that were held specifically for the evaluation of the program. For example, Stephanie and Jen ended up not using their note cards to give the introduction and background for each show in April. This had been brought up as a problem in November: "We really shouldn't be referring to our note cards because they get in the way of our interactions with the audience." When they did stop using the prompts, both actors felt much more comfortable and connected to the audiences.

> Jen: "And then, for us, one improvement was that we got rid of the note cards and just trusted that we knew what points to hit and we had the knowledge to talk about it. I think the note cards made us seem too stiff, [and this] opened it up for, 'Hey yeah, we're just going to talk about this.'"

The actors also felt that the evaluation was crucial for ensuring that the programs really connected for these school audiences in the non-museum setting. Stephanie, the program manager and lead actor in the department, stated numerous times how much she appreciated the opportunity to get feedback on some of their programs. In addition, the

actors appreciated the extra eyes for observation, audience participation, and adult presence to support appropriate student behavior.

The apparent disconnect between what the primary investigator observed occurring over the six month period and what the actors thought occurred may have been due to the lack of more formal recognition and an explicit understanding of the process use of the evaluation. As previously stated, the process use was not initiated until December, after an observable shift in the actors' discussions and attitudes towards their performances was noted. At this point, the evaluator merely started recording the debrief sessions and making more notes of the actors' behaviors and responses to student behaviors during the shows. Thus, the actors appreciated the evaluation process, respected the outcomes of the evaluation process, did not recognize their own personal development or growth through the experience, and did not make any major changes to the program after the evaluation ended.

Limitations

A number of limitations arose during this case study. The most limiting factors present in the evaluation were those of time and finances. The school year only runs from September to June, so there was a limited amount of time available to conduct the formative evaluation. The current evaluation would have, ideally, followed a pre-post-follow-up design and incorporated student focus groups to highlight and further clarify the effects that the program had on its young participants, but such in-depth evaluating could not be produced with the minimal budget and time constraints present. Generally, five to ten percent of a program's budget should be set aside for evaluating the program (Fitzpatrick, Sanders, & Worthen, 2004); in this case, the evaluation could not exceed

three percent of the program budget. To gather as much data within the constraints of the evaluation, observations were made of as many programs as possible. The incorporation of actor debriefs allowed actors and evaluators to routinely reflect upon the experiences of the most recent shows, creating data that could be catalogued and compared over time. To address the lack of semi-longitudinal data, participating teachers were called and interviewed two weeks after the program concluded. Unfortunately, the majority of teachers declined to participate, thus limiting the strength of the current findings.

During Phase One, data collection was minimal due to a lack of participating school groups, a lack of thorough communication about the program with participating school groups, and the delimiting choice made by the actors to not hand out surveys to groups of more than forty. The lack of adherence to data collection by the actors forced the evaluation findings to be based on less than half of the participating audiences. Since the actors were not comfortable collecting data from groups larger than forty, the data also do not reflect all participating audiences and schools, but just the smaller groups for which the actors performed. Thus, the data supporting recommendations for the program were far from robust and do not reflect the entirety of the current case study.

As previously stated, the actor debrief notes were turned into data after the project was well underway. The evaluator, recognizing development in the nature of the debrief conversations and questions, incorporated process use into the evaluation in the middle of the project. At this time, the concept of process use was not explained to the actors, and the primary investigator did not explain how she saw the actors changing the way they ran or reflected upon their programs. Patton (2007) identifies process use as a "sensitizing concept" (p. 103).

> A sensitizing concept raises consciousness about something and alerts us to watch out for it within a specific context. This is what the concept of process use does. It says things are happening to people and changes are taking place in programs and organizations as evaluation takes place, especially when stakeholders are involved in the process. Watch out for those things. Pay attention. Something important may be happening. The process may be producing outcomes quite apart from findings. Think about what is going on. Help the people in the situation pay attention to what is going on, if that seems appropriate and useful. Perhaps even make process use a matter of intention. (p. 103)

This study lacked the intentionality of incorporating process use as a sensitizing concept for the actors. If the actors had been made aware of the possibility of the evaluation having an effect on the intentions behind their behavior, they might have recognized the effects of the evaluation. Additionally, if process use had been explicated to the actors, they might have developed more through the evaluation because they would have been aware of and looking for the evaluation's impact on their reflection of the outreach program.

Implications and Future Research

This study has identified a number of outcomes possible in the development of science theater outreach programs. On their own, science programs can have a minimal impact on students' basic knowledge of science topics. Without additional activities (pre or post) and a scaffolding of information, young audiences will only retain the most consistently discussed pieces of information depicted through the theater programs.

Purposeful and intentional steps and language must be layered into the plays and discussions to ensure effective knowledge transference to audience members. Future research should focus on the effects of pre or post activities on class discussions, knowledge acquisition, and audience enjoyment and interest in the topics. How do pre and post activities and information affect how audiences participate with, respond to, and reflect upon a theater program? How does the theater program better fit with the classroom curriculum due to teachers intentionally using activities provided?

The lack of teacher engagement in, interest in, and attention to the programs was unexpected by the actors and the evaluator. When information is not communicated to teachers about the nature of the program they are having their class participate in, it appears that they may not see a benefit for themselves or their class beyond an enjoyable, relaxed hour. This was evident through the teachers' lack of participation in all aspects of the evaluation. Nearly all of the teachers refused to fill out the evaluation forms, and only 4 of the 17 teachers who filled out a survey were willing to speak further about the program's impact on their students and classroom. Many of the programs were purchased or scheduled by administrators or adults not involved in watching the program when it came to their school. Future studies of theater in formal educational settings should define and assess best practices for practitioners. A number of the actors worked for traveling theater programs before working at The Science Museum of Minnesota, but they were not proactive or reactive in trying to engage the adults in the audience or ask for their support and attention. How do facilitators or actors properly communicate with teachers or chaperones to elicit behavior that supports student learning and attention in a context such as theater?

The lack of awareness of change and the disregard for evaluation outcomes and suggestions raises questions around the true nature of evaluation in specific settings. In an informal learning environment (ILE) such as a museum, when staff are directed to create and continue programming they may not find enjoyable or fundamentally effective, how could there possibly be room for evaluation to have any type of impact that is recognized by the staff? Future studies in the field of ILEs should assess how effectively different evaluations are used and how the recommendations are implemented in making programmatic changes based on the format in which the evaluation was conducted. ILEs lack significant financial support, and evaluators work, first and foremost, to ensure the utility of the evaluation findings to improve programs for general audiences. These two contextual aspects of ILE evaluations make paramount the need for evaluations to be helpful, enlightening, and effective in causing change in the programs they assess. Scarce resources are devoted to evaluations, so the use of evaluations should be critical for all stakeholders. If this is not occurring in some situations, evaluators must work harder and more diligently to ensure the beneficial use of findings.

References

Amo, C. & Cousins, J. B. (2007). Going through the process: An examination of the operationalization of process use in empirical research on evaluation. *New directions for evaluation, 2007*(116). San Francisco, CA: Wiley Periodicals, pp. 5-26.

Ashford, J. B., Winston LeCroy, C., & Lortie, K. L. (2006). *Human behavior in the social environment* (3rd Ed.). Belmont, CA: The Thomson Corporation.

Astor-Jack, T., Kiehl Whaley, K. L., Dierking, L. D., Perry, D. L., & Garibay, C. (2007). Investigating socially mediated learning. In J. H. Falk, L. D. Dierking, & S. Foutz (Eds.), *In principle, in practice: Museums as learning institutions* (pp. 217-228). New York, NY: Altamira Press.

Baum, L. & Hughes, C. (2001). Ten years of evaluating science theater at the Museum of Science, Boston. *Curator, 44*(4), pp. 355-369. Retrieved January 15, 2008 from http://vnweb.hwwilsonweb.com.floyd.lib.umn.edu/hww/results/results_single_fulltext.jhtml;hwwilsonid=HXATUXETRXWRTQA3DIKSFGGADUNGIIV0

Berghammer, G. (1988). Drama goes to school: An examination of Theater-in-Education. *Youth theater journal, 2*(3), pp. 3-8.

Black, D. R. & Goldowsky, A. (1999). *Science theater as an interpretive technique in a science museum*. Paper presented at the meeting of the National Association of Research in Science Teaching, Boston, MA.

Bridal, T. (2004). *Exploring museum theater*. Lanham, MD: Rowman & Littlefield Publishers, Inc.

Bridal, T. (2000, September/October). Staging current science: Want to help visitors understand a cutting-edge topic? Turn it into a play. *ASTC Dimensions, 5*, pp. 16-18.

Brownlee, S. (1997). The case for frivolity: play isn't just fun. Young animals can't do without it. *U. S. news & world report, 122,* pp.45-47.

Bruner, J. (1996) *The culture of education*. Cambridge, MA: Harvard University Press.

Carden, F. & Earl, S. (2007). Infusing evaluative thinking as process use: The case of the International Development Research Centre (IDRC). *New directions for evaluation, 2007*(116). San Francisco, CA: Wiley Periodicals, pp. 61-73.

Casey, V. (2005, Fall). Staging meaning: Performance in the modern museum. *TDR: The drama review, 49* (3, T 187), pp. 78-95.

CLIMB Theater (2008). *About CLIMB*. Retrieved March 25, 2009 from http://climb.venus.webaloo.com/aboutus.aspx

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd ed.). Thousand Oaks, CA: Sage Publications.

Dalrymple, L. (2006). Has it made a difference? Understanding and measuring the impact of applied theater with young people in the South African context. *Research in drama education, 11*(2), pp. 201-218.

DeHart, G. B., Sroufe, L. A., & Cooper, R. G. (2000). *Child development: Its nature and course* (4th Ed.). Boston, MA: The McGraw-Hills Company, Inc.

Donmoyer, R. (1990). Generalizability and the single case study. In E. W. Eisner & A. Peshkin (Eds.) *Qualitative inquiry in education: The continuing debate*. New York, NY: Teachers College Press, pp. 175-200.

Ellenbogen, K. (2003, Winter). Sociocultural perspectives on museums, Part 1. *Journal of museum education, 28*(1), pp. 2.

Feagin, J. R., Orum, A. M., & Sjoberg, G. (1991). Introduction: The nature of a case study. In J. R. Feagin, A. M. Orum, & G. Sjoberg, (Eds.) *A case for the case study* (pp. 1-26).Chapel Hill, NC: University of North Carolina Press, pp. 1-26.

Fitzpatrick, J. L., Sanders, J. R., and Worthen, B. R. (2004). *Program evaluation: Alternative approaches and practical guidelines* (3rd Ed.). Boston, MA: Pearson Education, Inc.

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction* (7th Ed.).

Gesser-Edelsburg, A. (2005). Paradoxical outcomes in an educational drama about gang rape: ethical responsibilities of practitioners and educators. *Research in drama education, 10*(2), pp. 139-158.

Gliksman, L., Douglas, R. R., & Smythe, C. (1983). The impact of a high school alcohol educational program utilizing a live theatrical performace: A comparative case study. *Journal of Drug Education, 13*(3), pp. 229-247.

Gray, D. E. (2004). *Doing research in the real world*. Thousand Oaks, CA: Sage Publications.

Harner, M. A. & Preskill, H. (2007). Evaluators' descriptions of process use: An exploratory study. *New directions for evaluation, 2007*(116). San Francisco, CA: Wiley Periodicals, pp. 27-44.

Harris, J. W. (1989). *Visitor perspectives of the theater department's programs at the Science Museum of Minnesota*. St. Paul, MN: Science Museum of Minnesota.

Hinton, C., Miyamoto, K., & Della-Chiesa, B. (2008). Brain research, learning and emotions: Implications for education research, policy and practice. *European Journal of Education, 43*(1), pp. 87-103.

Holsclaw, D. S. (1996). *A comparison of the effectiveness of a Theater-in-Education design and a traditional didactic design in an alcohol prevention program: Changes in self-reported knowledge, attitude, and motivations* (Unpublished doctoral dissertation, New York University, 1996).

Hughes, C. H. (2007, Fall). Museum theater evaluation: A fascinating and frustrating challenge. *INSIGHTS, 17*(3), pp. 1-3.

Hughes, C. H. (2008). *Performance for learning: How emotions play a part.* (Unpublished doctoral dissertation, Ohio State University, 2008).

Jackson, A. & Rees Leahy, H. (2005, November). 'Seeing it for real…?' – Authenticity, theater and learning in museums. *Research in drama education, 10*(3), pp. 303-325.

Jackson, T. (1980). *Learning through theater: essays and casebooks on Theater in Education*. Manchester: Manchester University Press.

Jackson, T. (1993). *Learning through theater: new perspectives on Theater in Education*. London: Routledge.

Jackson, T. (2002, Fall). Between evaluation and research: Theater as an educational tool in museum theater. *Stage of the Art, 15*(1), pp. 6-9.

King, J. A. (2007). Developing evaluation capacity through process use. *New directions for evaluation, 2007*(116). San Francisco, CA: Wiley Periodicals, pp. 45-59.

Landy, R. J. (1982). *Handbook of educational drama and theater*. Westport, CT: Greenwood Press.

Long, S. (2007). *Learning goals of traveling theater shows*. St. Paul, MN: Science Museum of Minnesota.

Merriam, S. B. (1998). *Qualitative research and case study applications in education: Revised and expanded from Case study research in education*. San Francisco, CA: Jossey-Bass Publications.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: A sourcebook for new methods.* (2nd Ed.). Thousand Oaks, CA: Sage Publications.

Minneapolis Public Library (2001). *A history of Minneapolis: Arts and entertainment. An overview by staff at the Minneapolis public library*. Retrieved May 1, 2008 from http://www.mpls.lib.mn.us/history/ae2.asp

Minnesota Citizens for the Arts (2008). *Tourist art facts*. Retrieved May 1, 2008 from http://mncitizensforthearts.org/learn/artsresearch/tourism-arts-facts/

Patten, M. L. (2001). *Questionnaire research: A practical guide*. (2nd Ed.). Los Angeles, CA: Pyrczak Publishing.

Patton, M. Q. (1990). *Qualitative evaluation and research methods* (2nd Ed.). Newbury Park, CA: Sage Publications.

Patton, M. Q. (1997). *Utilization focused evaluation*. (3rd Ed.) Thousand Oaks, CA: Sage Publication.

Patton, M. Q. (1998). Discovering process use. *Evaluation, 4*, pp. 225-233.

Patton, M. Q. (2007). Process use as usefulism. *New directions for evaluation, 2007*(116). San Francisco, CA: Wiley Periodicals, pp. 99-112.

Patton, M. Q. (2008) *Utilization focused evaluation*. (4th Ed.) Thousand Oaks, CA: Sage Publication.

Prendergast, M. (2004, Fall). "Playing attention": Contemporary aesthetics and performing arts audience education. *Journal of aesthetic education, 38*(3), pp. 37-51.

Rossey, P. H., Lipsey, M. W. & Freeman, H. E. (2004). *Evaluation: A systematic approach* (7th Ed.). Thousand Oaks, CA: Sage Publication.

Science Museum of Minnesota (2008). *About us: History and mission.* Retrieved March 1, 2008 from http://www.smm.org/about/history/.

Science Museum of Minnesota Board (2007, September 27). *Strategic plan FY08-10*. St. Paul, MN: Science Museum of Minnesota.

Schauben, L., Mueller, D., & Schultz, J. L. (2006). *Bullying prevention program evaluation: CLIMB Theater.* St. Paul, MN: Wilder Research.

Seive, P. (2008) *Touring and education.* Retrieved October 27, 2008 from http://www.mixedblood.com/.

Serkownek, E. W. (1998). *Museum theater: Its history and practice* (Unpublished master's thesis, Cooperstown, 1998).

Soy, S. (1997). *The case study as a research method: Uses and users of information - LIS 391D.1 -- Spring 1997*. Retrieved April 13, 2008 from http://www.gslis.utexas.edu/~ssoy/usesusers/l391d1b.htm

Taylor, P. (2003, February). *The applied theater*. Paper presented at the Arizona State University Department of Theater symposium: What is "Cinderella" hiding? Theater/ideology/young people, Tempe, AZ.

Taylor, P. (2008, Fall). Have show; Will travel. *INSIGHTS, 18*(3), pp. 5-6.

Thomas, E. & Mulvey, A. (2008). Using the arts in teaching and learning: Building student capacity for community-based work in health psychology. *Journal of health psychology, 13*. pp. 239-250.

Yin, R. (1993). *Applications of case study research*. Newbury Park, CA: SAGE Publications.

Yin, R. (2009). *Case study: Design and methods* (4th Ed.). Los Angeles, CA : Sage Publications.

Appendix A: "Same Sides" Script

By Stacey Parshall

What happens when two siblings, a scientist and her sister, get into the hot debate over her new job-nanotechnology's impact on the environment? And when she pushes her perspective to include the world of her newborn son, is there a shift? Are they on the same sides, or were they in the first place?

MAGGIE, early 20's. On summer break from college. She's a biology major.

BRENDA, 30 something. A new mom. Scientist, biologist at a new company that is exploring ways of nanotechnology can impact pollution control.

SETTING: a kitchen. MAGGIE enters. She's drowsy. Yawning. Goes to the coffee maker, digs in cupboards, finds coffee and a mug. Doesn't quite know her way around the kitchen. Begins to make coffee. She takes a baby monitor out of her pocket, places it on the counter. Turns it up. Then proceeds to wait for coffee. There's a stack of files on the kitchen table. She sorta thumbs through them. BRENDA enters. She too is just waking up.

BRENDA

Mornin' Mags.

MAGGIE

Morning. (she closes the files)

BRENDA

He's sleeping. (*gives a tired "yeah" sign with her fists. laughs)*

MAGGIE

Yup. I just peeked.

BRENDA

Thanks. Did you notice how he holds his little hands? All curled up across his chest?

MAGGIE grins and nods.

BRENDA

(*Beat)* did you sleep alright?

MAGGIE eating cereal from a box. She nods.

BRENDA

Would you like a bowl?

She nods 'no'.

BRENDA

A spoon, maybe?

She nods 'no'. Goes to the refrigerator and takes out a jug of milk. Takes off the lid and begins to drink from the jug. BRENDA grabs her.

BRENDA

Whoa!

BRENDA takes the jug from her.

BRENDA

Carl would flip out if he saw you drinking out of the jug like that.

MAGGIE (*laughing))*

Sorry. Old habit.

BRENDA

Gross habit. Always has been. But we tried. Between mom and our sisters, we tried to raise you right, but you were always such the little piggy. (*laughs)*

MAGGIE makes a face at her, laughing. BRENDA pours some coffee but then freezes. Looks to the baby monitor.

BRENDA

Shhh.

MAGGIE

What?

BRENDA

I thought I heard him moving.

MAGGIE

Yeah. Baby's do that, Brenda. Geez. (*teases)* And you're the smart one in the family.

She moves closer to the monitor. But hears nothing.

BRENDA

He's still so little. And my instinct to run in there and make sure he's totally okay is really…huge. I think for the first month of Tyler's life all we did was stand over him and watch him.

MAGGIE

Wow.

BRENDA

Wow what? Too intense for you?

MAGGIE

No, man. It's really beautiful. You were always a pretty protective big sister, but I had no idea you'd be so maternal. It's very cool.

BRENDA

Thank you.

MAGGIE

Yeah. You wear it well, sister.

BRENDA shrugs, slightly embarrassed.

MAGGIE

And I thank you for letting me come crash for the summer. I need a break from school.

BRENDA

I'm glad you're following in my footsteps-Maggie the future biologist.

MAGGIE

And I'm glad I get to spend time with you guys.

BRENDA

You're really helping us out, too. With Carl's back at work and my new job.

MAGGIE flips through the files again.

MAGGIE

How is the new job?

BRENDA

It's… gonna be interesting.

MAGGIE

I hear a hesitation….what is this?

BRENDA

Uhmm…some research I'm reviewing. For the new job.

MAGGIE

What? (*reads closely)* Nanoparticles? Fullerenes?

BRENDA nods yes.

Uhm. Hmm. Yeah.

MAGGIE

Carbon 60? Precision engineered nanoparticles?

BRENDA

Yeah!

MAGGIE

Are you crazy? I've studied this stuff in class. It's dangerous!

BRENDA

Hold on—

MAGGIE

No. It's nasty stuff! Do you know that these little nanoparticles are so tiny they can break through… like..our normal blood barriers in our cells and travel to our brains? Where they do serious damage?

BRENDA

In some cases, in some studies, it's been found that might be possible but—

MAGGIE

But nothing? When these things go airborne we can…suck them in and not even know it! It's happened with fish, like in streams. And with rats—

BRENDA

—Wait a min—

MAGGIE

They've done tests and this crap could destroy us!

BRENDA

I know about the tests, okay? Of course I do.

MAGGIE

Then how can you work for this place?

BRENDA

I'm a biologist, Maggie.

MAGGIE

Yeah, and why do you think I wanted to be a biologist? You used to care about the environment. Geez! I remember getting these long lectures about recycling and how we need to "live green".

BRENDA

That's important—

MAGGIE

What happened to you then? They must be paying you some serious cash?

BRENDA

What?

MAGGIE

There's like millions or billions of dollars the government is spending on manufacturing and developing nanotechnology, right? So I'm sure you're gonna be making crazy cash doing this.

BRENDA

No—

MAGGIE

I mean, I get it. You have a family. A baby. You guys this nice house a block from the river and it all costs. I get it. But to sell out your values—

BRENDA

Wait. That's enough, Maggie.

MAGGIE

It's so sad—

BRENDA

Seriously, Mags! Stop!

(pause)

BRENDA

Wow. I forgot. You are still the queen of overreactions. (*sarcastic)* That's our Mags.

MAGGIE

That's not fair-

BRENDA

No, no, no. You had plenty to say and only some of it is right.

MAGGIE

It's right here! It's in your own files. Your own research!

BRENDA

I know what's in there! But you just need to relax.

MAGGIE (*quietly)*

Dad said you were doing this really important revolutionary work. If he knew—

BRENDA(*laughing, sarcastically)*

What? You're gonna tell on me? My gosh, you're looking at me like I'm 15 and I stole his car and drove through the neighbor's lawn.

MAGGIE

You did do that.

BRENDA

I know. My whole point is that I'm not a child. Now. I'm a biologist, a scientist and my new job is really important. (*holds up hand to stop MAGGIE from interrupting)*
And even though this company manufactures nanoparticles, *my job* is to help create ways to contain them, before they get into the environment. I'm part of a team of scientists—

MAGGIE

—pleeese—

BRENDA

—*This* company is working on their voluntary standards of care.

MAGGIE

That's a great idea. Let's let everyone make up their own rules.

BRENDA

There are no federal regulations or laws so many companies are working to create their own standards or rules. And that's where I come in. That's what all that research is about.

MAGGIE

What big company is gonna spend their time and money on actually implementing those kind of standards? They're probably just gonna pay you to do the research and write some big report that SAYS they have these standards—

BRENDA

Not every multi-billion dollar company is unethical, Maggie! They don't set out to deceive the public, their consumers. In fact, it is in their best interest to set standards or rules. They need public support and in this day and age, they can't afford NOT to pay attention to the outcry. No matter how hysterical—

MAGGIE

I'm not hysterical!

BRENDA

Really?

MAGGIE

You said it yourself, I'm not wrong.

(*pause)*

BRENDA

Okay. (*beat)* Not totally. You do have some things right.

MAGGIE

Like?

BRENDA

Like. Yes, research has been done and shown that there are possible—

MAGGIE

Possible? There *has* been detrimental impact on fish, and rats. There are huge concerns about the impact nanoparticles can have on people. What happens to our water system and does nanotechnology cause more harm than good for pollution control?

BRENDA

Alright, you're right. There are many things to be cautious about. And fix.

MAGGIE

Yeah.

BRENDA

But major changes have already happened.

MAGGIE

Yeah. More people are getting sick—

BRENDA

No. I'm talking about plenty of developments, already in place**.** For decades work has been happening on changing things. Look at diesel fuel emissions- new filters have already been created, and are being installed in new cars. And that's because research has already been done, and companies rose to the challenge set by the EPA to reduce those emissions.

MAGGIE

Yes they lowered the diesel fuel emissions, but increased the nanoparticle emmersions. You call that an improvement?

BRENDA

My point, Maggie, is that for more years than most people realize, research, discovery, creation of solutions, all of this has been going on. (*beat)* Nobody is so callous to not think about the environment.

MAGGIE

Right. You actually believe that?

BRENDA

Let it go, Maggie!

MAGGIE

You're trying to tell me that those big companies, no matter if they have their own care standards—that they created themselves-

BRENDA

Voluntary standards of care—

MAGGIE

—Whatever. When they're getting the big government money to manufacture these little killers—

BRENDA

—Maggie.

MAGGIE

—they're gonna care so much about the environment that they're gonna stop?

BRENDA

No. I'm not saying that at all because they won't.

MAGGIE

But—

BRENDA

They can't. And they shouldn't because nanotechnology is revolutionary and it can really help our future.

MAGGIE

At what cost?

BRENDA

That's the question. That's the exploration.

MAGGIE

Man—

BRENDA

—Look. Nanotechnology can be used to do a lot for the environment. It can treat waste stream effluents. It can minimize or even possibly eliminate the generation of waste all together. It can be used to clean up existing sites—

MAGGIE

—meanwhile—

BRENDA

—did you know that nanotechnology can make notifiers, like bar codes that can be attached to toxic substances so that authorities can be alerted when there are dangerous materials in our water, and in the soil? It's all part of prevention. It's practically necessary at this point.

MAGGIE scoffs. BRENDA drinks her coffee.

(*pause)*

MAGGIE

What about Tyler?

BRENDA

What? (*she grabs the monitor)* Did you hear something?

MAGGIE

Yeah. I heard his little voice say "Mommy, please don't destroy the environment. I sorta want it around when I grow up."

BRENDA puts the monitor down.

BRENDA

Maggie!

MAGGIE

Have you even thought about him? And what his world will be like in the future if this environment, what's left of it, is totally destroyed? Or what about the direct impact it could have on him, huh? What happens when these nanoparticles gets into his system now, when he's so young? He might not even live long—

BRENDA

Stop!! Just stop it! (*beat)* You don't say things like that? Not here. Not in my home, with him sleeping in the next room!

(*pause)*

MAGGIE

I'm just trying to make you see—

BRENDA

I know what you're doing.

MAGGIE (*tries to apologize)*

And maybe I went too..

BRENDA

Ya know, I do think about Tyler's future. Of course I do. How could I not? (*beat)* When I was first offered this job, I actually said no. I had the same concerns and reactions as you do. I even went so far to be…insulted by the offer. I thought I had made it really clear to them how I feel about the things, the environment and what we should be doing to save it. But then I did think about Tyler and it was because of him I chose to take this job. (*beat)*\The goal is about prevention and the extremely good things nanotechnology can do. And if I can help make that happen, then I am doing what's best for my son.. Or anybody's son. (*pause)* I hope you can see that we're really on the same team. The same side.

MAGGIE(*not convinced)*

I don't know….I mean, that all sounds so very…honorable...but… the risk…I mean who gets to decide what's worth risking…I mean I feel comfortable with you making those decisions, but what about other people? How do we decide if the good out weighs the bad?

The end

Appendix B: "Let's Talk About It" Script

By: Richard W Rousseau

We find Alice sifting through boxes. She has several boxes unpacked and she is looking through more – her search becomes more frantic.

Cynthia enters.

CYNTHIA Alice?

(No response)

Alice!

ALICE What?

CYNTHIA We're supposed to be packing up here.

ALICE Right.

CYNTHIA What are you doing?

ALICE I'm looking for the letters that Mom wrote to the clinic - the ones about gold nanoshells.

CYNTHIA Nanoshells. It's too late for gold nanoshells.

ALICE You never know.

CYNTHIA Alice, she is now in hospice. She's not coming back here. That's why we're packing up. All of the options have pretty much been exhausted. It's too late for that.

Alice continues unpacking.

CYNTHIA Alice!

ALICE Here they are. I found some of them.

CYNTHIA OK, so you found them. What are you going to do with them?

ALICE I'm (hesitates) I'm going to show them to Mom –

CYNTHIA That's ridiculous!

ALICE She was asking about them

CYNTHIA She's been asking about a lot of things lately. Some of which don't make any sense.

ALICE I don't understand the holdup – she volunteered three years ago.

CYNTHIA Three years ago it might have worked for mom – not anymore.

ALICE What do you want to do - do you want us to just let her die?

CYNTHIA We do what we can with what we've got.

ALICE We had gold nanoshells three years ago.

CYNTHIA No, we didn't. Gold Nanoshells were still in the experimental stage then... It's just too late for mom. Nanoshells are used to treat tumors…

ALICE And they are unlike any other treatment. It really is miraculous. They're so small they're invisible – tiny invisible pieces of silica coated in gold-listen to this *(reading)* nano-gold shells are injected into the body and the body won't reject them because gold is nontoxic to the blood stream and so they pass unnoticed - fall through the imperfections surrounding the tumor and collect at it's core. *(Stops reading)*There is no knife cutting anything away here – it's all so completely non-invasive- listen *(Reading)* – a laser light applied from outside the body penetrates to the core of the tumor and the light absorbed by the nanoshells heats to a point where it burns the tumor away – all so simple.

CYNTHIA Not really simple – You only see the miracle cure - not the consequences there's a lot more involved.

ALICE Like what?

CYNTHIA Like the fact that no one knows for certain what happens to the nanoshells after they've destroyed the tumor. Are they absorbed by the body? How are they absorbed? What happens to the body as a result of their absorption?

ALICE This is about cancer…

CYNTHIA Cancer that has gone well beyond the tumor stage – gold nanoshells won't do any good for mom.

ALICE But they could have – I don't understand why she wasn't allowed to be treated.

CYNTHIA It wasn't just about her – we don't know what these nanoshells will do –

ALICE What difference does it make!

CYNTHIA It makes a lot of difference – do they get into the environment? Are they passed from the body? Are they excreted? Do they get into the water supply? Think about mercury, asbestos, lead paint…

ALICE So what!

CYNTHIA So what? We need to run the appropriate experiments first. This whole field of nanoscale science– and I'm not just talking about gold nanoshells here – this huge, enormous revolution that involves the rearrangement of matter – the re-creation of substance - is something that necessitates a little caution. Did you know everyday latex-everyday latex becomes toxic at the nanoscale.

ALICE We're talking about cancer here.

CYNTHIA We're talking about life and death.

ALICE That's right, we are, that's exactly what we're talking about.

CYNTHIA Alice, I know this is hard . . . .if Mom wants to see the letters that she wrote requesting treatment with nanoshells – that's fine – but we have to face the reality here. *(resumes packing)*

ALICE *(Beat)* I honestly think that you are allowing this whole situation to cloud your judgment. There is a lot to be optimistic about.

CYNTHIA Maybe so. She did seem a little better yesterday.

ALICE I'm not just talking about Mom. I'm talking about the way that you're dismissing technology – the way you refuse to see the promise.

CYNTHIA The only promise here is that things will be radically different.

ALICE They are always different.

CYNTHIA Not like this. I have been researching the stuff.

ALICE I've done far more research on possible cures for cancer than you.

CYNTHIA We've tried them all. If they were available – if they weren't complete lunacy – mom was open to trying them. I'm talking about research involving nanoscale science – and not just gold nanoshells used for treating tumors – but all of the different types of nanoshells and quantum dots and fullerences and nanotubes – and who knows what else. They are probably developing another one as we speak.

ALICE That's progress.

CYNTHIA We simply don't know enough about what we are doing here.

ALICE We know how to do it. We know how to manipulate atoms and induce them to form new structures.

CYNTHIA And we have a lot of potential applications: stain resistant pants, energy efficient light bulbs, environmental safeguards, possible cures for cancer . . .

ALICE What is wrong with that?

CYNTHIA There is nothing wrong with that, which is why none of us is asking questions – It all seems so positive. At least with the atomic bomb, we knew from the beginning that it was dangerous.

ALICE This is getting ridiculous!

CYNTHIA No, it's not – it only seems ridiculous because you haven't thought about the consequences..

ALICE What does the atomic bomb have to do with it?

CYNTHIA It is the only comparable threat that we have had in our entire evolution.

ALICE You're exaggerating.

CYNTHIA Am I?

ALICE I think, in truth, that this has more to do with Mom. The fact that she's . . . not getting better - that she's in hospice and that she's not coming home.

CYNTHIA No.

ALICE When you get scared – when death can't be denied – when it becomes your focus, you leap around looking for other things to worry about.

CYNTHIA I'm not leaping around.

ALICE Today I drove to five different places before I drove over here – half the time I didn't know why.

CYNTHIA I know why I'm talking about it. I'm talking about it because nobody else is.

ALICE OK – talk.

CYNTHIA This is an issue that almost everyone else is ignoring. In this country – this country that prides itself on free speech – we are choosing distraction over substance. Did you know I was using sunscreen with nanoparticles in it and I didn't know it.

ALICE It's just sunscreen.

CYNTHIA You don't care what you put on your body or in it?

ALICE It's just sunscreen.

CYNTHIA The point is no one told me and I certainly didn't do the research myself. How many people have you heard participate in a discussion about this?

ALICE No one, other than you.

CYNTHIA Exactly. That's my point. This world is now engaged in manipulating the most elemental aspects of life itself without a dialogue that focuses on the consequences. Because quite frankly, we are seduced by the possibilities.

ALICE Yes, we are all seduced by the possibilities.

CYNTHIA We need to talk about this.

ALICE Yes.

CYNTHIA I mean, let's look at the consequences – we've never dealt with anything like this before and so there is no precedent.

ALICE No – not in the same way.

CYNTHIA It's an entirely different paradigm.

ALICE Right.

CYNTHIA It's a block away from "outside the box".

ALICE It is.

CYNTHIA And so above all, we need complete honestly here and like I said, we need to talk about it.

ALICE I've got cancer.

CYNTHIA What?

ALICE A lump – it showed up on a mammogram – I had an ultrasound – then a needle biopsy – it's malignant.

CYNTHIA When?

ALICE Today.

CYNTHIA Why didn't you tell me?

ALICE I guess I was too busy being seduced by the possibilities.

(end play)

Appendix C: Student Survey

Help us improve future theater programs for students. Let us know what you thought of the program and what you learned. Thank you for your help!

---

1. During today's program you saw two plays and participated in discussions about the plays.

- **In the first play, "Same Sides," Maggie and Brenda talked about Brenda's new job.**
- **In the second play, "Let's Talk About It," Cynthia and Alice talked about their sick mother.**

Rate your level of agreement or disagreement with the following statements about today's program.

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. I enjoyed the play "Same Sides."				
b. The play "Same Sides" was easy to understand.				
c. I enjoyed the play "Let's Talk About It."				
d. The play "Let's Talk About It" was easy to understand.				
e. I had a strong understanding of nanotechnology before today's program.				
f. I now feel like I know more about nanotechnology.				
g. Today's theater program helped me think about my own views of nanotechnology.				
h. I am interested in talking to my friends or family about what I learned during today's program.				
i. I would like to have the Science Museum of Minnesota do another theater program with my class.				

2. What are two ways you would describe what things are like at the nanoscale?

1 _____

2 _____

3. What is something new you learned about the ways nanotechnology can be <u>beneficial or helpful</u>?

_____

_____

_____

4. What is something new you learned about the ways nanotechnology can be <u>risky or harmful</u>?

_____

_____

_____

5. What other science topics would you be interested in learning about through theater?

_____

_____

_____

6. The following statements are about your experience during the discussions following each play. Rate how comfortable or uncomfortable you were with the following.

How comfortable were you…	Very Uncomfortable	Uncomfortable	Comfortable	Very Comfortable
a. Voicing your opinions during the discussions?				
b. Asking questions during the discussions?				
c. Responding to others' comments during the discussions?				

The following questions are to help us better serve school audiences.

7. What is your gender? ☐ Male ☐ Female

8. What grade are you in? _____

9. In what racial or ethnic group(s) do you identify yourself? (Check all that apply)

- ☐ African American
- ☐ American Indian or Alaskan Native
- ☐ Asian-American
- ☐ Hispanic/Latino
- ☐ White, not of Hispanic origin
- ☐ Other: _____

Appendix D: Teacher Survey

This year is the first time the museum has offered traveling theater programs. Your feedback will help to ensure we offer a beneficial experience for both you and your students. Thank you for your time!

---

1. How would you rate your overall experience with the Science Live Traveling Theater Program? Indicate the extent to which you agree or disagree with each of the following statements:

	Strongly Disagree	Disagree	Agree	Strongly Agree
a. I enjoyed the Science Live Traveling Theater Program.				
b. My students seemed to enjoy the Science Live Traveling Theater Program.				
c. I would recommend the Science Live Traveling Theater Program to other teachers.				

2. For each of the topics listed below, indicate the extent you feel the topic was addressed.

	Topic not addressed	Topic minimally addressed	Topic moderately addressed	Topic well addressed
a. The size of things at the nanoscale.				
b. The properties of things at the nanoscale.				
c. The positive impacts nanotechnology may have on the environment.				
d. The negative impacts nanotechnology may have on the environment.				
e. The potential use of nanoscience in medicine.				

3. Describe how the Nanoscience Theater Program fit within your curriculum/course of study. Provide examples of how you connected and/or will connect the theater program content to specific topics you are teaching in your classroom. (If the program did not fit within your curriculum/course of study, please explain why.)

4. Tell us a bit about your students who saw the NanscienceoTheater Program.

What grade(s) were your students in? _____

What was the date of the program? _____

5. Rate the age appropriateness of the plays for your students. If there were other classrooms also participating in the program, please think only about your students.

	Inappropriate	Somewhat Inappropriate	Somewhat Appropriate	Appropriate
a. Same Sides (Sisters argue about nanotechnology and the environmental impacts)				
b. Let's Talk about It (Sisters discuss their mom's cancer)				

6. Please explain any "Inappropriate" or "Somewhat Inappropriate" ratings.

7. Do you feel the lengths of the plays and discussions were appropriate to support student learning?

□ **Yes**

□ **No → If no, what would have been more appropriate lengths and why?**

8. Which of the following formats, in your opinion, strongly support student learning of science topics through the use of theater? (Check all that apply.)

__ Two plays and two discussions (today's theater program)
__ One longer play and one group discussion
__ Two plays and no discussion
__ One long play and no discussion
__ Other suggestions: _____

9. Do you feel the cost for the program ($250) is appropriate?

□ **Yes**

□ **No → If no, what would have been a more appropriate cost and why?**

10. What is the likelihood that you will use one of the Science Live Traveling Theater Programs in the future?

□ Very Unlikely
□ Unlikely
□ Likely
□ Very Likely

11. Please explain your response to Question 10.

12. Please share comments you may have about any program components. We would love to hear suggestions for improving the Science Live Traveling Theater Program for school audiences. Use the back of this sheet if necessary.

13. Thank you for your feedback! We are conducting follow-up interviews two weeks after the program as part of a master's thesis. If you participate, your name will be placed in a drawing for a $50 Target Gift Card. Please return the consent form with this survey if you are willing to participate.

Appendix E: Teacher Interview Protocol

Thank you, again for meeting with me to discuss the impacts the Science Museum's theater programs and discussion had on you.

1. What were your overall impressions of the theater program?
2. What did you think of the program's format, using a play and then a large group discussion?

The next series of questions are about your own personal experience with the theater program.

1. What were your reactions to the program? Did you think about the topic or discuss (nanotechnology)(race) with others?
2. Did the program change how you think about (nanoscience and nanotechnology)(race and racism)? How?
3. Did the program cause you to change or consider changing any aspects of your life? How?
4. How has this affected your teaching?

Now I'm going to ask you about your students' experiences with the program.

1. Did you do any preparation with your students before they participated in the theater program? Please describe what the preparation entailed (activities, discussions, etc.).
2. Have you discussed the subject of (nanoscience)(race) with your students since the program? What have you talked about?
3. Have these conversations caused any changes in your students? What are they and how do you know this?

4. Did the students raise any questions or start any discussions about the topic after the program? What did they ask/what did they discuss?
5. What changes would you suggest in order to improve the experience students have with the theater program? Why do you think these would cause improvements?
6. Do you have anything else you would like to share about the theater program?

Appendix F: Observation Sheet

Total number of students Date

Tally of students who:

- respond during introduction:
- respond during first discussion:
- respond during second introduction:
- respond during second discussion:

Observations (comments, questions, actions made by members of audience)

Appendix G: Debrief Protocol

What did you think of the program?

How did the setup of the space affect the program?

How did you think the discussions went?

Any issues or concerns about the program?

What could have been done differently by the school to make it a better program?

What could you have done differently to make the program better?

What could you have done differently to make it a better program?